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**ORIGINAL ARTICLE**

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RESEARCH ARTICLE

# The Brief Aggression Questionnaire: Turkish Validity and Reliability Study

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**Abstract**
The aim of this study is to test the psychometric properties of the "Brief Aggression Questionnaire (BAQ)," originally developed by Buss and Perry (1992) and revised into a short form by Webster et al. (2014), for Turkish adolescents and adults. The study group consisted of individuals aged 14–52, which is a total of 213 participants, including 168 males (mean age = 29.79) and 45 females (mean age = 26.50), selected through convenience sampling. The construct validity of the questionnaire was tested using Confirmatory Factor Analyses ($\chi 2$=447.78, $p<0.05$, $\chi 2/df$= 1.88, CFI= .97, SRMR= .032, and RMSEA= .034). For the convergent validity of the measurement tool, t-values, factor loadings, and Average Variance Extracted (AVE) were calculated; for discriminant validity, the values of Average Shared Variance (ASV), Maximum Shared Variance (MSV), √AVE, and inter-factor correlations were determined. Additionally, reliability analyses, including the internal consistency coefficient (Cronbach's Alpha) and Composite Reliability (CR) values, were computed. Our findings indicate that the BAQ is a reliable four-factor measurement tool that can be used to assess aggression in Turkish adolescents and adults.

**Keywords**
Agression Questionnaire, Short Form, Measurement, Validity, Reliability

## INTRODUCTION

Aggression is generally defined as any behavior intended to harm others (Bushman & Huesmann, 2010). More specifically, it refers to individual differences in thoughts (hostility), emotions (anger), and behaviors (verbal and physical aggression) that aim to harm another person (Webster et al., 2014). Throughout human history, aggression was an integral part of life for our ancestors living in small groups. As humans became more social, aggression towards others within the social group, crucial for an individual's survival, became less adaptive, and prosocial behaviors became more prevalent (Bushman & Huesmann, 2010). However, even with these changes, extreme forms of aggression have led to unparalleled human tragedies, with millions affected by wars and genocides (Anderson & Bushman, 2002). Aggression has caused more problems than it has solved (Bushman & Huesmann, 2010). Consequently, it is considered a maladaptive and destructive behavior across all societies. Despite societal changes since World War II, homicide rates have risen rather than fallen in several industrialized countries, particularly in the United States (Anderson & Bushman, 2002). Therefore, there is growing interest in understanding the underlying causes of aggressive behaviors.

Today, many social psychologists are interested in understanding why people become aggressive, what factors influence aggression, and how aggression can be reduced (Bushman & Huesmann, 2010). The multidimensional nature of aggression, which develops through the complex

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interaction of physiological, psychological, and social factors (Vitoratou et al., 2009), has made it a frequently researched topic across academic boundaries (Webster et al., 2014). Scientists from various fields, such as anthropology, sociology, and psychology, have attempted to elucidate the origins and development of aggression and its relationship with other behaviors (Lefkowitz et al., 2013). Although various measurement tools have been developed to evaluate aggression (Buss & Perry, 1992; Gladue, 1991; Orpinas & Frankowski, 2001; Raine et al., 2006), the main problem faced by researchers is to accurately and effectively measure individual differences in aggression without compromising validity and reliability (Webster et al., 2014). For this purpose, the Buss-Durkee Hostility Inventory (BDHI), one of the first and most widely used measures of aggression, was used (Buss & Durkee, 1957). The questionnaire, which includes subdimensions of assault, indirect, irritability, negativism, resentment, suspicion, verbal, and guilt (unrelated to the hostility items), consists of 66 items. The authors later conducted two studies among university students and reduced these seven subdimensions into two factors: aggressiveness (assault, indirect aggression, irritability, and verbal aggression) and hostility (resentment and suspicion), thereby attempting to avoid theoretical complexity (Buss & Durkee, 1957). Additionally, Bushman et al. (1991) supported the two-factor structure in their studies, demonstrating that the BDHI measures two dimensions of aggression.

In subsequent studies, Buss & Perry (1992) revised the BDHI to create the 29-item Buss-Perry Aggression Questionnaire (BPAQ). Unlike its seven-factor predecessor, the BPAQ focuses on four aspects of aggression: physical aggression, verbal aggression, anger, and hostility. Researchers have consistently supported the four-factor structure in numerous studies. The BPAQ is more efficient than the BDHI (29 items compared to 66 items) and has improved psychometric properties, including higher internal consistency reliability (Webster et al., 2014). Researchers have consistently supported the four-factor structure in numerous studies. The psychometric properties of the 29-item Turkish version of the BPAQ have been tested in various studies involving university students (Demirtas-Madran, 2012), adolescents (Önen, 2009), and athletes (Sözeren & Kelecek, 2019). Across these studies, which involved different sample groups, the common finding is that the Turkish version of the BPAQ is a valid and reliable instrument for measuring aggression (Kuzucu & Sarıot, 2020). Despite the popularity and widespread use of the BPAQ, the 29-item questionnaire has been considered too lengthy for certain research contexts, especially with the advent of advanced technology and analytical techniques. Researchers have expressed a need for shorter measures of aggression for use in applied settings, specialized samples, field studies, longitudinal research, and daily studies (Webster et al., 2014). Consequently, there has been increased demand for such tools (Widaman et al., 2011). To address this need, Bryant and Smith (2001) developed the short form of the BPAQ (BPAQ-SF). The new short form retains the same four-factor structure—physical aggression, verbal aggression, anger, and hostility— with each factor comprising three items. Unlike the original BPAQ, the BPAQ-SF uses a 6-point Likert questionnaire (Bryant & Smith, 2001). However, many studies involving the BPAQ-SF (Maxwell, 2008; Torregrosa et al., 2020) have preferred the 5-point Likert questionnaire version. The questionnaire has been adapted into Turkish by Kuzucu & Sarıot (2020), thus contributing to the literature.

In the study that forms the conceptual framework of our research, Webster et al. (2014) adapted an alternative short form of the BPAQ and evaluated it across different samples, thereby increasing its generalizability (Webster et al., 2015). The researchers selected three items with the highest factor loadings from each of the four subdimensions of the aggression questionnaire (physical aggression, verbal aggression, anger, and hostility) as defined by Buss & Perry (1992), creating the 12-item Brief Aggression Questionnaire (BAQ). Across five studies (N=3,996) conducted by Webster et al. (2014) and Webster et al. (2015), the BAQ demonstrated theoretically consistent convergent and discriminant validity models with other self-report measures. Confirmatory factor analyses confirmed the four-factor structure, and item response theory methods ensured adequate information recovery. The study results showed stable test-retest reliability and convergent validity aligned with behavioral measures of aggression. Unlike the BPAQ-SF (Bryant & Smith, 2001b), the BAQ includes reverse-scored items. Reverse-scored items are important for reflecting differences

between positive/negative associations and identifying participants' response tendencies. This can help reduce biases by forcing respondents to report a lack of aggression more accurately (Webster et al., 2014). Additionally, short measures are intended to reduce participant fatigue and inattentiveness. Thus, when used alongside other lengthy questionnaires, the complete 29-item BPAQ can avoid unnecessary item addition, which might be overly burdensome for participants. Despite the advantages of the BAQ, no research has been found that tests its psychometric properties in Turkish. Therefore, the aim of this study is to test the psychometric properties of the Brief Aggression Questionnaire (BAQ), originally developed by Buss & Perry (1992) and revised by Webster et al. (2014), for adolescents and adults in Turkish culture.

## MATERIALS AND METHODS

### Research Model

The research was conducted according to the single survey model, one of the most preferred general survey models in the social sciences. Studies conducted using the survey model aim to present an existing situation or reality as it is (Büyüköztürk et al., 2018). Survey models enable general judgments and inferences about the population through a sample taken from the population, especially when the population is large and difficult to reach (Karasar, 2020). Because this model aims to make general inferences about the population, it is recommended to reach large sample groups. Single survey models can be applied both instantaneously and temporally. Instantaneous surveys examine the situation at a specific moment, while temporal surveys address periodical changes (Bailey, 1987).

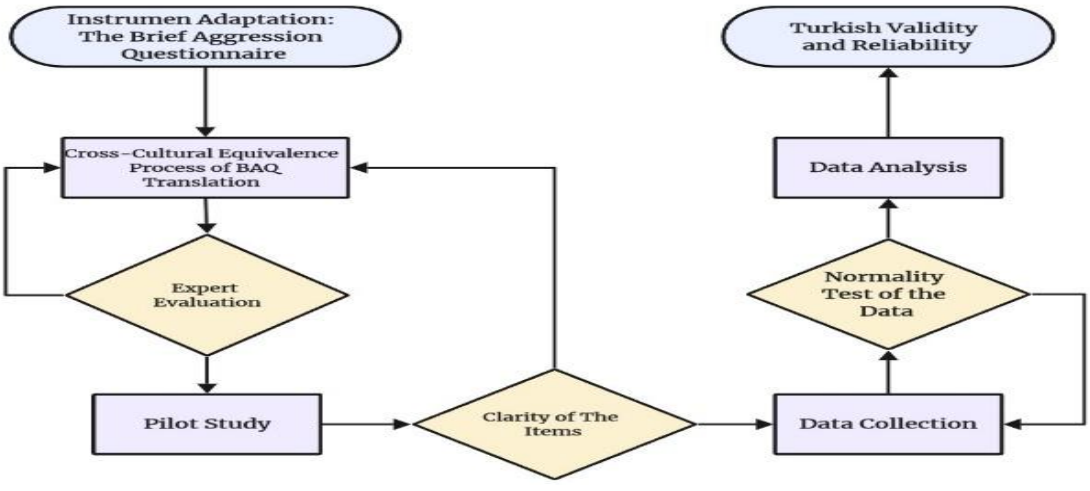


**Figure 1.** The flowchart of the study

### Participants

The study group consisted of individuals aged 14-52. A total of 213 participants, including 168 males (Mean age = 29.79) and 45 females (Mean age = 26.50), were selected using the convenience sampling method, one of the non-random sampling methods, as described by Yıldırım & Şimşek (2011). In quantitative research, the formula $n \geq 50 + 8x$ (number of items) is preferred for determining an appropriate sample size (Green, 1991). According to this formula, for a study using a 12-item questionnaire, a sample size of 146 or more ($n \geq 50 + 8x12$) was considered suitable.

### Data Collection Tools

The Brief Aggression Questionnaire (BAQ): The BAQ is the short form of the Buss-Perry Aggression Questionnaire (BPAQ), originally developed by Buss and Perry (1992) to assess individuals' levels of aggression and later adapted by Webster et al. (2014). The measurement tool consists of 12 items and is divided into the following subdimensions: (a) physical aggression, (b) anger, (c) verbal aggression, and (d) hostility. Each subdimension is assessed with three items, and one item in the anger subdimension is reverse-scored. The responses are recorded on a 7-point Likert questionnaire. Additionally, participants were asked to respond to a personal information

form, which included questions to identify their demographic characteristics (age, gender, education, and marital status).

**Cross-Cultural Equivalence Process of BAQ**

The translation procedures recommended by Brislin (1980) were followed to adapt the measurement tool to Turkish culture and create its Turkish version. Statements in the questionnaire were translated from English to Turkish and back-translated from Turkish to English to ensure linguistic equivalence. These translations were performed by four proficient translators (2 from translation studies and 2 independent), and evaluated by different researchers in the field of social sciences for conceptual and semantic comparison. Following expert evaluation, statements that created differences in meaning were corrected, leading to the final version of the questionnaire. The equivalence of meanings between the original English and Turkish versions of the statements in the questionnaire was verified. Subsequently, the comprehensibility of BAQ items was tested through a pilot study conducted with a sample group of 52 individuals, as recommended by Cattell (1978), which is at least three times the number of items in the questionnaire. Researchers conducted interviews with participants after the application, questioning the clarity of the items. Based on participant feedback, it was concluded that the BAQ items are understandable.

Table 1 presents the Turkish items of the BAQ obtained through translation.

**Table 1.** English and Turkish versions of the BAQ

| Factor and item in English | | Factor and item In Turkish | |
|---|---|---|---|
| Physical Aggression | | Fiziksel Saldırganlık (FS) | |
| $PA_1$ | Given enough provocation, I may hit another person. | $FS_1$ | Yeterince tahrik edilirsem başka birine vurabilirim. |
| $PA_2$ | If I have to resort to violence to protect my rights, I will. | $FS_2$ | Haklarımı korumak için şiddete başvurmam gerekirse, bunu yaparım. |
| $PA_3$ | There are people who pushed me so far that we came to blows. | $FS_3$ | Beni yumruklaşmaya varacak kadar zorlayan insanlar var. |
| Verbal Aggression | | Sözel Saldırganlık (SS) | |
| $VA_1$ | I tell my friends openly when I disagree with them. | $SS_1$ | Arkadaşlarımla aynı fikirde olmadığım zaman onlara açıkça söylerim. |
| $VA_2$ | When people annoy me, I may tell them what I think of them. | $SS_2$ | İnsanlar beni kızdırdığında, onlar hakkında ne düşündüğümü söyleyebilirim |
| $VA_3$ | My friends say that I'm somewhat argumentative | $SS_3$ | Arkadaşlarım, biraz tartışmacı olduğumu söylerler. |
| Anger | | Öfke (Ö) | |
| *$A_1$ | I am an even-tempered person. | *$Ö_1$ | Soğukkanlı bir insanım. |
| $A_2$ | Sometimes I fly off the handle for no good reason. | $Ö_2$ | Bazen sebepsiz yere sinirlenirim. |
| $A_3$ | I have trouble controlling my temper. | $Ö_3$ | Öfkemi kontrol etmekte zorlanırım. |
| Hostility | | Düşmanlık (D) | |
| $H_1$ | Other people always seem to get the breaks. | $D_1$ | Diğer insanlar her zaman şanslıymış gibi görünüyor. |
| $H_2$ | I sometimes fell that people are laughing at me behind my back. | $D_2$ | Bazen insanların arkamdan güldüğünü hissederim. |
| $H_3$ | When people are especially nice, I wonder what they want. | $D_3$ | İnsanlar özellikle nazik olduklarında, ne istediklerini merak ederim. |

Items were measured on a 7-point scale, where 1= Extremely Uncharacteristic, 7= Extremely Characteristic of Me, *Calculated as reverse items in the analysis.

**Data Analysis**

The study obtained written permission from the Kırıkkale University Social and Human Sciences Research Ethics Committee (Decision date: 24.06.2024 / Session No: 06). Participants were informed about the purpose and conduct of the research, and voluntary participation was ensured. Data for the study were collected face-to-face at different times. It took approximately 10 minutes for participants to complete the questionnaire forms, and the entire data collection process was completed over 3 weeks. The analysis proceeded with a total of 213 data sets, excluding 15 incomplete responses.

The validity and reliability of the BAQ were assessed in three stages. In the analysis process,

first, the univariate normality assumption of the data was examined. A range of ±2.00 was used as the reference for skewness and kurtosis values (George & Mallery, 2019). Upon reviewing Table 2, it was determined that the data met the assumption of univariate normality. Additionally, the multivariate normality distribution of the data was evaluated through test results. Due to meeting both univariate and multivariate normality assumptions, parametric test methods, specifically Maximum Likelihood (ML), were employed in this study. CFA was conducted to test the structure of the measurement tool. In the analysis process, model comparisons were tested over four-factor, hierarchical and single-factor models. In the second stage, validity and reliability tests of the questionnaire were conducted. For discriminant validity, √AVE, MSV, ASV, and inter-factor correlation values were calculated. Convergent validity was assessed using factor loadings, t-values, and Average Variance Extracted (AVE) values. In the third stage, the reliability of the measurement tool was examined using Cronbach's alpha for internal consistency coefficient and Composite Reliability (CR) value.

## RESULTS

### Stage 1. Level of Normality of Data

In the univariate normality assumption, it was determined that the data fall within the ±2.00 range, indicating that they have a univariate normal distribution (Table 2). Additionally, Mardia skewness and Mardia kurtosis values were calculated for the multivariate normality assumption. Based on these procedures, both univariate and multivariate normality assumptions were met. Therefore, Maximum Likelihood (ML) method was preferred during the Discriminant Factor Analysis (DFA) process (Şen, 2020).

**Table 2.** Normality test of the data

| | M | SD | Skewness | Kurtosis |
|---|---|---|---|---|
| Physical Agression | 4.79 | 1.63 | -.539 | -.967 |
| Verbal Agression | 4.60 | 1.49 | -.579 | -.787 |
| Anger | 4.80 | 1.54 | -.400 | -1.068 |
| Hostilitiy | 4.43 | 1.73 | -.179 | -1.326 |
| BAQ | 4.66 | 1.49 | -.515 | -1.038 |

### Stage 2. Model Comparisons

Confirmatory Factor Analysis (CFA) was conducted to test the conceptual structure of the (BAQ). According to Noar (2003), CFA goes beyond exploratory techniques to confirm the structure of the measurement instrument. It also allows for the comparison of different competing models rather than testing a single model. In the adaptation studies of BAQ, single-factor, four-factor, and hierarchical model structures were compared (Webster et al., 2014). Therefore, in line with the relevant literature, this study tested various competing models (single-factor, four-factor, and hierarchical factor models) (Figure 2).

***Single-factor model:*** Each of the twelve items was linked to a single aggression factor.

***Four-factor model:*** A four-factor structure was used to assess aggression. In this CFA, BAQ was modeled as an indicator of four first-level factors.

***Hierarchical model:*** Four first-level factors were linked to second-order high-order (aggression) factors.

**Table 3.** Comparisons of the models

| | | | | | | | | Model Comparison | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | $\chi^2$ | df | $X^2$/df | RMSEA | SRMR | TLI | CFI | | $\Delta\chi^2$ | Δdf |
| 1. Four-factor | 91.03 | 48 | 1.896 | .065 | .017 | .98 | .98 | | | |
| 2. Hierarchical | 94.44 | 50 | 1.889 | .064 | .018 | .98 | .98 | 2 vs.1 | 3.41 | 2 |
| 3. Single-factor | 333,56 | 54 | 6.177 | .156 | .032 | .88 | .90 | 3 vs. 2 | 239.12* | 4 |

In the study, the suitability of the data with the model was evaluated by examining the Root Mean Square Error of Approximation (RMSEA), Standardized-Root Mean Square Residual (SRMR), Tucker Lewis Index (TLI), The Comparative Fit Index (CFI) values. The acceptable fit values for these indices are typically between .05 and .08 for RMSEA and SRMR (Hu & Bentler, 1998), and greater than 0.90 for both CFI and TLI (Schermelleh-Engel et al., 2003). According to the literature, both models (four-factor and hierarchical) demonstrated acceptable fit indices. The proposed four-factor model was compared with two alternative models using $\chi^2$ difference tests. Upon examining the model comparisons, it was found that the fit indices for both the four-factor and hierarchical models were within satisfactory limits, and the $\chi^2$ difference tests were not significant (Table 3). The fit indices of the single-factor model ($\chi^2$/df = 6.177, CFI = 0.906, and RMSEA = .156) did not fall within acceptable limits, and $\chi^2$ difference tests with the hierarchical model were significant. The four-factor model ($\chi^2$/df = 1.896, TLI = .98, CFI = .986, SRMR = .017, and RMSEA = .065) and the hierarchical model ($\chi^2$/df = 1.888, TLI = .98, CFI = .985, SRMR = .018, and RMSEA = .064) were found to fit the data better compared to the single-factor model ($\chi^2$/df = 6.177, were found to fit SRMR = .032, and RMSEA = .156).

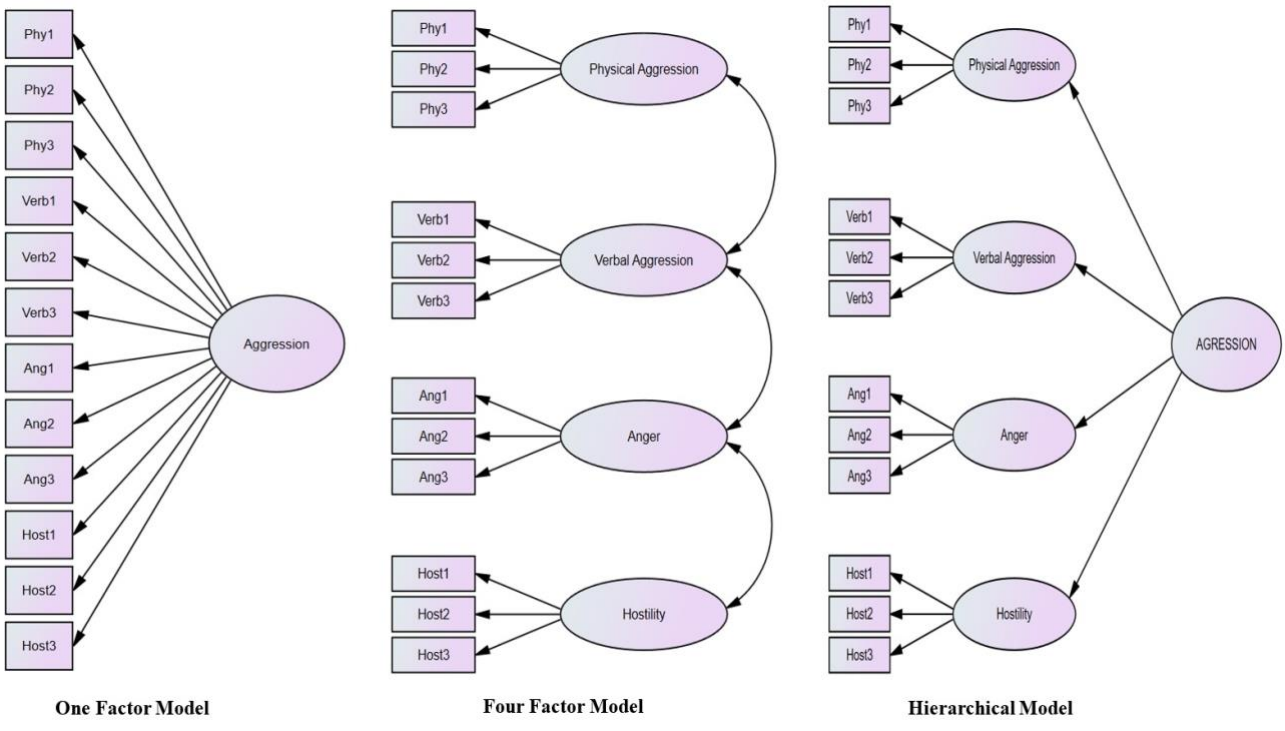


**Figure 2.** Tested Models. Physical Agression= Phy, Verbal Agression=Verb, Anger=Ang, Hostilitiy=Host

## Stage 3. Validity and Reliability Tests

### *Convergent Validity Test*

In this process, tests regarding the validity and reliability of BAQ were conducted using a four-factor model. According to the DFA findings, the four-factor model developed shows a good fit with the data ($\chi^2$=447.78, p<0.05, $\chi^2$/df= 1.88, CFI= .97, SRMR= .032, and RMSEA= .034). These goodness-of-fit values indicate that the model fits the theoretical structure and is reliable. In examining convergent validity, factor loading values, t-values, and Average Variance Extracted (AVE) were utilized. Researchers (Anderson & Gerbing, 1988; Bilgin & Kutlu, 2022; Hung et al., 2016) commonly use the strength of factor loadings and the significance of item t-values to evaluate convergent validity. When examining Table 4, factor loading values range between .76 and .93. Additionally, it was determined that factor loadings for all BAQ items are statistically significant (t-values $\geq \pm$ 1.96) (see Table 4). Lastly, AVE values were calculated for convergent validity. AVE calculation is a critical measure frequently used in DFA to assess the appropriateness of the model to the data and the reliability of measurement tools. Upon reviewing Table 4, AVE values range from .80 to .94. AVE values above 0.50 are recommended (Fornell & Larcker, 1981).

**Table 4.** The results of CFA, AVE, CR and cronbach alpha

| Factors and Items | λ | t-value | SE | $R^2$ | M | SD |
|---|---|---|---|---|---|---|
| Physical Agression (CR=.93; AVE=.83; α=.93) | | | | | | |
| $PA_1$ | .91 | 22.44 | .04 | .83 | 4.90 | 1.79 |
| $PA_2$ | .93 | 21.22 | .05 | .87 | 4.77 | 1.74 |
| $PA_3$ | .89 | 22.44 | .04 | .80 | 4.72 | 1.65 |
| Verbal Agression (CR=.92; AVE=.80; α=.93) | | | | | | |
| $VA_1$ | .90 | 19.63 | .05 | .82 | 5.00 | 1.71 |
| $VA_2$ | .91 | 19.10 | .05 | .84 | 4.86 | 1.58 |
| $VA_3$ | .87 | 19.63 | .05 | .76 | 4.56 | 1.67 |
| Anger (CR=.90; AVE=.76; α=.90) | | | | | | |
| $A_1$ | .76 | 23.59 | .04 | .59 | 4.51 | 1.55 |
| $A_2$ | .92 | 15.18 | .05 | .85 | 4.69 | 1.59 |
| $A_3$ | .92 | 23.59 | .04 | .85 | 4.62 | 1.73 |
| Hostilitiy (CR=.94; AVE=.85; α=.94) | | | | | | |
| $H_1$ | .91 | 22,92 | .04 | .84 | 4.62 | 1.85 |
| $H_2$ | .93 | 22.09 | .04 | .86 | 4.45 | 1.78 |
| $H_3$ | .90 | 22.92 | .04 | .82 | 4.22 | 1.86 |

***Discriminant Validity Test***

After confirming convergent validity of BAQ, discriminant validity tests were conducted. Initially, correlation coefficients between the factors of BAQ were examined to ensure the structural validity of the measurement tool and determine if it operates appropriately for its intended purpose. It was found that the correlations between the factors of BAQ were moderate (r=.81-.84, p<0.01). Previous studies suggest that correlation values not exceeding .85 (Brown, 2015) and .90 (John & Benet-Martinez, 2000) between factors indicate structural validity. Researchers commonly use the Average Variance Extracted (AVE) value as a robust method to assess structural discriminant validity (Fornell & Larcker, 1981; Franke & Sarstedt, 2019). In this method, the square root of AVE calculated for each construct should be greater than its correlations with other constructs. Additionally, another strong method for establishing discriminant validity involves calculating the Average Shared Variance (ASV) and Maximum Shared Variance (MSV). It is necessary for ASV<MSV and MSV<AVE (Hair et al., 2010). Upon reviewing Table 5, it was observed that the correlations between the sub-dimensions forming BAQ are each less than the square root of AVE for that sub-dimension. Furthermore, for all sub-dimensions, calculated ASV and MSV values indicate that ASV<MSV and MSV<AVE conditions are met. These findings provide strong evidence that BAQ ensures discriminant validity.

**Table 5.** Discriminant validity of the BAQ

| **Factor** | **MSV** | **ASV** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|---|---|
| **1.** Physical Agression | .70 | **.**68 | **(0.91)** | | | |
| **2.** Verbal Agression | .70 | **.**68 | 0.84** | **(0.89)** | | |
| **3.** Anger | .70 | .67 | 0.84** | 0.82** | **(0.87)** | |
| **4.** Hostilitiy | .67 | .66 | 0.81** | 0.82** | 0.81** | **(0.92)** |

**= p<0.01

***Reliability Testing Stage***

Following the validity assessment of BAQ, the structural reliability was evaluated. At this stage, the internal consistency coefficient (Cronbach's alpha) and the composite reliability (CR) of the factors were calculated sequentially (see Table 4). It was found that the alpha values calculated for all sub-dimensions ranged between .90 and .94. These values meet the accepted threshold of .70 for reliability (Taber, 2018). Finally, Composite Reliability (CR) was computed, which is a preferred method for assessing the reliability of measurement tools when there are multiple variables (see Table 4). The CR values for the sub-dimensions ranged between .90 and .94. Researchers generally consider CR values of .60 and above as

sufficientto ensure structural reliability of a measurement tool (Bagozzi & Yi, 1988). Based on these tests, BAQ is considered a valid and reliable measurement tool for assessing aggression.

## DISCUSSION

In this study, the *Aggression Questionnaire* developed by Buss and Perry (1992), It was aimed to adapt the *Brief Aggression Questionnaire* (BAQ), which was revised by Webster et al. (2014) for more efficient use, into Turkish (For more information, see: (Buss & Perry, 1992; Webster et al., 2014). The short form of the questionnaire consists of 12 items across four subscales: physical aggression, verbal aggression, anger, and hostility. Analyses confirmed that the questionnaire items loaded onto their respective subscales in a four-factor model, and these subscales were linked to a second-order aggression factor in a hierarchical model (see Table 3 and Figure 2). Furthermore, the questionnaire demonstrated construct validity and convergent-divergent validity (see Tables 4-5). In conclusion, it has been validated that BAQ is a reliable measurement tool for assessing physical aggression, verbal aggression, anger, hostility, and overall aggression in the Turkish context, thereby contributing to the field.

When examining the data structure of BAQ in the Turkish sample, it was observed that the goodness-of-fit indices of the questionnaire indicated a good fit with the collected data. The items belonging to the four subscales of the questionnaire explained variance at an excellent level ($R^2$>.70), demonstrating strong explanatory power (Field, 2009). The second-order aggression factor also showed good alignment with the data. Upon reviewing Table 3, it was found that the values comparing the four-factor model with the second-order single-factor model (hierarchical model) were very close. The $\Delta\chi^2$ value for model comparison was not significant, indicating no significant difference between the two models. These results suggest that both models are viable. To assess construct validity in the study, AVE and CR values were computed (see Table 4), indicating that these values support the construct validity of the questionnaire (Gürbüz, 2021). Another finding pertained to the convergent and discriminant validity of the questionnaire. Upon reviewing Table 5, MSV and ASV values confirmed that the questionnaire maintains both convergent and discriminant validity (Gürbüz, 2021).

Aggression typically manifests in forms such as physical (Eliot, 2021) and verbal (Kyranides et al., 2024), but can also appear in various forms like social aggression (Juliano et al., 2006). This behavior can have negative effects on individuals and groups (Dodge et al., 2008). Aggression is observed across various settings from early ages to adulthood, including educational environments (Uludag, 2013), workplaces (Mireille LeBlanc & Barling, 2004), and sports contexts (Lafuente et al., 2021), all of which can suffer from its detrimental effects. Accurately measuring this negative behavior and identifying its antecedents and outcomes are crucial for understanding human behavior and taking preventive measures against unexpected outcomes. Therefore, the BAQ serves as an important tool for adaptation in the Turkish context, enabling a deeper exploration of this topic.

BAQ, various empirical and adaptation studies have utilized the questionnaire (Monteiro et al., 2023; Pachi et al., 2021; Pachi et al., 2023; Penubarthi et al., 2023; Sijwali & Sharma, 2023). When compared with its previous forms and other aggression questionnaires, BAQ consistently yields similar results (Webster et al., 2014; Webster et al., 2015; Zimonyi et al., 2021). Furthermore, there are cultural and linguistic adaptation studies of the questionnaire. For instance, Pachi et al. (2021) adapted BAQ to Greek culture and language with a sample of 130 participants. Examination of the adapted questionnaire structure in Greek culture reveals a general Cronbach's Alpha value of .80, indicating high reliability, similar to findings in this study (Büyüköztürk, 2020). Moreover, fit indices suggest that the data fits very well, similar to the findings in this study. In another study, Monteiro et al. (2023) adapted the questionnaire to a Brazilian sample (393 participants). Model comparisons in the study showed that the fit indices of the one-factor model did not fall within the recommended values, unlike the findings in this study. However, the results of the four-factor model and second-order model were parallel to this study, showing good fit indices. These similarities indicate that the questionnaire accurately measures aggression in Turkish culture.

In our country, there are various studies to measure aggression. *The Buss-Perry Aggression Questionnaire*, adapted into Turkish by Önen (2009) and Demirtas-Madran (2012), has been

widely used in many studies (Güler & Özgörüş, 2021; Ulu & İkis, 2016). Additionally, various aggression questionnaires such as the *Children's Aggression questionnaire Parent Form* (Ercan et al., 2016), the *KAR-YA Aggression Questionnaire* for High School and University Students (Karataş & Yavuzer, 2016), and the *Club Aggression Questionnaire* (Kural & Elçi, 2023) are used. However, the BAQ, developed by Buss and Perry (1992) like the well-established BPAQ, evaluates aggression with fewer items, making it a shorter and more efficient form (Webster et al., 2014). Therefore, these characteristics distinguish the questionnaire from other measurement tools.

Aggression, reliably measured with a widely used tool like BAQ, can facilitate a better understanding of the antecedents and consequences of this behavior. The adaptation of this questionnaire allows distinguishing various forms of aggression (physical, verbal, anger, and hostility) in the Turkish sample, enabling a nuanced understanding of aggressive behaviors. As emphasized in previous studies (Dodge et al., 2008; Eliot, 2021; Kyranides et al., 2024), considering the negative effects of aggression on individuals and groups, having a culturally adapted tool like BAQ is highly valuable. BAQ facilitates the analysis of aggression, aiding in the development of targeted interventions and policies aimed at reducing these behaviors. Validating BAQ in the Turkish sample enriches the existing literature and provides a practical resource for addressing aggression in societal contexts.

**Limitations and Recommendations**

This study has several key limitations. One of these is its reliance on a limited age group, which may not fully reflect aggression behavior across all age groups in the Turkish population. Additionally, while the sample size was deemed sufficient for this study, a larger and more diverse sample could enhance the generalizability of the findings. Future research could consider including a wider age range and incorporating variables from different levels (such as socio-economic status, sports involvement, race, etc.) to examine the applicability of the questionnaire in different segments of the population. Furthermore, longitudinal studies could provide deeper insights into the changes in aggression over time and the long-term reliability of the BAQ. Particularly, investigating the underlying reasons for the emergence of aggressive behavior (e.g., socio-economic status, workplace environment, perception of bullying, domestic violence, peer relationships, etc.) could contribute to reducing and preventing such behavior.

**Conflict of Interest**

No potential conflict of interest has been declared regarding this article.

**Ethical Considerations**

This study was conducted with the approval of Kırıkkale University Social Sciences and Humanities Research Ethics Committee with the reference number (26.04.2024-No:06).

**Author Contributions**

Study Design: NGÇ; Data Collection: NGÇ; Statistical Analysis: BA, FY; Data Interpretation: BA, MC, FY; Manuscript preparation: NGÇ, BA, MC; Literature search: NGÇ, BA, MC. All authors have read and accepted the published version of the manuscript.

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RESEARCH ARTICLE

# Online Training Design: Improve Teachers Performance to Develop Inclusive Class Activity for Student with Disabilities

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**Abstract**

**Background and Aims:** Teachers play an important role in the success of class activities, especially physical activity that encourages student involvement in learning. Therefore, there is a need for systematic, effective, and efficient professional development. This study explores teachers' preferences for online training activities and the training materials they need. An online training platform with content on inclusive education was piloted. **Method:** The respondents involved were 45 teachers and principals from 14 elementary schools representing three sub-districts in Mojokerto City. Data was collected using a Likert scale questionnaire and analyzed quantitatively descriptively with Chi-Square. **Result:** The results of this study prove that teachers prefer asynchronous video explanations as online training activities, and teachers prefer synchronous video conferences less. Teachers need basic knowledge and inclusive classroom management skills. Meanwhile, teachers need intervention materials for students with disabilities in various ways. The Chi-Square test did not show any relationship (sign. P = 0,05) between online training experience and preferences for online learning activities. **Conclusion:** Thus, it can be concluded that there is no evidence of a relationship between experience in inclusive education training and preferences for inclusive education training materials. Therefore, it is recommended that local governments collaborate with competent universities to build accurate training designs.

**Keywords**
Inclusive Education, Professional Development, Online Learning, Learning and Teaching Materials

## INTRODUCTION

In recent years, the Indonesian education system has had more inclusive schools welcoming students with disabilities in both primary and secondary levels. By 2022, 37,502 such schools were supporting 130,500 students with disabilities. This figure excludes students in Islamic schools overseen by the Ministry of Religion and other inclusive schools, where another 144,782 students were receiving support. Altogether, this totals 275,282 students. However, this only covers around 40% of all school-aged children with disabilities. This reveals a considerable difference disabilities.

Teachers performance are a challenge in implementing effective class activities in inclusive schools. Research indicates that teachers generally view inclusive education positively, to some extent, which is influenced by their experience and training (Ediyanto et al., 2021; Junaidi et al., 2021). However, they face challenges in feeling confident and knowledgeable about using teaching methods such as differentiated and collaborative learning (Kurniawati, 2021). This aligns with global findings as highlighted in a 2018 OECD report, where educators across various countries expressed similar concerns, feeling unprepared to cater to diverse student needs and requesting a need for

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further training (Thomson & Hillman, 2019).

Ensuring effective inclusive education relies on creating a supportive learning atmosphere that meets the needs of all students. This requires teachers in regular schools to improve their teaching skills, addressing challenges such as understanding student with disability characteristics, using different teaching methods, and doing suitable assessments (Widajati et al., 2020; Wulandari & Hendriani, 2021). Research confirms these difficulties, with studies showing that teachers struggle with managing various learning styles and adapting teaching for specific disabilities (Damayanti et al., 2017; Mumpuniarti et al., 2020; Winarsih, 2013). Therefore, it's essential for teachers to undergo professional development focused on class activities of inclusive schools. This development should involve changing attitudes, expanding knowledge, and acquiring skills related to teaching diverse learners (Edwards et al., 2006). Important competencies include assessment, adapting teaching, managing classrooms, and collaborating (Khotimah & Reza, 2022; Krismanto et al., 2023; Majoko, 2019). Ideally, teachers should continuously enhance their professional skills through ongoing learning activities (Darling-Hammond et al., 2017; Postholm, 2012).

Various approaches exist for organizing professional development, including induction, mentoring, and in-service training (Nguyen et al., 2023). School-based models promise comprehensive and ongoing professional development tailored to the school's and its teachers' specific needs, potentially involving collaboration with teacher education institutions (Forlin & Sin, 2017; Juliana et al., 2021). The Indonesian Ministry of Education has implemented online training programs for teachers on inclusive education since 2020. These programs aim to equip teachers with skills in identifying students with special needs, conducting assessments, and developing individualized learning plans. While online training offers convenience and broad reach, its effectiveness remains limited by uneven accessibility, as demonstrated in Mojokerto, where only five elementary school teachers out of 378 have received the Ministry's training. This underscores the need for research to explore teachers' preferences and develop effective online training programs that cater to their diverse needs and learning styles (Dash et al., 2012; Koehler & Mishra, 2005; Lay et al., 2020; Rhode et al., 2017). Teachers' professional development policies at the basic education level are the authority of the district or city government. This is in line with the provisions in Law of the Republic of Indonesia Number 23 of 2014 concerning Regional Government. In connection with the policy of increasing teacher competency in implementing inclusive education, district or city governments, especially in East Java Province, face the challenge of unclear inclusive education management policies, especially concerning the readiness and availability of competent teachers in inclusive education (Junaidi, 2019). This research aims to improve inclusive education in Indonesia by exploring teachers' preferences regarding online training materials and activities. The findings will inform the development of a comprehensive professional development program for teachers in inclusive schools, potentially serving as a model for broader implementation across the country.

## MATERIALS AND METHODS

### *Participant*

The study involved 45 participants, including 14 school principals and 31 teachers from 14 elementary schools across three sub-districts in Mojokerto City. Of the participants, 36 were female and 9 were male (Table 1. Participants Demographic). The majority, 40 participants, had an undergraduate education background, while 5 held master's degrees.

### *Research Procedure*

Research Ethics Committee from Universitas Negeri Malang has certifiy the research procedur that involving teachers as participant with the number 15.10.7/UN32.14/PB/2024. The research was conducted through a structured survey, where participants were invited to complete a questionnaire aimed at assessing their preferences regarding training materials and online training activities specifically related to inclusive education. Initially, participants received a brief orientation on the purpose of the study and were informed about the topics covered in the questionnaire, which included online learning and inclusive education training content. The survey was distributed online to ensure accessibility and ease of completion. Participants were given two weeks to respond to the questionnaire, with reminders sent periodically to maximize response rates. Upon completion,

responses were collected and organized for statistical analysis.

***Data Collection***

Data was collected using a Likert scale questionnaire designed to assess teacher preferences for online training activities and specific training materials related to inclusive education. The questionnaire comprised 23 items, divided into three sections: 8 items focused on understanding inclusive education, 7 items assessed teaching skills specific to inclusive classrooms, and 8 items evaluated skills for teaching students with disabilities. The content of the material is coded based on aspect groups, Inclusive Education Knowledge A (A1-A8), Teaching Skills in Inclusive Class B (B1-B7), and Teaching Skill for Disability Student C (C1-C8). Additionally, the questionnaire included 6 items that explored participants' preferences for various aspects of online learning activities. This instrument has a value of 0.964 which can be interpreted as having good reliability (Table 2. Reliability Statistics). Subsequently, this instrument also underwent a validity test to ensure the alignment of each item with the aspects intended to be measured. The assessment indicated a sufficiently strong item-total correlation for the majority of the items, signifying that these items possess good validity in assessing preferences for various types of training materials. The correlation values range from 0.551 to 0.874. Most items exhibit an item-total correlation above 0.7, indicating that these items are highly associated with the overall construct being measured, which is the preference for training materials (Table 3. Validity Test).

***Statistical Analysis***

The data were analyzed using descriptive quantitative methods and inferential statistics. Descriptive statistics were employed to summarize and interpret the distribution of responses concerning teachers' preferences for online learning activities and inclusive education training materials. To examine potential relationships and dependencies, Chi-Square tests were conducted.These tests explored associations between several variables, including teachers' prior experiences with online courses, their interest in various online learning activities, their training backgrounds in inclusive education, and their preferences for specific training materials. The Chi-Square analysis provided insights into whether particular characteristics were related to preferences in training content and delivery methods. All statistical analyses were carried out using SPSS, with significance levels set to 0.05.

**Table 1.** Participants demographic

| Parameter | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 9 | 20% |
| Female | 36 | 80% |
| **Education Grade** | | |
| Undergraduate | 40 | 88,9% |
| Graduate | 5 | 11,1% |
| **Position/Role** | | |
| Teachers | 31 | 68,9% |
| Headmasters | 14 | 31,1% |
| **Trainig** | | |
| Trained (10-60 credit) | 17 | 37,8% |
| Untrained | 28 | 62,2% |
| **Employment Status** | | |
| Goverment Employees | 34 | 75,5% |
| Self Employees (Honorary) | 11 | 24,5% |

**Table 2.** Reliability statistics

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .964 | .969 | 23 |

**Table 3.** Validity test

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|
| Content_A1 | 77.89 | 96.965 | .734 | . | .962 |
| Content_A2 | 77.80 | 96.982 | .762 | . | .962 |
| Content_A3 | 77.78 | 97.222 | .678 | . | .963 |
| Content_A4 | 77.82 | 95.422 | .840 | . | .961 |
| Content_A5 | 77.76 | 96.462 | .848 | . | .962 |
| Content_A6 | 78.00 | 96.864 | .554 | . | .964 |
| Content_A7 | 77.78 | 97.949 | .668 | . | .963 |
| Content_A8 | 77.89 | 94.192 | .874 | . | .961 |
| Content_B1 | 77.84 | 96.998 | .742 | . | .962 |
| Content_B2 | 77.80 | 95.436 | .848 | . | .961 |
| Content_B3 | 77.78 | 96.086 | .793 | . | .962 |
| Content_B4 | 77.87 | 95.436 | .824 | . | .961 |
| Content_B5 | 77.93 | 95.109 | .735 | . | .962 |
| Content_B6 | 77.93 | 95.109 | .735 | . | .962 |
| Content_B7 | 77.78 | 96.859 | .788 | . | .962 |
| Content_C1 | 78.36 | 93.689 | .613 | . | .965 |
| Content_C2 | 78.33 | 94.227 | .551 | . | .966 |
| Content_C3 | 78.09 | 92.856 | .810 | . | .961 |
| Content_C4 | 77.82 | 96.331 | .749 | . | .962 |
| Content_C5 | 77.69 | 98.446 | .678 | . | .963 |
| Content_C6 | 78.16 | 92.907 | .722 | . | .963 |
| Content_C7 | 77.87 | 95.664 | .743 | . | .962 |
| Content_C8 | 77.82 | 95.013 | .814 | . | .961 |

Inclusive Education Knowledge A (A1-A8); Teaching Skills in Inclusive Class B (B1-B7); Teaching Skill for Disability Student C (C1-C8).

## RESULTS

All participants in the research have varying experiences in online courses, with different accumulations of instructional hours or learning courses. The majority, 86.6%, have engaged in online learning for 10 to 30 hours, while 13.4% have spent more than 30 hours. Table 4 displays six different online learning activities, along with the preferences expressed by respondents in percentages. Respondents were given four options to indicate their preferences: (1) not interested; (2) less interested; (3) interested; (4) very interested. 66.7% of respondents indicated a preference for reading text materials online, with 20% indicating they are very interested, and 13.3% indicating they are less interested. Viewing infographic online materials is preferred by 66.7%, with 31.1% of respondents indicating they are very interested. Listening to explanations from facilitators or speakers in video format asynchronously is highly preferred by respondents with a percentage of 55.6% and 44.4% indicating they are interested. Engaging in online discussions through chatting is favored by 55.6% of respondents, with 31.1% indicating they are very interested. Participating in synchronous learning activities through video conferencing is preferred by 57.8% of respondents, with 22.2% indicating they are very interested. Engaging in independent tasks such as project

assignments is favored by 73.3% of respondents, with 17.8% indicating they are very interested.

The six online learning activities, ranked in order of preference based on average percentage scores from most to least preferred by respondents, are as follows. First is watching explanatory videos from speakers or facilitators; Second, reading infographic materials; Third, engaging in online discussions or chatting through discussion forums; Fourth, working on tasks or projects independently; Fifth, reading text materials; Sixth, participating in synchronous video conferences. The Chi-Square test results regarding the correlation between experience in online learning participation and the variable of preferences for online learning activities across the six tested activities indicated no significant relationship. This means that teachers' experience in participating in online learning is not related to teachers' preferences for preferred online learning activities.

**Table 4.** Percentage of Preference for Online Learning Activities

| Online Learning Activity | Scale | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Text reading | 0 % | 13.3 % | 66.7 % | 20 % |
| Infography reading | 0 % | 2.2 % | 66.7 % | 31.1 % |
| Video presentation | 0 % | 0 % | 44,4 % | 55.6 % |
| Online discussion | 0 % | 13.3 % | 55.6 % | 31.1 % |
| Synchronous (web meeting) | 0 % | 20 % | 57.8 % | 22.2 % |
| Task | 0 % | 8.9 % | 73.3 % | 17.8 % |

The eight training materials presented in Table 5 on knowledge and understanding of inclusive education received preferences deemed highly needed by respondents ranging from 51.1% to 68.9%. These preferences were categorized into four groups: (1) not needed; (2) less needed; (3) needed; (4) highly needed. Respondents expressed a need for all eight materials related to knowledge and understanding of inclusive education, with percentages ranging from 28.9% to 44.5%. There is one material specifically about strategies for involving communities in the development of inclusive schools, which was deemed not needed by 2.2% of respondents. When ranked based on respondent preferences, the correct sequence is A5, A3, A7, A2, A4, A8, A1, and A6. Meanwhile, training materials on teaching skills in the classroom received assessments with over 55.6% of respondents expressing a high need for them. The sequence of materials based on respondent preferences is B3, B7, B2, B1, B4, B5, and B6.

Participating in synchronous learning activities through video conferencing is preferred by 57.8% of respondents, with 22.2% indicating they are very interested. Engaging in independent tasks such as project assignments is favored by 73.3% of respondents, with 17.8% indicating they are very interested.

The six online learning activities, ranked in order of preference based on average percentage scores from most to least preferred by respondents, are as follows. First is watching explanatory videos from speakers or facilitators; Second, reading infographic materials; Third, engaging in online discussions or chatting through discussion forums; Fourth, working on tasks or projects independently; Fifth, reading text materials; Sixth, participating in synchronous video conferences. The Chi-Square test results regarding the correlation between experience in online learning participation and the variable of preferences for online learning activities across the six tested activities indicated no significant relationship. This means that teachers' experience in participating in online learning is not related to teachers' preferences for preferred online learning activities.

The eight training materials presented in Table 2 on knowledge and understanding of inclusive education received preferences deemed highly needed by respondents ranging from 51.1% to 68.9%. These preferences were categorized into four groups: (1) not needed; (2) less needed; (3) needed; (4) highly needed. Respondents expressed a need for all eight materials related to knowledge and understanding of inclusive education, with percentages ranging from 28.9% to 44.5%. There is

one material specifically about strategies for involving communities in the development of inclusive schools, which was deemed not needed by 2.2% of respondents. When ranked based on respondent preferences, the correct sequence is A5, A3, A7, A2, A4, A8, A1, and A6. Meanwhile, training materials on teaching skills in the classroom received assessments with over 55.6% of respondents expressing a high need for them. The sequence of materials based on respondent preferences is B3, B7, B2, B1, B4, B5, and B6.

The distribution of respondent preference percentages regarding training materials related to teaching skills for students with disabilities is as follows. Five training material items received the highest rate of "highly needed" preferences: C5 75.5%; C8 66.7%; C4 64.5%; C762.3%; and C3 46.7%. The material on intervention for teaching children with Autism received equal preferences between "highly needed" and "needed" by respondents, at 44.5%. Two other materials received the highest percentage of "needed" preferences, precisely 42.2% for material on intervention for teaching children with visual impairments and intervention for teaching children with hearing impairments. Chi-square tests were conducted to determine the relationship between the variable of training experience in inclusive education and training material preferences and between the variable of respondent position, as teachers or school principals, and training material preferences. There are two categories of training experience: those who have not undergone training in inclusive education and those who have undergone training in inclusive education. A total of 28 respondents or 62.2% stated they had never participated in inclusive education training, while 17 respondents or 38% stated they had been involved in training in inclusive education.

This analysis proves that the eight materials on knowledge and understanding of inclusive education have a significance value of less than 0.005. This suggests that teachers' experience in attending inclusive education training influences their preferences for training materials. Teachers who have participated in inclusive education training determine the eight materials on knowledge and understanding of inclusive education as highly needed. The difference in respondents' positions as teachers and school principals is not related to their preferences for the eight materials on knowledge and understanding of inclusive education. Although respondents in the position of school principals tend to rate the materials on knowledge and understanding of inclusive education as highly needed, the Chi-Square results do not prove that there is a relationship between respondents' positions as school principals and teachers and their preferences for materials on knowledge and understanding of inclusive education. Similarly, the position of respondents as teachers and school principals does not affect their preferences for training materials on teaching skills in inclusive classrooms.

Testing between the variable of respondents' training experience and their preferences for instructional materials on teaching skills in inclusive classrooms indicates that four instructional materials have significance values lower than 0.05. This implies that the preferences of respondents for these four materials are shaped by their training background. This result suggests that respondents with training exposure in inclusive education favor these four materials related to teaching skills in inclusive classrooms.

Referring to Table 2, it is evident that respondents' training experience influences their preferences for materials on intervention for slow learners and specific learning difficulties. Both of these materials have significance values below 0.05. However, respondents' preferences for other materials are not significantly influenced by their training experience. Specifically, 94.1% of respondents with training experience express a high need for materials on intervention for slow learners, while 64.3% of respondents without training experience also express a high need for this material. Similarly, for materials on intervention for students with specific learning difficulties (such as dyslexia, dyscalculia, and dysgraphia), 88.2% of respondents with training experience express a high need for these materials, compared to 46.4% of respondents without training experience. The Chi-Square test on the relationship between respondents' roles as teachers or school principals and their preferences for materials on teaching skills in inclusive classrooms and teaching skills for students with disabilities did not show significant results. However, school principals tend to rate these materials as highly needed.

**Table 5.** Material Preferences and Chi Square Test

| Materials | Preference Scores (%) | | | | Chi Square | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | Value | Asym. Sig. |
| Inclusive Education Concept, Philosophy, Legal Standing (A1) | 0 | 0 | 44.4 | 55.6 | 16.454[a] | .000* |
| Inclusive education benefits, theory and research results (A2) | 0 | 0 | 35.6 | 64.4 | 10.499[a] | .001* |
| School's Inclusive environment strategy (A3) | 0 | 2.2 | 28.9 | 68.9 | 8.137[a] | .017* |
| Inclusive Policy Development strategy (A4) | 0 | 2.2 | 33.3 | 64.5 | 10.517[a] | .005* |
| Educational practice strategy (A5) | 0 | 0 | 31.1 | 68.9 | 12.339[a] | .000* |
| Public engagement strategy (A6) | 2.2 | 2.2 | 44.5 | 51.1 | 14.037[a] | .003* |
| Support system and networking stategy (A7) | 0 | 0 | 33.3 | 66.7 | 13.661[a] | .000* |
| Instructional design development (A8) | 0 | 4.5 | 35.6 | 60 | 9.194[a] | .010* |
| Recognizing the diversity and learning needs of students with disabilities (B1) | 0 | 0 | 40 | 60 | 5.688[a] | .017* |
| Developing academic assessment instruments for children with special needs (B2) | 0 | 2.2 | 31.1 | 66.7 | 9.285[a] | .010* |
| Developing Individual Educational Program (IEP) (B3) | 0 | 2.2 | 28.9 | 68.9 | 2.521[a] | .283 |
| Developing Adaptive Learning Plan in an inclusive class (B4) | 0 | 2.2 | 37.8 | 60 | 1.624[a] | .444 |
| Developing Compensatories Programs for students with disabilities (B5) | 0 | 2.2 | 42.2 | 55.6 | 8.047[a] | .018* |
| Developing Learning Media for students with disabilities (B6) | 0 | 2.2 | 42.2 | 55.6 | 8.047[a] | .018* |
| Developing Developmental Assessment Instrument (B7) | 0 | 0 | 33.3 | 66.7 | 5.720[a] | .017* |
| The Intervention for student with visual impairement (C1) | 4.4 | 17.8 | 42.2 | 35.6 | 3.605[a] | .307 |
| The Intervention for deaf student (C2) | 6.7 | 13.3 | 42.2 | 37.8 | 5.039[a] | .169 |
| The Intervention for student with motoric disabilities (C3) | 2.2 | 6.6 | 44.5 | 46.7 | 2.701[a] | .440 |
| The Intervention for student with intelectual disability (C4) | 0 | 2.2 | 33.3 | 64.5 | 3.984[a] | .136 |
| The Intervention for student with slow learner (C5) | 0 | 0 | 24.5 | 75.5 | 5.097[a] | .024* |
| The Intervention for student with autism (C6) | 4.4 | 6.6 | 44.5 | 44.5 | 4.372[a] | .224 |
| The Intervention for student with specifict learning disabilities (C7) | 0 | 4.4 | 33.3 | 62.3 | 7.999[a] | .018* |
| The Intervention for student with ADHD (C8) | 0 | 4.4 | 28.9 | 66.7 | 3.418[a] | .181 |

*Inclusive Education Knowledge A (A1-A8); Teaching Skills in Inclusive Class B (B1-B7); Teaching Skill for Disability Student C (C1-C8).*

## DISCUSSION

Referring to the findings of this research, the most preferred online training activities are watching explanatory videos from speakers or facilitators, reading infographic materials, engaging in online discussions or chatting through discussion forums, working on tasks or projects independently, reading text materials, and participating in synchronous video conferences. It is acknowledged that there is a scarcity of studies focusing on the quality of online teacher professional development (Meyer et al., 2023; Irvan et al., 2021). Teachers' preferences for these online training activities could provide a reference in the development of learning platforms for teacher competency development. The most favored activity among teachers is watching videos for explanations of materials by speakers, which correlates with the nature of online learning. In this context, participants have the flexibility to access materials at their convenience, replay them as needed, and choose their preferred learning environment (Degeng et al., 2023; Parsons et al., 2019).

Based on the findings of the previous studies, the variety of material formats significantly influences students' motivation to access each content. This includes various forms of materials such as videos, texts, audio, graphics, and animations (Rosli et al., 2021; Setyosari et al., 2022). The availability of these types of materials allows users to choose the type of information according to their needs. However, the situation changes if users encounter limitations in accessing all available content. Users with proficient computational skills demonstrate enhanced navigation abilities, thus benefiting from this learning design (Shahlan et al., 2021).

The results of this research align with previous studies regarding the effectiveness of online teacher training. Via online training, educators could engage in reflective practices to

gain insights from their teaching experiences (Nugraha et al., 2022; Rienties et al., 2013; Irvan et al 2021., & Jauhari, 2018). Additionally, online learning enables teachers to engage in discussions with communities or peers to discover and acquire new knowledge (Rodesiler, 2017; Yang, 2024). Online learning activities make it easier for teachers to organize their learning process according to their needs (Wynants & Dennis, 2018).

The next finding discusses respondents' preferences toward training materials. Respondents were presented with three sets of training materials: specifically training resources related to knowledge and understanding of inclusive education, training materials on teaching skills in an inclusive classroom, and training materials on teaching skills for students with disabilities. Each group consists of seven to eight specific items of materials. Based on the findings, respondents' training experiences were influencing their preference toward training materials on inclusive education (Prasetyo et al., 2021; Rasmitadila et al., 2023), especially in the groups of materials concerning knowledge and understanding of inclusive education and teaching skills in inclusive classrooms. This indicates that educators who have received training exhibit higher preferences and indicate a strong need for both sets of materials. The category of training materials on teaching skills for students with disabilities showed a strong preference, specifically for slow learners and students with specific learning difficulties. This correlation could be linked to the notable prevalence of slow learners and specific learning disorder observed within elementary school (Mumpuniarti et al., 2020).

Overall, there is a need to enhance the knowledge and skills of teachers working in inclusive schools using more relevant strategies to effectively support students (Prasetyo et al., 2021; Rasmitadila, R et al., 2023) This, of course, relies on the characteristics of the human resources in the area (Boyle et al., 2020; Wilson et al., 2020; Wilson et al., 2018; Irvan et al., 2023). The research findings shed light on the necessity of improving teacher competencies in providing inclusive education at elementary levels. As a result, there is a necessity for policies aimed at enhancing teacher competencies in elementary schools, which should be both practical and strategic, considering teachers' needs and the feasibility of program implementation. These findings could serve as a foundation for local governments' policymaking in implementing online teacher competency training programs.

## Conclusion

The research findings conclude that teachers show a preference for asynchronous learning, particularly through watching explanatory videos from speakers, while synchronous video conferencing is less favored. Teachers highly need training materials on basic knowledge and management skills for inclusive class activities. Based on the training experience undergone by the teachers, they need knowledge regarding various interventions in supporting students with disabilities. The Chi-Square test did not show a significant relationship between online training experience and preferences for online learning activities. Similarly, there was no evidence of a relationship between respondents' positions as teachers or school principals and their preferences for training materials. According to the Chi-Square test between training experience in inclusive education and preferences for training materials, there is a correlation for materials on knowledge and understanding of inclusive education, most materials on skills for conducting learning in inclusive classrooms, and only on two items of material on interventions for slow learners and specific learning difficulties. The follow-up plan for this training involves establishing a collaborative partnership with the Mojokerto City Government to enhance teachers' proficiency in inclusive education.

### *Ethical considerations*

Ethical Considerations This study was conducted with the approval of Research Ethics Committee Universitas Negeri Malang with the reference number 15.10.7/UN32.14/PB/2024.

### *Conflict of Interest*

The authors declare no conflict of interest.

### *Author Contributions*

Conceptualization, A.R.J., M.I. and P.S.; methodology, I.N.S.D.; software, M.D.K.D.; Formal analysis, P.S. and M.D.K.D.; Writing original draft preparation, A.R.J. and M.I.; Writing review and editing, I.N.S.D, M.I and MNJ. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

# Investigation of General Preparation Period in Turkish Elite Triathletes

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**Abstract**
Triathlon is an endurance-based sport, and performance success is strongly impacted by the training done throughout the general preparation phase. The aim of this study was to examine the duration, frequency, and volume of the general preparation phase training block in elite male triathletes. The 5-week training loads of 11 elite male triathletes (Height:179 cm ∓2.82, Weight: 76 ∓10.77 kg) in the general training period were examined. The weekly averages of endurance-based long-distance swimming training sessions were found to be (1.9 sessions, 204.5 minutes, and 5.4 kilometers), the weekly averages of endurance-based long-distance biking training sessions were found to be (1.5 sessions, 316.4 minutes, and 160 kilometers), the weekly averages of endurance-based long-distance running training sessions were found to be (1.5 sessions, 89.1 minutes, and 44.8 kilometers). These training sessions were identified as the most commonly performed exercises by coaches during the general preparation phase. The training sessions that are most frequently performed are followed by sprint swimming workouts in terms of duration and sprint biking workouts in terms of volume. When disciplines analyzed the durations of weekly training sessions, it was found that swimming accounted for approximately 360 minutes (Long: 204.5 minutes, Sprint: 128.2 minutes, Other: 27.27 minutes), biking accounted for approximately 460 minutes (Long: 316.4 minutes, Hill: 125.5 minutes, Sprint: 19 minutes), and running accounted for approximately 310 minutes (Long: 89.1 minutes, Hill: 62.1 minutes, Sprint: 61.3 minutes, Other: 98.1 minutes).

**Keywords**
Triathlon, Performance, Training, Periodization

## INTRODUCTION

Triathlon is a type of endurance sport that includes three consecutive non-interval sports; swimming, biking and running over various durations and formats (Ambrosini et al., 2022; Bentley et al., 2002). The research data generally agree that running economy, anaerobic threshold, and maximum oxygen uptake are the primary physiological factors that affect performance in this type of mainly aerobic sporting event (Millet et al., 2011; Puccinelli et al., 2020).

Amateur triathletes train for roughly 13 hours per week (Esteve-Lanao et al., 2017), whereas elite triathletes typically train for over 20 hours per week (Vleck et al., 2014). The general preparation period (GPP) is an essential part of the training cycle for elite athletes. Typically, the GPP focuses on strengthening the athlete's aerobic base, enhancing general fitness, and correcting any deficiencies or imbalances in their physical profile. During the GPP, triathletes aim to enhance their aerobic capacity, muscular endurance, strength, and overall physical conditioning to optimize performance in all three disciplines of the sport.

Elite triathletes follow rigorous training strategies based on their specific needs and goals. These strategies include a combination of endurance, strength and speed training in swimming, biking and running disciplines. To maximize their performance, triathletes prioritize

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consistent and progressive training that develops their aerobic and anaerobic capacity while minimizing the risk of injury. They also focus on nutrition and recovery to ensure optimal physical and mental health. Finally, triathletes also use strategies to develop mental toughness and maintain focus during long and challenging races. Overall, elite triathlete training strategies require a high level of dedication, discipline and endurance to achieve success in one of the most demanding endurance sports (Erdoğan, 2022).

This study aimed to investigate the general preparation period training block in triathlon athletes in terms of duration, frequency and volume. We hypothesized that triathletes have more volume on biking and running and more training frequency on swimming.

## MATERIALS AND METHODS

### *Participants*

Data (training parameters) from the 11 elite triathletes (Age: 23.4∓1.3, Height:179 cm∓2.82, Weight:76∓10.77kg, BMI: 23.7∓2.6) were recorded weekly. All triathletes were selected from the top 5 ranked athletes in the Turkish Championships. Ethical approval for the study was obtained from the University's ethics committee (approval number: E-34183927-000-00000903391). Participants provided informed consent and the research strictly adhered to the ethical principles of the Declaration of Helsinki.

### *Research Model*

In this study, we used quantitative research models to investigate elite triathletes' training parameters (duration, distance, frequency). In the general preparation phase, data was collected (interviews) from the triathlete coaches and recorded weekly as training duration (minutes), frequency (AU) and distance (km). Quantitative data were presented in tables and figures.

### *Data Collection Techniques*

The training records of 11 elite male triathletes in the Turkish Triathlon Federation classification were followed for 5 weeks. The coaches sent these data using the athletes' wearable watch devices. Athletes worked with different coaches in different places. To ensure homogeneity, we sent the coaches the same type of chart to keep records and asked them to collect these records at the end of the training. The training strategies were tried to be revealed by classifying the training performed in this training block, which is considered a general preparation phase and extremely important for triathletes. Except for the younger generation, triathletes are trained by the same trainers. However, a triathlon coach should be as knowledgeable as a middle-distance athletics coach, middle-distance swimming coach and road cycling coach. For this purpose, coaches follow the coach education programs of three different federations. Since triathlon is a developing sport in our country, the fact that there are not many licensed athletes in the elite category limits the study. The training sessions will be recorded firstly in terms of the number of training sessions, secondly in duration and finally, distance covered. Triathletes make use of athlete wearable technologies to track their training. These wearable technologies record training time and training distances. Coaches used this data to answer our questions. Although the wearable technologies differ in brand and model, this did not affect our study of time and distance information.

### *Statistical Analysis*

All data were presented as mean and standard deviation with 95% Confidence interval. Analysis of data was performed using the GraphPad Prism 9 software.

## RESULTS

Our results revealed that triathletes focus on all three events similarly in training frequency in the general preparation phase but slightly higher training frequency for swimming with an average of 1.9 sessions (Table 1, Figure 1).

In terms of duration, triathletes have long swimming, long biking and long running with an average duration of 204 minutes, 316 minutes and 89 minutes respectively. Triathletes have more training duration for biking and swimming (Table 2, Figure 2).

**Table 1.** Weekly training frequency in the general preparation phase

| Exercise | Frequency (AU) | | | |
|---|---|---|---|---|
| | Long | Sprint | Other | |
| **Swim** | 1.9±0.7 (1.4-2.3) | 1.5±0.5 (1.1-1.8) | 1±0.9 (0.4-1.7) | |
| | Long | Hill | Sprint | |
| **Bike** | 1.5±0.5 (1.1-1.8) | 1±0 (1-1) | 0.4±0.5 (0.1-0.8) | |
| | Long | Hill | Sprint | Other (i.e. easy jogging) |
| **Run** | 1.5±0.5 (1.1-1.8) | 0.6±0.5 (0.2-0.9) | 1±0 (1-1) | 0.8±0.4 (0.5-1) |

Data are presented mean and sd with 95% Confidence Interval; AU: Arbitrary Units

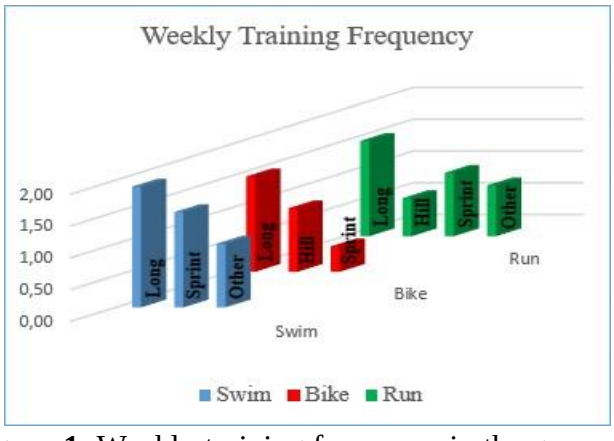


**Figure 1.** Weekly training frequency in the general preparation phase

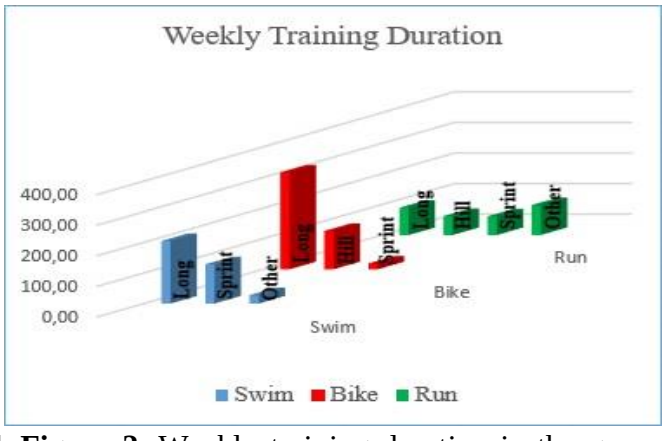


**Figure 2.** Weekly training duration in the general preparation phase

**Table 2.** Weekly training duration in the general preparation phase

| Exercise | Duration (minutes) | | | |
|---|---|---|---|---|
| | Long | Sprint | Other | |
| **Swim** | 204.5±111 (130-279.1) | 128.2±67.2 (83-173.2) | 27.27±31.3 (6.2-48.3) | |
| | Long | Hill | Sprint | |
| **Bike** | 316.4±100.7 (248.7-384) | 125.5±49.8 (91.9-159) | 19±24.2 (2.7-35.4) | |
| | Long | Hill | Sprint | Other (i.e. easy jogging) |
| **Run** | 89.09±75.03 (38.6-139.5) | 62.1±90.6 (1.2-123.1) | 61.3±32.9 (39.2-83.5) | 98.1±41.9 (70-126.3) |

As for the training distance covered, the same trend was observed. Triathletes have an average distance covered (km) for long swimming long biking and long running with 5.4 km, 160 km and 44.8 km respectively (Table 3, Figure 3).

**Table 3.** Weekly training distance covered in the general preparation phase

| Exercise | Distance (km) | | | |
|---|---|---|---|---|
| | Long | Sprint | Other | |
| **Swim** | 5.4±3.9 (2.8-8) | 2.7±2.4 (1.05-4.4) | 1±1.3 (0.09-1.9) | |
| | Long | Hill | Sprint | |
| **Bike** | 160±63.87 (117.1-202.9) | 42.3±28.3 (23.3-61.3) | 11.3±15.6 (0.83-21.8) | |
| | Long | Hill | Sprint | Other (i.e. easy jogging) |
| **Run** | 44.8±14.6 (34.9-54.6) | 5.1±5 (1.7-8.4) | 7.5±2.5 (5.7-9.1) | 5.5±3.8 (2.9-8.1) |

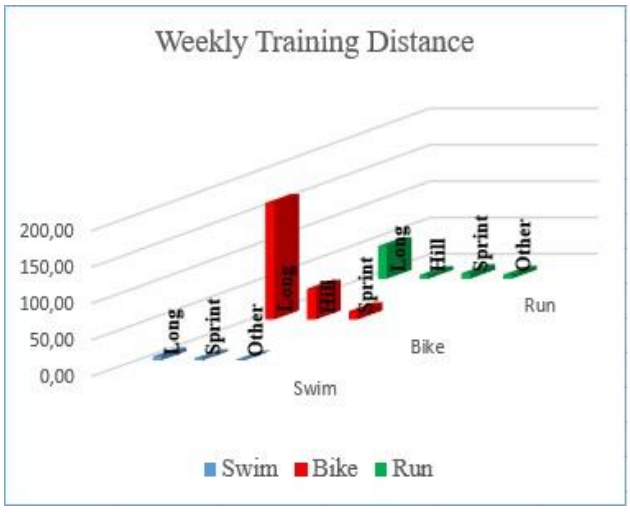


**Figure 3.** Weekly training distances in the general preparation phase

## DISCUSSION

The purpose of this study was to investigate the training parameters among Turkish elite triathletes in the general preparation phase. The results of this study showed that in terms of distance (km) triathletes cover more distance in biking whereas less distance in swimming. Secondly, in terms of duration, they have more training duration in biking and swimming. Furthermore, they have more training sessions in swimming. Our findings show that the weekly training load is mostly oriented towards long-distance endurance sessions, with the highest training volumes observed in biking (316.4 minutes, 160 km) and swimming (204.5 minutes, 5.4 km). In addition to endurance sessions, triathletes have included training such as sprint swimming, hill biking and sprint running workouts.

Similar to our research, the authors examined the training habits and injury occurrences among British triathletes during the competitive season of 1990. Participants reported an average weekly training distance of 100.2 km for cycling, 23.4 km for running and 4.2 km for swimming with an average training time of 7 hours per week across 7.9 sessions. We may conclude that triathletes perform more volume in cycling training sessions and less volume is performed in swimming sessions (Korkia et. al., 1994).

Triathlon is an endurance sport and includes swimming, biking, and running events. Performing these three branches on top of each other requires the use of different energy sources and meticulous planning of training for performance. When planning training, different periodization strategies are used to achieve the desired performance in competitions. The distribution between intensity and volume in macrocycles and mesocycles occurs in different training structures (Arroyo 2013; Uusitalo 1998). These training periodization models are traditionally based on high-volume and low-intensity training in the first phase of macrocycles, followed by a gradual increase in training intensity and a decrease in training volume (Bompa, Matveev 1981).

Triathletes' competition season usually starts in the spring and lasts until the end of summer. Before the competition season, triathletes have a preparation period, often referred to as the general preparation period, which is an important period for triathletes to prepare for the competition season. During this period, triathletes need to direct their training program and lifestyle in the right way to help them perform better on their race rides. This period is often called general preparation by coaches and physiologists worldwide and in various sports (Friel, 2013).

During the general preparation period, triathletes also strive to maintain a healthy lifestyle, including proper nutrition, sleep and rest, as well as sticking to their training program. This helps them to perform their race tasks at their best. The purpose of this period is for triathletes to train to improve their overall fitness, develop their strength and prepare for the racing season. This period usually covers 12-16 weeks before the end of winter and the start of the racing season. Training volume has a special place in training planning for triathletes. The distance to be covered by the triathlete, the number of training sessions and the duration of the training must be included in the training plan (Erdoğan, 2022).

In terms of specific training methods, endurance athletes in the general preparation phase should focus on building a base level of aerobic conditioning through low to moderate-intensity endurance training. This can include activities such as long-slow distance (LSD) running, biking and swimming which is considered an endurance sport, like other endurance sports, has a “dose-response” relationship in its training. Stimuli during training periods are related to the intensity, frequency and volume of training (Borresen & Lambert, 2009).

The general preparation period consists mainly of training in Zones 1 and 2. A study in Elite and Subelite triathletes showed that decreasing the

duration of training in Zone 1 (71%) and increasing the total duration of training in Zone 2 (21%) and Zone 3 (8%) caused a decrease in performance (Esteve-Lanao et al., 2005; Esteve-Lanao et al. 2007). In many descriptive studies, it has been reported that endurance athletes at the international and national level perform 10-13 units of training per week. Of these workouts, 80% of these workouts are known as low intensity and consist of workouts below 2 mmol/L lactate level (Seiler, 2010).

High-intensity planned training volume can increase injury and illness rates, but recent advances in this area can minimize this risk while maximizing performance. Strength training should be increased gradually, especially in biking. This is a common feature not only of the general preparation training period but of all periods. In February-May, when the competition date is approaching, strength training is more focused on full-exertion explosive efforts (Wallmann 2001).

There were several limitations to this study. The sample was drawn from Turkish national triathletes therefore the sample size is small and the results may not be generalized to the other nations' triathletes. Future studies should collect data with a large sample size and also for long-term training programs. Moreover, it would be beneficial to collect data on the injury patterns of triathletes so that coaches can be informed about the injury cases among triathletes.

In the general preparation period, it was determined that triathletes performed more long-distance swimming, long-distance biking, and long-distance running training in terms of the number of weekly training sessions and distance, as well as the time allocated, compared to other training sessions. In this period, elements such as the number of weekly training sessions, distance, and training duration, which are presented as training markers, should be well planned by coaches. However, endurance sports, such as triathlon, require more than just training time, number or mileage. With the combination of the markers mentioned in the study and the athlete's physical, social and mental state, the coach should manage the training of the general preparation period. We believe that the awareness of coaches will be increased with this stduy. The results of the study will verbally explained to the coaches in various workshops and they will be informed about training volume and intensity.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

## Author Contributions

Study Design: O.K., M.E., N.P., N.E.A. Data Collection: M.E., N.P. Statistical Analysis: O.K., N.P., Data Interpretation: O.K., M.E., N.P., N.E.A., Manuscript Preparation: O.K., M.E., N.P., N.E.A., Literature Search: O.K., M.E., N.P., N.E.A. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

# Confidence: What is the Condition of Indonesian Elite Athletes with Disabilities?

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**Abstract**
Sport is increasingly used as a tool to develop life skills, social abilities, and moral principles in addition to health, physical fitness, and achievement. The purpose of this study is to determine the level of self-confidence of elite Indonesian blind athletes who have practiced sports for a long time and produced results. In this study, a quantitative-descriptive methodology was selected. With the aim of including elite athletes with disabilities in Indonesia (both national and international), 47 athletes with disabilities were selected as research samples through a purposive sampling approach. The research instrument was a self-confidence questionnaire with a validity test of 0.93 and a reliability of 0.90 for athletes with disabilities. Elite athletes with disabilities in Indonesia have a confidence level of 82.98% in the very high category, 8.51% in the high category, 6.38% in the medium category, 2.13% in the low category, and no very low category. Furthermore, an average score of 91.60 was obtained, indicating that, overall, Indonesian elite athletes with disabilities have high self-confidence character in the areas of creative thinking, interpersonal motivation, self-confidence, optimism, responsibility, and rationality. There is a contribution of sports training in building the character of elite athletes with disabilities in Indonesia. The contribution of sports training to the self-confidence of athletes with disabilities is 64% within one year.

**Keywords**
Athletes With Disabilities, Sports Training, Elite Athletes, Self-Confidence

## INTRODUCTION

Sports training has been identified as a promising approach to enhancing student learning, especially in character development. According to Siedentop, the sport education model aims to enable students to learn and develop physical skills and various individual and social values such as team work, mutual respect, responsibility, and leadership (Barrot et al., 2021). Sports education is an innovative approach to teaching physical education that potentially improves student learning outcomes and character development. By giving students the opportunity to develop personal and social values through sports experience, model sports education can help drive holistic student development.

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Basic activities in the training of athletes that have an important role to play in the development of the character of the athlete include training systems and training programs. In relation to training activities, the training system is a formal process. Training is the activity or method of applying a program for athletes to build themselves by optimizing their knowledge, attitudes, physical condition, abilities, skills, talents, emotional control, and personality (Hadi, 2007). The impact of coaches' ethical leadership behaviour on athletes' voice and performance: The role of accountability. Sport, Business and Management (White & Rezania, 2019). The athlete will be motivated to strengthen both his body and mind when the coach compliments him on his actions (Hadi, 2011). The coaches see themselves as responsible for facilitating eight interrelated and interdependent themes of youth development literature, such as competence, self-confidence, connections, character, lifespan, climate, positive influence, and positive psychological capacity (Vella et al. 2013). Adolescent sports programs can be used to encourage positive development and build character (Hansen et al. 2003).

Character development through sports training is possible. Character is a moral construct made up of various traits (Weinberg & Gould, 2015). There are a few reasons to do research on the contribution of sports training to building the character of disabled athletes. First, the disabled are the largest minority group in the world (Friedman et al., 2006). According to (WHO, 2023), 16% of the world's population, or 1.3 billion individuals, are thought to be significantly disabled today. In the United States, there are 54 million people with disabilities (Legg et al., 2022), Indonesia, there are 22.97 million people with disabilities, or about 8.5% of the country's total population (KEMENKO PMK, 2023). Research on disability involvement in sports and physical activity is seen as a national priority in the U.S. (Ross et al., 2016). Second, it has often been argued that sports improve the quality of character (that is, self-esteem). The benefits of exercise for disability through some models suggest that most of the psychological development expressed in the disability empowerment model is positively influenced by physical activity if properly applied (Hutzler et al., 2007).

The research focuses on various issues related to the self-confidence of elite disabled athletes in Indonesia. A number of quantitative and qualitative studies have been carried out by experts to find out the picture of the self-confidence character of athletes in general based on the theories developed by experts. Nevertheless, research related to the image of confidence of disabled athletes in particular in Indonesia is still limited and lacks the attention of researchers and stakeholders.

## MATERIALS AND METHODS

In this study, a quantitative-descriptive methodology was selected. Providing an image and exposure of a topic, such as a circumstance, condition, occurrence, or otherwise, is the aim of descriptive study. Although the quantified method is designed to test pre-established hypotheses based on positivism and is applied in sample or population research, both the data collection process using research instruments and tools and the data analysis process are statistically quantitative (Fraenkel et al. 2012). In terms of design, the study employs two approaches: correlation testing and a one-shot case study.

### *Participants and Procedure*

Up to 47 elite impaired athletes from Indonesia who competed at the national and international levels made up the participating samples. To generate the necessary data, participant determination procedures are gained by purposive sampling techniques, which are predicated on information previously acquired regarding the description of demographic characteristics that meet the criteria (Fraenkel et al. 2012). Participants are elite disabled athletes at the national and international levels. Participants are given information about their consent to the voluntary completion of the forms, including research details, risks, benefits, confidentiality, and participant rights. The research follows the ethical principles of the Helsinki Declaration, giving priority to the rights and well-being of the participants. This study followed ethical standards and received approval from the STKIP Purwakarta College, West Java, Indonesia, with reference number 106/KM.01/STKIP-PWK/V/2024.

### *Data Collection Tools*

To gather research data for this study, we employed a lift or questionnaire. The research participants (disabled athletes) are provided with the lift/quesioner to collect data across the entirety of Indonesia. While the tuna driver fills out the

Google Form using PCs and Android smartphones, study participants fill out the lift questionnaire directly for the guided net tuna athlete. The data from the questionnaire is gathered, transcribed, examined, and evaluated.

***Instrumen***

The research instrument is a questionnaire on the implementation of sports exercises and a questionnaire on the self-confidence of disabled athletes that has been tested with a validity of 0.93 and a reliability of 0.90.

***Statistical Analysis***

The analysis of questioner data is done in a quantitative descriptive fashion. First, a homogeneity test and a normality test were used to assess the data. In descriptive statistics, studies of mean, median, mode, deviation standard, and percentage data are employed (Fraenkel et al. 2012). Data processing and analysis can be displayed in the form of histograms, diagrams, tables, and images to represent the data that has been processed. In this study, the categorization in scores and total scores used is a five-point categorization that refers to the norm of categorization (Azwar, 2018).

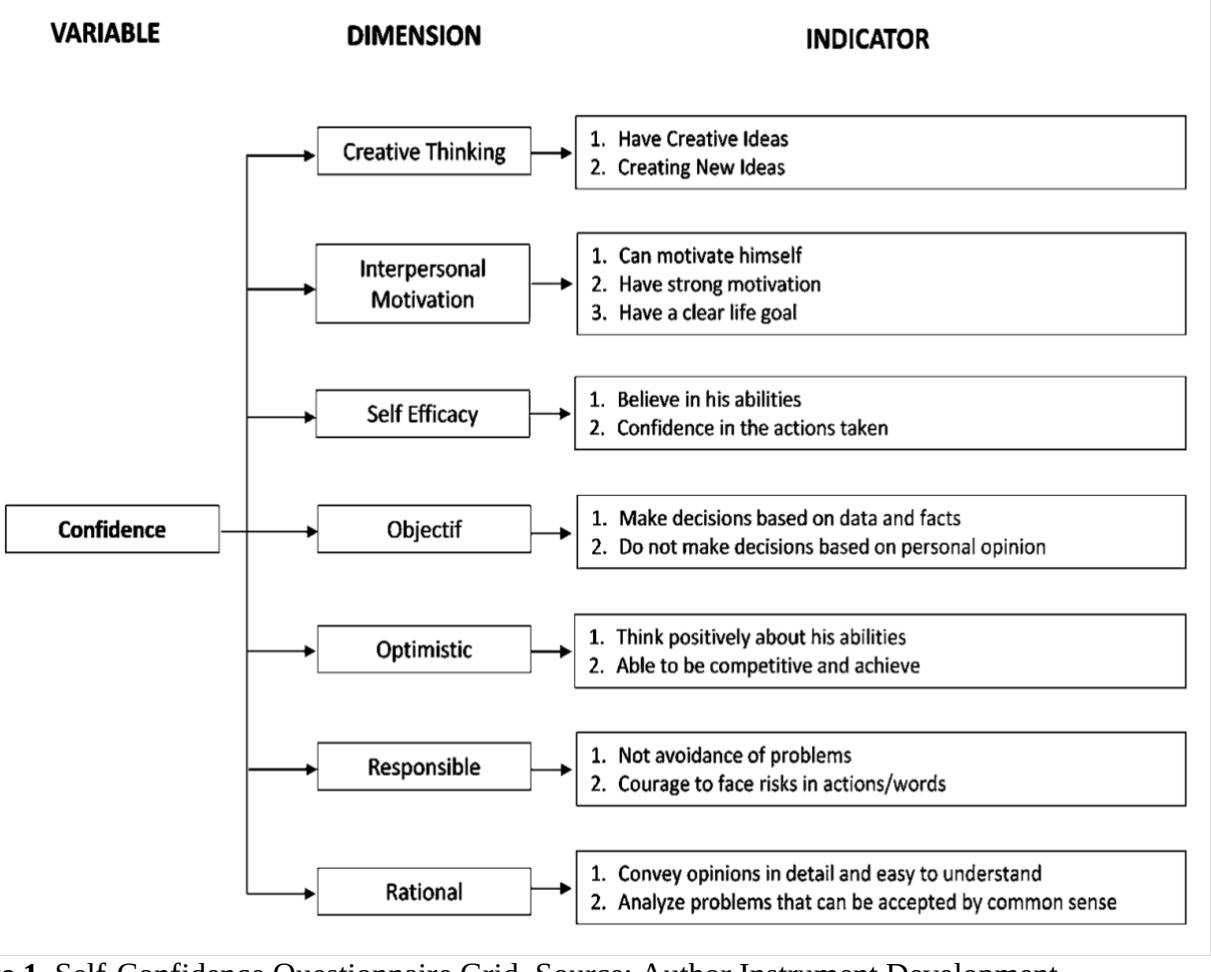


**Figure 1.** Self-Confidence Questionnaire Grid, Source: Author Instrument Development

## RESULTS

Multiple dimensions make up self-confidence variable data, which is subsequently analyzed. The outcomes are thereafter categorized into five groups: extremely high, high, medium, low, and extremely low. The frequency and proportion of each category are acquired after they have been categorized based on scores. See the following table for a more thorough breakdown of the percentages of the learning planning dimensions:

From Table 1, it can be seen that the self-confidence character of the disabled elite athletes is 74.47% in the very high category, 19.15% in the high category, 4.26% in the moderate category, 2.13% in the low category, and not found in the very low category.

**Table 1.** Percentage of Data from Research on Confidence in Elite Athletes with Disabilities

| No | Norms | Category | Frequency | Percentage |
|---|---|---|---|---|
| 1. | X ≤ 39 | Very Low | 0 | 0 % |
| 2. | 39 < X ≤ 53 | Low | 1 | 2,13 % |
| 3. | 53 < X ≤ 67 | Medium | 2 | 4,26 % |
| 4. | 67 < X ≤ 81 | High | 9 | 19,15 % |
| 5. | 81 < X | Very High | 35 | 74,47 % |
| | Total | | 47 | 100 % |

Source: Primary Data Author

## DISCUSSION

Based on the data processing and analysis, it was discovered that 35 Indonesian disabled athletes (74.47%) had very high confidence in the category, nine athletes (19.15%) had higher confidence, two athletes (4.26%) had moderate confidence, one athlete (2.13%) had low confidence, and no athlete (0%) had very low confidence in the category.

One of the predictors of success in competition is self-confidence, because the athlete's confidence is the primary underlying capital in his or her personality; it is formed through the process of practicing and interacting with the surrounding community (Komarudin, 2015). Having the ability to think creatively must be crucial in the present world (Hong, 2014), while self-confident characters can motivate interpersonal learning (Syed, 2014). Self-confidence is the conviction that one can accomplish anything they set their minds to and that they are accountable for everything they do (Greenacre et al., 2014). This classification forms the basis for researchers to determine the dimensions of self-confidence in characters that include six dimensions: creative thinking, interpersonal motivation, belief, objective, optimistic, and rational.

The dimension of creative thinking includes indicators of having creative ideas and creating a new idea. Research shows that creativity is determined by a belief in the power of self-efficiency in society (Haase et al. 2018). Self-confidence as one of the essential elements of social competence that emphasizes that creative personality is curiosity, patience, as well as the courage to accept change and innovation and take risks (Sipahi, 2018).

The interpersonal motivation dimension includes indicators that can motivate themselves, have strong impulses, and have a clear purpose in life. The results show that "there is a significant correlation between self-confidence and motivation for student speaking performance." (Setyawati et al. 2023). In other words, self-confidence and motivation: based on the results of research, it has been found that self-confidence correlates positively and significantly with interpersonal motivation to know something, intrinsic motivation for experiencing stimuli, external regulation, identification, and extrinsic motivation (Rasimin & Sarman, 2023).

The dimension of confidence, which includes an indicator of belief in one's own abilities and confidence in the endeavors undertaken, explains that the philosophy of self-fulfillment has a close connection with self-confidence (Sin, 2017). Self-confidence is essentially the psychological state of someone who has a high level of self-assurance in order to maximize their potential and do the best possible activities. The objective dimension, which includes indicators that are able to make decisions based on data and facts and not on personal opinions. Objective decision-making is also influenced by culture or customs (Odongo, 2016). Research results conclude that self-confidence can influence decision-making objectively (Certel et al. 2022).

The optimistic dimension, which includes indicators of positive thinking about self-esteem and being able to compete for achievement, is in line with research in "The Relationship Between Self-Confidence and Optimism," which explains that discipline has a correlation with self-confidence (Rizky, 2023).

A rational dimension, which includes indicators capable of analyzing acceptable issues and conveying opinions, ideas, and opinions in detail and easily understood, One of the indicators of self-confidence is rationality (Carbone et al., 2021). Research finds that Rational Emotive Behavior Therapy (REBT) has effectiveness in improving child self-confidence (Lathifa et al. 2023). A rational attitude begins with the realization

that you are capable of creating your own beliefs. You are the one who chooses how you want to live.

Based on the description provided above, the author considers that self-confidence, which includes six dimensions of creative thinking, interpersonal motivation, belief dimension, objective dimension, optimistic dimension, and rational dimension, is very important to be built through sports training, as it is an important factor in supporting the performance of Indonesian elite disabled athletes.

***Conclusions***

Sport has a significant contribution to shaping the character of elite disability athletes in Indonesia, with sports training having a large influence on their self-confidence, recorded at 64% in the moderate category. These findings suggest that despite progress, there is still potential for greater improvement in character development through sport. Therefore, it is recommended that future researchers continue this study with a focus on developing a more comprehensive sports training program. Further research should also include an evaluation of the implementation of sports training, to understand how best to improve the confidence and social skills of athletes with disabilities in Indonesia. With this continued effort, it is hoped that there will be more significant improvements in their character and confidence, as well as in their overall quality of life.

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***Conflict of Interest***

All authors declare that this manuscript has no conflict of interest with any party.

***Ethics Statement***

The writing of this article has gone through all ethical procedures related to the academic realm. All the principles of the Declaration of Helsinki were complied with number ethical cleareance is 106/KM.01/STKIP-PWK/V/2024, with special emphasis on informed consent and the vulnerability of the study population.

***Authors Contribution***

Study Design, DP, BT, YH, EB, and DTPP; Data Collection, DP, BT, YH, EB, and BB; Statistical Analysis, DP, BT, YH, EB, and DTPP; Data Interpretation, DP and BT; Manuscript Preparation, DP, BT, BB and RAL; Literature Search, DP, BT, DB, YH, BB, and RAL. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

# Validity and Reliability of the Turkish Version of the Plantar Fasciitis Pain / Disability Scale

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**Abstract**

**Purpose:** The objective of this study is to create a Turkish adaptation of the Plantar Fasciitis Pain/Disability Scale (PFPS) and to evaluate its construct validity and internal consistency. **Method:**The Turkish version of the PFPS was developed in accordance with the established translation and back-translation processes. The translated version of the scale was administered to a sample of 138 patients diagnosed with plantar fasciitis (PF). Validity was also evaluated using the Turkish version of the Foot Function Index (FFI). The test-retest reliability of the PFPS was determined by administering the scale to 138 patients on two occasions. **Findings**:The test-retest reliability was investigated through the utilisation of a paired t-test, an intraclass correlation coefficient analysis (ICC), and a Cronbach's alpha score. Construct validity was investigated through the utilisation of Pearson's correlation analysis. The Turkish version of the PFPS exhibited high internal consistency and test-retest reliability (Cronbach's alpha = 0.844, ICC = 0.997), as well as good construct validity, demonstrating a significant correlation with the FFI ($p < .001$). Furthermore, a notable difference was observed between the lower and upper 27% groups ($p = 0.000$). **Conclusion:** The Turkish version of the PFPS has been demonstrated to be a reliable, valid, and responsive instrument for patients with PF. Nevertheless, further studies involving a greater number of age groups, genders and languages are required to confirm the responsiveness of the PFPS and to provide further evidence of its full validity.

**Keywords**
Plantar Fasciitis, Foot, Pain Measurement, Validation Studies

## INTRODUCTION

Plantar Fasciitis (PF) is recognized as the most frequently occurring cause of chronic pain in the anteromedial process of the calcaneus (Tahririan et al. 2012; Cutts et al.2012). PF is one of the most common overuse injuries resulting in heel pain, affecting 10% of the general population at some point in their lives. Therefore, it is also reported to be a significant cause of increased health expenditures (Song, 2024). It has been reported that chronic weight bearing and repetitive overloading of the foot in daily activities or sports can result in the development of PF. This condition is reported to be prevalent in both those who are physically active and those who are sedentary (Menon & Jain, 2018).

The most fundamental symptom of PF is characterized by an abrupt, intense pain in the heel upon waking or upon the initial ambulation following a period of prolonged inactivity (Trojian & Tucker,2019; Landorf, 2015). In general, patients describe heel pain as non-radiating, throbbing, scorching or piercing without paresthesia (Johnson et al. 2014).

A variety of treatment modalities are employed in the management of PF, including non-invasive, invasive, conservative, and surgical approaches. Although PF is a prevalent condition across ethnicities and cultures, there is currently no universally accepted standard of treatment (Agudiez-Calvo et al. 2021). Various conservative treatments such as activity modification, oral analgesics, shoe modifications, night splints,

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exercise approaches, injections, and extracorporeal shock wave therapy has been reported in the literature to be effective in relieving pain in PF (Song, 2024).

As the specific cause of PF is not fully understood and is multifactorial, early and accurate prognostic evaluation of patients with PF is important for the selection of the optimal treatment pathway. In the literature, questionnaires translated into Turkish such as the Foot Function Index (FFI) and the Foot and Ankle Outcome Survey (FAOS) are used to assess PF. These questionnaires assess foot and ankle problems without taking into account specific changes in pain due to PF. Despite the assessments used, Willis et al. developed the Plantar Fasciitis Pain/Disability Scale (PFPS) in 2009 (Willis et al., 2009). This questionnaire provides a detailed examination and analytical analysis of patients' pain due to PF. The PFPS examines symptomatic questions used in the differential diagnosis of PF and its impact on activities of daily living.

Considering the prevalence of PF, there is a need for adaptation of the PFPS into Turkish and validation studies for its use in the clinical evaluation of PF patients in Türkiye. In view of the fact that this scale is used in many fields and applications, the purpose of this study was to investigate the validity and reliability of the Turkish version of the PFPS.

## MATERIALS AND METHODS

### *Subjects*

The study cohort comprised 138 volunteers aged between 18-65 years, who had been diagnosed with plantar fasciitis and had experienced pain for a minimum of six weeks. Participants with cognitive, mental, or psychological disorders, as well as those who had undergone foot and ankle surgery were excluded. In the initial phase of the study, the researchers gathered data pertaining to the participants' demographic characteristics. The participants were required to read and sign the study information and informed consent forms.

This research has met ethical rules. Research ethical approval was obtained Research Ethics Committee with project number E-10840098-772.02-845, dated 03/02/2022. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures. The study was conducted as a cross-sectional study between April 2022 and May 2023.

### *Translation and cross-cultural adaptation*

Once the requisite permissions had been obtained from the authors, the Turkish version of the PFPS was conducted in accordance with the cultural adaptation algorithm by Beaton et al. (Beaton et al., 2000). The original of PFPS was in English. The PFPS was translated from English to Turkish by two different professionals who are native English speakers with a good command of Turkish. Subsequently, a single Turkish text was produced from the two translated texts. Two native Turkish speakers with proficiency in English translated the Turkish text back into English. The results of both texts were compared with each other, after which the final version of the translation was evaluated by translators who were fluent in both Turkish and English (Epstein et al., 2015). The scale was found to be readily comprehensible, with no difficulty encountered in understanding any of the questions posed. No cultural adaptation was undertaken, as the activities included in the scale did not necessitate any culturally specific modifications.

### *Description of the questionnaires*

The PFPS is comprised of 19 items. Twelve items pertain to pain, while seven items pertain to functioning. The maximum score that can be attained from the questionnaire is 100, with a minimum score of 0. A higher score indicates a greater degree of pain and disability (Willis et al., 2009). In accordance with the findings of the validity and reliability research, the PFPS was re-administered to the participants after a period of three days with the objective of assessing the test-retest reliability.

The 23-item Foot Function Index (FFI), comprising three sections, was employed as a reference questionnaire. The first section assesses foot pain resulting from foot pathologies, the second section the degree of difficulty in performing various functional activities, and the third section activity limitations. The 9-item pain subscale is employed to quantify the level of foot pain experienced in a range of situations, whereas the 9-item disability subscale is utilized to ascertain

the degree of difficulty encountered when undertaking various functional activities as a consequence of foot-related issues. The five-item activity limitation subscale is employed to assess limitations to activity resulting from foot problems. Each item is assigned a score on a scale of 0 to 10,difficulty). The values collected for each sub-section are divided by the number of questions in the section and subsequently multiplied by 100, thus enabling the calculation of the section scores. In order to arrive at the total score, the scores awarded to each question in the index are aggregated, divided by the total number of questions, and then multiplied by 100 (Budiman-Mak et al., 2013).

***Statistical Analysis***

The sample size was calculated using the sampling formula, resulting in a value of n = $(1.96)^2(0.1)(0.1)/(0.05)^2$ = 138 for this non-homogeneous population. In the context of scale adaptation, it is recommended that the number of individuals represented should be five times the number of scale items included. The number of participants has been deemed sufficient for the purposes of scale development and statistical procedures in descriptive research. The data obtained from the study were subjected to evaluation in a computer environment utilizing the statistical software packages SPSS 22.0 and AMOS.

***Reliability***

The reliability of the scale was evaluated in accordance with the criteria of test-retest reliability and internal consistency. To determine the test-retest reliability, the scale was administered to the participants with a three-day interval between each administration, and the scores were subsequently compared. The test-retest reliability was calculated using a paried t-test and an intraclass correlation coefficient analysis (ICC). An ICC above 0.70 is generally accepted as an indicator of excellent reproducibility (Weir, 2005). The internal consistency of the data was evaluated by calculating the Cronbach's alpha coefficient. A value of 0.7 and above is generally considered to indicate satisfactory internal consistency (Tsang et al., 2017).

***Validity***

In order to ascertain the validity of the scale, it was subjected to an assessment of construct validity. This refers to its behaviour in relation to other assessment tools. Construct validity was determined through a comparative analysis of the PFPS results with those obtained from the FFI. Pearson's correlation analysis was employed to evaluate the interrelationship between the variables.

In terms of content validity, the scale is expected to demonstrate a clear distinction between two distinct groups, namely those falling within the lower and upper 27% ranges, at the two extremes of the measurement spectrum, namely the floor and ceiling (Hozo et al., 2005). The existence of differences between two groups is indicative of their distinctiveness. The absence of a difference between the two groups indicates that the range encompassing the lowest and highest scores is narrow. The scale distinctiveness was evaluated through the implementation of an independent samples t-test, which was conducted between the lower and upper 27% groups.

## RESULTS

The study included 138 participants (25 Males/113 Females) with a mean age of 49.066 ± 10.796 years and a mean body mass index of 31.293 ± 5.619 kg/m² who met the inclusion criteria. Table 1 illustrates the test-retest reliability and internal consistency of the PFPS scale. The Intraclass Correlation Coefficient (ICC) correlation values pertaining to the concordance between test-retest measurements were found to be statistically significant ($p < 0.05$). In light of these findings, it can be concluded that the scale is a reliable instrument for making measurements over a short period of time.

The correlation analysis between PFPS and FFI, as a means of evaluating the scale's validity, is presented in Table 2. The results of the correlation analysis with FFI in relation to scale validity were statistically significant ($p < 0.05$).

The differentiation of the scale according to the lower-upper 27% groups, the results of the content validity assessment, are presented in Table 3. A significant difference was identified between the lower and upper 27% groups ($p < 0.05$), thereby confirming the capacity of the scale to discriminate between different distinctions.

**Table 1.** Descriptive items and test-retest reliability of the plantar fasciitis pain/disability scale

| No | ICC (95% CI) (n=138) | α | p |
|---|---|---|---|
| Item1 | 0.937 (0.913-0.954) | 0.824 | 0.000 |
| Item 2 | 0.996 (0.994-0.997) | 0.836 | 0.000 |
| Item 3 | 0.987 (0.982-0.99) | 0.843 | 0.000 |
| Item 4 | 1 (1-1) | 0.845 | |
| Item 5 | 0.972 (0.961-0.98) | 0.838 | 0.000 |
| Item 6 | 0.998 (0.997-0.999) | 0.837 | 0.000 |
| Item 7 | 1 (1-1) | 0.836 | |
| Item 8 | 0.979 (0.971-0.985) | 0.846 | 0.000 |
| Item 9 | 0.997 (0.996-0.998) | 0.844 | 0.000 |
| Item 10 | 0.997 (0.996-0.998) | 0.841 | 0.000 |
| Item 11 | 0.991 (0.987-0.993) | 0.836 | 0.000 |
| Item 12 | 0.987 (0.983-0.991) | 0.841 | 0.000 |
| Item 13 | 0.986 (0.98-0.990) | 0.837 | 0.000 |
| Item 14 | 1 (1-1) | 0.846 | |
| Item 15-1 | 0.997 (0.996-0.998) | 0.837 | 0.000 |
| Item 15-2 | 0.979 (0.972-0.985) | 0.831 | 0.000 |
| Item 15-3 | 0.933 (0.907-0.951) | 0.847 | 0.000 |
| Item 15-4 | 0.988 (0.984-0.991) | 0.833 | 0.000 |
| Item15-5 | 0.972 (0.962-0.980) | 0.833 | 0.000 |
| Item15-6 | 0.959 (0.943-0.970) | 0.834 | 0.000 |
| Item15-7 | 0.975 (0.965-0.982) | 0.834 | 0.000 |
| Item15-8 | 0.978 (0.969-0.984) | 0.834 | 0.000 |
| Item15-9 | 0.993 (0.991-0.995) | 0.833 | 0.000 |
| Item15-10 | 0.955 (0.938-0.968) | 0.846 | 0.000 |
| Item15-11 | 0.984 (0.978-0.988) | 0.861 | 0.000 |
| Item16 | 0.997 (0.996-0.998) | 0.839 | 0.000 |
| Item17 | 0.998 (0.997-0.999) | 0.844 | 0.000 |
| Item18 | 0.992 (0.989-0.994) | 0.839 | 0.000 |
| Item19 | 0.961 (0.946-0.972) | 0.840 | 0.000 |
| **PFPS Total** | 0.997 (0.996-0.998) | 0.844 | 0.000 |

α:Cronbach's alpha; ICC: Intraclass correlation coefficient; PFPS: Plantar Fasciitis Pain/Disability Scale

**Table 2.** Correlation between plantar fasciitis pain/disability scale and foot function ındex

| | | | PFPS Total |
|---|---|---|---|
| **FFI** | **Pain** | r | 0.464** |
| | | p | 0.000 |
| | **Disability** | r | 0.463** |
| | | p | 0.000 |
| | **Activity limitation** | r | 0.307** |
| | | p | 0.000 |
| | **Total** | r | 0.408** |
| | | p | 0.000 |

*<0.05; **<0.01; Pearson's correlation analysis; FFI: Foot Function Index; PFPS: Plantar Fasciitis Pain/Disability Scale

**Table 3.** Differentiation of plantar fasciitis pain/disability scale scores according to lower-upper 27% groups

| Groups | Lower 27% (n=37) | Upper 27% (n=37) | t | sd | p |
|---|---|---|---|---|---|
| | Mean±SD | Mean±SD | | | |
| PFPS | 45.406±7.845 | 71.189±4.652 | -17.196 | 72 | **0.000** |

Independent Groups T-Test; SD: Standard Deviation; PFPS: Plantar Fasciitis Pain/Disability Scale

## DISCUSSION

The study demonstrated that the Turkish version of the PFPS exhibited satisfactory reliability and validity in the assessment of patients with PF. Moreover, the scale was found to be sensitive to the changes that occur in individuals with PF. The Turkish psychometric features of the PFPS were found to be comparable to those of the first version of the PFPS.

A review of the literature revealed that PFPS was a frequently employed method for assessing pain in numerous studies. Karagounis et al. proposed that PFPS can be applied in any setting and can differentiate between plantar fascia pain and other pathologies that cause heel pain (Karagounis P et al.,2011). The effect of conservative treatment on pain in plantar fasciitis has also been evaluated by other studies using PFPS (Sheridan et al.,2010;Boonchum et al.,2020). Additionally, an analysis of existing literature reveals a prevalence of studies on plantar fasciitis in female subjects compared to males (Hashmi et al.,2021).

In our study, a comparison was made with the Spanish validation study conducted by Agudiez-Calvo et al. and the FFI results (Agudiez- Calvo et al. 2021). Statistical analyses should demonstrate no difference between the validity of a scale and the reliability and repeatability of the measurement method. Furthermore, the results reflect the validity of the scale, and the detection of changes between repeated measures shows the sensitivity of the scale. Willis et al., who developed the PFPS, assessed 400 people with complaints of heel pain of various etiologies. They reported that the PFPS was effective in measuring PF-specific pain, that there were significant differences between patients with other heel pain and patients with PF, and that this questionnaire may be an effective method in the diagnosis and assessment of PF-specific pain (Willis et al., 2009). Although it has been used in many studies since the publication of this study (Gupta, 2012; Boonchum et al., 2020), only one study has translated the scale into Spanish and assessed its validity. In their study, Agudiez-Calvo and colleagues reported that the Cronbach's alpha coefficient demonstrated satisfactory reliability in the adaptation of the scale into Spanish. The lowest question, number 2, had a value above 0.7, while the remaining questions had values above 0.9 (Agudiez-Calvo et al. 2021). The results of this study indicate that the Turkish version of the PFPS is a valid and reliable scale. The Cronbach's alpha coefficient exceeded 0.8 for all items in our study, which yielded comparable outcomes to the aforementioned study. This was due to the internal consistency analysis of the Turkish version of the PFPS.

In the existing literature, it is emphasized that the time between the applications of the scale should be taken into account in the evaluation of test-retest reliability (Tsang et al., 2017). Accordingly, in our study, the retest was conducted three days later to ensure that the participants could recall their responses to the scale items, prevent fatigue, and enhance sensitivity to changes. In the present study, the internal consistency of the scale was evaluated, as were the test-retest reliability of the items and the overall reliability of the scale. The results of all evaluations indicated that the scale exhibited good reliability. Furthermore, the scale demonstrated good reliability when evaluated through ICC, with the majority of values exceeding 0.9. The assessment of sensitivity to changes confirmed that the scale is sensitive to changes and may be useful for objectively recording changes in individuals with a diagnosis of PF prior to a specific

treatment. In light of these findings, it was concluded that the Turkish version of the PFPS is an effective instrument for discerning differences in our study.

The results of the correlation analyses conducted with the FFI to evaluate the construct validity of the Turkish version of the PFPS were found to be statistically significant. In light of the aforementioned results, it was concluded that the Turkish version of the PFPS is a valid scale. The limitations of this study is that the majority of participants were women. It was not possible to generalise the statistical results due to the limited number of male participants. The second limitation is that the application of the PFPS is limited to self-reports by participants.

### *Conclusion*

The current pain scales are effective in measuring general pain; however, they lack the capacity to include questions that would allow for specific, objective, and analytical measurement of change in PF-specific symptoms. PFPS serves to illustrate the distinction between patients with plantar fasciitis and those with other pathologies that present with heel pain. In conclusion, the results of our study demonstrate that the Turkish version of the PFPS is a reliable and valid scale for patients with plantar fasciitis. Nevertheless, further studies involving participants from different age groups, genders and languages are required to confirm the responsiveness of the PFPS and to validate its full validity.

### *Conflict of Interest*

We affirm that the article we have authored does not involve any conflict of interest.

### *Ethics Statement*

The study was conducted in accordance with the Principles of the Declaration of Helsinki and was found ethically appropriate. Approval from the Istanbul Medipol University Non-Interventional Ethics Committee was obtained (file number E-10840098-772.02-845, dated 03/02/2022).

### *Author Contributions*

Conception and design of the study, SÖG, EA; Data collection, SÖG, NHY,BNK; Data analysis and interpretation, SÖG, NHY; drafting the article and/or its critical revision, SÖG, NHY, EA. All authors have read and approved the published version of the manuscript.

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RESEARCH ARTICLE

# The Effect of Using Yaker Strategy (CLM) on Some Coordination Abilities and Learning Basic Skills in Freestyle Swimming for Beginners Aged (8-12) Years

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**Abstract**
The research aimed to identify the effect of the Yaker strategy on some coordination abilities and learning the basic skills of freestyle swimming for beginners. As for the problem of the research, the researcher noticed that there is a weakness in the use of modern strategies in teaching the basic skills of freestyle swimming and a weakness in taking into account scientific, cognitive and technological progress in all games in general. In the field of swimming in particular, the researcher assumed that there were statistically significant differences in the results of the post-tests between the control and experimental groups in the variables under study. The researcher prepared educational units for the Yaker strategy and applied them to members of the experimental group, while members of the control group underwent the educational units prepared by the specialized trainer, and the ready-made statistical package SPSS was used to draw the results, as the results of the research showed an improvement in the group's basic freestyle swimming skills tests. Experimentation and development of combinatorial capabilities. The Yaker strategy (CLM) also affected the experimental group's combinatorial abilities to learn free swimming. Based on what emerged from the research results, the researcher recommended adopting the Yaker strategy in learning the basic skills of free swimming and acquiring the combinatorial abilities of beginners, in addition to the necessity of children learning to swim properly. Academic and interest in cognitive and motor abilities in teaching swimming.

**Keywords**
Yaker Strategy (CLM), Coordination Abilities, Freestyle Swimming

## INTRODUCTION

The scientific, cognitive and educational development taking place in all fields, especially in the educational process in particular, aims to advance it to the furthest limits and fields, moving away from old educational strategies and methods, making the learner a part of the educational process and having a shared role in the educational process (Abbas & Malih, 2021). We notice today that some fields suffer from there is a great stagnation in the use of modern educational strategies and methods that have proven effective in various cognitive, motor and physical fields and fields, and that most teachers and teachers are still far from keeping pace with the development and progress achieved by educational thought recently. Since learners differ in their abilities and aptitudes, it is clear that some of them learn and respond more quickly, and some may delay or be slow in absorbing them. All of this cannot be achieved in a traditional educational environment, as they cannot be taught in an educational environment without addressing their minds and concepts and renewing and updating the concepts (Hatem & Abdul Hussein, 2024).

Old school, eliminating misconceptions, and establishing correct cognitive structures are a class in which the teacher's goal is to complete the subject to be taught without addressing the

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students' minds. All of this is done through the use of modern strategies and methods that contribute to creating an educational environment that works to immerse the learner in being a part of it. Sport attracts because of the characteristics it carries of practitioners and lovers. It is an outlet for many individuals in general and swimming in particular. It is also considered one of the things that brings learners together the most, and this competition takes place in a sporting manner and within the sporting scope that is framed within the framework of the sporting spirit that refines the soul and elevates the practitioners. To the top level, and one of these sports that attracts the largest portion of learners is swimming. It is a beautiful game with wonderful requirements for a beautiful figure and smooth performance of skills (Ügüten & Ersöz, 2024).

Despite the difficulty of performing it, it is worth the effort and effort, and this game is due to its fast and powerful movement. Educational programs for swimming are an indispensable basis for moving from the education stage to the training stage in swimming and reaching advanced levels. It is also a basis for practicing various areas of swimming (Ackley, 2013). Furthermore, swimming is just one of the many water sports that it is utilized for. The person moves around the aquatic environment using his body, which seems a little odd to him because it's a totally different medium from the one he's used to moving on land. The subject matter he covers in the water is entirely distinct from that on land, and the swimmer's body may experience physiological changes as a result of the water's pressure. Apart from the emotional strain brought on by the unfamiliar surroundings and exposure to a wide spectrum of emotions (Rateb, 1999).

Freestyle swimming is considered one of the easiest types of swimming because learners tend to do it and it is loved by children. Therefore, it must be learned at an early age using the best strategies, methods and educational methods that increase the speed of children's learning and the will to put in more effort towards learning these basic skills of freestyle swimming. The freestyle is (one of the important methods that a beginner must learn and master, as it is the foundation of the four swimmers, and this method is preferred by all swimmers because of the speed and fun (Zaki & Ratib: 1980). Swimming movements of various types are considered among those skills or movements whose performance requires the acquisition of good coordination ability by the learner or beginner so that he can perform parts or all of the movements of that skill with high coordination, which can be achieved with the help of these various exercises, especially the use of coordination exercises and the development of the learner's ability to perform. More than one movement or skill for different parts of the body at the same time, "Performing any of the four types of swimming skills (freestyle, breaststroke, back, butterfly) requires the learner or beginner to move all of the head, arms, and legs together at the same time and in different directions or movement paths depending on the type of swimming, which requires a good level of motor coordination (nervous). - Muscular) which can be acquired and developed by focusing on the use of general and specific auxiliary exercises as an important part of educational means, which is expressed as "means of direct communication that help learners acquire knowledge, skills, attitudes and methods (Al-Dulaimi, 2008).

Since this age stage is considered one of the most important stages in teaching swimming because it is considered the first nucleus for learners, the psychological factor and fear are at a lower level at these ages than at older ages, as well as to create an educated, athletic generation free of diseases, so attention must be given to this age stage on the academic, sports and health levels.

The researcher discovered that the authorized educational programs fall short of the goals that educators and trainers have set for themselves through his experience and his evaluation of earlier research and studies, due to the difficulty of teaching swimming skills because they are practiced in a water environment that is different from the normal environment like other activities, and the lack of consideration of strategies for modern and appropriate educational methods, and that Some teachers and trainers still rely on the traditional learning method. Which is not compatible with the method of modern education, especially for young age levels, as well as the presence of weakness among some children in motor coordination and in performing harmonic exercises when learning and practicing swimming because of the difficulty they suffer in performing harmonic exercises and linking movements because the sport of swimming requires motor abilities and linking movements, and here lies the problem of the

research. The extent to which the application of strategies, methods and educational methods affects the acquisition of combinatorial abilities for the basic skills of freestyle swimming for beginners. Creating combinatorial workouts to improve beginners' motor skills in free swimming. Putting together instructional materials using Yackir (CLM). Identifying the effect of the Yacker Strategy (CLM) on some coordination abilities and learning the basic skills of freestyle swimming for beginners aged (8-12) years.

There are statistically significant differences in the results of the pre- and post-tests for the control and experimental groups in the variables under study. There are significant differences in the results of the post-tests for the control and experimental groups in the variables under study.

## MATERIALS AND METHODS

### *Research Methodology*

In order to accommodate the nature of the problem that needed to be solved, the researcher employed the experimental technique in the study methods, using two groups: the experimental group and the control group.

The research community and its sample:
The research community was identified with a group of beginners whose names were registered in educational swimming courses in the Suli Sport Hubs pool for the year (2024). They numbered (35) beginners, and they were divided into two groups. The experimental group included (12) beginners, and the educational units of the Yaker strategy were applied. On them, and the control group, which includes (12) beginners, the strategy used by the swimming teacher was applied to them, and (5) beginners were chosen as a reconnaissance sample, and (6) learners were excluded due to their lack of commitment to the educational units and their absence for more than three educational units, and the percentage reached The research sample is from the original population (68,571), which is a good proportion of the research sample. The researcher conducted homogeneity coefficients to ensure the homogeneity of the sample, as shown in Table (1).

**Table 1.** Displays the arithmetic means, standard deviations, and skewness coefficient for the experimental and control groups' anthropometric data

| Variables | Measurement Unit | Mean | Std. Deviation | Skew ness |
|---|---|---|---|---|
| Age | Year | 10.566 | 0.380 | 0.901 |
| Length | Cm | 142.833 | 4.593 | 0.808 |
| Weight | Kg | 44.083 | 3.549 | 0.942 |

The value of the skewness coefficient is less than (-+1), which indicates the homogeneity of the research sample. In order to achieve the equality of the two groups (experimental and control) in the research variables: coordination abilities and basic skills in free swimming, the researcher conducted skill tests for equality for the two groups: the experimental group and the control group on two days (Saturday-Sunday) corresponding to 1-2/1/2024, the first day at 10 am, The second day at 4 pm includes:
The first day: coordination tests under discussion (jumping, balance, crawling)
The second day: free swimming skill tests (buoyancy, forward glide, forward glide, regular breathing). As shown in Table (2).

**Table 2.** Displays the t-test value, standard deviations, and arithmetic means for the fundamentals of freestyle swimming

| Variables | Experimental group | | Control group | | t | Sig | Sig |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | valuen | level | type |
| Floats | 13‹11 | 0‹69 | 12‹67 | 0‹81 | 1‹42 | 1‹02 | Sig |
| Flow | 2‹41 | 0‹51 | 2‹79 | 2‹58 | 0‹79 | 1‹00 | Sig |
| Regular breathing 10/s | 5‹33 | 1‹23 | 5‹41 | 1‹24 | 0‹16 | 0‹88 | Sig |

**Table 3.** Shows the equivalence tests for the experimental and control groups for combinatorial abilities

| Variables | Experimental group | | Control group | | t valuen | Sig level | Sig type |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | | | |
| Balance | 8.666 | 0.887 | 9.333 | 0.984 | 1.742 | 0.564 | Non Sig |
| Jumping | 14.083 | 2.392 | 13.583 | 2.065 | 0.548 | 0.589 | Non Sig |
| Crawling | 51.916 | 3.579 | 48.083 | 5.884 | 1.928 | 0.090 | Non Sig |

***Tests and Measurements Used***

The tests and measurements were chosen based on sources and references related to swimming (Alawi & Radwan, 2008; Rateb, 1990) and (Khater & Al-Beik, 1984). These tests were presented to a group of experts and specialists in the field of swimming, and the tests were selected. Which obtained an agreement rate of (75%) or more. Tests were also chosen for combinatorial abilities (Hasanein, 2004) and (Khoshnaw, 2010). These tests were presented to a group of experts and specialists in the field of swimming, tests, measurements and motor learning, which obtained an agreement rate of (75%) and more than the experts and specialists whom the researcher sought. As for the skill tests, the tests that achieved an agreement rate of (75%) or higher were approved based on the opinions of experts and specialists.

***Specifications of Freestyle Skill Tests*** (Rateb, 1998)

Regular breathing test for 10 seconds. Horizontal forward buoyancy test. Flow test (front glide). Freestyle swimming test for a distance of 25 meters. Freestyle technical performance evaluation card: The researcher intended to use a form to evaluate the technical performance of learners prepared by (Yawar, 2016).

The freestyle swimming skills were divided into (body position, leg strikes, arm movements, breathing, and coordination), and grades were given according to the importance and difficulty of each part of the skills, as follows:

1- (16) degrees for body position skill.
2- (16) marks for the skill of striking the legs.
3- (24) degrees for the skill of arm movements.
4- (20) marks for breathing skill.
5- (24) degrees for the matching skill

***Tests for Coordination Abilities***

Moving balance test for a distance of (2) meters1

Rope jumping test-2

Crawling test

The researcher conducted statistical transactions to extract the scientific basis for the tests, as follows:

***Validity Tests***

The researcher verified this validity when the test items were presented to a group of experts and specialists in the fields of (teaching methods, tests, measurement, and swimming) to confirm the validity of the test items in measuring what they were designed to do and measuring the behavior components that they measure. Their number was (15) specialists, and they unanimously agreed on Their opinions on the validity of all items of the skill tests for free swimming and coordination abilities.

***Reliability of Tests***

Reliability in its general concept is that the test performed by the researcher gives the same results if the test is repeated on the same group and under the same conditions at a later time. To verify the stability of the test, the researcher used the retest method, where the tests were repeated after (7) days on the same group that was tested, and the reliability coefficient reached (0.84).

***Exploratory experience***

The exploratory experiment was to be carried out by the researcher in order to test the experimental and control groups on Saturday, June 1, 2021, in the Soli Sport swimming pool on the survey sample, which numbered (5) learners, in order to determine the time period that the tests take in general and to know the ability of the assistant work team. In terms of numbers, the extent of the research sample's response, their interaction with the tests, and the efficiency of the devices and tools used and the imaging of the relevant tests under study.

***Yackir Strategy Educational Units***

The researcher intended to prepare educational units for the Yaker Strategy (CLM) according to the steps of the strategy by informing the researcher of the sources related to teaching and learning the subject of swimming, as well as his experience in the field of the game, and in

accordance with the requirements and requirements of the educational process. The number of units reached (12) educational units by (3) educational units per week for days (Saturday - Monday - Wednesday) for a period of (4) weeks, with a time of (90) minutes for each educational unit, as the application of the program began on Saturday, corresponding to 8/6/2024, until Wednesday, corresponding to 3/7/2024 The stages of Yaker strategy were applied as mentioned by (Adel & Amer, 2014) in the main section of the lesson in the educational and applied aspects, as follows:

***The Invitation Stage***

In this stage, the attention of the learners is drawn to the lesson and they are invited through several means, including asking some questions or contradictory events that require thinking about a solution to them. The largest and primary role of the teacher is through inviting them, provoking them, and motivating them in order to identify the problem and find appropriate solutions to it, whenever the problem is. The proposed question has roots in the learners and their responses and interaction with it were quicker by performing the required activities using the means and methods that they deem appropriate for the lesson. However, the role of the student at this stage is almost limited compared to the roles assigned to him in the subsequent stages.

***Exploration Stage***

In this stage, the learner researches and explores the problem or questions that need to be answered, and he has a fundamental and participating role in building knowledge himself and interacting with the rest of the group to solve the problem and with direct experiences, which are represented by many activities that raise for them questions that are difficult to answer, which makes them in a state of imbalance, this stage is also called the stage of cooperative activities, where the work of the learners begins with the activities and questions posed in the previous stage by working in heterogeneous cooperative groups to conduct experiments or through research and exploration. When each group finishes the work and arrives at appropriate solutions and ideas for the questions or problems, their ideas are compared to each other to be collected. The necessary information and data. The role of the teacher is to be prepared for all the activities and experiments required, encourage the students as they work, guide and assist them in developing their thinking, and guide the sources of knowledge related to the subject.

***The Stage of Proposing Solutions and Explanations (Explanation)***

In this stage, suggestions and solutions to the problem or question presented are presented and alternatives to the solutions are presented through the learners going through new experiences. The role of the learners in this stage is to reach the required concepts by interpreting the results and solutions and comparing them through discussion under supervision. The teacher makes adjustments to their concepts and perceptions if they are wrong or need to be modified. The teacher's role is to manage and organize the discussion, help the learners to communicate their ideas and suggestions to the rest of the group members, and participate with the learners in evaluating their proposed ideas and solutions to solve the problem.

***The Stage of Taking Action (Application)***

In this stage, the learner applies the solutions and experiences he has arrived at to solve new problems or other similar situations and benefit from them in new teaching and learning situations. The role of the teacher is to give the learners sufficient time to apply what they have reached and to help and guide them in applying it. What they have learned on their own in new situations related to the topic. This stage is one of the most important stages of the strategy because at this stage the learners have finished building their knowledge on their own and now have the ability and ability to apply and generalize what they have learned in new situations. The duration of the educational unit was ninety minutes, and the educational units for the two research groups were similar in their preparatory and final sections, and differed only in their main section.

***Posttests***

The researcher conducted post-tests for the two research groups, the control group and the experimental group, at the same time, conditions and procedures for both groups to ensure that no group was biased. Post-tests were conducted to test the coordination abilities of the control and experimental groups. Then the researcher conducted tests of the basic skills of free swimming. The tests were conducted on Saturday, 6/7/ 2024 at ten in the morning.

***Statistical Methods***

The researcher used the ready-made statistical package (SPSS) to analyze the data statistically and extract the results. Descriptive statistics of the data obtained from this study were performed using mean and standard deviation for numerical variables and frequency and percentage analysis for categorical variables. Independent Samples t-Test was used for categorical variables involving two groups. P<0.05 was accepted as the significance level.

## RESULTS

Presenting the findings of the pre- and post-tests to evaluate the experimental and control groups' coordination skills.

**Table 4.** Displays the post-test arithmetic means and standard deviations as well as the computed T-value for the coordination abilities tests for the experimental and control groups

| Variables | Experimental group | | Control group | | t valuen | Sig level | Sig type |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | | | |
| Balance | 4.456 | 0.698 | 7.566 | 0.957 | 3.193 | 0.000 | Sig |
| Jumping | 21.133 | 2.1320 | 16.583 | 1.956 | 7.460 | 0.000 | Sig |
| Crawling | 32.445 | 5.357 | 38.000 | 3.340 | 5.923 | 0.000 | Sig |

**Table 5.** Displays the computed T-value for the free swimming skill performance as well as the values of the arithmetic means and standard deviations for the post-test.

| Variables | Experimental group | | Control group | | t valuen | Sig level | Sig type |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | | | |
| Body position | 13.00 | 0.95 | 8.66 | 0.49 | 13.00 | 0.00 | Sig |
| Leg strikes | 12.41 | 0.66 | 8.66 | 0.49 | 13.45 | 0.00 | Sig |
| Arm strikes | 17.00 | 1.12 | 11.58 | 0.51 | 17.31 | 0.00 | Sig |
| Breathing | 14.50 | 0.90 | 10.83 | 0.57 | 14.31 | 0.00 | Sig |
| Coordination | 19.08 | 0.99 | 11.91 | 0.66 | 20.80 | 0.00 | Sig |

## DISCUSSION

It is clear from Table 4 that there are significant differences in the combinatorial abilities, and this is evident through a difference in the arithmetic means and standard deviations of the tests, which indicates the effect of the exercises and units prepared by the researcher in developing the combinatorial abilities and developing (moving balance, harmony, crawling) for the group. experimental research, the researcher attributes this progress to the varying proportions of the educational units used by the teacher and the repetition of exercises that were developed in a precise scientific manner and avoiding randomness, in addition to the use of feedback that he gives to his students while teaching them to perform the skills, and this is what (Abboud, 2013) indicates that diversity in exercise It renews activity and motivation for continuity of performance and avoiding confusion and randomness, giving him a greater opportunity to achieve high results and face the changing playing situations that occur in competition.

The researcher also believes that the reason for this development is that learners at this stage prefer motor coordination when performing skills, and this is what Abdel Hamid Sharaf confirms: “At this stage, neuromuscular coordination begins to improve, so there is nothing preventing the child from giving the child some difficult movements that require coordination between nerves and muscles.” (Sharaf, 2005), the researcher attributes the reason for this development in the experimental group to the educational units prepared by the researcher according to Yaker strategy and the exercises prepared by the researcher. This is what led to the superiority of the experimental group, and the beginners also mastered the skills and skill movements, as (Abbas Ahmed Saleh) stressed that “good curricula for physical education It includes a broad framework that provides almost all learners with the opportunity to learn and participate in various sports, whether individual or selected group sports” (Saleh, 2000).

Table (5) shows us the results of the research that were presented for the post-tests of the experimental and control research groups, as the researcher believes that these skills give confidence to the learner during the process of teaching swimming, remove fear from him, and adapt to the new environment, which is water, as they were well influenced by Sample members, one of the most important exercises that led to the development of the technique is placing the body extended parallel to the surface of the water, with the process of holding and repeating breathing, which leads to the development of the technique (Yauer & Alfarage, 2021).

The researcher attributes that the reason for the development is the experimental group's use of Yaker CLM strategy, which contributes to helping learners acquire proper conversational language through dialogue and discussion between learners and the teacher and reduces wasted effort and difficulties facing the teacher, and this is what it indicates (Ibrahim, 2018). The stages of this strategy make the learners interact with each other on the one hand and with their teacher on the other hand while discussing the steps to detail the skill to be learned, increasing and accumulating their information, and reaching the advancement of the skill aspect. In addition, the nature of mathematical work requires continuous interaction between learners and their cooperation together, and gives clarity about the extent of their awareness and awareness in implementing what is required of them (Zaid & Neamah, 2021)

The researcher also believes that learning how to swim for beginners is a very important matter, and it is necessary to make learning it fun, teach them how to feel comfortable in the water, and improve abilities in general and coordination abilities in particular, that is, the gradual acquisition of motor coordination for free swimming, as the acquisition of motor coordination for free swimming can We attribute it to the similarity between the movements and exercises presented to learners in terms of body parts moving in different directions at the same time (Aziz, 2010).

Salama (2014) points out that the use of educational programs and well-prepared combinatorial exercises contributes positive effects reflected in the improvement and development of skill performance acquisition. The educational units of the Yaker strategy also contributed to improving the movement of the body as a whole in the water environment, or what is called positive total body coordination, which made a significant contribution to the teaching and development of breathing, leg strikes, and arm strikes. This is especially true because the exercises' unique qualities and diversity give students the chance to express their inclinations and desires while also enjoying the experience of performing the exercises and putting themselves into the game. This was demonstrated through the process of analyzing the results, which resulted in this development in coordination abilities and an improvement in basic skills in freestyle swimming.

## *Conclusions*

The results of the research showed a development in the coordination abilities and basic skills of free swimming for the experimental group. The effectiveness of the exercises prepared by the researcher in improving the coordination abilities and basic free swimming skills of the experimental group. The effectiveness of Yaker educational strategy in improving some coordination abilities and teaching the basic skills of free swimming.

## *Recommendations*

Adopting the Yaker strategy in learning the basic skills of freestyle swimming and improving the harmonic abilities of freestyle swimming for beginners. The necessity of children learning to swim academically and paying attention to the motor abilities of beginners. Conduct studies and research similar to Yaker strategy in other swimming events (breaststroke, backstroke, butterfly).

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## *Conflict of Interest*

There is no personal or financial conflict of interest within the scope of the study.

## *Ethics Statement*

The study was conducted in accordance with the principles of the declaration of helsinki and was found ethically appropriate. approval from the mustansiriyah university social sciences ethics committee

## *Author Contributions*

Conception and design of the study: F.A.Y & A.S.A; Data collection: F.A.Y & A.S.A; Data

analysis and interpretation: F.A.Y & A.S.A; Drafting the article and/or its critical revision: F.A.Y & A.S.A; Final approval of the version to be published: All authors have read and approved the published version of the manuscript.

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RESEARCH ARTICLE

# Effect of Aquatic Exercise Training in Young Female Individuals With Chronic Ankle Instability

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**Abstract**

**Purpose:** The purpose of this research was to examine effect of aquatic exercise training in young females with chronic instability of the ankle. **Method:** The research comprised of 100 female individuals aged 20-30 years that fulfilled the inclusion and exclusion criteria. Participants were separated into two categories with equal participants, control group (n=50) and experimental group (n=50) by using SPSS software. Experimental group underwent hydrotherapy program while control group underwent land-based exercise program with frequency of twice a week for about 6 weeks. The scores were statistically analysed by using paired and unpaired t-test. **Findings:** The findings showed that the two groups improved significantly in ROM. Group B improved significantly in ankle dorsiflexion, plantarflexion, inversion, and eversion ($p < 0.0001$), while the Group A showed p values of 0.0271, 0.3758, 0.4466, and 0.0452, respectively. The experimental group exhibited more improvement in MMT than the control group. The experimental group had significant strength in dorsiflexors, plantarflexors, invertors, and evertors ($p < 0.0001$), while the control group had significant strength dorsiflexors, invertors, and evertors ($p = 0.0015$, 0.0055, and 0.0020) and plantarflexors ($p = 0.0207$), respectively. The experimental group improved SEBT significantly ($p < 0.0001$) in all directions, while the control group exhibited significant results ($p< 0.0001$,0.0068,0.0062,0.0031,0.0090, 0.0423,0.0167).**Conclusion:** It concluded that the aquatic training program had shown a significant positive response in improving ROM, muscle strength and balance among young females experiencing chronic instability of the ankle.

**Keywords**
Ankle instability, Ankle Sprain, Balance, Hydrotherapy, Muscle Strength

## INTRODUCTION

Chronic Ankle Instability (CAI) is a condition characterized by remaining symptoms associated with ankle sprain, such as prolonged pain, recurring instances of sprain, and the sensation that the ankle feels unstable in any way (Al-Mohrej & Al-Kenani, 2016). CAI growth requires an acute ankle sprain injury (Hertel & Corbett, 2019).The twisting of the ankle joint comprises concurrent inversion and plantarflexion, which is among the most prevalent cause of damage in ankle sprain where any of the ligaments within the ankle joint are stretched or partially torn. Because the anterior talofibular ligament (ATFL) is the most weakened, it is most typically injured during an ankle sprain. Approximately 93% of individuals with minor ankle sprain do not receive appropriate treatment (Al-Mohrej & Al-Kenani, 2016; Hertel & Corbett, 2019). According to Mackenzie M. Herzog's study,

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70% of people who suffer a mild ankle sprain acquire chronic ankle instability (Herzog et al., 2019). Chronic ankle instability causes include repeated ankle sprains, ankle joint diseases, and an one-time ankle injury at young ages (Al-Mohrej & Al-Kenani, 2016; Herzog et al., 2019). Women in the middle stages of life experience a wide range of hormonal abnormalities, as this age category encompasses each of the postpartum and menopausal periods. Research on persistent instability of the ankle across a range of demographic groups and information resources showed that the incidence of chronic instability of the ankle is 2.6 times greater in women as compared to men (Herzog et al., 2019; Heitz et al., 1999). This is due to women's bodies fluctuate in the amounts of progesterone, estrogen, and testosterone, which are critical for the structure of ligament the collagen and the preservation of the integrity of the ligaments. Women, especially those in their middle years, might be even more susceptible to sprains due to increased flexibility in ligaments and tendons, a condition primarily caused by the hormone estrogen (Heitz et al., 1999).

Furthermore, two potential causes has identified by earlier research as probable causes of persistent ankle instability. The initial process involves structural harm to the connecting ligamentous tissues resulting in instability in mechanics caused by ligament flexibility and increased joint movement of the talocrural, subtalar, and inferior tibiofibular joints. Functional instability is another mechanism, wherein an individual experiences persistent sprains and an imbalance in postural stability, regardless of whether they have a sensation of ankle give-away (Nualon et al., 2013; Hertel , 2000). Problems in balance and joint positioning sensing, which primarily rely on afferent signals for intricate sensory-motor emancipation will result straight away from these. Meanwhile, resilient proprioception, defined as a capacity to incorporate sensory inputs from diverse mechanical receptors, is critical for maintaining dynamic joints and functional stability (standing, walking, and running) (Tabassum & Azim, 2024). While previous studies discovered that the ankle serves an important role in preserving balance, the medical literature reveals that nearly all of rehabilitation centers for sprains of the ankle include both strengthening and perception of position activities (Ben Moussa Zouita et al., 2013; Blackburn et al., 2000; Bernier & Perrin, 1998).

Many researchers have investigated the impact of exercises for strengthening, proprioceptive activities, or a combined effort of the two on an individual's restoration to activities of daily living. Furthermore, Han et al. reported that overall and sports-specific training, injuries related to sports, and sports-induced exhaustion may all impact ankle proprioception, potentially leading to decreased balance abilities (Han et al., 2015). Additionally, ROM was assessed as an indicator of ankle sprains. Dorsiflexion range was a substantial predictor of ankle sprain. Postural sway and presumably sense of position were additionally predictive factors (de Noronha et al., 2006). However, early studies indicate that people with a restricted ankle dorsiflexion motion might be more susceptible to ankle sprains. Thus, studying dynamic equilibrium, as well as static equilibrium and range of motion, is critical for preventing ankle injury. The theoretical as well as scientific study has declared that equilibrium and sense of position is vital abilities for any the participant and must be taken into account as a component of a rehabilitation regimen (Jain et al., 2014; Thein & Brody, 1998). Additionally, research suggests that land-based activity might be more advantageous for individuals who experience injuries to the ankle by enhancing ankle stability and re-educating the muscles and ligaments around the ankle joint.

The previous research done on the impact of plyometric activities on land discovered that the human being is subjected to a significant impact loading, which causes compressions of the vertebrae and the lower limbs (Donoghue et al., 2011; Yalfani et al., 2015). Most recreational activities include jumping and cutting on the ground, therefore the force exerted on the ground is stronger than on water, resulting in a high loading effect on the joint during land-based training. Then, taking into account the physical features of water (buoyancy, viscosity, hydrostatic pressure, and temperature) might be more effective in improving balance and sense of position on an aquatic program (Abadi et al., 2017; Manjrekar et al., 2024). Underwater exercise, often referred to as aquatic exercise, has been frequently employed in rehabilitation programs, particularly when training under normal gravitational settings can be challenging and uncomfortable. Water buoyant properties minimize the amount of weight that

bones, joints, and muscles must carry. The amount of weight that is carried reduces with increasing immersion in water, as a person standing underneath the water to the depth of their xiphoid process bears around 28% to 35% of their own body weight, based on gender. With increased exercise and greater rate of movement, the percentage of bearing weight increases. The comforting temperature and vacuum of the water also minimize edema and improve circulation of blood (Thein & Brody, 1998; Donoghue et al., 2011). As a result, the water's environment promotes initial active mobilisation and dynamic strengthening. In the research conducted by Nualon et al., it was discovered that the hydrotherapy and land-based treatment groups had enhanced ankle ability to function as evidenced by single-limb jumping ability (Nualon et al., 2013). Similarly, Yalfani et al., (2015) found that aquatic exercise improved pain alleviation, performance, and dynamic along with static balance in patients with chronic sprains of the ankle, although there appeared to be no statistically noteworthy distinction when compared to land exercise (Yalfani et al., 2015).

However, there has been no focus done on managing young females with chronic ankle instability experiencing limited range of motion, strength and impaired balance to recover to get back to their daily activities soon. These females need a training program to improve all these components. The goal of the present research aimed to examine the effect of 6 weeks of rehabilitative training in both land and water media on young females with chronic instability of the ankle. By employing and executing the physical characteristics of water, rehabilitation programs for young females may be able to increase the effects of training.

## MATERIALS AND METHODS

### *Participants*

A total of 100 females ([n= 4× (SD)2 /mean ×(€)2]) were randomly selected for this experimental study, which was carried out using the computerized SPSS software. The study included females in the age range of 20 to 30 years who had a record of a minimum of one substantial ankle sprain; the first sprain must have happened a minimum of one year before to study enrollment and the most recent injury had to occur at least three months before the study enrollment. Women with medical records of history of lower limb orthopedic surgeries, past experience of lower extremity fractures or situations for which diagnostic imaging is not advised (such as pregnancy) were disqualified from the research. The study included The institutional ethical council of KVVDU, Karad provided ethical authorization (Protocol No.295/2022-2023). This experimental study was conducted at Krishna College of Physiotherapy in Karad. The participant were provided with informed consent along with the volunteer form covering study details, risks, benefits, confidentiality, and participant rights. Procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975.

The goal of the study was explained to the participants, and they were informed about the procedure. Participants will receive a quick assessment prior to the evaluation. These 100 females were randomly assigned to one of two groups. Group A as well as Group B by the using the envelope technique. Before the treatment starts, two envelopes bearing the group names A and B were created, and subjects were instructed to select one. The Star Excursion Balance Test (SEBT), manual muscle testing (MMT), and range of motion (ROM) were used as pre-test measures of outcome. They gave the individual the intervention that was assigned to them in the envelope. Aquatic training were given to group A , whereas, traditional land-based training were given to group B participants. For approximately six weeks, each group engaged in the activities. The investigation was conducted for about six months.

***Group A (Aquatic Training)***

Every participant was requested to participate in an aquatic treatment session at Krishna Vishwa Vidyapeeth's Hydrotherapy Pool, which is part of Krishna College of Physiotherapy. A 50-minute training schedule was devised, interspersed with a 10-minute recovery time. Ten minutes of warm-up, thirty minutes of active exercise, and ten minutes of cooling down comprised the workout routine. For around six weeks, the 50-minute workout regimen was followed two times a week. A physiotherapist and an aquatic exercise instructor oversaw this program. The pool's temperature was kept between 33°C and 34°C. The workouts were progressively raised in both intensity and frequency for a period of 6 weeks. We paid greater attention to the participant's safety and security during every

training session than we did to precision. Therefore, in order to prevent injuries, we gave the patient instructions to complete the exercise with slightly altered movement. The exercise program is mentioned in Table 1.

***Group B (Land Based Training)***

The six-week land-based training course took place in a therapy room next to the hydrotherapy pool. Same exercises were given to this group as that for aquatic training group.

***Data Collection Tools***

***Range of Motion (ROM)***

Active dorsiflexion, plantarflexion, inversion, and eversion ROM were measured with a universal goniometer. The participant was directed to actively and maximally move their ankle in four directions. Three measurements were taken in each direction, from which a mean degree was determined. To avoid movement of the hips and knee movement, the same assistance stabilized the fibula and tibia. The Goniometer's ICC coefficients ranged from 0.81 to 0.94 (Cox et al., 2018; Norkin & White, 2016).

**Table1.** Exercise protocol for group A aquatic exercise program (Ragab, 2020; Singh et al., 2022; Kadav et al., 2023).

| Program | Exercise | Intensity (Week 1--> Week 6) | Frequency (sets of repetition) (Week 1--> Week 6) |
|---|---|---|---|
| Warm up (10 minutes) | Static walk | - | - |
| | Jog in a place | - | - |
| | Combination stretching | - | - |
| Strength Training (10 minutes) | Double-leg squat | 10 repetitions | 3 ----> 6 |
| | Single leg squat | 10 repetitions | 3 ----> 6 |
| | Hip flexion-extension using theraband | 10 repetitions | 3 ----> 6 |
| | Hip abduction-adduction using theraband | 10 repetitions | 3 ----> 6 |
| Balance training and Range of Motion (ROM) exercise (20 minutes) | Walking forward and backward (meter) | 20 meter | 20×4 ---->20×8 (Progress to eyes closed) |
| | Tandem walking (meter) | 20meter | 20×4 ---->20×8 (Progress to eyes closed) |
| | Toe raises (steps) | 10--->15 | 1-----> 6 |
| | Heel raises (steps) | 10--->15 | 1-----> 6 |
| | Step up and step down | 10 steps | 1-----> 6 |
| | Side stepping-Right and left side | 10--->15 steps | 1-----> 6 |
| | Forward lunges | 10 steps | 2-----> 6 |
| | Side lunges | 10 steps | 2-----> 6 |
| | Standing knee lift- Right & Left (marching) | 10 steps | 3 ----> 6 |
| | Hip kickers- Right & Left | 10 steps | 3 ----> 6 |
| | Deep water bicycle | 1 minute | 3 ----> 6 |
| | One leg balance-right &left (Eyes open to eyes closed) | Front (hold 3 counts),& Side to side (hold 3 counts) | 3 ----> 6 |
| | Single limb stance and catching and throwing the ball (Eyes open to eyes closed) | Hold the position:30 seconds-60seconds | 3 ----> 6 |
| | Wall pushups | 10 | 3 ----> 6 |
| Cool Down (10 minutes) | Combination Stretching | - | - |
| | | | |
| | Joint relaxation | - | - |
| | Deep breathing | - | - |

***Manual Muscle Testing (MMT)***

The following MMT methods and grading method will be used while performing MMT on the gluteus medius, gluteus maximus, quadriceps, tibialis anterior, tibialis posterior, peroneus longus/brevis (group), and gastocnemius. The examinations will be stopped if the subject experiences pain or is unable to maintain the test

position at a particular level of resistance. To identify weakness in the muscles, these assessments continue to have sufficient validity and intra-rater consistency (Kendall et al., 2005).

***Star Excursion Balance Test (SEBT)***

A diagnostic test for dynamic balance is the SBET. Participants will take a unilateral stance in the middle of a grid that has 45-degree intervals marked around it. Participants will perform three repetitions of the single-limb squat reach after completing a training trial that consists of six repetitions in one of the eight test directions. There will be a pair of trials conducted: one in which the participant has to stand on both the afflicted as well as unaffected limbs. Anterior, lateral, anterolateral, posterolateral, posterior, medial, anteromedial, and posteromedial are among the test directions. After three repetitions in every direction, the observing therapist will note the distance covered between the reaching extremity's heel and stance toe. In between each trial, there will be a fifteen-second break. If the participant does not (1) sustain bearing weight throughout the test, (2) elevates the stance foot, (3) lose balance, or (4) fails to maintain or start positions for one second, they won't be allowed to repeat. The reliability of the test at hand is satisfactory (ICC =.67-.97) (Gribble et al., 2007; Hertel , 2000; Kinzey & Armstrong, 1998).

## RESULTS

100 female participants in the research were allocated into two distinct categories, group A and group B, consisting of 50 individuals each, using a simple method of random sampling. Group B underwent a land-based exercise regimen two times for every week for about six weeks, whereas Group A received an aquatic exercise regimen. When comparing to a land-based training program, the impact of an aquatic training regimen was considerably more successful for treating chronic instability of the ankle in young females, in accordance with the statistical evaluation.

**Table 2.** Demographic variables

| Variables | Number of participants (%) | |
|---|---|---|
| | Group A (n=50) | Group B (n=50) |
| Age (Mean) | 24.28±4.43 | 25.06±5.20 |
| BMI (kg/m$^2$) (mean) | 23±3.295 | 23.34±3.088 |
| Injured Leg | | |
| Right | 33 (66%) | 36(72%) |
| Left | 17(34%) | 14(28%) |

***Interpretation***

Table 2 show the mean age of the 100 participants in Group A was 24.28±4.43 and in Group B was 25.06±5.20. The mean BMI in Group A was 23±3.295, while in Group B it was 23.34±3.088. However, the wounded leg was also taken into account. In Group A, 66% of 100 participants had right side ankle sprains and 34% of females had left side ankle sprains, but in Group B, 72% had right side ankle sprains and only 28% had left side ankle sprains.

***Interpretation***

Table 3 shows a significant difference ($p < 0.0001$) in mean values of ROM value for individuals with chronic instability of the ankle in Group A for ankle dorsiflexion, plantarflexion, inversion, and eversion, while Group B had p values of 0.0271, 0.3758, 0.4466, and 0.0452. The post-test mean values for ankle dorsiflexion and plantarflexion between the ROM groups were determined to be significant ($p = 0.0410$ and $p = 0.0457$). There was a substantial difference in ankle inversion and eversion ($p=0.0484$) respectively.

***Interpretation***

Table 4 shows the findings of the comparison of the mean values of MMT scores within the groups of individuals with persistent ankle instability. It was discovered that the ankle dorsiflexors, plantarflexors, invertors, and evertors of Group A were extremely significant ($p < 0.0001$), and that the ankle dorsiflexors, invertors, and evertors of Group B were very significant ($p = 0.0015$, 0.0055, and 0.0020) and for plantarflexors it was substantially significant ($p = 0.0207$). The findings of the post-test mean variations between two groups of ROM for ankle dorsiflexors, plantarflexors, and evertors were determined to be extremely significant ($p = 0.0002$, 0.0003, and <0.0001), whereas ankle evertors were shown to be very significant ($p = 0.0010$).

**Table 3.** Range of motion (ROM)

| ROM | Pretest | Posttest | p value | t value |
|---|---|---|---|---|
| Dorsiflexion | | | | |
| Group A | 8.98±2.14 | 11.06±3.07 | <0.0001 | 4.240 |
| Group B | 8.64±2.43 | 9.8±3.010 | 0.0271 | 2.279 |
| Interference | 0.4599 | | 0.0410 | |
| Plantarflexion | | | | |
| Group A | 39.02±5.06 | 41.82±7.10 | <0.0001 | 5.276 |
| Group B | 38.88±5.41 | 39.24±5.55 | 0.3758 | 0.8937 |
| Interference | 0.8941 | | 0.0457 | |
| Inversion | | | | |
| Group A | 29.44±3.726 | 31.92±4.711 | <0.0001 | 5.720 |
| Group B | 29.96±3.95 | 30.26±3.504 | 0.4466 | 0.7673 |
| Interference | 0.5001 | | 0.0484 | |
| Eversion | | | | |
| Group A | 9.16±3.38 | 11.02±4.58 | <0.0001 | 8.475 |
| Group B | 9.18±3.46 | 9.56±2.37 | 0.0452 | 2.055 |
| Interference | 0.9768 | | 0.0484 | |

**Table 4**. Manual muscle testing (MMT)

| MMT | Pretest | Posttest | p value | t value |
|---|---|---|---|---|
| Dorsiflexion | | | | |
| Group A | 3.14±0.75 | 4±0.75 | <0.0001 | 6.143 |
| Group B | 3±0.90 | 3.42±0.75 | 0.0015 | 3.364 |
| Interference | 0.4028 | | 0.0002 | |
| Plantar flexion | | | | |
| Group A | 3.08±0.69 | 4.14±0.88 | <0.0001 | 6.419 |
| Group B | 3.1±0.54 | 3.46±0.95 | 0.0207 | 2.391 |
| Interference | 0.8730 | | 0.0003 | |
| Inversion | | | | |
| Group A | 3.16±0.79 | 4.04±0.69 | <0.0001 | 5.755 |
| Group B | 3.06±0.61 | 3.5±0.88 | 0.0055 | 2.902 |
| Interference | 0.4836 | | 0.0010 | |
| Eversion | | | | |
| Group A | 3.02±0.82 | 4.1±0.50 | <0.0001 | 8.088 |
| Group B | 3.12±0.59 | 3.4±0.57 | 0.0020 | 3.259 |
| Interference | 0.4867 | | <0.0001 | |

***Interpretation***

Table 5 illustrates the findings of comparison of the mean values of SEBT scores within the groups of individuals with persistent ankle instability. For Group A, the findings revealed that the anterior, anterolateral, posterolateral, posterior, medial, anteromedial, and posteromedial scores were extremely significant ($p<0.0001$), while for Group B, the findings revealed that the medial and anteromedial scores were extremely significant ($p<0.0001$), while the lateral, anterolateral, posterolateral, and posteromedial scores were found to be very significant ($p=0.0068,0.0062,0.0031,0.0090$) and anterior and posterior were significant ($p=0.0423,0.0167$) respectively. The post-test mean values between the ROM groups for the medial direction were found to be highly significant ($p = 0.0041$);whereas, the anterior, lateral, anterolateral, posterolateral, posterior, anteromedial, and posteromedial directions were found to be highly significant ($p=0.0343$, 0.0344, 0.0362, 0.0227, 0.0135, 0.0497, and 0.0475).

**Table 5.** Star excursion balance test (SEBT)

| SEBT | Pretest | Posttest | p value | t value |
|---|---|---|---|---|
| Anterior | | | | |
| Group A | 70.68±6.60 | 74.62±5.64 | <0.0001 | 5.927 |
| Group B | 71.78±6.33 | 72.16±5.81 | 0.0423 | 2.086 |
| Interference | 0.7002 | | 0.0343 | |
| Lateral | | | | |
| Group A | 82.7±5.73 | 85.4±5.70 | 0.0006 | 3.692 |
| Group B | 82.1±6.93 | 82.8±6.40 | 0.0068 | 2.824 |
| Interference | 0.6382 | | 0.0344 | |
| Anterolateral | | | | |
| Group A | 79.98±4.83 | 83.1±6.30 | <0.0001 | 7.254 |
| Group B | 80.18±5.07 | 80.58±5.533 | 0.0062 | 2.858 |
| Interference | 0.8406 | | 0.0362 | |
| Posterolateral | | | | |
| Group A | 81.48±6.652 | 85.02±6.33 | <0.0001 | 5.287 |
| Group B | 81.02±6.554 | 81.94±6.96 | 0.0031 | 3.115 |
| Interference | 0.7284 | | 0.0227 | |
| Posterior | | | | |
| Group A | 69.72±6.77 | 74.08±5.20 | <0.0001 | 7.632 |
| Group B | 70.16±6.12 | 71.12±6.49 | 0.0167 | 2.477 |
| Interference | 0.7341 | | 0.0135 | |
| Medial | | | | |
| Group A | 59±4.14 | 62.7±4.33 | <0.0001 | 12.278 |
| Group B | 59.54±4.39 | 60.26±3.96 | <0.0001 | 4.938 |
| Interference | 0.5286 | | 0.0041 | |
| Anteromedial | | | | |
| Group A | 61.26±5.62 | 64.16±5.38 | <0.0001 | 9.667 |
| Group B | 61.06±5.55 | 62±5.48 | <0.0001 | 6.950 |
| Interference | 0.8583 | | 0.0497 | |
| Posteromedial | | | | |
| Group A | 62.12±4.85 | 65.08±5.73 | <0.0001 | 6.353 |
| Group B | 62.4±5.02 | 62.94±4.89 | 0.0090 | 2.722 |
| Interference | 0.7774 | | 0.0475 | |

## DISCUSSION

The current study "Effect of aquatic exercise training in young female individuals with chronic ankle instability" was undertaken to examine the effect of aquatic training on Chronic Ankle Instability among the young females and to compare the effect of aquatic training and traditional land-based exercise training on Chronic Ankle Instability in young females. This research was conducted at Krishna College of Physiotherapy in Karad, with 100 individuals who met the inclusion criteria. This research enrolled only females aged 20 and 30 who had experienced at least one severe ankle sprain, with the primary sprain occurring a minimum of one year before the registration in research and the common recent injury had to have happened at least three months prior to enrollment in the study. Following protocol and ethical board approval, individuals were enrolled in the research after informed permission was obtained. 100 female individuals were assigned at random into two distinct groups using the sealed envelope method, and each group received an exercise regimen for six weeks: Group A received an aquatic training regimen, while Group B received a land-based training program. In order to assess the response of balance and ankle joint muscular strength, the studies employed ROM, MMT, and SEBT as outcome measures. In this research, young females with persistent instability of the ankle were evaluated to investigate whether

an aquatic training program affected their ROM, MMT, and balance. The purpose of the present research was to examine the effect of an aquatic exercise program on ROM, MMT and balance among young females with chronic ankle instability.

Previous research has shown people that with both acute and repeated ankle sprains often exhibit decreased postural control. Similarly, individuals with persistent ankle instability are frequently found to have functional abnormalities in postural control. It is quite probable that a combination of compromised proprioception and neuromuscular control is the cause of these postural abnormalities (Docherty et al., 2006; Wikstrom et al., 2007; Ross & Guskiewicz, 2006). Several researches have examined the impact of proprioceptive exercises, strengthening exercises, or the combination of the two on a patient's return to activities of daily living (Ben Moussa Zouita et al., 2013). Nevertheless, no previous study has yet been conducted on the efficacy of aquatic training in managing young female individuals who have chronic ankle instability, which is why this investigation was carried out. At the completion of the sixth week, Group A exhibited much better strength, ROM and balance compared to Group B.

In 2020, Ragab conducted a study to evaluate the effects of a combined program consisting of hydrotherapy and land-based exercises versus land-based exercises alone in patients suffering from chronic lateral ankle sprains. Results showed that while there was no significant difference ($p > 0.05$) between the groups, patients in the hydrotherapy group and the combined group had improved in terms of discomfort, ankle functional ability, range of motion, and satisfaction. In the present research , the control group exhibited substantial improvement with p values of 0.0271, 0.3758, 0.4466, and 0.0452, while the interventional group showed larger improvement in ankle dorsiflexion, plantarflexion, inversion and eversion ROM with a p value of <0.0001.

Singh et al.'s research from 2022 aims to establish the superiority of water versus land as a training medium for balancing exercises associated with the functional ankle instability. Based on the study's findings, both groups trained balance for mechanical instability of the ankle just as well (Singh et al., 2022). The findings of this research found that the aquatic training group outperformed other groups. Group B showed significantly better improvement for both medial and anteromedial ($p<0.0001$), while another group found significant improvement for anterior and posterior ($p=0.0423$, 0.0167) and very significant improvement for lateral, anterolateral, posterolateral, and posteromedial ($p=0.0068$, 0.0062, 0.0031, 0.0090).

In 2022, Arulekar and Shinde did a study with the objective of reviewing the state-of-the-art physiotherapy procedures and techniques in CAI and its difficulties and future directions. Overall, this study discovered that the reviewed literature indicated the difficulties associated with CAI, which primarily focus on a single area of treatment. It also proposed prospects for CAI studies and the setting up of a patient-centered, structured protocol for both the short- and long-term effects of the intervention. According to research by Yelfani et al. (2015), women with chronic ankle sprains in between the ages of 20 and 30 could experience better pain alleviation, performance, and static and dynamic stability when engaging in land- and water-based workouts (Abadi et al., 2018).

Evidently the water's buoyancy and non-weight bearing characteristics minimize the dynamic balance that affects the direction and pace of motions during training. As a result, even while buoyancy operates against gravity, it makes joints, muscles, and tendons feel lighter in water than they would on land (Nualon et al., 2013; Thein & Brody, 1998; Donoghue et al., 2011; Abadi et al., 2017).Additionally, water's viscosity, resistance, and speed of response all come to an end (Prentice et al., 2004). Because of arm swing into the water, there may be decreased joint flexibility, increased drag, and greater difficulty maintaining stability when standing erect (Donoghue et al., 2011).Consequently, compared to the land-based group, the aquatic group would experience fewer repeats. The only aspect of underwater running that is comparable to on-land running or walking is the upright posture; nevertheless, the hydrotherapy group's participants benefit from the non-weight bearing training in the hot water since it helps reduce discomfort and swelling (Hoogenboom & Lomax, 2004).

Studies have indicated that aquatic exercise is more beneficial for improving flexibility and ROM in patients, older adults, and those with health issues (Pöyhönen et al., 2002; Wang et al., 2007; Takeshima et al., 2002). Similar findings were made in this study, which showed that ROM significantly improves in individuals with chronic

instability of the ankle. As a result, the current study showed that among females with chronic ankle instability, a water training program had a therapeutically beneficial impact on strength, range of motion, and balance. These findings highlight the potential for a holistic approach in the treatment of ankle instability, Therefore, the alternative hypothesis—that an aquatic exercise program has a significant impact on young girls with chronic ankle instability—is accepted by this study.

There are numerous limitations on the study. The findings may not be as broadly applicable to the general population due to a possible small sample size. Additionally, the results are not as applicable to males or older persons with CAI due to the unique focus on young females. A long-term evaluation of the advantages and sustainability of water exercise may also be impossible due to the study's brief duration. Middle-aged women might be selected in future attempts, and larger samples should be used in future studies to improve generalizability, as young females were enlisted for this project.

### *Clinical Implications*

A promising approach to rehabilitation is aquatic training, which enhances strength, ROM, balance, and functional results. They offer a low-impact setting that lessens the strain on the ankle joints and makes efficient strengthening and conditioning possible. For individuals with chronic ankle instability (CAI), this could mean less pain and an enhanced standard of life. The accessibility and tolerability of aquatic workouts make them an ideal choice for individuals who find traditional land-based activities difficult. Including aquatic exercise in rehabilitation regimens can enhance long-term results and lower the chance of recurrence. Additionally, it makes it possible for them to recognize and address any musculoskeletal system abnormalities or defects. Aquatic exercise also promotes general well-being by lowering stress, elevating mood, and addressing psychological obstacles to physical engagement.

### *Suggestions*

Comprehensive studies can be conducted to create aquatic training regimens that address deficiencies such as reduced proprioception linked to CAI. Depending on the patient's disability and functional objectives, the intensity, time span, and advancement should be tailored to them specifically. More studies needs to investigate the impact of aquatic exercise on the motivation, mood, and perceived exertion of young females.

## Conclusion

The study concluded that aquatic treatment performs efficiently for enhancing strength, range of motion, and balance. After treatment, the patient has also experienced a calming and relaxing impact from aquatic therapy because the amount of fatigue and strain on their muscles is decreased. Furthermore, these young ladies may work out in a water-based environment safely and successfully because of the physical characteristics of water. It was determined that the aquatic training program had improved strength, balance and ROM in a considerably positive way. In contrast, the control group's post-test results for strength, ROM and balance showed very little change. The findings revealed that a 6-week aquatic exercise program helped young females with persistent ankle instability improve their range of motion, muscle strength, and balance.

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### *Conflict of İnterest*

There are no conflicting relationships or activities.

### *Ethics Statement*

This research followed ethical standards and received approval from the Institutional Ethical Committee of Krishna Vishwa Vidyapeeth, KIMSDU dated 17/01/2023 and numbered 295/2022-2023.

### *Author Contributions*

Design of the Study: SS, IK and SS; Data Gathering: PJ, AS; Statistical Evaluation: SS; Data interpreting: PJ and SS; Writing of the Manuscript: PJ and SS; Search of the Literature: PJ and SS. Each author has reviewed the final draft of the manuscript and given their approval.

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RESEARCH ARTICLE

# The Contribution of the Psychological Pressures That Football Referees Are Exposed to Through Visual Media to Their Level of Performance

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**Abstract**
The study purposes to identify the contribution of the psychological pressures that football referees are exposed to through visual media to their level of performance. To achieve this, The researchers used the descriptive correlational approach. The study was conducted on a sample consisting of 86 referees, who were divided separately according to the referee's specialization into referees, their number was 37, and assistant referees, numbering 49. For the purposes of data collection. The researchers used two tools for the study. The first tool relates to measuring psychological pressures, while the second and third tools relate to measuring the level of performance of the referees and their assistants. After the process of collecting the data, which was processed statistically using the statistical package program (SPSS). The study findings showed the existence of an inverse relationship at pe value ($\alpha \leq 0.05$) between the psychological pressures that referees are exposed to, and all their performance standards, as psychological pressure explains (18.10%) of the decline in their performance level. The results also showed that there is an inverse relationship between the psychological pressures that football assistant referees are exposed to via visual media and all of their performance standards, as psychological pressures contributed to (%19.50) of the decline in their performance level.

**Keywords**
Psychological Pressures, Visual Media, Level of Performance, Football

## INTRODUCTION

Football referees are the most important components of the game, and they are its backbone, and the focus of attention of all members of the football sports system, including players, coaches, administrators, and fans, is on them because they separate between the competing teams on the field (Alakhdar et al, 2020). The decision taken by the referee in any situation is may be a major reason for winning or losing the match, so it is often Their decisions are subject to doubt and negative criticism from components of the sports system in general, specifically when they lose a match or competition, which exposes them to great psychological pressure that makes them lose the ability to concentrate, predict and respond which increases their anger and irritability, and exposes them to physical and mental exhaustion, thus affecting their level of performance and reducing their abilities to make the right decisions (Johnsan & Haugen, 2013). In addition to that, the chants of the fans, their annoying voices, their profanity, decisive matches such as finals, promotion and relegation matches for teams, refereeing errors, anxiety, exhaustion, life-threatening dangers, professional conflicts, and living conditions are among the most important and dangerous pressures that football referees are exposed to (Bastug et al, 2016; Alhadali, 1992).

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In light of the tremendous technical progress and technology of the means of communication and information, the sports media, with the visual, audio and print media materials it provides through pages and specialized television channels, has played a positive and vital role in acquiring information and knowledge, raising the level of sports awareness, and modifying behavior in a manner consistent with sound sports values and traditions by transmitting and disseminating news. Information and sports topics that capture the attention of the masses, such as explaining the rules and laws of sports games and activities to the public, on the one hand. On the other hand, Onisi (2023) believes that the sports media also plays a negative role, as it has contributed greatly to stirring up strife and encouraging acts of violence and riots by shedding light on mistakes of referees questioning their integrity and impartiality, and exaggerating some sporting events and matches, conveying some untruthful details about the course of the competition, and trying to catch mistakes made by players, coaches and administrators and shed light on them, in addition to publishing information and secrets that might spark violence and riots in sports stadiums, exposing the private lives of referees, and the media's favoritism of some referees and praising them at the expense of others.

In this regard, Bakhsh and Faten (2016) mentioned that the negative media directed towards referees in general and football referees in particular casts a shadow and negative psychological effects on the referees and their level of performance in terms of their being afflicted with some digestive, respiratory and nervous system diseases and memory disorders and weakness, where thinking patterns become disturbed, irrational and illogical as well. The emotional effects of referee's increase, such as an increase in psychological tension, obsession, the appearance of depression, helplessness, weak moral controls, irritability, and isolation (Atlı et al., 2024). The results of many studies have agreed that the psychological pressures to which referees are exposed may greatly affect their level of performance because of losing the ability to concentrate (Gomes et al, 2021; Bulgurcuoglu, 2020; Brigantiet al, 2018; Voight, 2009; Anshel& Ekmeci, 2014, Coumas, 2014; Felix&Ettl, 2011; Nevill et al, 2002).

In light of the tremendous technical and technological progress in the means of communication and information, the sports media, with the visual, audio and print media materials it provides through pages and television channels, has played a positive and vital role in acquiring information and knowledge, raising the level of sports awareness, and modifying behavior in a way that is compatible with sound values, customs and traditions by publishing news and sports topics that capture the attention of the masses, such as explaining the rules and laws of sports games and activities to the public (Ahmad & Alkhatib, 2016). Because of the importance of the issue of psychological pressures to which football referees are exposed via visual media, this study came as a practical attempt by the researcher with the aim of identifying the contribution of psychological pressures to which football referees are exposed via visual media to their level of performance.

## MATERIALS AND METHODS

### *Participant*

The researchers used the descriptive correlational approach, where the total study sample consisted of 86 football referees in Palestine, divided separately according to the referee's specialization into field referees, numbering 37 referees, and assistant referees, numbering 49 referees, who were chosen in the most convenient way from the study community, as the sample of field referees represents what 74% of its society, and the sample of assistant rulers represents approximately 61% of its society, and Table (1) show the sample Characteristics.

**Table 1.** Characteristics of the study sample according to the variables of age, height & body mass (n = 86).

| Variables | Mean | Standard deviation | Skewness |
|---|---|---|---|
| Age (Year) | 33.86 | 1.64 | 0.091 |
| Height (cinMeter) | 1.77 | 5.71 | 0.907 |
| Body mass (Kg) | 76.93 | 5.86 | 1.08 |

It is clear from the results of Table (1) that the values of the skewness coefficient are between (± 3) and this indicates that the study sample is subject to the normal distribution

This study was conducted in accordance with the ethical standards and ethical approval was obtained from the Ethics Committee, with reference number (21.07.2024). The participants signed informed consent document through a volunteer form that outlines the research procedures, risks, benefits, confidentiality, and participant rights. The current research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing the rights and welfare of the participant in its design, procedures, and confidentiality measures.

***Data Collection Tools***

Two tools were used for the study

***Psychological Pressures Tool***

A tool for the psychological pressures that both field referees and assistant referees are exposed to in football in Palestine via the visual media. The tool prepared by (Muhammad and Sahib, 2017). The tool as a whole consists of 30 items Which requires responding them according to the five-point Likert scale: Very high (5) degrees, high (4) degrees, medium (3) degrees, low (2 degrees), and (1) degree for very low

***Referees Performance Tool***

It was based on the tool used to evaluate referees in the referees' circle of the Palestinian Football Association and approved by the Asian Football Confederation in sport season in (2023-2024). The tool as a whole consists of 50 items divided into two separate sections. The first section measures the performance of the field referees and its number is 40 items distributed over four criteria and areas. The second section measures the performance of the assistant referees and its number is 10 items Which requires responding them according to the five-point Likert scale: Very high (5) degrees, high (4) degrees, medium (3) degrees, low (2 degrees), and (1) degree for very low.

The study was conducted in the 2022-2023 sports season.

***Statistical Treatments***

SPSS (Version 26.0) package program was used to analyze the data obtained as a result of measurements and calculations. It was determined whether the data were normally distributed or not by the Shapiro–Wilk test. A Pearson correlation coefficient and simple linear regression analysis were applied to find answers to the questions of the study and reach its results. The significance level was determined as $p \leq 0.05$.

## RESULTS

Results related to the study question, which states: Is there a statistically significant relationship between the psychological pressures that football referees in Palestine are exposed to via visual media and their level of performance?

To answer this question, (the Pearson correlation coefficient) was used, and the results of Table (2) show this.

**Table 2.** The relationship between the psychological pressures that football referees in Palestine are exposed to via visual media and their level of performance

| Performance standards for field referees | Psychological pressures | Performance standards for assistants referees | Psychological pressures |
|---|---|---|---|
| Accuracy in decision making | -0.47 | Accuracy and consistency in making decisions | -0.44 |
| Controlling the match | -0.42 | Controlling the match | -0.41 |
| Fitness | -0.33 | Fitness | -0.42 |
| Cooperating with others | -0.36 | Overall level of performance | -0.44 |
| Overall level of performance | -0.43 | | |

* A statistically significant relationship in (0.05≥-a)

It is clear from the results of table number (2) that;

There is a statistically significant inverse relationship at the level of significance (0.05≥-a) between the psychological pressures to which football field referees in Palestine are exposed through the visual media and the overall level of their performance. Where the value of the Pearson correlation coefficient was (-0.43), and there is also a statistically significant inverse relationship between psychological pressures and all their performance standards, where the values of the Pearson correlation coefficient ranged between (-0.47-0.33).

There is a statistically significant inverse relationship at the level of significance (0.05≥-a)

between the psychological pressures to which football assistant referees in Palestine are exposed via visual media and the overall level of their performance, as the value of the Pearson correlation coefficient was (-0.44). There is also a statistically significant inverse relationship between psychological pressures and all meanings of performance for them, as the values of the correlation coefficient were Pearson respectively (0.42,-0.41,-0.44).

To determine the contribution of psychological stress through visual media to the level of performance of both field referees and assistant referees in Palestine, (simple linear regression) analysis was used. The results show this.

**Table 3.** Summary of the results of simple linear analysis to determine the effect of psychological pressures via visual media on the performance level of field referees in Palestine

| The source | Sum of squares | Degrees | Average | F Value | Level of significance | B Value | R2 |
|---|---|---|---|---|---|---|---|
| Regression | 1.65 | 1 | 1.65 | 7.73 | *0.0009 | 5.74 | 0.181 |
| Error | 7.49 | 35 | 0.21 | | | -0.43 | |
| Sum | 9.14 | 36 | | | | | |

* A statistically significant effect at the significance level in (0.05≥a)

It is clear from the results of the following table that there is a statistically significant effect at the level of significance of the psychological pressures that arena referees are exposed to in Palestine via visual media on their level of performance. Where the value of R2 was (0.181), this means that psychological pressures explain (18.10%) of declining in the level of performance among the field referees in Palestine, and Figure No. 1 shows this.

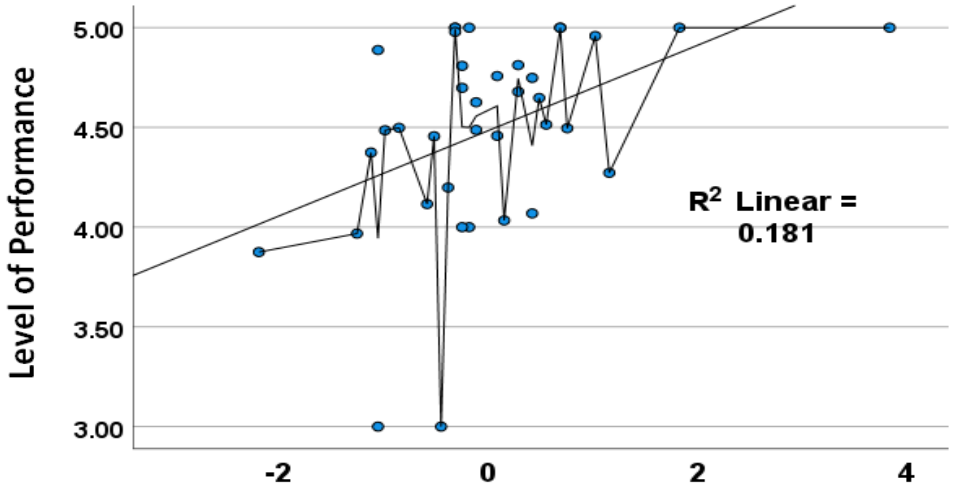


**Figure 1.** The regression line of the effect of psychological pressures through visual media on the level of performance among field referees in Palestine.

It is clear from the results of the table that there is a statistically significant effect at the level of significance of the psychological pressures that assistant referees are exposed to in Palestine via visual media on their level of performance. Where the value of R2 was(0.195), this means that psychological pressures explain (19.50% )of declining in the level of performance among the field referees in Palestine, and Figure No. 2 shows this.

**Table 4.** Summary of the results of simple linear analysis to determine the effect of psychological pressures via visual media on the performance level of assistant referees in Palestine

| The source | Sum of squares | Degrees | Average | F Value | Level of significance | B Value | R2 |
|---|---|---|---|---|---|---|---|
| Regression | 4.55 | 1 | 4.55 | 11.36 | *0.002 | 6.15 | 0.195 |
| Error | 18.84 | 47 | 0.40 | | | -0.66 | |
| Sum | 23.39 | 48 | | | | | |

* A statistically significant effect at the significance level in (0.05≥a)

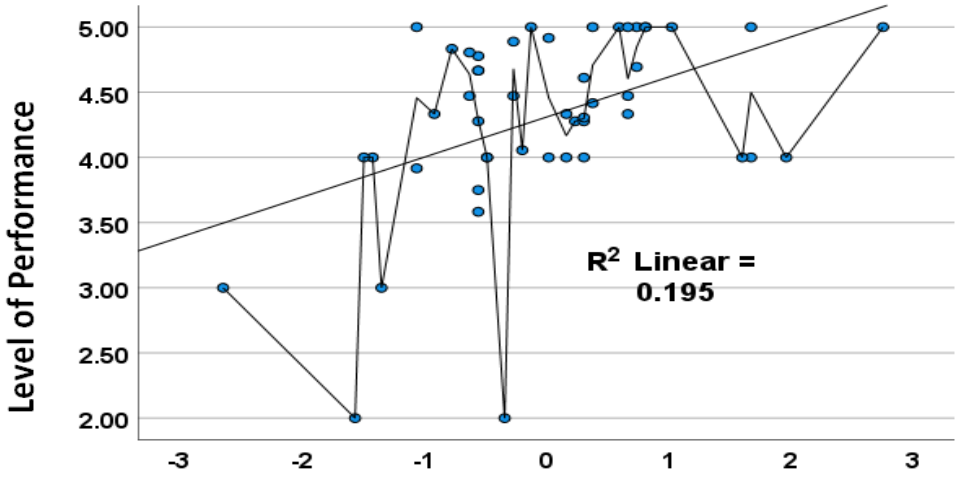


**Figure 2.** The regression line of the effect of psychological pressures through visual media on the level of performance among assistant's referees in Palestine

## DISCUSSION

The results of the study in Table One showed that there is a statistically significant inverse relationship at the level of significance (0.05>-a) between the psychological pressures to which football referees in Palestine are exposed via visual media and the overall level of their performance. The value of the Pearson correlation coefficient was (-0.43) The results also showed a statistically significant inverse relationship between psychological pressures and all their performance standards, where the values of the Pearson correlation coefficient ranged between (-0.33-_-0.47). This means that the psychological pressures that field referees are exposed to in Palestine explain the percentage (18.10%) decline in their level of performance. It is also clear from the results of the study that there is a statistically significant inverse relationship at the level of significance (0.05>-a) between the psychological pressures that football assistant referees are exposed to in Palestine before the visual media and the overall level. For their performance. The value of the Pearson correlation coefficient was (-0.44) and it was also shown that there was also a statistically significant inverse relationship between psychological pressures and all their meanings of performance.

This is where the values of the Pearson correlation coefficient were respectively (-0.44-0.41-0.42). This means that the psychological pressures that assistant referees are exposed to in Palestine explain 19.5% of the decline in their level of performance. In general, the results of this study were consistent with the studies of: (Ogabor et al., 2023; Webb et al., 2023; Wang et ak,2023; Pizzera et al., 2022; Soriano et al., 2021; Wang et al., 2021; Gomes et al 2021; Aguirre-loaiza et al., 2020; Gustafsson et al., 2017). How does the researcher attribute this to a number of factors, the most important of which are the referees' experience, their high level of physical fitness, and the provision of security and personal protection men, which greatly helped them to be alert, energetic, focused, and in the correct positioning, distributing effort throughout the match, in addition to the continuous cooperation between the field referees and the assistant referees, which reduced the level of

psychological stress among referees and their high level of performance."

## Conclusion

Through the results of the study, the researchers conclude that the level of performance among football referees in Palestine is closely related to the level of psychological pressure they are exposed to through visual media. The more psychological pressure among referees, the lower their level of performance, and vice versa.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.


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## Ethics Statement

This study was conducted in accordance with the ethical standards and ethical approval was obtained from the Ethics Committee, with reference number (21.07.2024).

## Author Contributions

Study Design, MB; Data Collection, MB, HS; Statistical Analysis, MB, HS, AQ, MA and RK; Data Interpretation, MB, Hs and RK; Manuscript Preparation, MB, HS, AQ, MA and RK; Literature Search, MB, HS, AQ, MA and RK. All authors have read and agreed to the published version of the manuscript

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RESEARCH ARTICLE

# Effectiveness of The Sumatera Selatan Bersatu Gymnastics Model in the Improvement of Students' Physical Fitness

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**Abstract**
The aim of this study was to improve the physical fitness of students at Bina Darma University in Palembang. The South Sumatera Bersatu gymnastics model was identified as one of the potential methods to improve students' physical fitness. The purpose of this study was to analyse the effectiveness of using the South Sumatera Bersatu Gymnastics Model in improving the physical fitness of students. The scope of the study included students with an average age of 19 years. The method used in this study is an experiment with a group pre-test and post-test design. The research sample was taken through purposive sampling with an age criterion of 19 years. The intervention in the form of implementing the Bersatu Sumatera Selatan Bersatu model was carried out for 8 sessions in each session doing 5 repetitions. Physical fitness data were collected before and after the intervention using the Indonesian Physical Fitness Test. The results showed that the use of the South Sumatra Selatan Gymnastics Model significantly improved physical fitness. The resulting t-scores (a total of 41,583 for the pre-test and 64,673 for the post-test) indicate that these differences are highly statistically significant, with p-values (Sig.) that are extremely low ($p<0.000$). There was a significant improvement in various physical fitness indicators such as muscle strength, flexibility, endurance and speed after the students enrolled in the gymnastics programme.The conclusion South Sumatera Bersatu gymnastics model is effective in improving the physical fitness of students in Palembang. This research suggests that this gymnastics model could be adopted as part of physical education programmes in schools to improve students' health and fitness.

**Keywords**
Effectiveness, Gymnastics model, Sumatra Selatan Bersatu, Physical Fitness, Student

## INTRODUCTION

Physical fitness is one of the important aspects in supporting students' physical and mental health, which directly affects their learning ability and academic performance (Ellyas et al., 2023; Harvianto & Bernisa, 2019; Muslimin et al., 2022).Students who have a good level of physical fitness tend to have higher stamina, better concentration and the ability toparticipate actively in classroom activities (Daulay et al., 2023; Rizki et al., 2023). Bina Darma University students have a low level of physical fitness in sports activities.

Data from various health surveys show that many students are less physically active, which can have a negative impact on their overall health. Therefore, efforts are needed to improve the physical fitness of students through effective and

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enjoyable methods. One of the efforts that can be made is to apply the appropriate and effective gymnastics model. The gymnastics model of South Sumatera Bersatu was identified as a potential method to achieve this goal, given the local culture and characteristics contained in its movements.

Physical fitness is the ability of a person to perform daily activities efficiently and without excessive fatigue, and to have reserve energy for additional activities (Hadi et al., 2023; Meka et al., 2023; Mosteoru et al., 2023). The importance of physical fitness encompasses not only physical aspects, but also mental and emotional health, with a significant impact on the prevention of chronic diseases such as obesity, diabetes, heart disease and hypertension (Belli et al., 2022; Henriana, 2023). Good physical fitness can improve cardiovascular endurance, muscle strength, flexibility and healthy body composition (Ahn et al., 2024; Duncan et al., 2021; Helper et al., 2024). Physical fitness is very important for students because it has a positive impact on academic performance and mental health. Regular physical activity can improve concentration, memory and learning ability, which overall helps to improve academic performance. (Kavanagh et al., 2023; Makaruk et al., 2023; Vibarel-Rebot et al., 2023). Physical fitness also helps develop discipline, teamwork and self-confidence, which are important skills in everyday life (Cao et al., 2024; Liu et al., 2024; Morais et al., 2024).

Previous studies have shown that different types of exercise and physical activity can make a significant contribution to improving physical fitness (Honrubia-Montesinos et al., 2021; Ribeiro et al., 2024). Previous studies have looked at the relationship between physical fitness and body weight in primary school children and found that weight gain led to a decrease in physical fitness, especially in children with higher body weights (Aliriad, Adi, et al., 2023). To investigate the relationship between moderate-to-vigorous physical activity and health-related physical fitness indicators in adolescents aged 12-16 years in southern Punjab, Pakistan. The results showed a positive relationship between physical activity and indicators of hand grip strength, modified pull-ups, plank exercises and 20m shuttle run tests, indicating that increased fitness can improve body composition, muscle strength, core muscle endurance and aerobic capacity in both sexes. (Hamdani et al., 2023).

Research on the influence of the kindergarten environment on the physical development of pre-school children shows that kindergartens that provide physical education and special gyms have better physical fitness scores (Aliriad, Da'i, et al., 2023; Satria et al., 2023). The study also found that teachers' professional qualifications and participation in physical education are important factors in children's physical development. Research on aerobic exercise, yoga and floor exercise programmes has been shown to improve muscle strength, flexibility, endurance and other components of fitness (Field, 2016; Zhang et al., 2024). However, each type of exercise has different characteristics and effectiveness depending on the target group and the conditions under which it is delivered. Some studies suggest that a gymnastics programme that is structured and tailored to the needs and characteristics of the participants can produce more optimal results. However, specific studies evaluating the effectiveness of the Bersatu Sumatera Selatan Bersatu model are still limited. The lack of in-depth research on the effectiveness of this gymnastics model indicates the need for further studies to ensure that this model can be widely applied and provide maximum benefits.

This study aims to evaluate the effectiveness of the South Sumatera Bersatu Gymnastics Model in improving physical fitness among students of Bina Darma University Palembang. The benefits of research for students can improve physical fitness through the application of the South Sumatra Bersatu Gymnastics Model, as well as motivate them to exercise regularly. Thus, physical fitness not only supports physical health, but also provides holistic benefits for individual development, especially for students who are at an important stage of growth and development.

## MATERIALS AND METHODS

### *Participant*

This study uses experimental methods with a group pre-test and post-test design (Darwin et al., 2021; Syahrizal & Jailani, 2023). The respondent in this study was a 19-year-old student of Bina Darma University Palembang. The respondents were selected based on their willingness to participate in the gymnastics programme during the study period. A total of 25 students participated in this study.

Ethics Committee approval required This article was approved by the Ethics Committee of Health Research Islamic Hospital Malang, Malang City, East Java, Indonesia with number (No.106/ KEPK/RSI-U/VII/2024). Participants provide informed consent with a volunteer form that includes details about the research, risks, benefits, confidentiality and rights of participants. The study will strictly adhere to all the principles contained in the WHO Ethical Guidelines 2011 and CIOMS 2016, prioritising the rights and well-being of participants in the design, procedures and confidentiality measures.

***Data Collection Tools***

The data collection procedure was carried out in several stages as follows:

***Pre-Test***

Before the gymnastics intervention, all respondents measured their physical fitness using the Indonesian Physical Fitness Test (TKJI), which consisted of a 60-metre sprint test, a 60-second body lift hanging test, a 60-second sitting lying test, an upright jump test, and a 1200-metre running test.

***Gymnastics Intervention***

Then the respondents followed the gymnastics model programme of South Sumatera Bersatu for 8 weeks, with a frequency of 2 times per week. Gymnastics activities used are Gymnastics South Sumatra United with a duration of 8 minutes and performed for 5 repetitions in each session of the exercise programme.

***Post-Test***

After 8 weeks, all respondents underwent physical fitness tests, namely 60-metre sprint test, 60-second body lift hanging test, 60-second sitting lying test, upright jump test, 1200-metre running test.

**Table 1**. Research participants

| Sample | Age (years) | Height (cm) | Weight (kg) | Gender | IMT |
|---|---|---|---|---|---|
| 1 | 19 | 168 | 70 | Male | 24.8 (Normal) |
| 2 | 19 | 170 | 68 | Male | 23.5 (Normal) |
| 3 | 19 | 172 | 72 | Male | 24.3 (Normal) |
| 4 | 19 | 167 | 67 | Male | 24.0 (Normal) |
| 5 | 19 | 169 | 71 | Male | 24.8 (Normal) |
| 6 | 19 | 171 | 69 | Male | 23.6 (Normal) |
| 7 | 19 | 173 | 73 | Male | 24.4 (Normal) |
| 8 | 19 | 166 | 66 | Male | 23.9 (Normal) |
| 9 | 19 | 168 | 70 | Male | 24.8 (Normal) |
| 10 | 19 | 170 | 68 | Male | 23.5 (Normal) |
| 11 | 19 | 172 | 72 | Male | 24.3 (Normal) |
| 12 | 19 | 167 | 67 | Male | 24.0 (Normal) |
| 13 | 19 | 169 | 71 | Male | 24.8 (Normal) |
| 14 | 19 | 171 | 69 | Male | 23.6 (Normal) |
| 15 | 19 | 173 | 73 | Male | 24.4 (Normal) |
| 16 | 19 | 166 | 66 | Male | 23.9 (Normal) |
| 17 | 19 | 168 | 70 | Male | 24.8 (Normal) |
| 18 | 19 | 170 | 68 | Male | 23.5 (Normal) |
| 19 | 19 | 172 | 72 | Male | 24.3 (Normal) |
| 20 | 19 | 167 | 67 | Male | 24.0 (Normal) |
| 21 | 19 | 169 | 71 | Male | 24.8 (Normal) |
| 22 | 19 | 171 | 69 | Male | 23.6 (Normal) |
| 23 | 19 | 173 | 73 | Male | 24.4 (Normal) |
| 24 | 19 | 166 | 66 | Male | 23.9 (Normal) |
| 25 | 19 | 168 | 70 | Male | 24.8 (Normal) |

The table shows data from 25 samples of 19-year-old men. Each sample was between 166 cm and 173 cm tall and weighed between 66 kg and 73 kg. All Body Mass Index (BMI) values, calculated using the formula BMI = Weight (kg) / (Height (m) - Height (m)), were within the normal range of 23.5 to 24.8, indicating that all samples had a healthy weight for their height. This table provides a comprehensive overview of the physical characteristics of the sample studied.

**Table 2.** Indonesian physical fitness test program for 8 weeks

| Types of tests | Description | Aim |
|---|---|---|
| 60 metre sprint test | Competitors run 60 metres as fast as possible. | To assess speed and explosive power. |
| 60 Second Body Lift Hanging Test | Participants hang from the horizontal bar and lift their bodies up and down for 60 seconds. | To assess the strength and endurance of the arm and shoulder muscles. |
| 60 second sit test | Participants lie down and sit down as much as possible within 60 seconds. | To measure abdominal strength and endurance and waist flexibility. |
| Standing Jump Test | Participants jump as high as possible from a standing position and measure the height of the jump. | Assesses limb muscle strength and vertical explosive power. |
| 1200 metre run test | Competitors run 1200 metres at their best speed. | Measures cardiovascular and aerobic endurance. |

**Table 3.** Indonesian physical fitness test

| Value | 60 metre sprint test (A) | 60 Second Body Lift Hanging Test (B) | 60 second sit test (C) | Standing Jump Test (D) | 1200 metre run test (E) |
|---|---|---|---|---|---|
| 5 | S.d – 7,2” | 19 - Up | 41 - Up | 73 - Up | s.d – 3’14” |
| 4 | 7.3” – 8,3” | 14 – 18 | 30 – 40 | 60 – 72 | 3’15” – 4’25” |
| 3 | 8,4” – 9,6” | 9 – 13 | 21 – 29 | 50 – 59 | 4’26” – 5’12” |
| 2 | 9,7” – 11,0” | 5 – 8 | 10 – 20 | 39 – 49 | 5’13” – 6’33” |
| 1 | 11,1” dst | 0 - 4 | 0 – 9 | 38 dst | 6’34” dst |

**Table 4.** Classification assessment norms of physical freshness

| No | Total Value | Classification Of Physical Freshness |
|---|---|---|
| 1 | 22-25 | Very good (BS) |
| 2 | 18-21 | Good (B) |
| 3 | 14-17 | Medium (S) |
| 4 | 10-13 | Less (K) |
| 5 | 5-9 | Less than a minute (s) |

***Statistical Treatments***

The data collected from the physical fitness test were analysed using SPSS 23 software. Data analysis was performed using t-test. The significance level was determined as $p \leq 0.05$.

## RESULTS

This study uses two stages of testing, namely pre-test and post-test, to evaluate the effectiveness of the Gymnastics Model of Sumatra Selatan Bersatu in improving the physical fitness of students at Universitas Bina Darma. In the pre-test phase, students underwent a series of fitness tests covering five categories: a 60-metre run to measure speed, a 60-second body lift hanging test to measure arm muscle strength and upper body endurance, a lying down test to measure abdominal muscle strength, an upright jump to measure explosive leg strength, and a 1200-metre run to test cardiovascular endurance. These pre-test results are used as a baseline to compare changes in physical fitness after an exercise programme.

After the pre-test, the students undergo the South Sumatera Bersatu Gymnastics Model exercise programme, which is designed to improve overall fitness through strength, flexibility and endurance training. After completing the exercise programme, a post-test is conducted using the same tests as the pre-test to assess the improvement in physical fitness. The post-test results showed a significant improvement compared to the pre-test, with the average score increasing from around 15.0 to 20.0. Statistical analysis using the t-test showed a very high t-value and a low level of significance (Sig. 0.000), indicating that the difference between the pre-test and post-test scores did not occur by chance.

This study aims to evaluate the effectiveness of the Sumatera Selatam Bersatu Gymnastics Model in improving physical fitness among students of Bina Darma University Palembang.

Physical fitness data collected from pre-test and post-test were analysed using t-test to compare the results between pre-test and post-test groups. The physical fitness table of Bina Darma University students in Table 5. shows the results of pretest and posttest scores of 25 samples. In the pretest stage, the scores given include five categories: 60 metre run (A), 60 second body lift hanging test (B), lying down (C), jumping upright (D) and 1200 metre run (E). Pretest scores range from 13 to 20, with most scores between 13 and 18. The post-test scores also cover the same five categories, with the lowest score being 18 and the highest being 23. Most post-test scores range from 18 to 22. There was a significant increase in physical fitness scores after the post-test, with an average pre-test score of around 15.0 and an average post-test score of around 20.0. Overall, there was a consistent improvement from pretest to posttest scores in most samples, indicating an improvement in the physical fitness of the students after the exercise programme.

**Table 5.** Results of pre-test and post-test Physical Fitness

| Category | Pre-test | Pre-test | Post-test | Post-test |
|---|---|---|---|---|
| Very Good | 0 | 0% | 7 | 28% |
| Good | 4 | 16% | 18 | 72% |
| Medium | 18 | 72% | 0 | 0% |
| Less | 3 | 12% | 0 | 0% |
| Less Than Once | 0 | 0% | 0 | 0% |

**Table 6.** Descriptive analysis of pre-test and post-test physical fitness

| Sample | Pretest | | | | | Total | Classification | Postest | | | | | Total | Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | | | A | B | C | D | E | | |
| 1 | 3 | 2 | 3 | 2 | 3 | 13 | Less | 4 | 3 | 4 | 3 | 4 | 18 | Good |
| 2 | 2 | 2 | 4 | 3 | 3 | 14 | Medium | 4 | 3 | 4 | 4 | 4 | 19 | Good |
| 3 | 3 | 3 | 4 | 4 | 4 | 18 | Good | 5 | 4 | 5 | 3 | 5 | 22 | Very Good |
| 4 | 2 | 3 | 3 | 3 | 4 | 15 | Medium | 4 | 4 | 4 | 3 | 4 | 19 | Good |
| 5 | 3 | 2 | 3 | 2 | 3 | 13 | Less | 5 | 3 | 5 | 4 | 4 | 21 | Good |
| 6 | 3 | 3 | 4 | 2 | 3 | 15 | Medium | 4 | 4 | 3 | 3 | 5 | 19 | Good |
| 7 | 3 | 2 | 3 | 3 | 4 | 15 | Medium | 4 | 3 | 4 | 4 | 4 | 19 | Good |
| 8 | 4 | 3 | 3 | 2 | 3 | 15 | Medium | 5 | 3 | 5 | 3 | 5 | 21 | Good |
| 9 | 3 | 3 | 4 | 3 | 3 | 16 | Medium | 4 | 4 | 3 | 4 | 4 | 19 | Good |
| 10 | 4 | 4 | 4 | 4 | 4 | 20 | Good | 5 | 5 | 4 | 3 | 5 | 22 | Very Good |
| 11 | 3 | 4 | 3 | 3 | 4 | 17 | Medium | 4 | 5 | 4 | 5 | 4 | 22 | Very Good |
| 12 | 4 | 3 | 3 | 2 | 3 | 15 | Medium | 4 | 3 | 4 | 4 | 4 | 19 | Good |
| 13 | 2 | 3 | 4 | 2 | 3 | 14 | Medium | 4 | 4 | 3 | 4 | 5 | 20 | Good |
| 14 | 3 | 3 | 3 | 3 | 4 | 16 | Medium | 4 | 4 | 3 | 4 | 4 | 19 | Good |
| 15 | 3 | 2 | 3 | 2 | 4 | 14 | Medium | 4 | 4 | 4 | 3 | 4 | 19 | Good |
| 16 | 2 | 2 | 4 | 3 | 3 | 14 | Medium | 5 | 5 | 3 | 5 | 4 | 22 | Very Good |
| 17 | 2 | 3 | 4 | 4 | 3 | 16 | Medium | 4 | 4 | 3 | 4 | 3 | 18 | Good |
| 18 | 3 | 2 | 3 | 3 | 4 | 15 | Medium | 4 | 3 | 4 | 3 | 4 | 18 | Good |
| 19 | 3 | 2 | 3 | 2 | 3 | 13 | Less | 4 | 4 | 4 | 3 | 4 | 19 | Good |
| 20 | 4 | 3 | 3 | 2 | 3 | 15 | Medium | 3 | 5 | 3 | 5 | 3 | 19 | Good |
| 21 | 4 | 4 | 4 | 3 | 4 | 19 | Good | 5 | 4 | 5 | 5 | 3 | 22 | Very Good |
| 22 | 3 | 3 | 4 | 4 | 4 | 18 | Good | 5 | 3 | 5 | 4 | 5 | 22 | Very Good |
| 23 | 3 | 2 | 3 | 3 | 3 | 14 | Medium | 5 | 4 | 5 | 4 | 5 | 23 | Very Good |
| 24 | 4 | 2 | 3 | 2 | 3 | 14 | Medium | 5 | 4 | 4 | 5 | 3 | 21 | Good |
| 25 | 3 | 3 | 4 | 2 | 3 | 15 | Medium | 5 | 3 | 4 | 3 | 5 | 20 | Good |

**Tabel 7.** One-sample statistics

| | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Pretest | 25 | 15.3200 | 1.84210 | .36842 |
| Postest | 25 | 20.0800 | 1.55242 | .31048 |

**Tabel 8.** One-sample test

| | Test Value = 0 | | | | | |
|---|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Pretest | 41.583 | 24 | .000 | 15.32000 | 14.5596 | 16.0804 |
| Postest | 64.673 | 24 | .000 | 20.08000 | 19.4392 | 20.7208 |

The test results of one sample showed a comparison between the pretest and posttest scores with a test value of 0. On the pretest, the value of t is 41.583 with degrees of freedom (df) 24, significance (Sig. 2-tailed) 0.000 and mean difference 15.32000. The 95% confidence interval of this difference is between 14.5596 and 16.0804. In the post-test, the value of t is 64.673 with degrees of freedom (df) 24, significance (Sig. 2-tailed) 0.000 and mean difference 20.08000. The 95% confidence interval of this difference is between 19.4392 and 20.7208. These results show that there is a significant difference between the pretest and posttest scores, with a high t-value and very low significance (0.000) indicating that this difference does not occur by chance. The mean difference on the post-test is higher than that on the pre-test, indicating a significant increase in the post-test score.

## DISCUSSION

Gymnastics South Sumatra Bersatu, as a form of local intervention, can have a significant positive impact on the physical fitness of students. The results of the study provide new insights into the effectiveness of local culture-based exercise programmes at Bina Darama University, Pelembang, Indonesia. Physical activity that is structured and adapted to the local cultural context may be more acceptable and effective in improving the physical health of participants. Approaches that take into account cultural and social aspects can increase participants' involvement in improving physical fitness.

Overall, these findings reinforce the understanding that exercise programmes based on the local culture of Senam Sumatera Bersatu can be an effective tool for improving physical fitness. The results also emphasise the integration of cultural aspects in the design of health and wellness programmes, which can lead to better participation and more optimal outcomes. The level of physical fitness, frequency of exercise and physical injuries have a significant impact on the fitness of Bina Darma University students. These findings suggest that higher education institutions and sports departments should pay more attention to these factors in order to improve the overall physical fitness of society. Concrete steps that can be taken include the provision of adequate sports facilities, the promotion of active lifestyles and injury prevention counselling.

His other research has shown that physical fitness in men is influenced by socio-economic factors, whereas in women it is influenced by natural environmental factors (Gericke et al., 2024; Monyeki et al., 2024; Peterson et al., 2024).Longitudinal studies show that physical fitness, specifically coordination and muscle fitness, can predict self-rated health in adolescents and young adults (Deng et al., 2024; Fridolfsson et al., 2024; Stanković et al., 2023). These findings suggest that interventions aimed at improving these aspects of physical fitness may have long-term beneficial effects on individual health. Therefore, programmes aimed at improving coordination and muscle fitness in adolescents need to be widely developed and implemented.

The results of the various studies mentioned above show that physical fitness is not influenced by a single factor, but is the result of a complex interaction of various social, economic, environmental and technological factors (Hackett et al., 2024; Towns et al., 2024). This highlights the need for a multidisciplinary and holistic approach to improving the physical fitness of adolescents and the general population. However, the implementation of an effective strategy requires strong support and commitment from various parties, including governments, educational institutions and communities. Using the natural environment in regional physical fitness strategies can support access to safe and affordable green spaces and sports facilities.

On the other hand, the increasing use of technology, especially the Internet, as a tool to promote physical fitness requires the development of intuitive and inclusive digital platforms (Bazalo et al., 2024; Kisiel-Sekura et al., 2024; Lewandowski et al., 2024). An intelligent and digital sports public service system must be designed with different demographics and specific needs in mind. The development of the Global Observatory on Physical Fitness as a global coordination and monitoring centre is an essential step in addressing the lack of fitness priorities in the public health agenda to support more effective policies and programmes in different countries.

***Conclusions***

Gymnastics South Sumatra Bersatu as a form of local intervention, can have a significant positive impact on the physical fitness of students. This provides new insights into the effectiveness of local culture-based training programs in the context of higher education in Indonesia. This study confirms that physical activity that is structured and adapted to the local cultural context can be more acceptable and effective in improving the physical health of participants. These results reinforce the understanding that local culture-based gymnastics programs such as senam Sumatera Selatan Bersatu can be an effective tool in improving physical fitness. In practical terms, the results of this study emphasize the importance of integrating cultural aspects in designing health and wellness programs, which can lead to better participation and more optimal results. Higher education institutions and policymakers may consider adopting local culture-based gymnastics programs as part of Student physical fitness curricula. Future research can develop more exercise programs that are rooted in other local cultures, so that they can be adopted by various communities throughout Indonesia. The training and development of instructors focused on teaching local culture-based gymnastics programs needs to be improved to ensure effective and sustainable implementation. This research has made an important contribution to our understanding of the effectiveness of local culture-based fitness programs.

***Conflict of ınterest***

The authors declare no conflict of interest. No financial support was received.

***Ethics Statement***

Ethical clearance (No.106/KEPK/RSI-U/VII/2024) for this research was obtained from the Research Ethics of Health Research Ethics Committee of Malang Islamic hospital, Malang City, East Java, Indonesia

***Author Contributions***

Study Design, NS ; Data Collection, NS, ET ; Statistical Analysis, ET,ES,AS,AT,IBE and RWK; Data Interpretation, ES, AS, AT, IBE and RWK; Manuscript Preparation, NS, ET,ES,IBE and RWK; Literature Search, IBE and RWK. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

# Morning vs Evening Psychological Skills Training: Impacts on Psychosomatic Health in Kho-Kho Players

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**Abstract**
This study aims to investigate how the timing of exercise impacts psychological skill training and its influence on psychosomatic variables among college-level female Kho-Kho players. The study's subjects included 45 Kho-Kho players from various colleges in Tamil Nadu; each group had 15 subjects. The age range of the players was 18 to 25 years old. They had played Kho-Kho for a minimum of three years. Group I is the Psychological Skills Training Morning Group (PSTM), Group II is the Psychological Skills Training Evening Group (PSTE), and Group III is the control group. These groups consist of people who participated in inter-college tournaments in Tamil Nadu. To determine the effectiveness of the training method, the experimental group trained for 30 minutes in morning and evening practices for 6 weeks, while the control group continued the regular curriculum without receiving any special practices. The Depression Anxiety Stress Scales (DASS) encompassing 42 items will be utilized to measure depression, anxiety, and stress levels. Results from ANOVA indicated significant differences among the groups for depression ($F = 4.36326$, $p < 0.05$), stress ($F = 5.66268$, $p = 0.006647$), and anxiety ($F = 4.17362$, $p = 0.02222$). Post-hoc comparisons highlighted that the Psychological Skills Training Morning Group (PSTM) displayed significant differences compared to both the Psychological Skills Training Evening Group (PSTE) and the control group for depression, stress, and anxiety, indicating morning sessions' potential efficacy. Morning interventions seemed particularly effective in managing depression, stress, and anxiety compared to evening sessions or no intervention.

**Keywords**
Psychological Skill Training, Psychosomatic Variables, Dass, Kho-Kho, Women

## INTRODUCTION

The field of sport psychology has devoted much attention to understanding the complex interactions between psychological variables and sport performance (Cerezuela et al., 2024). The study of psychosomatic variables, which involve the complex interaction of mind and body, is particularly important in this field (Lange-Smith et al., 2023; Barker et al., 2020). The most popular game in rural India, aside from Kabaddi, is the reasoning game Kho-Kho, which has an incredibly lengthy history. Among all of India's native group games, it is currently very widely recognized

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(Hussain & Cunningham, 2021). The expectation for these games is still high due to the widespread enthusiasm. It is quite difficult to determine the origin of Kho-Kho, although many historians think it is a modified version of "tag" or "catch," which is essentially the act of pursuing and touching a person. Originally from Maharashtra, Kho-Kho was known as Rathera in the past and was played on "raths," or chariots (Tripathi & Mishra, 2022; Tiwari & Agashe, 2016). A common technique is psychological skills training (PST), which teaches athletes techniques to improve the caliber and consistency of their performance. Psychological skills as cognitive-somatic methods, such as self-talk, imagery, and relaxation, while others use trait-like elements like drive, confidence, and concentration (Bekbossynov et al., 2023; Sanjaykumar, Rajkumar, & Lakshmi, 2023). Individual psychological elements, such as motivation, self-assurance, focus, visualization, and psychosomatic skills, have been the subject of most empirical research due to their impact on performance (Thelwell, Greenlees, & Weston, 2006; Turner et al., 2020). Likewise, a few studies have suggested that the use of cognitive abilities such as visualization, goal-setting, self-talk, and relaxation are crucial areas in sport psychology (Jun, Kim, & Choi, 2023; Sadeghi et al., 2010; Sanjaykumar, Rajkumar, & Lakshmi, 2024). The most common treatment for anxiety problems nowadays is cognitive behavioral therapy (CBT). Nonetheless, many individuals do not have total remission, with recovery rates of only 50%. Attempts to improve therapy efficacy have increased as a result (Frederiksen et al., 2021).

This study aims to investigate how the timing of exercise impacts psychological skill training and its influence on psychosomatic variables among college-level female Kho-Kho players.

## MATERIALS AND METHODS

### Participants

The study's subjects included 45 Kho-Kho players from various colleges in Tamil Nadu; each group had 15 subjects. The age range of the players was 18 to 25 years old. They had played Kho-Kho for a minimum of three years. Only individuals who are willing to participate and have signed an informed consent letter will be evaluated, as this is a qualitative and quantitative method of study.

Before the study commenced, all participants were fully briefed on the study's objectives, procedures, potential risks and benefits, confidentiality protocols, and their rights. The study was approved by the Ethics Committee of H.S. Skovoroda Kharkiv National Pedagogical University (Approval No. KhNPU/PhES/EC/3/3/2024), adhering to the ethical guidelines outlined in the Declaration of Helsinki for research involving human participants. Throughout the research, strict adherence to ethical standards was maintained, prioritizing the participants' well-being, protecting their rights, and ensuring confidentiality at every stage.

### Research Model

Group I is the Psychological Skills Training Morning Group (PSTM), Group II is the Psychological Skills Training Evening Group (PSTE), and Group III is the control group. These groups consist of people who participated in inter-college tournaments in Tamil Nadu, India. The experimental group will receive self-talk, visualization, relaxation, and PST training from the programme using cognitive behavioral therapy (CBT) and the control group followed their regular curriculum without participating in any specialized training sessions during the study period.

To determine the effectiveness of the training method, the experimental group trained for 30 minutes in morning and evening practices for 6 weeks, while the control group continued the regular curriculum without receiving any special practices. They were trained in a 6-week experiment. We examined the effectiveness of this PST training across age groups for psychological conditions including depression, anxiety, and stress.

### Data Collection Tool

Before administering the treatment, participants will undergo an initial assessment, serving as a pre-test. Subsequently, upon completion of the intervention, a post-test assessment will be conducted. The Depression Anxiety Stress Scales (DASS) encompassing 42 items will be utilized to measure depression, anxiety, and stress levels (Szabo & Lovibond, 2022). Each domain consists of 14 items, with respondents rating the frequency and intensity of symptoms using a 4-point Likert scale.

### Statistical Analysis

The study utilized ANOVA, with a significance level of 0.05, to examine the effects of treatment while accounting for initial differences

among the 45 female Kho-Kho players. This method allowed for an analysis of how the timing of psychological skills training impacted depression, stress, and anxiety levels across the groups.

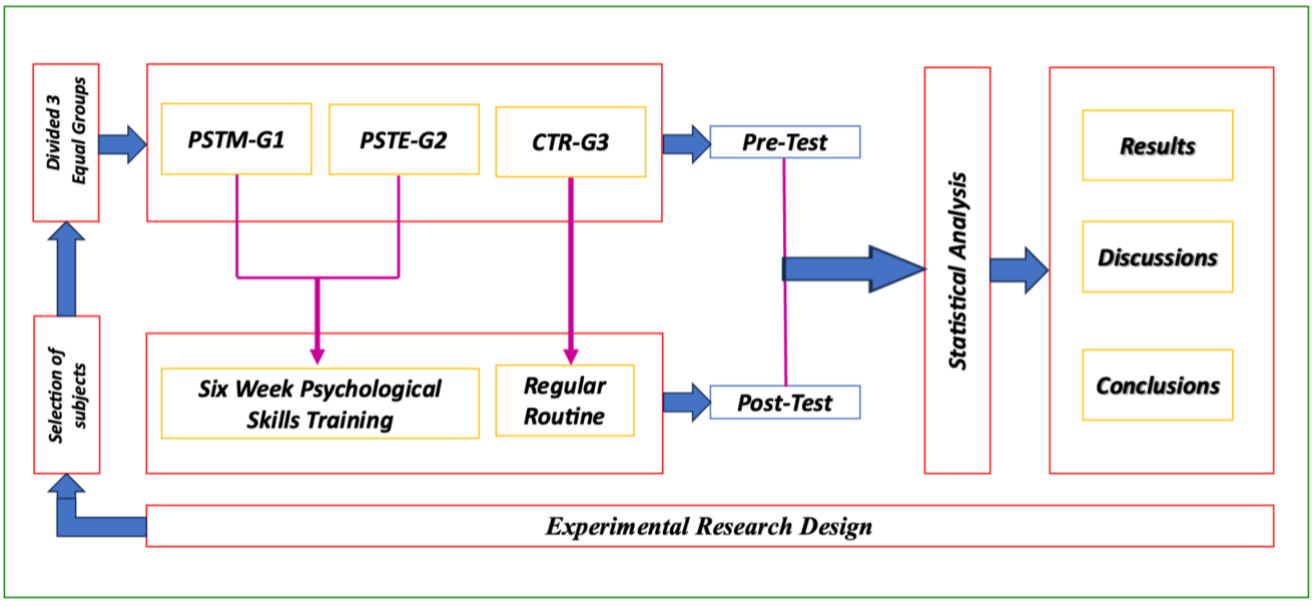


**Figure 1.** Architecture of the methodological process

## RESULTS

This study investigates the effects of exercise timing on psychological skill training and psychosomatic variables in female Kho-Kho players. It analyses significant variations in depression, stress, and anxiety levels across morning and evening training groups, as well as a control group.

**Table 1.** Pre and post test data for depression, stress and anxiety

| Variable | Group | Pre-Test Mean | SD | Post-Test Mean | SD | p-value |
|---|---|---|---|---|---|---|
| Depression | PSTM | 12.33 | 3.45 | 8.27 | 2.95 | 0.010* |
| | PSTE | 11.67 | 3.22 | 9.00 | 3.01 | 0.052 |
| | Control | 12.53 | 3.68 | 11.67 | 3.48 | 0.203 |
| Stress | PSTM | 15.67 | 4.78 | 9.27 | 3.62 | 0.003* |
| | PSTE | 14.93 | 4.21 | 11.67 | 4.10 | 0.024* |
| | Control | 16.53 | 4.92 | 14.67 | 4.87 | 0.142 |
| Anxiety | PSTM | 14.67 | 3.97 | 10.33 | 3.54 | 0.011* |
| | PSTE | 13.93 | 3.84 | 11.83 | 3.65 | 0.059 |
| | Control | 15.33 | 4.11 | 14.10 | 4.25 | 0.239 |

Standard Deviation (SD), *Significant at $p < .05$

The pre- and post-test results indicate significant improvements in depression, stress, and anxiety for the Psychological Skills Training Morning (PSTM) group, with post-test p-values of 0.010 for depression, 0.003 for stress, and 0.011 for anxiety, demonstrating the effectiveness of the intervention. The Psychological Skills Training Evening (PSTE) group also experienced reductions in stress ($p = 0.024$) and anxiety ($p = 0.059$).

**Table 2.** ANOVA results and post-hoc group comparisons for depression

| Source | SS | df | MS | F | p-value |
|---|---|---|---|---|---|
| Between-groups | 128.0444 | 2 | 64.0222 | 4.36326 | 0.01898 |
| Within-groups | 616.2667 | 42 | 14.673 | | |
| Total | 744.3111 | 44 | | | |
| **Comparison** | **Mean Difference** | | | **SD** | **p-value** |
| PSTM vs PSTE | 2.6667 | | | 4.1346 | 0.032* |
| PSTM vs Control | 4.0667 | | | 3.9725 | 0.015* |
| PSTE vs Control | 1.4 | | | 4.1129 | 0.385 |

Source of variance (SS), mean squares (MS), degrees of freedom (df), *Significant at $p < .05$

The ANOVA analysis indicates a significant difference in depression psychological variable among the groups ($F = 4.36326$, $p < .05$), with post-hoc comparisons revealing specific distinctions. While the Psychological Skills Training Morning Group (PSTM) displays notable differences compared to both the Psychological Skills Training Evening Group (PSTE) (mean difference = 2.6667, SD = 4.1346) and the control group (mean difference = 4.0667, SD = 3.9725), there is no significant difference observed between the Psychological Skills Training Evening Group (PSTE) and the control group (mean difference = 1.4, SD = 4.1129).

**Table 3.** ANOVA results and group comparisons for stress

| Source | SS | df | MS | F | p-value |
|---|---|---|---|---|---|
| Between-groups | 219.2444 | 2 | 109.6222 | 5.66268 | 0.006647 |
| Within-groups | 813.0667 | 42 | 19.3587 | | |
| Total | 1032.3111 | 44 | | | |
| **Comparison** | **Mean Difference** | | | **SD** | **p-value** |
| PSTM vs PSTE | 2.9333 | | | 3.7378 | 0.027* |
| PSTM vs Control | 5.4 | | | 4.4056 | 0.004* |
| PSTE vs Control | 2.4667 | | | 4.8437 | 0.064 |

Source of variance (SS), mean squares (MS), degrees of freedom (df), *Significant at $p < .05$

The ANOVA analysis demonstrates a significant difference in stress levels among the groups ($F = 5.66268$, $p = 0.006647$), suggesting that the intervention type or timing has an impact on stress management outcomes. Post-hoc comparisons reveal that the Psychological Skills Training Morning Group (PSTM) significantly differs from both the Psychological Skills Training Evening Group (PSTE) (mean difference = 2.9333, SD = 3.7378) and the control group (mean difference = 5.4, SD = 4.4056). However, there is no significant difference observed between the Psychological Skills Training Evening Group (PSTE) and the control group (mean difference = 2.4667, SD = 4.8437).

**Table 4.** ANOVA results and group comparisons for anxiety

| Source | SS | df | MS | F | p-value |
|---|---|---|---|---|---|
| Between-groups | 144.8444 | 2 | 72.4222 | 4.17362 | 0.02222 |
| Within-groups | 728.8 | 42 | 17.3524 | | |
| Total | 873.6444 | 44 | | | |
| **Comparison** | **Mean Difference** | | | **SD** | **p-value** |
| PSTM vs PSTE | 3.1 | | | 4.002 | 0.041* |
| PSTM vs Control | 4.3333 | | | 4.125 | 0.017* |
| PSTE vs Control | 1.2333 | | | 4.2276 | 0.394 |

Source of variance (SS), mean squares (MS), degrees of freedom (df), *Significant at $p < .05$

The ANOVA analysis indicates a significant difference in anxiety levels among the groups (F = 4.17362, p = 0.02222), suggesting that the interventions or treatments have an impact on anxiety outcomes. Post-hoc comparisons reveal that the Psychological Skills Training Morning Group (PSTM) significantly differs from both the Psychological Skills Training Evening Group (PSTE) (mean difference = 2.8, SD = 4.2873) and the control group (mean difference = 4.3334, SD = 3.2921). Additionally, a significant difference is observed between the Psychological Skills Training Evening Group (PSTE) and the control group (mean difference = 1.5334, SD = 4.456).

## DISCUSSION

The research study aimed to investigate the effect of exercise timing on psychological skill training, specifically in the morning and evening, on psychological variables including stress, anxiety, and depression. The results from the analysis of variance (ANOVA) for each psychological variable revealed significant differences among the groups, indicating that the timing of interventions has a notable impact on psychological outcomes (Tiwari & Agashe, 2016; Hu & Chen, 2023).

In terms of depression, the ANOVA analysis indicated a significant difference among the groups (F = 4.36326, p < .05). Post-hoc comparisons revealed that the Psychological Skills Training Morning Group (PSTM) showed significant differences compared to both the Psychological Skills Training Evening Group (PSTE) and the control group, highlighting the potential efficacy of morning sessions in managing depression. Similarly, the analysis for stress levels also demonstrated significant differences among the groups (F = 5.66268, p = 0.006647). Post-hoc comparisons revealed that the Psychological Skills Training Morning Group (PSTM) significantly differed from both the Psychological Skills Training Evening Group (PSTE) and the control group, emphasizing the potential effectiveness of morning interventions in reducing stress levels. Moreover, for anxiety, the ANOVA analysis revealed significant differences among the groups (F = 4.17362, p = 0.02222). Post-hoc comparisons showed that the Psychological Skills Training Morning Group (PSTM) significantly differed from both the Psychological Skills Training Evening Group (PSTE) and the control group, indicating the potential benefits of morning sessions in anxiety management (Tripathi & Mishra, 2022; Hamilton & Fremouw, 1985; Vella-Fondacaro & Romano-Smith, 2023).

These findings underscore the importance of exercise timing in psychological skill training interventions for managing stress, anxiety, and depression. Morning sessions appear to be particularly effective in improving psychological well-being compared to evening sessions or no intervention. These results have significant implications for designing and implementing psychological interventions, emphasizing the need to consider the timing of interventions to optimize outcomes (Lange-Smith et al., 2023; Boughattas, Salha, & Moella, 2022). Further research exploring the underlying mechanisms and long-term effects of exercise timing on psychological variables is warranted to provide deeper insights into the relationship between exercise timing and psychological well-being (Romero-Gonzalez et al., 2020; Sanjaykumar, Rajkumar, & Lakshmi, 2023; Komarudin et al., 2024).

### *Conclusion*

The research investigated the influence of exercise timing on psychological skill training, focusing on depression, stress, and anxiety variables. Results from ANOVA indicated significant differences among the groups for depression, stress, and anxiety. Post-hoc comparisons highlighted that the Psychological Skills Training Morning Group (PSTM) displayed significant differences compared to both the Psychological Skills Training Evening Group (PSTE) and the control group for depression, stress, and anxiety, indicating morning sessions' potential efficacy. Morning interventions seemed particularly effective in managing depression, stress, and anxiety compared to evening sessions or no intervention. These findings suggest that exercise timing plays a crucial role in psychological skill training outcomes, emphasizing the importance of considering timing factors in designing effective interventions for psychological well-being. Future research should explore the underlying mechanisms of these effects and examine their generalizability across diverse populations and contexts to optimize the delivery of psychological interventions. Overall, the study underscores the significance of timing in psychological skill training programs and

highlights morning sessions as promising avenues for enhancing mental health outcomes.

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**Conflict of Interest**

We affirm that the article we have authored does not involve any conflict of interest.

**Ethics Statement**

The study was approved by the Ethics Committee of H.S. Skovoroda Kharkiv National Pedagogical University (Approval No. KhNPU/PhES/EC/3/3/2024), adhering to the ethical guidelines outlined in the Declaration of Helsinki for research involving human participants.

**Author Contributions**

Conception and design of the study, SS, PYL, SN and RP; Data collection, SS, PYL, SN; Data analysis and interpretation, SS, NR, ZK and AMN; Drafting article and critical revision, SS, PYL, SN, RP, NR, ZK and AMN. All authors have read and approved the published version of the manuscript.

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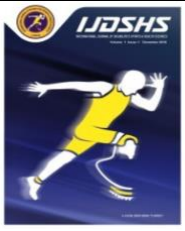

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RESEARCH ARTICLE

# Tennis Flat Serve Kinematic Features in Young Athletes: A Feasibility Study

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**Abstract**
The aim of this study is to examine body kinematics in tennis straight serve. 5 elite male tennis players (mean age 18.4±3.3 years, mean height 182.3±5.6 cm, mean weight 72.2±7.9 kg) were included in the study. We determined the angle of inclination from the ball to the body and the impact position of the ball during serve movements of young male tennis players at the center and sideline. The collected data on ball impact height, front and back distance of the front foot from ball impact, angle of incidence, and overall inclination using a motion head device (i.e., Dartfish motion program). Repeated measures ANOVA was used to determine the athletes' serve performance. Result: tennis serve skill with player A, B and C, the angle of incidence showed a significant main effect in both performances ($p<.05$) and training period ($p<.001$), and the interaction between performance and training period was also significant ($p<.01$). Tennis serve skill with player D and E, the angle of incidence did not show a main effect in the performance, and the main effect was significant in the training period ($p<.001$). However, the interaction between performance and training period was not significant. In conclusion, the result showed that young players improved their tennis serve success rates and ball striking heights after training. These findings show that tennis serve training and kinematic analysis can improve tennis serve skills.

**Keywords**
Tennis, Centerline, Sideline, Flat Serve, Impact Height, Ball-To-Body Tilt, Incidence Angle

## INTRODUCTION

The tennis serve is considered one of the most complex and challenging techniques in the sport. It is difficult to learn the most accurate technique because upper and lower extremity movements require complex coordination (Bingul et al., 2016). Accordingly, the tennis serve is both the most important and the most difficult shot to master and comes in three basic types: straight, topspin and slice. Straight shot (topspin) and slice (sidespin) use similar upper body temporal and kinematic properties to produce large translational ball speeds (Sheets et al., 2011).

The straight serve (i.e., flat serve) is potentially the fastest, while the topspin serve is generally the most consistent. Although speed production is critical for straight serve performance, the boundaries and dimensions of the serve box require that an accuracy component be maintained (Whiteside et al., 2014). Serving at high speed generally provides a great advantage in tennis (Chow et al., 2003). The important key factors of the serve are the speed and direction of the racket, the height of the ball at the time of impact, the weight of the racket, the angle of the racket at the moment of impact, and the speed and direction of the ball at that moment.

Player skill explains 31% of the variation in serve speed. In conjunction with player height, player skill contributes approximately 60% of serve speed variance (Martin et al., 2014). Yet, because it places a great deal of strain on young athletes' shoulder and elbow joints, this technique has been

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linked to severe injuries (Abrams et al., 2012). In tennis competition, the repetitiveness of the serving motion throughout the course of a player's career has a traumatic effect (Martin et al., 2014). There is no quantitative research on tennis serves that raise the success rate of serves and lower the risk of injury, despite the increased risk of injury when games last between 50 and 150 minutes. Hence, in order to assist young tennis athletes, a developmental and kinematic approach to tennis serves is required. According to several research, tennis matches of all sizes are affected by a prevalent medical condition known as repetitive abuse injuries to the upper limb joints of tennis players (Abrams et al., 2012; Hjelm et al., 2012; Marx et al., 2001). At the sub-stage, excessive anterior shoulder force that is applied repeatedly produces ligament relaxation. Excessive humeral head translation and external rotation cause pain and discomfort during the arm cocking stage. So, it is favorable in competition and helpful in preventing player damage to reduce the frequency of serving by raising the serve's success rate.

According to Chaw et al., (2003), kinematic data were used to examine the features of the first and second serves. As a result, the first serve's average impact ball forward position was substantially further forward than the second serve's value. The ball was said to be moving faster (Chaw et al., 2003). Martin et al., (2014) also demonstrated that while limb movement speed decreases, the speed of the ball increases with the energy quality of the hand segment-racquet segment in the trunk. This finding implied that the injured athlete had a high ratio of energy absorbed by the shoulders and elbows, decreased ball speed, and a low quality of energy flow across the upper limb exercise chain.
The serve action begins with the feet, employs the knees and legs, the butt and weight, and impacts the ball with the upper body and arms while enhancing serve performance and minimizing damage. Hence, all body components and a chain of exercises can be effectively utilised to generate strokes (Goktepe et al., 2009). For instance, some research on tennis serve motions focused on how better approaches can result in high efficiency and fewer accidents (Aguinaldo et al., 2007; Aguinaldo et al., 2007, 2009). The most efficient server is one that can optimize power (ball speed) while putting the least amount of strain on the joints, and kinematic variables are a fantastic way to confirm this difference (Martin et al., 2014). Yet, a lot of players differ individually in their sub- actions depending on their strength, size, gender, position, and on-field ability. Athletes and leaders can benefit from standardized kinematic data that enables the performance of appropriate sub- movements during training and competition.

Previous studies showed that using the whole body in an integrated way can improve the power of the sub (Goktepe et al., 2009), angular momentum (Fleisig et al., 2003), joint angle (ankle, shoulder, elbow) (Goktepe et al., 2009), lower limb coordination, and shoulder joint (Reid et al., 2008), elbow, shoulder rotation angle, and ball speed (Martin et al., 2013). However, in order to assess the integrated whole-body approach for ball impact motion, it is important to examine the inclination angle between the ball and the body.

The purpose of this study was to quantitatively analyze the kinematic features related to the impact position of the ball and the ball-to-body tilt angle, examining their association with serve success (targeted at the center and sideline) and failure during a flat tennis serve in young athletes. More specifically, the front- to-back distance between the heel and the ball was computed as the height ratio, the vertical height of the ball at the time of ball impact was determined, and the inclination angle for the two coordinates was quantitatively determined. Also, it was done to compute the angle of incidence using the dimensions of the tennis court and the vertical coordinates of the ball. This gave each player access to quantitative information. Also, we looked at whether each player's flat serve performance had improved following a 12-week training period. The goal of the drill is to contact the ball as accurately and quickly as possible at a high point.

## MATERIALS AND METHODS

### *Participants*

Five male tennis players participated our study. Table 1 lists their demographic details. They were all athletes who competed in national competitions. The research was approved by the Institutional Review Board and conformed to the Declaration of Helsinki. All aspects were conducted in accordance with the relevant guidelines and regulations of the institution. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and

participant rights before participation in the experiment.

**Table 1.** Demographic characteristics

| Subject | Gender | Age (Years | Height (cm) | Weight (kg) |
|---|---|---|---|---|
| A | Male | 18 | 189.1 | 84.9 |
| B | Male | 12 | 143.5 | 40.6 |
| C | Male | 12 | 156.7 | 56.6 |
| D | Male | 12 | 152.3 | 43.3 |
| E | Male | 12 | 160.8 | 78.7 |

***Test Procedure***

The training program in this study was conducted five days a week for a total of 12 weeks. This specialized tennis serve training program adopted an individualized approach, taking into consideration the technical abilities and physical conditions of the players. Each training session was focused on improving specific tennis serve skills, centering on the technical execution of various serve types (flat, slice, and kick serves), and aimed at enhancing each player's serve mechanics, launch angles, and swing speeds. The sessions included a variety of serve practices and technical approaches. Players performed a specific 10- minute warm-up before each session and executed two serves to adapt to the protocol. The tennis balls used in training were regularly replaced to maintain high quality. Players strived to achieve maximum speed and accuracy in each session, with clear objectives set. Regular target practice and speed measurements were conducted to increase the accuracy and consistency of serves. Advanced video analysis tools and speed measuring equipment were utilized to thoroughly analyze and propose improvements for each player's serve motion. Throughout the training period, players repetitively practiced various serve techniques, focusing on improving the accuracy and speed of their serves. The training also emphasized physical training related to serving, particularly strengthening the upper body and core muscles. This systematic approach played a significant role in enhancing the players' serve performance.

***Data Collection***

The measurement subjects per in warm-up activities and tennis serve drills for 30 minutes prior to measurement after being briefed on the process and intended outcome. Following that, the flat serve process was repeatedly tried on the T line and the W line until it was successfully completed five times (Figure 1). The serve movement was accomplished in a high-speed film with an iPhone XS MAX model capable of high speed capable of up to 240 fps in order to precisely measure a very rapid serve action.

The video was filmed in real time and took place in the court opposite the serve. The participants tennis serve was filmed from start to finish. Each trial was filmed, and the camera angle was adjusted according to the participant serve motion before being filmed for each trial. After that, the measurement image was calculated by the height of the ball at the time of serving impact using the Dart Fish Analyzer program. Vertical Displacement (V: Vertical Displacement) and Front Distance (H: Horizontal Displacement) were divided into the height of each subject. Furthermore, using a two-dimensional coordinate to calculate the tilt angle from the front of the foot to the ball. The incident angle of the ball was calculated using the vertical height and the horizontal distance to which the ball is impacted. For the pre-post measurement of this study, a flat serve training of 12 weeks after the first measurement was performed, followed by the second measurement. The reason we need to compare success from the centerline and the sideline is because the performance of an opposing player returning a serve can vary depending on the position. The formula is follows (i.e., this formula used to calculate the impact during content to ball)

$$\theta = \tan^{-1}\left(\frac{V}{H}\right)$$

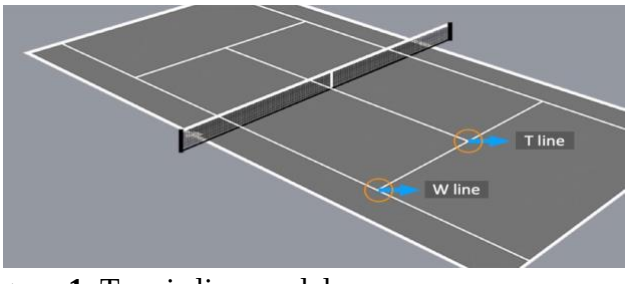


**Figure 1.** Tennis line model

### *Statistical Analysis*

Statistical analysis was performed separately for variables of the tennis serve. Each serve variables was performed repeated ANOVA. Repeated measures ANOVA is data that measures the same subject multiple times over time. For all analyses, statistical significance was set at a level of 0.05. We performed all analysis using SPSS 18.0.

## RESULTS

In this study, five male tennis players measured the success-centerline serve, success-sideline serve, failure impact height of the ball, anterior and posterior distance between the front foot and the impact ball, angle of tilt between the ball, and angle of incidence. The values from each person's analysis findings are listed below.

### *Characteristics of Tennis Serve Skill With Player A*

Repeated measures ANOVA was performed to verify the interaction effect between performance and training period on the characteristics that affect the serve-performance of player A (Table 2). As a result, the main effects of performance ($p<.05$) and training period ($p<.001$) were significant on impact height. Also, the interaction effect between performance and training period was significant ($p<.01$). Next, the main effect of the anterior and posterior distance did not show a significant difference in performance, and the main effect was significant in the training period ($p<.001$). Also, the interaction effect between performance and training period was not significant. The main effect on the tilt angle of the whole body was found during the training period ($p<.001$), and the interaction effect between the performance and the training period was significant ($p<.05$). Finally, the angle of incidence showed a significant main effect in both performances ($p<.05$) and training period ($p<.001$), and the interaction between performance and training period was also significant ($p<.01$).

**Table 2.** Serve-characteristics of player A

| Division | Period | Serve Performance | | | | Source | F | P |
|---|---|---|---|---|---|---|---|---|
| | | Success Centerline | Success Sideline | Failure | Total | | | |
| | Pre | 128.5±5.75 | 125.12±1.22 | 119.62±2.52 | 124.41±3.2 | Performance | 5.556 | .010* |
| Impact | Post | 129.5±3.09 | 125.86±1.98 | 129.88±1.48 | 128.43±2.83 | Period | 12.852 | .001*** |
| Height (%) | Total | 129.0±4.39 | 125.49±1.60 | 124.75±5.75 | 126.41±3.91 | Performance X Period | 7.749 | .003** |
| | Pre | 81.3±1.57 | 22.63±2.49 | 23.8±2.95 | 22.03±3.31 | Performance | .174 | .841 |
| A-P | Post | 82.52±1.3 | 15.34±3.8 | 14.49±3.16 | 15.62±3.27 | Period | 30.659 | .001*** |
| Distance (%) | Total | 81.91±1.5 | 18.99±2.21 | 19.14±5.69 | 18.83±4.59 | Performance X Period | 2.900 | .074 |
| Whole- | Pre | 81.3±1.57 | 79.76±1.11 | 78.74±1.52 | 79.93±1.7 | Performance | .640 | .536 |
| Body | TilPost | 82.52±1.3 | 83.06±1.72 | 83.64±1.4 | 83.07±1.46 | Period | 35.112 | .001*** |
| Angle( Degree) | Total | 81.91±1.5 | 81.41±2.21 | 81.19±2.93 | 81.5±2.23 | Performance X Period | 4.034 | .031* |
| Incidence | Pre | 6.42±0.39 | 6.05±0.17 | 5.66±0.29 | 6.05±0.42 | Performance | 3.417 | .049* |
| Angle (Degree) | Post | 6.64±0.26 | 6.52±0.26 | 6.81±0.22 | 6.66±0.26 | Period | 37.732 | .001*** |
| | Total | 6.53±0.33 | 6.29±0.32 | 6.23±0.65 | 6.35±0.46 | Performance X Period | 7.740 | .003** |

### *Characteristics of tennis serve skill with player B*

Repeated measures ANOVA was performed to verify the interaction effect between performance and training period on the characteristics that affect the serve-performance of player B. As a result, the main effect was significant in the training period ($p<.001$) for impact height. However, it did not appear during the performance. Also, there was a significant interaction effect between performance and training period ($p<.01$). Next, the main effect of the anterior and posterior distance did not show a significant difference in performance and the training period. Also, the interaction effect between performance and training period was not significant. The main effect on the tilt angle of the whole body was not found during the performance and training period. Also, the interaction effect between the performance and the training period did not appear significantly. Lastly, the angle of incidence showed a significant main effect in the training period ($p<.01$) and was not significant in

the interaction between performance and training period.

**Table 3.** Serve-characteristics of player B

| Division | Period | Serve Performance | | | | Source | F | P |
|---|---|---|---|---|---|---|---|---|
| | | Success Centerline | Success Sideline | Failure | Total | | | |
| Impact Height (%) | Pre | 116.53±3.08 | 121.12±2.04 | 121.12±1.83 | 119.59±3.14 | Performance | 1.609 | .221 |
| | Post | 127.63±1.56 | 126.36±2.34 | 125.21±1.23 | 126.4±1.94 | Period | 78.875 | .001*** |
| | Total | 122.06±6.29 | 123.74±3.45 | 123.17±2.61 | 123.99 ±4.12 | Performance X Period | 8.042 | .002** |
| A-P Distance (%) | Pre | 9.57±3.29 | 10.6±4.48 | 16.98±13.94 | 12.38±8.71 | Performance | 1.732 | .198 |
| | Post | 12 ±5.16 | 8.93±2.89 | 13.02±2.5 | 11.32±3.87 | Period | .191 | .666 |
| | Total | 10.79±4.27 | 9.77±3.66 | 15±9.67 | 11.85±6.64 | Performance X Period | .589 | .563 |
| Whole-Body Tilt Angle (Degree) | Pre | 85.32±1.57 | 85±2.15 | 82.08±6.45 | 84.13±4.02 | Performance | 1.674 | .209 |
| | Post | 84.63±2.32 | 85.95±1.38 | 84.07±1.12 | 84.88±1.76 | Period | .442 | .513 |
| | Total | 84.98±1.9 | 85.48±1.78 | 83.08±4.49 | 84.51±3.08 | Performance X Period | .475 | .628 |
| Incidence Angle (Degree) | Pre | 5.24±0.2 | 5.41±0.27 | 5.1±0.74 | 5.25±0.45 | Performance | 1.475 | .249 |
| | Post | 5.66±0.28 | 5.75±0.24 | 5.49±0.13 | 5.63±0.24 | Period | 8.107 | .009** |
| | Total | 5.45±0.32 | 5.58±0.3 | 5.3±0.54 | 5.44±0.41 | Performance X Period | .038 | .963 |

***Characteristics of tennis serve skill with player C***

Repeated measures ANOVA was performed to verify the interaction effect between performance and training period on the characteristics that affect the serve-performance of player C. As a result, there was no main effect in the training period on impact height, and the main effect was significant in performance ($p<.01$). Also, the interaction effect between performance and training period was not significant. Next, the main effect was significant in the training period on the anterior-posterior distance ($p<.001$) and the tilt angle of the whole body ($p<.001$). The main effect in the angle of incidence was significant in the training period ($p<.001$). However, the interaction between performance and training period was not significant.

**Table 4.** Serve-characteristics of player C

| Division | Period | Serve Performance | | | | Source | F | P |
|---|---|---|---|---|---|---|---|---|
| | | Success Centerline | Success Sideline | Failure | Total | | | |
| Impact Height (%) | Pre | 130.17±3.8 | 122.09±3.32 | 130.59±3.36 | 127.62±5.19 | Performance | 6.357 | .006* |
| | Post | 130.73±5.54 | 128.22±3.23 | 129.89±2.63 | 129.62±3.86 | Period | 2.114 | .159 |
| | Total | 130.45±4.49 | 125.16±4.47 | 130.24±2.87 | 128.62±4.61 | Performance X Period | .118 | .118 |
| A-P Distance (%) | Pre | 20.35±4.14 | 20.63±4.26 | 20.63±7.47 | 20.53±5.1 | Performance | .007 | .993 |
| | Post | 13.38 ±4.36 | 13.24±6.94 | 12.68±3.35 | 13.1±4.74 | Period | 14.684 | .001*** |
| | Total | 16.86±5.44 | 16.93±6.68 | 16.66±6.88 | 16.82±6.14 | Performance X Period | .979 | .979 |
| Whole-Body Tilt Angle (Degree) | Pre | 81.16±1.56 | 80.43±1.92 | 81.08±3.1 | 80.89±2.15 | Performance | .128 | .880 |
| | Post | 84.21±1.73 | 84.16±2.94 | 84.44±1.43 | 84.27±1.98 | Period | 17.527 | .001*** |
| | Total | 82.69±2.24 | 82.29±3.06 | 82.76±2.88 | 82.58±2.73 | Performance X Period | .942 | .942 |
| Incidence Angle (Degree) | Pre | 4.93±0.06 | 4.55±0.23 | 4.93±0.28 | 4.81±0.27 | Performance | 5.055 | .015* |
| | Post | 5.27±0.14 | 5.16±0.23 | 5.26±0.15 | 5.23±0.17 | Period | 36.618 | .001*** |
| | Total | 5.1±0.21 | 4.86±0.38 | 5.1±0.27 | 5.02±0.31 | Performance X Period | .224 | .224 |

***Characteristics of tennis serve skill with player D***

Repeated measures ANOVA was performed to verify the interaction effect between performance and training period on impact height among the characteristics that affect the serve- performance of player D. As a result, there was no main effect in performance on impact height, and the main effect was significant in the training period (p<.001). Also, there was no significant interaction effect between performance and training period. Next, the main effect of the anterior-posterior distance was significant in the training period (p<.001), and the main effect was not significant in the performance. The interaction effect between performance and training period was not significant. In addition, the main effect of the tilt angle of the whole body was significant in the training period (p<.001), and the main effect was not significant in the performance. The interaction effect between performance and training period was not significant. The angle of incidence did not show the main effect in performance, and the main effect was significant in the training period (p<.001). However, the interaction between performance and training period was not significant.

**Table 5.** Serve-characteristics of player D

| Division | Period | Serve Performance | | | | Source | F | P |
|---|---|---|---|---|---|---|---|---|
| | | Success Centerline | Success Sideline | Failure | Total | | | |
| Impact Height (%) | Pre | 127.36±2.26 | 127.36±2.74 | 128.86±2,9 | 127.62±5.19 | Performance | 1.094 | .351 |
| | Post | 119.65±3.8 | 121.76±2.22 | 129.89±2.63 | 121.89±3.02 | Period | 42.811 | .001*** |
| | Total | 123.51±5.02 | 124.56±3.69 | 130.24±2.87 | 125.37±3.86 | Performance X Period | .359 | .072 |
| A-P Distance (%) | Pre | 0.75±7.26 | 5.6±5.44 | 0.62±7.77 | 2.32±6.82 | Performance | 1.539 | .235 |
| | Post | 11.82 ±4.33 | 13.43±2.87 | 10.42±2.42 | 11.89±3.32 | Period | 23.478 | .001*** |
| | Total | 6.28±8.11 | 9.52±5.82 | 5.52±7.49 | 7.11±7.14 | Performance X Period | .227 | .799 |
| Whole-Body Tilt Angle (Degree) | Pre | 89.66±3.3 | 87.48±2.55 | 89.67±3.43 | 88.93±3.08 | Performance | 1.438 | .257 |
| | Post | 84.33±2.18 | 83.73±1.28 | 85.12±1.18 | 84.39±1.6 | Period | 25.131 | .001*** |
| | Total | 87±3.85 | 85.6±2.74 | 87.39±3.41 | 86.66±3.33 | Performance X Period | .251 | .251 |
| Incidence Angle (Degree) | Pre | 6.36±0.4 | 6.12±0.39 | 6.44±0.52 | 6.3±0.43 | Performance | 1.090 | .352 |
| | Post | 5.42±0.37 | 5.44±0.11 | 5.6±0.21 | 5.49±0.25 | Period | 38.320 | .001*** |
| | Total | 5.89±0.62 | 5.78±0.45 | 6.02±0.58 | 5.9±0.55 | Performance X Period | .350 | .350 |

***Characteristics of tennis serve skill with player E***

Repeated measures ANOVA was performed to verify the interaction effect between performance and training period on impact height among the characteristics that affect the serve- performance of player E. As a result, there was no main effect on impact height, and the main effect was significant in the training period (p<.01). Also, there was no significant interaction effect between performance and training period. Next, the main effect of the anterior-posterior distance was significant in the training period (p<.001), and the main effect was not significant in the performance. The interaction effect between performance and training period was not significant. Also, the main effect of the tilt angle of the whole body did not show a significant difference in performance and the training period. Also, the interaction effect between performance and training period was not significant. Finally, the angle of incidence did not show a main effect in the performance, and the main effect was significant in the training period (p<.001). However, the interaction between performance and training period was not significant.

**Table 6.** Serve-Characteristics of player E

| Division | Period | Success Centerline | Success Sideline | Failure | Total | Source | F | P |
|---|---|---|---|---|---|---|---|---|
| Impact | Pre | 117.92±2.21 | 117.53±3.35 | 117.94±2,99 | 117.79±2.68 | Performance Period | 1.351 | .278 |
| Height (%) | Post | 119.63±2.2 | 119.89±2.21 | 123.31±4.14 | 120.94±3.27 | Performance | 8.619 | .007** |
| | Total | 118.78±2.26 | 118.71±2.95 | 120.62±4.43 | 119.37±3.21 | X Period | 1.112 | .345 |
| A-P Distance | Pre | 2.89±1.1 | 2.89±2 | 2.63±2.83 | 2.8±1.98 | Performance Period | 1.017 | .377 |
| (%) | Post | 5.65 ±4.75 | 7.09±2.5 | 9.46±1.71 | 7.4±2.99 | Performance | 20.256 | .001*** |
| | Total | 4.27±3.67 | 4.99±3.1 | 6.04±4.22 | 4.49±3.66 | X Period | 1.359 | .276 |
| Whole-Body | Pre | 91.39±0.81 | 91.42±1.01 | 91.3±1.36 | 91.37±1.06 | Performance Period | .987 | .388 |
| Til Angle | Post | 128.71±7.85 | 93.37±1.19 | 94.38±0.84 | 105.49±3.29 | Performance | 1455 | .239 |
| (Degree | Total | 110.05±5.59 | 92.39±1.46 | 92.84±1.94 | 98.43±8.99 | X Period | .987 | .389 |
| Incidence | Pre | 5.75±0.17 | 5.73±0.1 | 5.74±0.17 | 5.74±0.14 | Performance | 2.578 | .097 |
| Angle | Post | 5.95±0.21 | 6.04±0.2 | 6.31±0.19 | 6.1±0.24 | Period | 31.369 | .001*** |
| (Degree) | Total | 5.85±0.21 | 5.89±0.22 | 6.02±0.35 | 5.92±0.26 | Performance | 2.838 | .078 |

## DISCUSSION

In tennis, serve is one of the most important components of scoring performance. Due to this importance, a number of studies have been conducted on the specific biomechanics of tennis serves (Abrams et al., 2011; Shim et al., 2006; Sheets et al., 2011; Whiteside et al., 2014). Tennis players have the most control over the game during the serve, which is probably the most significant stroke in the sport. For young tennis players, the goal of the current study was to measure the vertical height of the ball at the moment of ball impact and the front-to-back separation between the heel and the ball. The outcome demonstrated that there was no significant difference between the factors that affected the five tennis players' serves, both successfully and unsuccessfully. These outcomes are a result of the varying tennis levels and expertise of each player.

A comparison investigation of each player's sub-characteristics revealed that players A, B, and C had varying vertical impact heights based on their successes and failures. The varied pattern in the trend of changing the height of impact shows that each athlete has various sub-characteristics. Since the service motion is dependent on the storage and release of elastic energy, the dynamic nature of the stroke cannot be explained by a single, independent performance factor. The results of this study are consistent with the idea that player skills influence serve performance.

According to the United States Tennis Association (USTA; 2021), depth, height, direction, speed, and spin are the ball's five main controls, (Martin et al., 2013). The ability to produce tennis strokes with practice depends on mastering these controls. According to prior research, expert players (i.e., professionals) display more developed neuromuscular coordination patterns during the serve action than less experienced players (i.e., young athletes) do (Martin et al., 2014). In light of this, it is likely that a number of factors, including skilled players, contribute to serve skill. With regard to success and failure, the sub of A in particular displayed a difference in the body's overall tilt angle.

The failure chance was discovered to be approaching when the ball was excessively positioned in the forward-upward orientation. The height of the ball hit is directly related to the difference in angle of incidence according to success and failure in players A and B. In addition to comparing the distance between the ball and the net while serving, the angle of incidence is hypothesized to have an impact on the opponent's defensive strategy. The impact height had a tendency to be lower at successful serves than unsuccessful ones after 12 weeks of training, and the whole body's angle of inclination and incidence had a bigger angle at successful serves than at unsuccessful ones. Given that serving is among the hardest abilities to master, it would appear that skill level and serve performance are associated. Before to contact, tennis players must compensate at the distal (elbow, wrist) joints, which helps them adjust to the impact position and manage the projection angle (Whiteside et al., 2013).

Hence, in order to acquire the mechanical or perceptual skills necessary for the tennis serve, the

player must modify the server's performance and control the stochastic unpredictability of the ball contact position (Whiteside et al., 2013). As a result, the two-dimensional coordinate system used in this study was used to monitor the impact position of the ball according to the success (center, sideline) and failure of the serve, and the tilt angle of the entire body was examined. Also, based on the results of this study, it might be related to the stability required of a similar end position encountered at the tennis serve's ball contact stage. Participants in this study who played tennis demonstrated that, as in the previous study, positioning the ball forward enhanced the likelihood of success. The standardization of the height ratio should also be taken into consideration, even though the results of this study are similar to those of earlier investigations. It is clear that posture correction is necessary or has a greater chance of improving when athletes demonstrate statistical significance in each variable in serving time. Thus, the results of this research imply that tennis players, coaches, and associated researchers can easily develop models that can successfully serve and apply them in the real world.

In order to increase the vertical height of the ball, the distance between the heel and the front-to-back distance between the heel and the ball at impact, it is necessary to quantitatively measure the impact position of the ball and the inclination angle between the ball and trunk according to success (center and sideline) and failure in the tennis serve action. It was determined using a ratio. Using the two coordinates, the inclination angle was determined. Also, the tennis court standard and the ball's vertical position data were used to compute the angle of incidence.

***Conclusion***

In conclusion, the serve is a shot in a tennis game that initiates a point. The objective was to give each player useful quantitative information. Also, each player's measurement results were statistically presented in this study to identify the features of each player's tennis serve and the variables that influence that player. The success rate of the serve increased with the height of the ball's impact, however it varied for each player during the tennis serve. Despite the fact that the participants' ability levels varied greatly, there was not a statistically significant difference when taken as a whole.

It is believed that it is vital to check many variables through 3D analysis rather than 2D analysis and that further research on players with high sub-skills will provide more trustworthy data. Also, the outstanding players demonstrated results that were more evident than those expected after 12 weeks of flat serve instruction, whereas the less-than-excellent players exhibited outcomes that were comparable to those of the exceptional players. However, there was no statistically significant difference; as a result, the flat serve talent can be improved if trained using more extensive training and the traits discovered in this study. Future research might similarly train coaches on how to offer both autonomy-supportive and structured coaching programs focused on improving tennis serve skills (Cheon et al., 2024a,b).

***Conflict of Interest***

No potential conflict of interest was reported by the authors.

**Ethics Statement**

The research was approved by the Institutional Review Board. And informed consent was obtained from each subject before participation in the experiment (No, 1266/February/2022).

**Author Contributions**

Conception and design of the study, SH and YG; Data collection, SH; Data analysis and interpretation, SH; Drafting article and critical revision, YG; All authors have read and approved the published version of the manuscript.

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RESEARCH ARTICLE

# Acute Effects of Passive and Proprioceptive Neuromuscular Facilitation (PNF) Stretching Techniques on Speed, Agility, and Explosive Strength in Youth Basketball Players: A Randomized Controlled Trial

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**Abstract**

**Objective**: The aim of this study was to examine the acute effects of static passive and proprioceptive neuromuscular facilitation (PNF) stretching techniques on agility, speed, and lower-extremity explosive power in youth basketball players. **Methods**: Twenty male basketball players were randomized as passive and PNF groups. A single session of passive or PNF stretching techniques was applied to each group on the hamstring, quadriceps and calf group muscles. Outcome measurements consisted of the T Agility Test for agility, the 30-Meter Sprint Test for speed, the Standing Long Jump Test and the Lateral Jump Test for lower-extremity explosive power. **Results**: In within-group comparisons, statistically significant improvements were found in the passive group in all tests ($p<0.05$) except the 30-meter sprint test ($p>0.05$). In the PNF group, a significant improvement was found only in the T Agility Test in within-group comparisons ($p=0.05$). In the between-group comparison, no statistical difference was found between the two groups ($p>0.05$). **Conclusion**: In conclusion, static passive stretching before activity may have a greater effect on lower-extremity explosive power compared to PNF stretching. Additionally, PNF stretching improved agility, and did not cause any negative acute effects on speed and explosive strength. In the future, we think that conducting studies on how long the positive or negative acute effects of stretching techniques continue will be important for warm-up programs.

**Keywords**
Basketball, Passive Stretching, PNF Stretching, Athletic Performance

## INTRODUCTION

Stretching techniques can play an important role in preventing musculoskeletal injuries, relieving muscle pain, increasing muscle strength capacity, and improving activities of daily living or athletic performance. There are various stretching techniques available, including dynamic, static, ballistic, and proprioceptive neuromuscular facilitation (PNF). Static and PNF stretching are two commonly used techniques (Lim et al., 2014).

Despite many studies conducted, debates about the most effective approach and technique for stretching still continue in clinical practice and literature (Lempke et al., 2018; Reid et al., 2018). It is known that static stretching can affect subsequent performance, and perceptions of the benefits of static stretching in a pre-activity routine vary considerably (Kay & Blazevich, 2012). While most current research suggests that static stretching negatively impacts performance, there are also studies that show no decrease in performance (Chaouachi et al., 2010; Hayes & Walker, 2007; Power et al., 2004). Altered afferent feedback from the proprioceptors of the stretched muscle has been advocated as a possible underlying mechanism by

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which passive static stretching reduces the capacity to produce muscle force (Cè et al., 2020; Trajano et al., 2017). However, a review by Rubini et al. showed that static, ballistic, and PNF stretching methods produced similar effects on maximal force production (Rubini et al., 2007). The effects of stretching techniques are studied in a wide range due to various factors such as acute and chronic effects, different stretching methods and durations. It has been emphasized that this wide scope is one of the main reasons why stretching effects are unclear (Kay & Blazevich, 2012).

Another type of stretching that is widely used is PNF stretching. Although studies on PNF are limited, there are controversial results on the benefits of PNF stretching. It has been reported that PNF stretching should not be prescribed in specific warm-up programs because it impairs muscle performance (Gomes et al., 2011; Sá et al., 2016). Another study reported that none of the stretching protocols (static, dynamic, and PNF) caused decline in muscle performance (Manoel et al., 2008). Additionally, the effects of PNF stretching on jumping performance are also controversial (Christensen & Nordstrom, 2008; Church et al., 2001).

The effects of static passive and PNF stretching on muscle performance are contradictory in the literature. We also did not encounter any study examining the acute effects of PNF stretching on basketball players. We believe that we will contribute to the literature on the selection of stretching techniques in warm-up programs. The aim of this study was to examine the acute effects of static passive and PNF stretching techniques on agility, speed, and lower-extremity explosive power in youth basketball players.

## MATERIALS AND METHODS

### *Trial Design*

A randomised controlled trial followed the CONSORT statement guidelines. The study was approved by the Halic University Non-Interventional Clinical Research Ethics Committee (04.07.2024/156) and was registered on the Clinical Trials (number:NCT06591052).

### *Participants and Study Setting*

Individuals on the Bahçeşehir College Sports Club basketball team were included in the study between July and August 2024. Informed consent was obtained from eligible participants and their families who agreed to participate voluntarily. Twenty participants who met the inclusion criteria were randomized into two different groups (passive group and PNF group) using a sealed envelope method.

The inclusion criteria were as follows: being (a) male; (b) between 14-18 years of age; having (c) at least 2 years of basketball experience; (d) participated in regular team training for at least 2 months; (e) a body mass index of < 29.9 kg/m$^2$. The exclusion criteria were as follows: (a) presence of pain and/or history of injury in the lower extremity within the last 6 months; (b) history of orthopedic surgery of the lower extremity.

### *Study Groups and Interventions*

All participants performed agility, speed, and lower-extremity explosive strength tests after the same warm-up program. All participants had experience with the tests (having previously performed these tests during team training). After the initial assessments, participants underwent passive stretching or PNF stretching by the same physiotherapist. The tests were repeated immediately after the stretching interventions.

The passive stretching was applied to the hamstring, quadriceps, and calf group muscles by the same physiotherapist to the participants in the passive group. The muscle to be stretched was brought to the most lengthened position by the physiotherapist, and this position was maintained for 30 seconds. Three stretches were applied, and a 30-second rest period was given between each muscle group (O'Sullivan et al., 2009; Prentice, 2021).

The “hold-relax” technique, which is one of the special techniques of PNF, was applied to the hamstring, quadriceps, and calf group muscles by the same physiotherapist to the participants in the PNF group (Adler et al., 2007). The muscle to be stretched was brought to the most extended position by the physiotherapist (These positions are the same as those used in passive stretching). In this extended position, a maximum isometric contraction was performed in the antagonist direction for 5-8 seconds (Rowlands et al., 2003). After isometric contraction, the participant was asked for active relaxation (5 seconds were waited after complete relaxation was achieved), then the increase in the direction of movement was passively controlled. The end point of the advanced range of motion was

maintained for 30 seconds. Three stretches were applied and a 30-second rest period was given between each muscle group.

### *Outcome Measurements*

Agility was assessed with a T-test. Four 38 cm cones forming a T shape were placed as markers for the turning points. The athlete starts at cone A and sprints to cone B. Then, they shuffle to the right to cone D, shuffle to the left to cone C, and return to cone B. Finally, they sprint back to the starting point at cone A to complete the test. Each participant performed three trials with at least two minutes of rest in between. If necessary, participants were given a longer rest period. The duration of the test was recorded in seconds using a stopwatch by an experienced researcher. The best time was kept for analysis (França et al., 2022).

Speed was measured using a 30-meter (m) sprint test conducted on a straight track. For the test, the start and finish lines were marked and the distance between them was measured as 30 meters. During the test, participants took a ready position at the start line and started running with the whistle of the physiotherapist. At the finish line, the time was recorded with a stopwatch to the nearest 0.01 seconds. Each participant performed two trials with at least two minutes of rest in between. If necessary, participants were given a longer rest period. The 30-m sprint test performance was determined as the best time obtained in both trials (Xiong et al., 2022).

Lower-body explosive power was assessed with the Standing Long Jump Test (SLJT) and Lateral Jump Test (LJT). For the SLJT, participants were asked to jump forward as much as possible from a standing position with both legs and arms accelerating. The test was performed twice, and for analysis, the highest score (the distance between the test starting line and the heel closest to this line) was recorded in centimeters. If subjects fell back or touched the ground with another part of the body, another attempt was allowed (Marin-Jimenez et al., 2024). In LJT, the participant aligned the lateral edge of his primary (dominant) foot sideways to the starting line, then came to a squat position and performed a maximum jump to the side. The test was performed twice, the distance between the medial part of the primary foot and the starting line in the position reached after the jump was recorded (Trzaskoma et al., 2015).

The tests were conducted in the order of agility, speed, and explosive strength. A minimum of two minutes of rest was given between tests. If necessary, participants were given a longer rest period.

### *Statistical Analysis*

"Statistical Package for Social Sciences Version 24" (SPSS, Chicago, IL, USA) statistical program was used to data analysis. Numerical data were given as mean±standard deviation; qualitative variables were given as number and percentage (%). The normality of data were examined with skewness and kurtosis values. To compare within-group differences, "Paired-samples T-Tests" for normally distributed numerical variables and "Wilcoxon signed rank test" for non-normally distributed variables. In between-group comparisons, "Independent Samples T-Test" was used, taking into account the normal distribution of the data. The level of statistical significance was set at $p<0.05$.

Mean change (Δ) was used in between-groups comparisons. Δ were calculated using the formula: Δ = After test value – Before test value

## RESULTS

Table 1 shows the comparison of the demographical characteristics of the participants. There was no statistically significant difference between the groups ($p>0.05$).

The within-group and between-group comparisons, along with effect sizes, are presented in Table 2. In within-group comparisons, a significant difference was found in the T agility test *($p=0.002$)*, SLJT *($p=0.049$)*, and LJT *($p=0.034$)* parameters in the passive group, whereas no statistically significant difference was found in the 30-m sprint test (*$p=0.087$*). In the PNF group, no statistically significant difference was found in all tests except the T Agility Test *($p=0.005$)* in the within-group comparisons. No statistical difference was found between the two groups in the comparison of the mean change (Δ) variables of the outcome measures between the groups *($p>0.05$)*.

**Table 1.** Comparison of demographic characteristics between groups

| | Passive Group (n=10) $\bar{X}$±SD (min-max) | PNF Group (n=10) $\bar{X}$±SD (min-max) | t | p[a] value |
|---|---|---|---|---|
| **Age (years)** | 15.50 ± 0.70 (14-16) | 15.30 ± 0.82 (14-16) | 0.582 | 0.567 |
| **Height (cm)** | 187.70 ± 4.76 (178-194) | 186.40 ± 8.55 (173-196) | 0.419 | 0.679 |
| **Weight (kg)** | 80.80 ± 6.89 (70-93) | 82.70 ± 8.26 (70-96) | -0.558 | 0.583 |
| **Body Mass Index (kg/m$^2$)** | 22.91 ± 1.38 (20.80-24.84) | 23.79 ± 1.64 (21.60-26.49) | -1.287 | 0.214 |
| **Basketball Experience (years)** | 6.30 ± 1.41 (3-8) | 5.30 ± 0.94 (4-7) | 1.853 | 0.080 |

[a] = Independent Samples T-test; $\bar{X}$±SD = mean ± standard deviation

**Table 2.** Effects of the interventions on outcome measures

| | Passive Group (n=10) | | | | PNF Group (n=10) | | | | Between groups (Before-test) | Difference Between Groups | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before | After | Δ | p value | Before | After | Δ | p value | p value | p value | Cohen's d |
| **T Agility Test (s)** | 10.17±0.50 | 9.88±0.42 | -0.28±0.21 | **0.002[a]*** | 10.03±0.43 | 9.78±0.39 | -0.25±0.19 | **0.005[b]*** | 0.534[c] | 0.747[c] | -0.146 |
| **30-Meter Sprint Test (s)** | 5.31±0.39 | 5.23±0.32 | -0.08±0.14 | 0.087[a] | 5.27±0.43 | 5.21±0.39 | -0.06±0.10 | 0.069[a] | 0.839[c] | 0.747[c] | -0.146 |
| **Standing Long Jump Test (cm)** | 220.50±9.39 | 223.60±7.30 | 3.10±4.33 | **0.049[a]*** | 221.50±13.31 | 221.10±14.27 | -0.40±6.20 | 0.842[a] | 0.848[c] | 0.160[c] | 0.654 |
| **Lateral Jump Test (cm)** | 205.10±8.94 | 211.00±7.03 | 5.90±7.48 | **0.034[a]*** | 207.00±13.17 | 215.30±16.13 | 8.30±11.85 | 0.054[a] | 0.710[c] | 0.594[c] | -0.242 |

Data are expressed as mean ± standard deviation

Δ: difference between after and before the interventions

*p<0.05

a Comparison between before and after the intervention using Paired Samples T-test

b Comparison between before and after the intervention using Wilcoxon signed-rank test

c Comparison between passive and PNFgroups using the Independent Samples T-test

## DISCUSSION

This study investigated the acute effects of static passive and PNF stretching on agility, speed, and lower-extremity explosive strength in youth basketball players. It was found that static passive stretching improved agility and explosive strength, but PNF stretching only provided significant differences in agility. Neither stretching technique had any effect on speed. No difference was found between the two groups in the comparison of the difference variables between the groups.

Chatzopoulos et al., (2014) reported that static stretching had a negative acute effect on balance and agility performance compared to dynamic stretching in high school female athletes. Fletcher & Monte-Colombo (2010) found that pre-activity static stretching negatively affected both 20-m sprint and Balsom agility test. However, according to research by Amiri-Khorasani et al., (2010) static stretching did not show any effect on professional football players' performance on the Illinois agility test. The acute effects of static passive stretching protocols on athletes were studied and found to result in a significant increase in 20-m sprint test time (Nelson et al., 2005). Another study showed that short-term static stretching protocols provided acute improvement in

10 and 20-m sprint and T agility test performance, while longer-term static stretching protocols had neither positive nor negative effects (Avloniti et al., 2016). In the study conducted by Favero et al., subjects with low baseline flexibility scores were observed to have increased performance after static stretching and improved 40-m sprint times. In contrast, subjects with high baseline flexibility scores were found to be negatively affected after static stretching and their sprint times slowed down. In the current study, T agility test time was shortened after static passive stretching, but no change was found in the 30-m sprint test time (Favero et al., 2009). The results of our study reflect the differences in the literature. Further studies are needed to standardize the outcome measures and stretching protocols used.

We found only two studies examining the acute effects of PNF stretching on agility. In elite youth soccer players, no significant effects were found on Balsom agility test performance after static or PNF stretching (Jordan et al., 2012). Another study noted that PNF stretching had no significant acute effects on agility or sprint times in active men (Burgess et al., 2019). Our study was conducted on basketball players and agility performance increased after PNF stretching. This difference in our study may be due to the use of different PNF special techniques and/or the fact that our sample consisted of youth basketball players and/or the use of different agility tests, and/or a variety of stretching protocols.

Malek et al., (2024) compared dynamic stretching, PNF stretching, and a no-stretching control group in terms of jumping and sprint performance in their study on recreationally active men and found that the PNF stretching group increased vertical jumping and 20-m sprint performance compared to the control group. However, Alemdaroğlu et al., (2017) compared the acute effects of static, ballistic, PNF stretching in their study on taekwondo practitioners and stated that all three stretching techniques may negatively affect 10 and 20-m sprint performance. In our current study, no significant change was found on 30-m sprint performance after PNF stretching. These different results reflect the uncertainty of the acute effect of PNF stretching on speed tests.

Melocchi et al., (2021) promoted dynamic stretching instead of static stretching to improve vertical jump performance in young female artistic gymnasts. However, Oliveira et al., (2016) reported in their study on trained healthy athletes that jumping and running ability did not change after static stretching. Similarly, Gesel et al., (2022) reported that static and ballistic stretching had no effect on isometric strength and vertical jump testing. The many studies have shown that static stretching before activity has no effect on strength and power (Kingsley et al., 2013). However, a 2021 review reported that static stretching negatively affects jumping performance in runners (Ullman et al., 2021). Pacheco et al., (2011) demonstrated that static stretching in warm-up programs can be recommended to improve activities requiring explosive power. In our study, similar to this study, explosive strength evaluated with standing long jump and lateral jump tests improved after static passive stretching. We believe that the variations in the literature regarding the acute effects of static stretching are related to the variety of samples, stretching protocols, outcome measures, and flexibility levels.

To prevent a possible decrease in performance after longer stretching periods (>60 seconds), dynamic activities can be performed after stretching. However, it remains unclear whether this strategy is suitable for isolated PNF stretching applications for different muscle groups. Konrad et al. recommended avoiding dynamic or PNF stretching during warm-up, especially to optimize explosive or reactive muscle contractions (Konrad et al., 2022). Malek et al., (2024) compared dynamic stretching, PNF stretching and a no-stretching control group in terms of jumping and sprint performance in their study on recreationally active men and found that the PNF stretching group increased vertical jumping and 20-m sprint performance compared to the control group. Church et al., (2001) reported that PNF interventions would negatively affect vertical jump performance. Christensen & Nordstrom (2008) showed that PNF and dynamic stretching had no significant effect on vertical jump. The results of our study were that PNF stretching had no acute effects on jumping performance. However, all of the studies evaluated vertical jumping, and our study differs from the studies in the literature because it always included both the standing long jump and lateral jump tests.

***Limitations of the Study***

The limitations of our study include the small number of participants. In addition, although it is known that using photocells timing system is more accurate in measuring results for more sensitive

results, we used a stopwatch due to lack of equipment. Another limitation may be the absence of a dynamic stretching group and a control group and. Finally, dividing our participants into groups according to their flexibility levels using the block randomization method could have made the results of our study more reliable.

***Conclusions***

For basketball players, stretching and warming up are critical to enhancing performance and reducing the risk of injury. In particular, this study found that incorporating static passive stretching before activity in youth basketball players may be more beneficial for improving lower-extremity explosive power compared to PNF stretching. Improvements in agility and lower-extremity explosive power were found after static stretching, except speed. Additionally, PNF stretching improved agility, and did not cause any negative acute effects on speed and explosive strength. In the future, we think that conducting studies on how long the positive or negative acute effects of stretching techniques continue will be important for warm-up programs. In addition, more studies are needed to determine which stretching techniques have a positive or negative acute effect on which muscle group. EMG measurements performed during activities performed after different stretching techniques may be important in determining the mechanical effects of the interventions.

## Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Ethics Statement

The study was approved by the Halic University Non-Interventional Clinical Research Ethics Committee (04.07.2024/156).

## Author Contributions

Study Design: AÇ, NC; Data Collection: NC; Statistical Analysis: AÇ; Data Interpretation: AÇ, NC, DŞA, MYK; Manuscript Preparation: AÇ, DŞA, MYK; Literature Search: AÇ, NC, DŞA, MYK. All authors have read and agreed to the published version of the manuscript.

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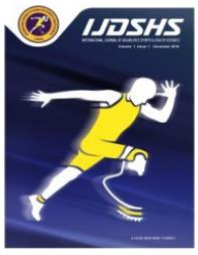

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RESEARCH ARTICLE

# Stress Factors Among South Korean Youth Soccer Players: An Analysis of Club and Pro Youth Teams

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**Abstract**
This study aimed to analyze stress factors among South Korean youth soccer players, focusing on differences between Pro Youth and Club Team players. Surveys were conducted with 284 players registered with the Korea Football Association in 2024, examining various stress dimensions including performance, training, interpersonal, and game-related stress factors. Statistical analyses included t-tests and ANOVA to determine differences across demographics. Results revealed that Pro Youth players experienced significantly higher levels of performance stress (M = 2.88, SD = 0.73, p = 0.012) and training stress (M = 2.75, SD = 0.72, p = 0.021) compared to Club Team players. Positional analysis indicated midfielders reported relatively high stress levels in performance stress (M = 2.86, SD = 0.67), influenced by their dual offensive and defensive responsibilities, though statistical significance with other positions was limited. Less experienced players (less than one year) showed elevated interpersonal stress (M = 2.60, SD = 0.68). These findings highlight the intense psychological demands placed on youth soccer players, particularly in highly competitive environments. Tailored stress management interventions, including role-specific support and psychological skills training, are recommended to mitigate these challenges and promote sustainable athlete development.

**Keywords**
Youth Soccer, Stress Factors, Competitive Sports, Psychological Support, South Korea

## INTRODUCTION

Youth soccer plays a critical role in the physical and emotional development of young athletes, providing a platform to build teamwork, discipline, and resilience. However, unmanaged stress in youth sports has been linked to significant physical and psychological issues, such as increased injury risk, burnout, and long-term mental health problems. Recent studies underscore the importance of balancing physical activity with psychological wellbeing to maximize the benefits of youth sports while mitigating risks. For example, participation in sports is shown to reduce anxiety and depression when managed positively, but excessive or high-intensity training can elevate cortisol levels, leading to stress and reduced performance (Negara et al., 2022; Scales et al., 2023). In particular, South Korea's youth soccer system is characterized by an intense focus on success, where young players must navigate the dual pressures of athletic performance and academic achievement. Unlike in many Western contexts, where recreational participation is emphasized, South Korean youth athletes often face the added burden of societal and familial expectations, which can exacerbate stress levels. This unique cultural context underscores the necessity for targeted stress management strategies that address the specific challenges faced by these young athletes.

### *Importance of Stress Management in Youth Sports*

Unmanaged stress in youth athletes can result in both physical and mental health problems,

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including higher injury rates, loss of motivation, and withdrawal from sports (Reilly & Ekblom, 2005; Scanlan et al., 2005; Côté et al., 2007).

The high-pressure environment of South Korean youth soccer, combined with cultural expectations for academic and athletic success, further heightens these risks. This makes the development of effective stress management interventions a crucial component of youth athlete development.

***Objectives and Literature Gap***

While previous research has explored stress in youth sports, a significant gap remains in understanding how these stressors uniquely affect South Korean youth soccer players. Most studies have focused on Western athletes, with limited attention to the stress experiences of Asian youth athletes. A study highlights stress as a key factor in athlete exhaustion among South Korean youth athletes (Kim & Cho, 2023). This study examines distinct stress factors in fluencing South Korean youth soccer players, providing evidence-based recommendations for tailored interventions catering to their specific needs.

***Theoretical Framework***

The study is grounded in the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), which posits that stress results from an individual's appraisal of the demands placed upon them and their perceived ability to cope. This model is particularly relevant in the youth sports context, where players constantly evaluate their performance, training demands, and social interactions (Vealey et al., 2016).

## MATERIALS AND METHODS

This research adhered to ethical standards for studies involving human participants. Ethical approval was obtained from the Jeonju University Institutional Review Board (Approval No. jjIRB-240215-HR-2023-1110). All participants were informed of the study's purpose, and written consent was obtained prior to participation. The confidentiality and rights of all participants were strictly protected throughout the research process.

***Participants***

This study included 284 youth soccer players registered with the Korea Football Association in 2024. Out of 300 participants, 16 responses were excluded due to unreliable or insincere answers.

The participants were categorized based on grade level, years of experience, team type, and playing position (See **Table 1**). Specifically, 29.6% were in the 4th grade, 19.0% in the 5th grade, and 51.4% in the 6th grade. Regarding experience, 48.9% had less than 1 year of experience, 37.0% had 1-3 years, 9.5% had 3-5 years, and 4.6% had more than 5 years of experience. In terms of team type, 56.7% were part of Club Teams, while 43.3% were Pro Youth players. Position-wise, 47.2% were Forwards (FW), 30.3% were Midfielders (MF), 18.7% were Defenders (DF), and 3.9% were Goalkeepers (GK).

**Table 1.** Demographic characteristics of participants

| Characteristics | Categories | Percentage(%) |
|---|---|---|
| Grade Level | 4th Grade | 29.6 |
| | 5th Grade | 19.0 |
| | 6th Grade | 51.4 |
| Experience | Less than 1 year | 48.9 |
| | 1-3 years | 37.0 |
| | 3-5 years | 9.5 |
| | More than 5 years | 4.6 |
| Team Type | Club Team | 56.7 |
| | Pro Youth | 43.3 |
| Position | Forward(FW) | 47.2 |
| | Midfielder(MF) | 30.3 |
| | Defender(DF) | 18.7 |
| | GoalKeeper(GK) | 3.9 |

***Procedures***

The data was collected using self-administered surveys, employing a convenience sampling method. Both the researcher and research assistants conducted the surveys directly to ensure data reliability. Participants were instructed to complete the survey independently without external influence.

### *Survey Questionnaire*

The questionnaire used in this study was based on established scales for assessing stress factors in youth sports, with refinements by Lee (2006) to assess stress factors in youth sports. The final version was specifically tailored to the context of youth soccer and included 33 items scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To ensure the validity and reliability of the questionnaire, a factor analysis was conducted, which confirmed the constructs of the instrument. Items with low factor loadings were removed, enhancing the precision of the tool. The final version of the questionnaire was reviewed and validated by experts in sports science and statistics. The internal consistency of the questionnaire was measured using Cronbach's alpha, with reliability coefficients as follows: Pre-Game Stress (.822), Game Outcome Stress (.786), Performance Stress (.863), Interpersonal Stress (.678), Leisure Stress (.682), Training Stress (.611), In-Game Stress (.709), and Social Stress (.691). These results indicate that the questionnaire reliably measured the intended stress factors, confirming its overall robustness.

### *Data Analysis*

Collected data were analyzed using SPSS Version 26.0. Analytical methods included factor analysis, reliability analysis, frequency analysis, t-tests, one-way ANOVA, and post-hoc analysis using the Scheffé test. Each analysis was conducted systematically to align with the study's objectives and hypotheses (See **Table 2**).

**Table 2.** Analysis techniques and purposes

| Analysis Technique | Purpose |
|---|---|
| Factor Analysis | To validate the survey instrument's constructs |
| Reliability Analysis | To assess the internal consistency of items |
| Frequency Analysis | To describe demographic characteristics |
| T-test | To compare stress levels between 2 groups |
| One-Way ANOVA | To examine differences across multiple groups |
| Scheffe Test | To identify specific group differences |

## RESULTS

### *Descriptive Statistics of Stress Factors*

The highest stress levels were noted in match outcome stress (M = 2.89, SD = 0.74) and in-game stress (M = 2.66, SD = 0.71), reflecting the intense pressures associated with competitive play. Performance stress also ranked high (M = 2.88, SD = 0.73), indicating that the pressures to perform well significantly impact young athletes. In contrast, leisure stress (M = 2.50, SD = 0.70) and interpersonal stress (M = 2.60, SD = 0.68) were ranked lower, suggesting these factors, while still impactful, contribute less to overall stress levels (See **Table 3**). These findings underscore the significant psychological demands placed on youth soccer players, particularly during high-stakes matches, which can contribute to performance anxiety and overall stress. Understanding the hierarchy of stress factors can inform targeted interventions, prioritizing high-impact areas like outcome and performance stress.

**Table 3.** Descriptive statistics of stress factors

| Stress Factor | Mean (M) | Standard Deviation (SD) | Rank |
|---|---|---|---|
| Outcome Stress | 2.89 | 0.74 | 1 |
| Performance Stress | 2.88 | 0.73 | 2 |
| In-game Stress | 2.66 | 0.71 | 3 |
| Interpersonal Stress | 2.60 | 0.68 | 4 |
| Leisure Stress | 2.50 | 0.70 | 5 |
| Training Stress | 2.75 | 0.72 | 6 |

### *Stress Variation by Demographics*

Significant differences in stress levels were observed based on team affiliation, grade, experience, and position (p-values ranging from 0.01 to 0.04). Pro Youth players experienced significantly higher stress levels than Club Team

players, particularly in performance and training stress (p = 0.012) (See **Figures 1-2**). Effect size analysis revealed moderate to large effects (Cohen's d ranging from 0.5 to 0.8), indicating that the differences are not only statistically significant but also practically meaningful.

***Position-Specific Stress Differences***

The analysis revealed significant differences in stress levels among different playing positions. Specifically, midfielders (MF) exhibited notably high stress levels in Pre-Game Stress (M = 2.81, SD = 0.64) and Performance Stress (M = 2.86, SD = 0.67), which can be attributed to their dual role in both offense and defense, requiring constant decision-making and physical exertion. Defenders (DF) showed distinctive stress patterns, particularly recording the highest levels of Interpersonal Stress (M = 2.75, SD = 0.62), likely reflecting the intensive collaborative demands of defensive coordination. Forwards (FW) demonstrated consistent stress levels across categories, with notably elevated Game Outcome Stress (M = 2.63, SD = 0.69), reflecting the pressure to score goals. Goalkeepers (GK), although fewer in number, generally experienced lower stress levels across most categories (ranging from M = 2.35 to M = 2.50), but their role's critical nature suggests intense pressure during key game moments.(See **Table 4**).

***Effect Sizes and Practical Significance***

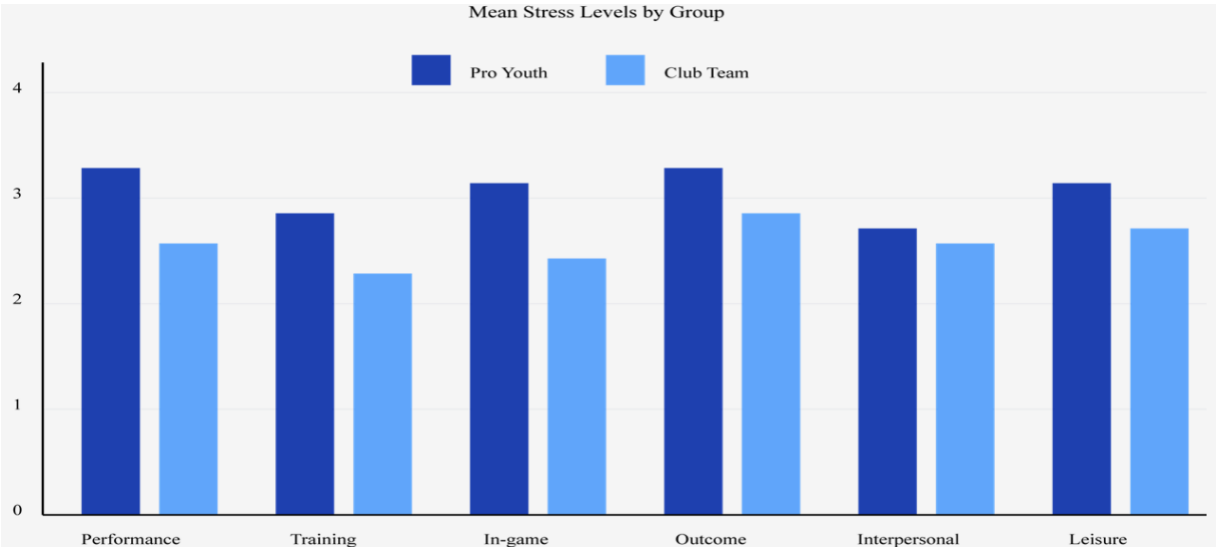


**Figure 1.** Mean stress levels by group (Pro Youth vs. Club Team); This bar graph shows the differences in stress levels between Pro Youth and Club Team players across various stress factors.

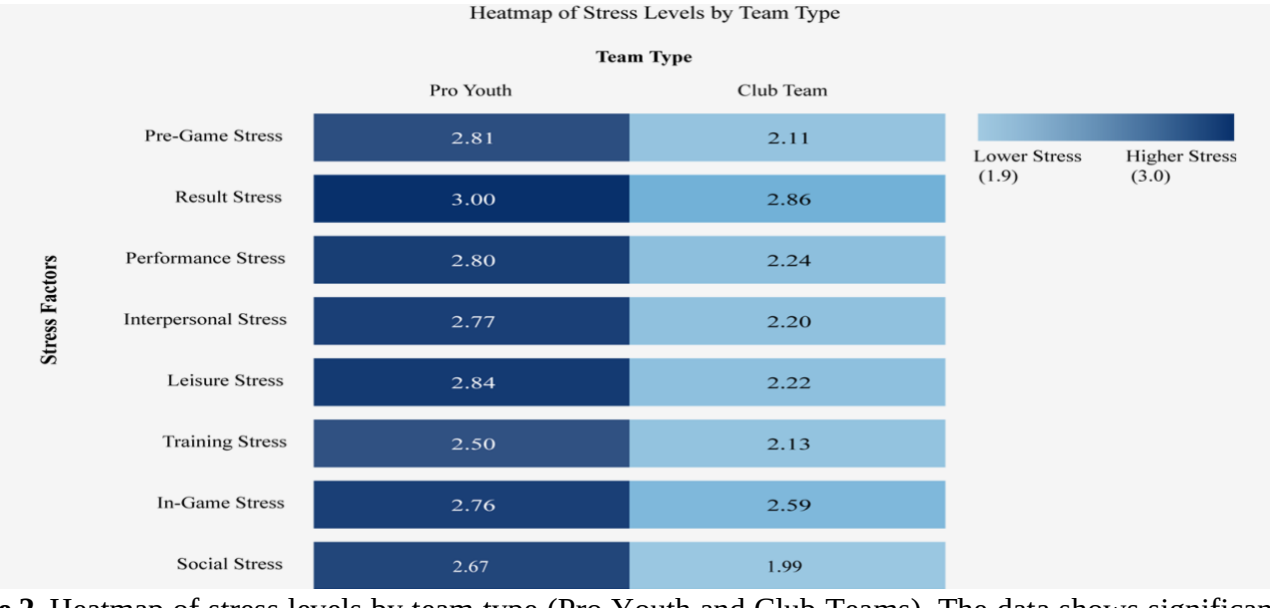


**Figure 2.** Heatmap of stress levels by team type (Pro Youth and Club Teams). The data shows significant differences in stress factors between team types, particularly in result and performance stress.

**Table 4.** Position-specific stress levels

| | Position | Pre-Game Stress (M±SD) | Performance Stress (M±SD) | Interpersonal Stress (M±SD) | Game Outcome Stress (M±SD) |
|---|---|---|---|---|---|
| 1 | Midfielder | 2.81±0.64 | 2.86±0.67 | 2.55±0.58 | 2.45±0.59 |
| 2 | Defender | 2.45±0.58 | 2.63±0.60 | 2.75±0.62 | 2.30±0.57 |
| 3 | Forward | 2.70±0.65 | 2.55±0.68 | 2.60±0.59 | 2.63±0.69 |
| 4 | Goalkeeper | 2.50±0.59 | 2.45±0.60 | 2.35±0.58 | 2.40±0.62 |

Effect sizes were calculated to provide insight into the practical significance of the findings beyond statistical significance. A Cohen's d value of 0.76 between Pro Youth and Club Team players suggests that the competitive environment significantly impacts stress levels.

Positional differences also showed large effect sizes, particularly for midfielders (Cohen's d = 0.81), indicating that their dual role in defense and offense contributes to higher stress levels (See **Figure 3**).

***Stress Analysis by Experience***

The analysis revealed that players with less than one year of experience reported higher levels of interpersonal and leisure stress compared to more experienced players, with a moderate effect size (Cohen's d = 0.65) (See **Figure 4**). This indicates that newer players face notable adjustment challenges in youth soccer, which can heighten stress levels due to unfamiliarity with competitive demands and social dynamics. Additionally, analysis by experience level showed varying patterns of stress across different factors, with notably higher stress levels in certain domains for less experienced players (See **Figure 5)**.

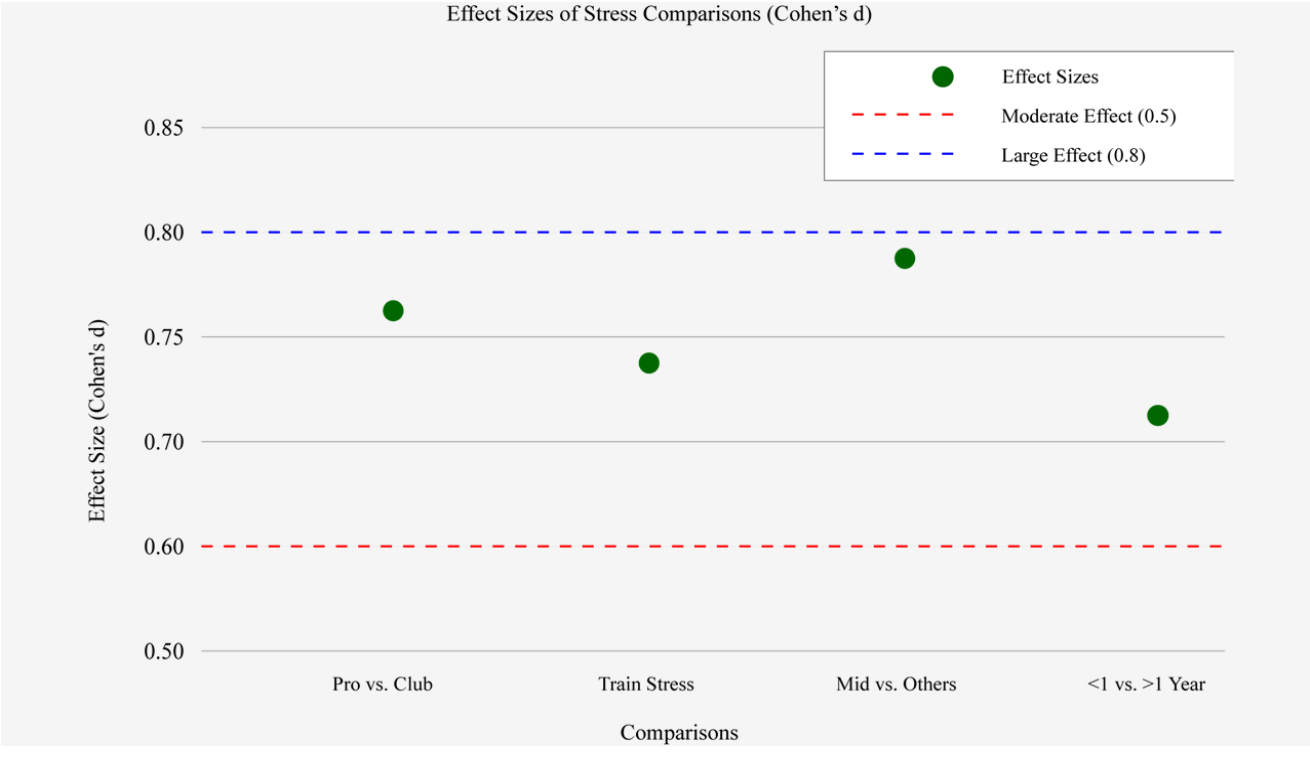


**Figure 3.** Effect sizes of stress comparisons (Cohen's d); This scatter plot highlights the effect sizes of stress comparisons, illustrating the substantial differences among groups


**Figure 4.** Stress Levels by Experience; A line plot showing how stress levels change with experience, emphasizing the need for tailored support for less experienced players.

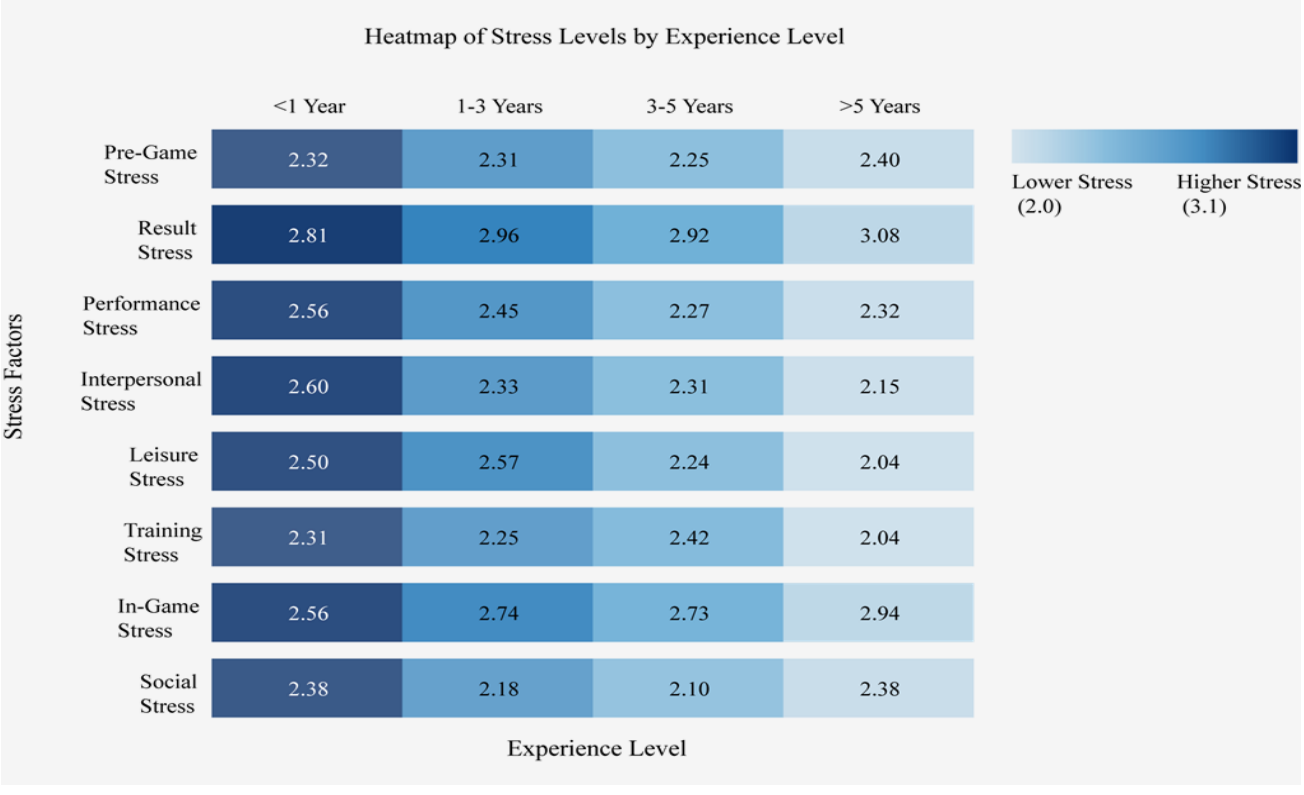


**Figure 5.** Heatmap of stress levels by experience level. The data shows varying patterns of stress factors across different experience groups.

## DISCUSSION

### *Implications of Stress Factors on Youth Athletes*

The results of this study highlight the significant impact of various stress factors on youth soccer players in South Korea. Specifically, Pro Youth players exhibited higher stress levels related to performance (M = 2.88, SD = 0.73) and training (M = 2.75, SD = 0.72), aligning with findings from previous studies that emphasize the pressures associated with competitive youth sports (Gould et al., 1993; Olmedilla et al., 2019). These elevated stress levels suggest that the increased demands of competitive training and high expectations

contribute significantly to the overall stress burden on young athletes. A study by Nobari et al., (2021) on youth soccer players further supports this, showing significant stress differences across playing positions.

The high stress observed in midfielders can be attributed to their critical role in both defense and offense, requiring constant decision-making, physical exertion, and strategic play. This dual responsibility places them under continuous psychological and physical strain, which aligns with findings in similar contexts where positional roles contribute significantly to stress variation (Smith et al., 1990).

***Comparison with Existing Literature***

The findings of this study are consistent with the broader literature on youth sports, which indicates that performance anxiety, interpersonal conflicts, and training pressures are prevalent stressors among young athletes (Scanlan et al., 1991). However, this study uniquely identifies how these stress factors are amplified within South Korea's competitive youth soccer culture. The cultural emphasis on success and performance in South Korea likely amplifies the psychological burden on young athletes, necessitating culturally sensitive stress management approaches.

***Practical Implications and Interventions***

Given the identified stress factors, several tailored interventions are recommended to help manage stress among youth soccer players. Relaxation training, cognitive-behavioral techniques, and structured leisure activities have been shown to be effective in reducing performance anxiety and overall stress (Hanton et al., 2005; Gledhill et al., 2017). Coaches should receive training to recognize signs of stress in their players and incorporate stress-reducing practices into their coaching strategies, such as modifying training intensity and providing positive reinforcement.

Role-specific support mechanisms are also crucial, particularly for high-stress positions like midfielders. Individualized psychological support tailored to specific positional demands can help mitigate the heightened stress levels observed among these players. Integrating psychological skills training into routine practices can empower players with tools to manage competitive pressures effectively.

***Long-Term Impacts and Future Directions***

The implications of stress on youth athletes extend beyond immediate performance issues. Chronic exposure to high stress levels can lead to burnout, dropout from sports, and long-term mental health issues (Côté et al., 2007). Therefore, implementing consistent and long-term stress management strategies is essential for sustaining youth athletes' engagement and well-being. Future research should consider longitudinal studies that examine the effectiveness of these interventions over time and explore how sustained support can improve both performance and mental health outcomes.

***Critical Evaluation and Limitations***

Despite the valuable insights provided by this study, several limitations should be acknowledged. The use of self-reported data may introduce biases, such as social desirability bias, which can affect the accuracy of the reported stress levels. Moreover, the convenience sampling method limits the generalizability of the findings to all youth soccer players. Future research should employ more rigorous sampling methods and consider a broader demographic to validate the findings. Additionally, exploring the cross-cultural applicability of the proposed interventions could provide further insights into how stress management strategies might be adapted for different contexts.

***Conclusion***

This study provides valuable insights into the stress factors affecting youth soccer players in South Korea. By identifying the specific stressors and their impacts, this research underscores the need for targeted stress management interventions tailored to the unique needs of youth athletes in highly competitive environments.

***Recommendations***

Stress Management Training: Implement educational programs for players, coaches, and parents to recognize and manage stress effectively.
Psychological Support Programs: Provide access to mental health professionals specializing in sports psychology to help players cope with performance-related stress.

Structured Leisure Time: Incorporate leisure and relaxation periods into training schedules to allow players to recover physically and mentally.
Role-Specific Support: Develop tailored support mechanisms based on player positions and experience levels to address specific stressors unique to each role.

***Future Research Directions***

Future studies should explore the longitudinal effects of stress on youth athletes and assess the

efficacy of different intervention strategies through randomized controlled trials. Additionally, examining the role of cultural factors in shaping stress perceptions and responses among young athletes in different regions could provide further insights.

### *Conflict of Interest*

We declare that the article we have written is not involved in any conflict of interest.

### *Ethical Statement*

This research adhered to ethical standards for studies involving human participants. Ethical approval was obtained from the Jeonju University Institutional Review Board (Approval No. jjIRB-240215-HR-2023-1110).

### *Author Contribution*

Study design, CC and YH; Data collection, CC and YH; Statistical analysis, IC and DK; Data interpretation, CC, IC and DK; Literature search, CC, YH and IC. All authors have read and approved the published version of the manuscript.

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RESEARCH ARTICLE

# Investigation of the Views of Health Professionals in the Field of Orthotics Prosthetics on Evidence-Based Orthotics Prosthetics Practices

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**Abstract**
**Purpose:** The aim of the study was to find out what the Turkish orthotic prosthetic community thought about the use of evidence-based practices. **Material and methods:** Our study included 134 participants (59 females, 75 males) who have been working in the field of orthotics and prosthetics in hospitals, clinics and academic institutions in Turkey for at least six months. Study data were collected using the Evidence-Based Practice Questionnaire (DI-EBPQ), Health Sciences-Evidence-Based Practice Questionnaire (HS-EBP), and Information Literacy Self-Efficacy Scale (DTILSES) developed by the researcher. Data analysis was done using SPSS 26.0 program. **Results:** The total scores of HS-EBP and DTILSES were significantly higher in those with master's/doctorate degrees ($p<0.001$), those who received evidence-based practice training ($p<0.001$), those who believed positively in evidence-based practice ($p=0.003$), and those with advanced evidence-based practice knowledge ($p<0.001$). In addition, the total DTILSES score was higher in those working in university hospitals ($p<0.001$). A high positive correlation and significant relationship were found between HS-EBP sub-dimensions and DTILSES sub-dimensions ($p<0.05$). **Conclusion:** As a result, it was found that healthcare professionals working in the field of orthotics and prosthetics needed evidence-based practice training and their awareness of evidence-based practices was low.

**Keywords**
Evidence-Based Practice, Orthosis, Prosthesis, Health Sciences

## INTRODUCTION

Evidence-based practice (EBP) refers to the clinical use of up-to-date and accurate evidence published on the subject in the decision-making process regarding practices such as medical care and treatment (Şahin & Acar, 2023; Dinçer et al. 2015). The inclusion of evidence-based practices in health was first based on medical studies in the 1970s, then in the United Kingdom and in the United States in the 1990s. When the definition of clinical practice emerged, it was defined as the observation of the effects of treatments in clinics and the routine use of practices, and it has evolved into its current meaning in the last twenty years (Şenyuva, 2016). Evidence-based practices have also gained importance in interdisciplinary evaluations in recent years. These sciences are at the forefront of practical evidence-based applications in nursing, physiotherapy and rehabilitation, occupational therapy, social service, dental medicine and medical sciences (Çay & Daşbaş, 2020; Alcan, 2020; Yılmaz et al. 2019; Çankaya et al. 2018; Çan&Toraman; 2022; Akaltan, 2019). Evidence-based practices are important in the rehabilitation and prevention of limb injuries by health professionals (İlhan & Erbahçeci, 2023). Training should be planned for the use, research and interpretation of evidence-based practices by health professionals, and models appropriate to health professionals should be used to convert these practices into clinical trials (Deliktaş & Kabukcuoğlu, 2017; Oral et al. 2016).

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There is a lack of studies in the current literature investigating the evidence-based practices of healthcare professionals working in the field of orthotic prosthetics in Türkiye. This study aimed to increase awareness of evidence-based practice in this field by investigating the perspective of healthcare professionals working in the field of orthotic prosthetics on evidence-based practice.

## MATERIALS AND METHODS

### *Study Design*

This study is a descriptive type research. Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of the affiliated institution with the approval number E-10840098-772.02-7484 dated 23.11.2023. The study was conducted in accordance with the Helsinki Declaration and registered on www.clinicaltrials.gov with the registration number NCT06175364.

### *Participants*

The study was conducted between December 2023 and May 2024 by 134 volunteers (59 females, 75 males) to examine evidence-based orthotic prosthetic practices by health professionals in Türkiye. Volunteer health professionals in the area of orthotic prosthetic were informed about their work and endorsed an "informed consent form".

The criteria for inclusion in the study are; having worked in hospitals, clinics, academic units in Türkiye for at least 6 months, being able to read and write Turkish. Exclusion criteria for the study; employees working outside the orthosis prosthesis sector were not included in the study.

### *Data Collection Tools*

The data collection tools used in the study were delivered for completion through Google Forms and face-to-face interviews were conducted using the questionnaire method. The necessary permissions to use the scale were obtained by e-mail.

### *Demografic Information and Evidence-Based Practice Questionnaire (DI-EBPQ)*

A evidence-based practice assessment questionnaire, prepared by the researchers, asked participants about their age, gender, educational degree, work experience (year), working hours (week),working center and prosthetic orthosis center ownership. There are also questions that involve questioning for evidence-based practice. These topics include; receiving training in evidence-based practice, the belief that evidence-driven practice has a positive impact on treatment outcomes, the level of knowledge of evidence-oriented practice, follow-up information on scientific journals, information on the preparation of scientific publications, the implementation of evidence-based practice in the working center, the need for a supervisor (expert) in the profession and where professional knowledge is needed.

### *Health Sciences-Evidence Based Practice Questionnaire (HS-EBP)*

HS-EBP, a scale developed by Fernandez et al., Turkish validity and reliability study was conducted by Şahin et al. It is a 60 item 10 likert scale where participants measure information about health sciences-evidence based practice to examine psychometric properties (Şahin & Acar, 2023; Fernández-Domínguez et al. 2022).

HS-EBP consists of three main sections. These sections are the sections: Beliefs and Attitudes (12 items), Practices (36 items) and Barriers-Facilitators (12 items). High scores indicate a more supportive attitude or behaviour towards the implementation of evidence-based practices in clinical practice.

### *Developing The Information Literacy Self-Efficacy Scale (DTILSES)*

Developed by Kurbanoğlu and Akkoyunlu the scale of 28 substances with 7 sub-dimensions is rated as a likert type with 7 (Kurbanoglu et al. 2006). These sub-dimensions include identifying the need for information, initiating search strategies, finding and accessing resources, evaluating information, synthesizing and utilizing the interpretation of information, information and communication, and process evaluation. As the total score increases, these lower-size skills increase.

### *Statistical analysis*

The number of participants to be included in the study was determined by the G*Power 3.1.9.4 software, with an impact magnitude of 80% statistical strength and a significance of 5% of 134 participants.

The data were analyzed in the IBM SPSS version 26.0 for Windows. Descriptive statistical methods such as count, percentage, mean, and standard deviation were used for data evaluation. The Shapiro-Wilk normality test was used for the conformity of numerical variables to the normal

distribution. "Student's t Test" was used when comparing the two groups and "Mann Whitney-U test" when it did not. When comparing more than two groups, the parametric test provided the preconditions of "Varyance Analysis", when not the "Kruskal Wallis Test" was used. The relationship between the two continuous variables was evaluated with the Spearman Correlation Scale, where the Pearson Correlations Scale and the parametric test did not provide preconditions.

## RESULTS

This study was completed with a total of 134 participants (59 females, 75 males). The demographic information and evidence-based practice questionnaire (DI-EBPQ) are shown in Table 1. The average age of the participants in our study was 32.23 ± 8.32. 82.8% of participants had at most a bachelor's degree level of education, 41.8% worked in a prosthetic orthosis center and 92.5% did not have an center ownership. Participants of 75.6% didn't evidence-based practice. The participants' evidence-based application knowledge levels were 65.7% basic, 27.6% intermediate, and 6.7% advanced. 98.5% of participants believed that evidence-based practices had a positive impact on treatment outcomes. 59% of participants did not follow scientific journals, 64.9% did not publish related to their profession and 71.6% did not the of evidence-based practice in the working center. 88.8% of respondents found that a consultant was necessary in their profession. When professional information was needed, 40.3% of the places supported were found to be Internet, 37.3% were colleagues, and 14.2% were supervisor.

**Table 1.** Demografic information and evidence-based practice questionnaire(DI-EBPQ) (n=134)

| Age (year) | **n (%)** |
|---|---|
| Avg ± Sd / M (min-max) | 32.23 ± 8,32 / 30 (21-62) |
| Gender | |
| Female / Male | 59 (44) / 75 (56) |
| Educational Degree | |
| High School/Associate/Bachelor/Master's-Ph.D. | 16 (11,9)/53 (39,6)/42 (31,3)/23 (17,2) |
| Work experience (year) | |
| Avg ± Sd / M (min-max) | 8.40 ± 8.23 / 6 (1-39) |
| Working hours (week) | |
| Avg ± Sd / M (min-max) | 44.72 ± 8.61 / 45 (10-80) |
| Working center | |
| Prosthetic orthosis center | 56 (41.8) |
| Public Hospital | 36 (26.9) |
| University Hospital | 21 (15.7) |
| Prosthetic orthosis center ownership | |
| Yes | 10 (7.5) |
| No | 124 (92.5) |
| Receiving training in evidence-based practice | |
| Yes / No | 33 (24.6) / 101 (75.4) |
| The belief that evidence-driven practice has a positive impact on treatment outcomes | |
| Yes / No | 132 (98.5) / 2 (1.5) |
| The level of knowledge of evidence-oriented practice | |
| Basic/Intermediate/Advanced | 88 (65.7) / 37 (27.6) / 9 (6.7) |
| Follow-up information on scientific journals | |
| Yes / No | 55 (41) / 79 (59) |
| Information on the preparation of scientific publications | |
| Yes / No | 47 (35.1) / 87 (64.9) |
| The implementation of evidence-based practice in the working center | |
| Yes / No | 38 (28.4) / 96 (71.6) |
| The need for a supervisor (expert) in the profession | |
| Yes / No | 119 (88.8) / 15 (11.2) |
| Where professional knowledge is needed | |
| Internet/Colleague/Supervisor | 54 (40.3) / 50 (37.3) / 19 (%14.2) |

HS-EBP total score and DI-EBPQ comparisons are shown in Table 2. The HS- EBP total score compared to DI-EBPQ there was a significant difference between educational degrees, working center, receiving training in evidence-based practice, in the condition of following scientific journals, profession-related publication (article/compilation), use of evidence-based practice in the study and considering the level of knowledge of evidence-based practice (basic, intermediate, advanced) (p<0.001). There was a significant difference in the belief that evidence-based practices had a positive effect on treatment outcomes (p=0.003).

**Table 2.** Comparison of the HS-EBP total score with the DI-EBPQ

| | HS-EBP total score | Statistics (*p*) |
|---|---|---|
| | Avg ± Sd | |
| Gender: Female / Male | 6.2 ± 2.08/5.9 ± 1.98 | t=0.869 p=0.386 |
| Educational Degree: High School/ Associate/ Bachelor / Master's-Ph.D. | 5.24 ± 2.18/4.88 ± 1.81/6.62 ± 1.39/ 8.17 ± 1.08 | **F=24.996p<0.0 01** |
| Working center: Prosthetic orthosis center/Public Hospital/University Hospital | 5.43 ± 2/5.46 ± 1.75/6.56 ± 1.77 | **F=13.14 p<0.001** |
| Prosthetic orthosis center ownership | | t=1.748 p=0.083 |
| Yes / No | 7.1 ± 2.68 / 5.95 ± 1.95 | |
| Receiving training in evidence-based practice | | **t=6.411** |
| Yes / No | 7.75 ± 1.41 / 5.47 ± 1.88 | **p<0.001** |
| The belief that evidence-driven practice has a positive impact on treatment outcomes | | **t=3.076 p=0.003** |
| Yes / No | 6.1 ± 1.97 / 1.79 ± 1.12 | |
| The level of knowledge of evidence-oriented practice | | **F=42.524** |
| Basic/Intermediate/Advanced | 5.14 ± 1.7 / 7.53 ± 1.4 / 8.65 ± 0.97 | **p<0.001** |
| Follow-up information on scientific journals | | **t=9.557** |
| Yes / No | 7.58 ± 1.38 / 4.96 ± 1.68 | **p<0.001** |
| Information on the preparation of scientific publications | | **t=8.009 p<0.001** |
| Yes / No | 7.6 ± 1.25 / 5.18 ± 1.85 | |
| The implementation of evidence-based practice in the working center | | **t=8.409 p<0,001** |
| Yes / No | 7.93 ± 1.26 / 5.28 ± 1.77 | |
| The need for a supervisor (expert) in the profession | | t=0.109 p=0.914 |
| Yes / No | 6.04 ± 1.99 / 5.98 ± 2.4 | |
| Where professional knowledge is needed | | F=1.754 |
| Internet/Colleague/Supervisor | 5.94 ± 2.25/6.39 ± 1.89/5.19 ± 1.45 | p=0.159 |

t: Independent Sample t Test; F: ANOVA; n: The number of participants; %: percentage; Avg: average; Sd: standart deviation; HS-EBP: Health Sciences-Evidence Based Practice; p < 0.05 was considered to be significant.

DTILSES total score and DI-EBPQ comparisons are shown in Table 3. DTILSES total score compared to demographic information and evidence-based practice questionnaire; there was a significant difference between education degrees, working center, receiving training in evidence-based practice, in the condition of following scientific journals, profession-related publication, the implementation of evidence-based practice in the working center and considering the level of knowledge of evidence-based practice, there was a significant difference between basic, intermediate and advanced (p<0.001). Where was a significant difference in the responses to the question of where you get support when you need professional knowledge (internet, colleagues and supervisor).

HS-EBP with the DTILSES linear regression analysis are shown in Table 4. Linear regression analysis model was statistically significant (F=222.833; p<0.001). According to the model, an increase of one unit in the HS-EBP scores increased the DTILSES by 0.660 unit.

A linear regression analysis between DTILSES and the sub-dimensions of the HS-EBP are shown in Table 5. Linear regression analysis model was statistically significant (F=96.622; p<0.001). According to the model, the application sub-size, with 0.360 units, has the strongest impact on information literacy. Beliefs and attitudes have a negative effect of 0.139 units, which reduces the literacy of information. Reducing barriers or

increasing facilitators also has a positive effect on information literacy .

**Table 3.** Comparison of the total scores of the DTILSES with the DI-EBPQ

| | DTILSES | Statistics (*p*) |
|---|---|---|
| | Avg ± Sd | |
| Gender: Woman / Man | 4.67 ± 1.85/4.78 ± 1.55 | t=-0.357 p=0.722 |
| Educational Degree: High School/ Associate/ Bachelor/ Master's-Ph.D. | 3.73± 2.08/ 3.89± 1.52/ 5.43± 0.97 /6.11 ± 1.3 | **F=19.565 p<0.001** |
| Working center: Prosthetic orthosis center/Public Hospital/University Hospital | 4.25 ± 1.8/4.43 ± 1.56/4.99 ± 1.2 | **F=9.822 p<0.001** |
| Prosthetic orthosis center ownership | | |
| Yes / No | 5.61 ± 1.91 / 4.66 ± 1.66 | t=1.715 p=0.089 |
| Receiving training in evidence-based practice | | |
| Yes / No | 6.05 ± 0.75 / 4.3 ± 1.69 | **t=5.741 p<0.001** |
| The belief that evidence-driven practice has a positive impact on treatment outcomes | | |
| Yes / No | 4.76 ± 1.67 / 2.79 ± 2.53 | t=1.656 p=0.100 |
| The level of knowledge of evidence-oriented practice | | |
| Basic/Intermediate/Advanced | 4 ± 1.55/6.01 ± 0.87/6.62 ± 0.52 | **F=37.956 p<0.001** |
| Follow-up information on scientific journals | | |
| Yes / No | 5.81 ± 1.1 / 3.98 ± 1.62 | **t=7.295 p<0.001** |
| Information on the preparation of scientific publications | | |
| Yes / No | 6.03 ± 0.8 / 4.03 ± 1.63 | t**=7,92 p<0,001** |
| The implementation of evidence-based practice in the working center | | |
| Yes / No | 6.16 ± 0.76 / 4.17 ± 1.62 | **t=7,263 p<0,001** |
| The need for a supervisor (expert) in the profession | | |
| Yes / No | 4.66 ± 1.71 / 5.29 ± 1.47 | t=-1,362 p=0,176 |
| Where professional knowledge is needed (Internet/Colleague/Supervisor) | 4.41 ± 2.01/5.05 ± 1.4/4.18 ± 1.2 | **F=3.801 p=0.012** |

t: Independent Sample t Test; F: ANOVA; n: The number of participants; %: percentage; Avg: average; Sd: standart deviation; p < 0.05 was considered to be significant

**Table 4.** HS-EBP with the DTILSES linear regression analysis

| | **β** | **se** | **zβ** | **t** | **p** | **for β %95 Confidence Interval** | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Model: DTILSES | | | | | | | |
| Still | 0.752 | 0.281 | | **2.673** | **0.008** | 0.196 | 1.308 |
| HS-EBP | 0.660 | 0.044 | 0.792 | **14.928** | **0.000** | 0.573 | 0.747 |
| Model Significance: **F=222.833; p<0.001; $R^2$=0.628** | | | | | | | |

β: Regression coefficient; se: Standard error; zβ: Standardized regression coefficient; F: ANOVA; R2: Coefficient of Determination; t: Independent Sample t Test; %: percentage; p < 0.05 was considered to be significant

**Table 5**. Analysis of the Linear Regression Between the DTILSES and the Sub-Dimensions of the HS-EBP

| | *β* | *se* | *zβ* | *t* | *p* | *β* için %95 Güven Aralığı | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Alt* | *Üst* |
| **Model: DTILSES** | | | | | | | |
| Still | 2.576 | 0.468 | | **5.501** | **0.000** | 1.649 | 3.502 |
| HS-EBP Beliefs and Attitudes | -0.139 | 0.062 | -0.117 | **-2.251** | **0.026** | -0.261 | -0.017 |
| HS-EBP Practice | 0.360 | 0.056 | 0.525 | **6.407** | **0.000** | 0.249 | 0.471 |
| HS-EBP Barriers - Facilitators | 0.243 | 0.050 | 0.381 | **4.819** | **0.000** | 0.143 | 0.343 |
| Model Significance: $F$=96.622; $p$<0.001; $R^2$=0.690 | | | | | | | |

β: Regression coefficient; se: Standard error; zβ: Standardized regression coefficient; F: ANOVA; t: Independent Sample t Test; %: percentage; p < 0.05 was considered to be significant

## DISCUSSION

The study examined evidence based orthotic prosthetic practices by health professionals in Turkey, their knowledge and attitudes about EBP, and the obstacles they encountered in reflecting on the EBP clinic. While the study investigates the knowledge, attitudes and barriers of health professionals to EBP, it is one of the first studies in the field of evidence-based orthotic prosthetic in Türkiye.

A study of 68 nurses with at least one year of work experience, conducted by Xie et al. (2017), showed higher EBP performance in high-education nursing in the EBP knowledge assessment test (Xie et al. 2017). Chen et al. (2020) , studied with 1166 executive nurses in 54 hospitals in China, and found that postgraduates had higher EBP knowledge scores (Chen et al. 2020). The study conducted by Nilsagard & Lohse, (2010) with 2160 physiotherapists found that health professionals at the postgraduate had higher levels of EBP knowledge (Nilsagard & Lohse, 2010). The study conducted by Küçükoğlu et al. (2017) with 104 nurses working in the hospital emergency unit, it was observed that the average EBP knowledge and attitude scores of higher education degrees (master's/doctoral degree) were higher.When the knowledge levels of orthotic prosthetic professionals who participated in our study were examined regarding EBP, it was found that the EBP knowledge level of master's/doctoral graduates had a higher score than other education degrees (Küçükoğlu et al. 2017). The EBP knowledge levels of the participants in our study were 65.7% basic level, 27.6% intermediate level, 6.7% advanced level. The level of EBP knowledge in those with higher education degrees was significantly higher than those with other education degrees, which was similar to our study. Our study is compatible with the literature.

When studies on EBP of health professionals regarding their work experience, years of experience and working hours are examined, the study conducted by Durmuş et al. (2017) with 150 nurses at Muş State Hospital, nurses' problem-solving abilities and evidence-based practice attitudes were investigated. The study, the high duration of experience positively affected the attitude towards evidence-based practices (Durmuş et al. 2017). The study conducted by with Şen & Yurt (2021), with 92 nurses working at a foundation university hospital in Istanbul, found that nurses' high degree of education, long tenure, and receiving EBP training positively affected evidence-based practice (Şen & Yurt, 2021). Our study, the average professional experience period (years) was 8.40 ± 8.23. Weekly working hours were 44.72 ± 8.61. The mean age was 32.23 ± 8.32 years. In our study, it was observed that the level of EBP increased as age, working time and experience increased. Our study was similar to the literature.

When studies investigating the effect of health professionals receiving training on EBP on EBP skills are examined, the study conducted by Nilsagard & Lohse, (2022) with 2160 physiotherapists, 21% of the physiotherapists received EBP training, and in the study conducted by Jette et al. (2003) with American Physical Therapy Association member physiotherapists (n=488), 37% of them received EBP training (Nilsagard & Lohse, 2022; Jette et al. 2003). Our study, it was determined that 24.6% of 134 professionals working in the field of orthotic prosthetic science received EBP training. It was observed that the total score and all subparameters

scores of the HS-EBP questionnaire were higher in those who received EBP training than in those who did not receive EBP training. The average EBP education qualification of the participants in our study is similar to the literature.

When the studies investigating the obstacles to EBP are examined, in another study conducted by Ammouri et al. (2014) with 414 nurses in Oman, they stated that the biggest obstacles to developing EBP were insufficient time for research and insufficient resources to change practices. They reported that nurses with more experience used EBP more, had more positive attitudes towards EBP, and had fewer obstacles to research (Ammouri et al. 2014). In the study conducted by Upton et al. (2012) in England with 6 different professions including orthopedist, physiotherapist, dietitian, speech and language therapist, psychologist and podiatrist, they stated that health professionals have the skills to access research databases, but time and financial loss concerns hinder EBP (Upton et al. 2012). In our study, it was observed that 75.4% of the 134 health professionals working in the field of orthotic prosthetic did not receive EBP training, and 88.8% thought that a consultant was necessary in their profession. When looking at the obstacles to the implementation of EBP in clinical studies, studies in the literature support our study results.

When the studies investigating the attitudes of health professionals towards EBP are examined, in their study with 125 nurses, Lunden et al. (2021) found that nurses' attitudes towards EBP were positive (Lunden et al. 2021). Another study conducted by Alkhatib et al. (2020) with 262 nurses in Saudi Arabia, nurses attitudes towards EBP and their education level were investigated, and it was observed that there was no difference between their education degrees (Alkhatib et al. 2020). The study conducted by Aslan & Gürdap, (2021) with 193 nurses at a university hospital in Eastern Anatolia of Türkiye, it was seen that the nurses' attitudes towards evidence-based practices were positive (Aslan & Gürdap, 2021). Our study, when the attitudes and beliefs towards EBP among health professionals working in the field of orthotic prosthetic science were examined, ıt was observed that the belief and attitude scores of the participants were higher in those who obtained information from academicians, those who believed that EBP positively affected treatment outcomes, those with a postgraduate education, those who followed professional journals/publications, those who published about their profession, those who used EBP in the institution where they worked, and those who thought that counseling was necessary. Our study is similar to the literature in this respect.

When the current professional journal/publication follow-up studies on EBP of health professionals are examined, the study conducted by Yılmaz et al. (2019) with 200 nurses working in the internal and surgical clinics of a university hospital in the Marmara Region of Türkiye, it was found that following current developments, attending expert meetings and monitoring research ensured the continuous development of nurses and increased their professional knowledge and skills (Yılmaz et al. 2019). The study conducted by Şen & Yurt, (2021) with 92 nurses working in a foundation university hospital in Istanbul, it was stated that the majority of nurses did not follow professional publications and did not participate in research (Şen & Yurt, 2021). It was observed that 59% of the health professionals who participated in our study did not follow professional journals or publications, and 64.9% did not publish anything related to their profession. When compared according to demographic characteristics, it was seen that the scores in the belief-attitude, practice and barriers-facilitator sub-parameters of the HS-EBP questionnaire were higher in those who followed professional journals/publications. When compared according to demographic characteristics, it was seen that the information literacy self-efficacy scale total score was higher in those who followed professional journals/publications. In this context, clinical applications, ıt was seen that it is important to follow current journals or publications in basing scientific data.

## Conclusion

The level of EBP knowledge was found to be high in health professionals in the field of orthotic prosthetic with higher age and experience. Only 24.6% of health professionals working in the field of orthotic prosthetic science have received EBP training, 98.5% believe that EBP positively affects treatment outcomes, 88.8% need consultancy while performing clinical practices and they cannot access the EBP information source. EBP was determined that the lowest was professional associations with 8.4%. 59% of the participants do not follow professional journals or publications, 64.9% did not publish anything related to their profession, it was observed that 71.6% did not use evidence-based

practices in the institution they worked for. The total score of the HS-EBP questionnaire was significantly higher in master's/doctoral graduates. Master's/PhD graduates constitute 30.8% of the total participants. HS-EBP questionnaire total score, EBP knowledge was significantly higher in those with an advanced level and in those who believed that EBP positively affected treatment outcomes.

In the total score of the HS-EBP questionnaire, no difference was found between participants who worked in a prosthetic orthosis center, a university hospital, a state hospital, or those who owned an institution. Additionally, there was no significant difference between the places where support was received when professional knowledge was needed. the information literacy self-efficacy scale total score, it was significantly higher in participants who worked at a university hospital, received EBP training, published professionally, and followed professional journals/publications. In the information literacy self-efficacy scale total score, no significant difference was found in participants who owned an institution, believed that EBP positively affected treatment outcomes, and stated that they needed counseling. There was also no significant difference between genders.

With the linear regression analysis performed between the total scores of the HS-EBP questionnaire and the total scores of the information literacy self-efficacy scale, it was found that the relationship between the two scales was linear.

In conclusion, we recommend scientific meetings in order to increase the awareness of evidence-based practice among healthcare professionals in the field of orthosis and prosthesis. Considering that awareness increases as the level of education increases, raising awareness by adding evidence-based practices to the associate and bachelor's degree syllabus within the scope of the course another recommendation.

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### *Conflict of interest*

The authors declare that they have no conflict of interest.

### *Clinical Trial Number*

Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of the affiliated institution with the approval number E-10840098-772.02-7484 dated 23.11.2023.

### *Author Contribution*

Study design, AA and GBE; Data collection, GBE and EA; Statistical analysis, GBE and EA; Data interpretation, AA, GBE and EA; Literature search AA, GBE and EA. All authors have read and approved the published version of the manuscript.

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RESEARCH ARTICLE

# The Moderating Role of Self-Regulation in the Emotional Intelligence and Life Quality of University Students

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**Abstract**
This research is based on the aim of examining the perspective of the quality of life of university students based on the level of emotional intelligence by placing self-regulation as a moderator variable, both in general and based on each student category. The research was conducted using a survey method of 560 selected university students and determined using a purposive sampling technique. All participants were sports and non-sports university students from five universities. The Emotional Intelligence Scale (EIS), self-regulation Questionnaire (SRQ) and Life Quality Scale (LQS) are used as instruments in this study. All collected data were analyzed using the structural equation model analysis technique and the type of AMOS version 20 application. Based on the results of the analysis it was found that overall, the perspective of university student quality of life was directly influenced by the level of emotional intelligence, but not applicable to non-sports and sports university student categories. In addition, it was found that self-regulation did not moderate the relationship between the quality of life perspective and the level of emotional intelligence.

**Keywords**
Emotional İntelligence, Self-Regulation, Quality Of Life, University Students

## INTRODUCTION

The results of a survey found that university students are active users of the internet. All university student academic and non-academic activities are always related to the internet. Therefore, the internet is an integral part of student life. On the one hand, the use of internet access is needed by students as a medium for seeking information on their study assignments at the university. However, on the other hand, it can cause bad habits for students. The need, accompanied by the ease of accessing the internet, was found to be a driving factor for the tendency for students to experience high internet addiction (Tiarania et al., 2014). The internet has become the main supplier of student needs and influences various aspects of one's life both socially, individually, academically, and even the formation of one's lifestyle.

Excessive use of technology will pose health risks (such as hypokinetics and unhealthy eating patterns) which can reduce the quality of life for university students, and can even threaten death (Ngafifi, 2014). It has been reported in several studies that a sedentary bad lifestyle can increase illness and negative feelings, such as anxiety, difficulty concentrating, depressed mood, physical inactivity and difficulty socializing due to excessive use of the internet (Peltzer & Pengpida, 2014; Rodríguez-Fernández et al., 2017). If this problem

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is left unchecked, it will greatly affect the quality of human life itself in living their daily lives.

As a multidimensional concept, quality of life is a very important aspect because it covers all areas of life including health, expectations, work, family, environment and other life situations (Muhaimin, 2010). Having a good quality of life is the goal of every human being who lives in order to achieve ideal life satisfaction and well-being. According to World Health Organization (WHO, 1996), quality of life is a person's perception of the conditions of cultural life and the value system in which individuals are associated with goals, expectations, and concerns (Gülgösteren, 2023; Knezevic et al., 2024).

Psychological factors are one of the important factors that are very useful for controlling all events experienced by individuals in their lives (Rohmah et al., 2012). It was reported by Jacob & Sandjaya (Jacob & Sandjaya, 2024) that individuals who do not suffer from mental emotional disorders, 2.5 times have a better quality of life (73.2%) compared to individuals who suffer from mental emotional disorders. Al-Huwailah (Al-Huwailah, 2017) reported the results of his research that every university student needs a quality psychological, mental-spiritual, and social environment, which can be achieved by providing knowledge and instilling positive values, developing life skills and emotional intelligence related to quality of life. This, can help individuals to cope with life situations and understand them in various perspectives. Thus, emotional intelligence has a major influence on the quality of human life in living their daily lives.

Emotional intelligence is a composite construct, including different emotional reasoning abilities, such as the ability to receive, understand, and regulate emotions which has a major influence on one's life satisfaction (Gul et al., 2014). As a composite construct, emotional intelligence is defined as the ability to control desires and delay their fulfillment, regulate moods, separate feelings from thoughts, and put oneself in the shoes of others. Therefore, in a theoretical perspective (Bar-On, 2006), emotional intelligence is constructed by various dimensions, namely the dimensions of intra-personal, inter-personal, adaptation, stress management and general mood. These five dimensions have interrelated meanings, namely how to regulate oneself regarding individual emotional problems both to oneself and to others. For that reason, the self-regulation variable in this study is placed as a moderator variable that might strengthen or weaken the relationship between emotional intelligence and students' quality of life. Sari (Sari, 2014) explained that self-regulation is an integral part of the individual self that consistently regulates and manages the individual's thoughts, emotions, behavior, and environment.

Several studies have found that emotional intelligence, self-regulation and quality of life can be developed through positive experiences in the form of routine physical activity (Baciu & Baciu, 2015; Kruger & Sonono, 2016; Li et al., 2009; Rodríguez-Fernández et al., 2017), including the level of education. Experience, level of education and positive activity, especially physical activity have a major influence on the development of emotional abilities and self-regulation to achieve one's life welfare related to all aspects of quality of life, so the importance of increasing sports participation at the university level must be strengthened and implemented (Li et al., 2009; Rodríguez-Fernández et al., 2017).

Based on the focus and constellation of these problems, this study will examine the perspective of the quality of life of sports university students, namely students who have contributed to physical activity (sports) in their subjects and non-sports university students, namely students who do not or have little contribution in physical activity in their subjects based on the level of emotional intelligence, whether the moderator variable of self-regulation can strengthen or weaken the influence of that perspective.

This research has crucial value especially because the ability to understand and manage one's own and others' emotions is one of the main abilities to improve the quality of life which is marked by achieving success and a more satisfying life happiness. Good self-regulation will have a positive impact on someone to always be on a path that is in accordance with their life goals. This can be developed through the contribution of experience, education and positive physical activity.

## MATERIALS AND METHODS

The research was conducted using the survey method, a research method that is generally used to gather information about the existence of something both physical and material in the form of facts or behavioral and social phenomena. Data collection was carried out using a parallel participant design

or cross-sectional survey, which is a process of collecting data at a certain time (Creswell, 2012).

***Participants***

Participants involved in this study amounted to 560 university students. Participants were selected and determined using a purposive sampling technique, namely students coming from sports and non-sports study programs, male and female gender, and registered as active students in 2019-2022 from several universities. Data collection was carried out for two months, from May 2 to June 30, 2022.

Research is carried out strictly, then security and welfare. Participants are given priority during study design and implementation and steps are taken to ensure data confidentiality. Permission to conduct research was obtained from Mınıstry of Educatıon, Culture, Research and Technology, Universitas Pendidikan Indonesia, numbered B-1040/UN40.PL/PJ.00.00/2022. All participants gave their opinions written informed consent. Consent form detailing research procedures, potential risks and benefits, data confidentiality measures, and participant rights.

**Table 1.** Characteristics of participant demographic variables

| No. | Criteria | Category | AUSP | | N-SUSP | | SUSP | |
|---|---|---|---|---|---|---|---|---|
| | | | Sum | % | Sum | % | Sum | % |
| 1. | Gender | Male university student | 274 | 49% | 151 | 27% | 336 | 60% |
| | | Female university student | 286 | 51% | 409 | 73% | 224 | 40% |
| 2. | Student category | Sport | 347 | 62% | - | - | - | - |
| | | Universitas Pendidikan Indonesia | - | - | - | - | 194 | 56% |
| | | University of Majalengka | - | - | - | - | 45 | 13% |
| | | University of Siliwangi | - | - | - | - | 31 | 9% |
| | | University of Surya Kencana | - | - | - | - | 7 | 2% |
| | | STKIP Cimahi | - | - | - | - | 66 | 19% |
| | | Non-Sport | 213 | 38% | - | - | - | - |
| | | Education | - | - | 85 | 40% | - | - |
| | | Economics and Business | - | - | 51 | 24% | - | - |
| | | Language and Literature | - | - | 34 | 16% | - | - |
| | | Social Science | - | - | 43 | 20% | - | - |
| 3. | Age | 19-20 years | 336 | 60% | 352 | 63% | 330 | 59% |
| | | 21-22 years | 196 | 35% | 190 | 34% | 202 | 36% |
| | | 23-24 years | 28 | 5% | 17 | 3% | 28 | 5% |
| 4. | University | Universitas Pendidikan Indonesia | 314 | 56% | 375 | 67% | 314 | 56% |
| | | University of Majalengka | 56 | 10% | 90 | 16% | 67 | 12% |
| | | University of Siliwangi | 78 | 14% | 73 | 13% | 50 | 9% |
| | | University of Surya Kencana | 78 | 14% | 22 | 4% | 34 | 6% |
| | | STKIP Cimahi | 34 | 6% | - | - | 95 | 17% |
| 5. | Enrollment year | 2019-2020 | 112 | 20% | - | - | - | - |
| | | 2020-2021 | 101 | 18% | - | - | 84 | 15% |
| | | 2021-2022 | 117 | 21% | - | - | 140 | 25% |
| | | 2022-2023 | 230 | 41% | - | - | 336 | 60% |
| | | **Total** | **560** | **100%** | **560** | **100%** | **560** | **100%** |

*Note:* AUSP = All university student participants; N-SUSP = Non-sport university student participants; SUSP = Sport university student participants

## Procedures

The research was carried out in three stages of the process, namely the preparation, implementation, and final stages. The preparatory phase consists of identifying and formulating problems, determining and selecting participants,

preparing and validating instruments, as well as the research design to be used. The implementation phase includes research data collection activities for two months (58 days) at five universities in West Java province, on 560 sports and non-sports students, starting from class 2021-2024, aged between 19-24 years, both male and female university students. The final stage consists of data analysis and interpretation activities using structural equation modeling (AMOS application program version 20), formulating conclusions, implications, and recommendations.

***Instrument***

***Life Quality Scale (LQS) adapted from WHOQOL-BREF***

LQS is measured by 26 items, spread over four dimensions of quality of life, namely physical, psychological, social relations and environmental conditions. This scale is accessed via the link provided by WHO (1996) and has been translated into Indonesian through parallel back translation (Nunez et al., 2006). The CFA results for 560 participants obtained good goodness of fit values (RMSEA = 0.000, p-values = 0.353, GFI = 0.994, TLI = 0.999 and PNFI = 0.333). The four dimensions obtained standardized loading estimate values > 0.60, so that none of the items included in the four dimensions were excluded. This model obtained a construct reliability value of 0.818 and a variance extracted (AVE) of 0.532.

***The Self-Regulation Questionnaire (SRQ)***

The self-regulation scale was adapted from the factor structure of the Self-Regulation Questionnaire (SRQ) at Spanish Universities", consisting of indicators of goal setting, persistence, and decision making (Pichardo et al., 2014), and translated into Indonesian through a parallel back translation procedure (Nunez et al., 2006) nuneznu. The results of the EFA and CFA obtained good goodness of fit values (RMSEA = 0.041, p-values = 0.212, GFI = 0.961, TLI = 0.984, CFI = 0.99 and PNFI = 0.583). The complete model is proven fit after going through the modification process twice. The final result, this scale has nine items with fairly good convergent validity. Overall, the self-regulation construct obtains a reliability value of 0.901 with a variance extracted (AVE) of 0.520.

***The Emotional Intelligence Scale***

*The emotional intelligence scale* was developed based on Bar-on's theoretical framework (Bar-On, 2006), consisting of intrapersonal, interpersonal, general mood, stress management, and adaptability dimensions. The results of the EFA and CFA obtained 27 items. The complete model proved fit after going through the modification process once (RMSEA = 0.040, p-values = 0.058, GFI = 0.939, TLI = 0.974, CFI = 0.981 and PNFI = 0.675). Convergent validity through the standardized loading estimate value > 0.50, so that it can be said that it meets the valid criteria. Meanwhile, the reliability of this latent construct obtained a value of 0.94 with a variance extracted (AVE) value of 0.534.

**Statistic Analysis**

There are two statistical analysis procedures used, namely the SEM analysis procedure and the SEM moderation method. In the SEM analysis procedure, all data collected was analyzed using SEM analysis techniques, the AMOS 20 application program. The analysis procedure was carried out through the following stages: (1) development of a theoretical model based on conceptual study of variables which were elaborated into several indicators. emotional intelligence variables (Bar-On, 2006), self-regulation variables (Pichardo et al., 2014), and quality of life variables (WHOQOL-BREF-1996 (WHO, 1996); (2) development of causality relationship flowcharts between factors or indicators using the AMOS 20 application program (figure 1), with the quality of life equation ($\eta 1$) = $\gamma 1\xi 1 + \gamma\ 2\xi 2 + z1$; (3) assessing the identification of the structural model to see the unique set of parameters, whether consistent with the data or not, if there is a unique solution from the values of the structural parameters, then the model can be identified and consequently the parameters can be estimated and the model can be tested; (4) assessing the goodness of fit based on goodness of fit measures: (a) absolute fit measures (overall measures include CMIN, probability values, GFI, RMSEA), (b) incremental fit measures (TLI and CFI), and (c) parsimony of fit indices using PNFI values (5) model interpretation and model modification.

The analytical procedure using the SEM moderation method was carried out in two stages, namely: the first stage consisted of activities (a) estimating the model on two exogenous variables $\xi 1$ and $\xi 2$ to predict the endogenous variable $\eta 1$ (figure 2); (2) the output results are used to calculate the loading factor value of the interaction latent variable ($\lambda$ interaction) and the error variance value ($\theta q$) of the interaction latent variable indicator. An analysis flowchart using the moderation construct is presented in Figure 2.

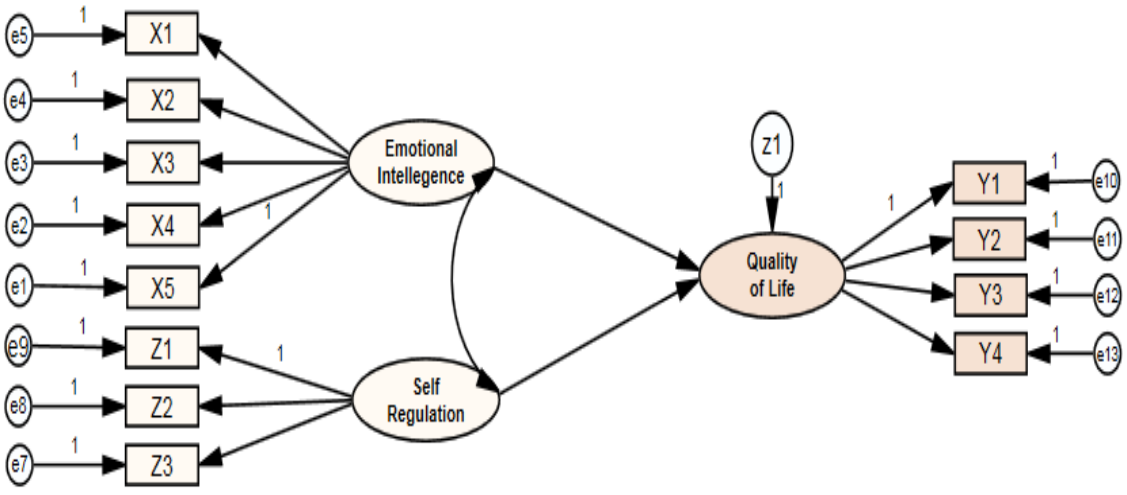


**Fig 1.** Flowchart of the causality relationship between indicators

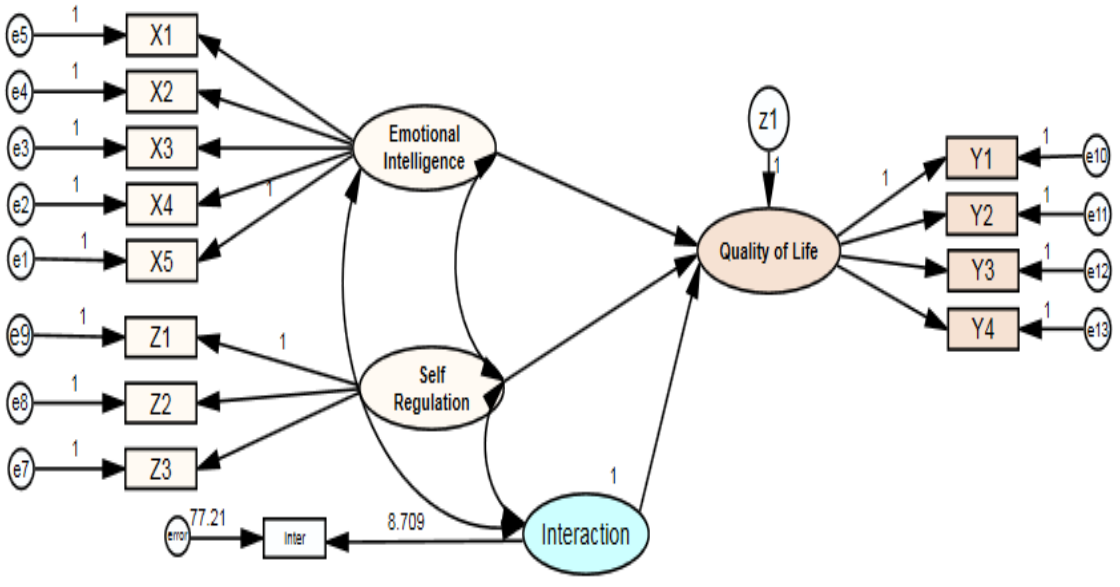


**Fig 2.** SEM Moderation Flowchart

## RESULTS

### Descriptive Statistics

According to the descriptive statistics in table 2, it is known that the emotional intelligence variable for sport university student participants has the highest mean (83.59), while the highest mean for self-regulation variables is for non-sport university student participants (27.65), and the highest mean for quality variables life occupied sport university student participants (86.73)

### *The Analysis of Demographic Variables*

*All university student participants.* According to the demographic variable data, the participants numbered 560 students from the 2021-2024 class with active status. Most participants were female students (51%), age range 19-20 years (60%), mostly from the Universitas Pendidikan Indonesia (56%), sports study program (62%), and class of 2024 (41%). As for the average value of the three constructs, the results obtained were 82.88 for the emotional intelligence variable, 26.73 for the self-regulation variable, and 83.72 for the quality of life variable.

*Non-sport university student participants*. The number of non-sports university student participants was 213 out of a total of 560 non-sports students, namely students from non-sports study programs, consisting of students from the Faculties of Education, Social Sciences, Languages and

Literature, and Economics and Business). Most of the participants were female university students (73%), aged 19-20 years (63%), participants from the Universitas Pendidikan Indonesia (67%), from the Faculty of Education (40%). As for the average value of the three constructs is 81.61 for emotional intelligence, 27.65 for self-regulation, and 82.82 for quality of life.

*Sport university student participants*, a total of 347 out of 560 sports study program students, namely students from the study programs of Physical Education, Health, and Recreation, Sport Coaching Education, Sport Science, and Elementary School Physical Education Teacher Education. Most of the university students are male (60%), aged 19-20 years (59%), the majority of participants are from the Universitas Pendidikan Indonesia (56%), especially the 2024/2025 class (60%). As for the average value of the three variables is 83.59 for emotional intelligence, 26.22 for self-regulation, and 86.73 for quality of life.

**Table 2.** Descriptive statistics of emotional ıntelligence, self-regulation, and quality of life variables of all university students, non-sport university students, and sport university student participants.

| **All University Student Participants** | | | | | | |
|---|---|---|---|---|---|---|
| **Variable** | N | Minimum | Maximum | Mean | | Std. Deviation |
| | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic |
| Emotional intelligence | 560 | 60.00 | 110.00 | 82.88 | .551 | 10.75 |
| Self-regulation | 560 | 9.00 | 45.00 | 26.73 | .35 | 6.73 |
| Quality of life | 560 | 55.00 | 114.00 | 83.72 | .49 | 9.51 |
| Valid N (listwise) | 560 | | | | | |
| **Non-Sport University Student Participants** | | | | | | |
| **Variable** | N | Minimum | Maximum | Mean | | Std. Deviation |
| | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic |
| Emotional intelligence | 213 | 60.00 | 107.00 | 81.61 | .958 | 11.14 |
| Self-regulation | 213 | 11.00 | 45.00 | 27.65 | .57 | 6.58 |
| Quality of life | 213 | 54.00 | 107.00 | 82.82 | .89 | 10.36 |
| Valid N (listwise) | 213 | | | | | |
| **Sport University Student Participants** | | | | | | |
| **Variable** | N | Minimum | Maximum | Mean | | Std. Deviation |
| | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic |
| Emotional intelligence | 347 | 60.00 | 110.00 | 83.59 | .67 | 10.49 |
| Self-regulation | 347 | 9.00 | 45.00 | 26.22 | .43 | 6.77 |
| Quality of life | 347 | 62.00 | 118.00 | 86.73 | .65 | 10.24 |
| Valid N (listwise) | 347 | | | | | |

### *Assumption Test*

*All university student participants.* The results of the analysis of the assumption test on all university student participants proved that the data were normally distributed in a multivariate manner. The scatter-plot indicator between the mahalanobis distance and the chi-square tends to form a straight line and more than 50% the value of the mahalanobis distance is less than or equal to the chi-square. This is the main requirement that must be met in SEM analysis. The results of the multicollinearity test on the determinant matrix covariance output of AMOS obtained a value of 488601278153.243 (much greater than zero), meaning that there is no indication of multicollinearity or singularity problems, so the data can be used in research. In addition, the data on the results of the mahalanobis distance on the p2 column values were found to be all above 0.00. This means that there are no outlier data or no data that must be removed from the analysis (Ghozali, 2022). Likewise for *non-sport university student participants*, the data were found to be normally distributed in a multivariate manner, the value of the determinant matrix covariance was much higher than zero (629461150918.365), and from the results of the maha-lanobis distance, no value was found in the p2 column below 0.00. The same results were found in the *sport university student participants* data, it was proven that the data were normally

distributed in a multivariate manner, there was no multicollinearity problem because the determinant matrix covariance value was far above zero (92981309.224), and there were no outlier data in the mahalanobis distance results as indicated by the value in column p2 was found to be all above 0.00. In accordance with the results of this analysis, it is evident that all the basic assumptions of the SEM analysis technique have been fulfilled, and the analysis can proceed to the overall model fit assessment based on the three goodness of fit size categories (Ghozali, 2022; Lei & Wu, 2007) (table 3).

***Model Fit Test***

The Goodness of Fit (GoF) model test was carried out three times, namely on all university student participants, non-sport university student participants, and sport university student participants (table 3).

**Table 3.** Goodness of Fit Model Results of All University Students, Non-Sport University Students, and Sport University Student Participants.

| Participants | Criteria | Limit Value | Model | Conclusion |
|---|---|---|---|---|
| **All university student participants** | **Absolut Fit Indices** | | | |
| | $X^2$, Sig. Probability | ≥ 0.05 | 0.000 | No-fit |
| | GFI | > 0.90 | 0.927 | Better fit |
| | RMSEA | ≤ 0.08 | 0.075 | Better fit |
| | **Incremental Fit Indices** | | | |
| | CFI | > 0.90 | 0.947 | Better fit |
| | TLI | > 0.90 | 0.926 | Better fit |
| | **Parsimoni Fit Indices** | | | |
| | PNFI | > 0.90 | 0.707 | Marginal fit |
| **Non-sports university student participant** | **Absolut Fit Indices** | | | |
| | $X^2$, Sig. Probability | ≥ 0.05 | 0.001 | No-fit |
| | GFI | > 0.90 | 0.897 | Marginal fit |
| | RMSEA | ≤ 0.08 | 0.071 | Better fit |
| | **Incremental Fit Indices** | | | |
| | CFI | > 0.90 | 0.941 | Better fit |
| | TLI | > 0.90 | 0.924 | Better fit |
| | **Parsimoni Fit Indices** | | | |
| | PNFI | > 0.90 | 0.669 | Marginal fit |
| **Sports university student participant** | **Absolut Fit Indices** | | | |
| | $X^2$, Sig. Probability | ≥ 0.05 | 0.000 | No-fit |
| | GFI | > 0.90 | 0.935 | Better fit |
| | RMSEA | ≤ 0.08 | 0.061 | Better fit |
| | **Incremental Fit Indices** | | | |
| | CFI | > 0.90 | 0.961 | Better fit |
| | TLI | > 0.90 | 0.949 | Better fit |
| | **Parsimoni Fit Indices** | | | |
| | PNFI | > 0.90 | 0.709 | Marginal fit |

According to table 3, the complete model for all university student participants is good enough (marginal fit), although the chi-square value is not significant (p-values < 0.05). According to Ghozali (Ghozali, 2022), the chi-square value is strongly influenced by the number of participants, the greater the participants, the more significant it will be. For this reason, the authors ignore the chi-square assumption and assume that the model meets the marginal fit criteria for interpretation. This is because there are still sufficient criteria to represent each GoF category. Empirical research depends on the judgment of each researcher when assessing the feasibility of the model and is not required to fulfill all GoF criteria. Likewise for the non-sports university student participant and sports university student participant models, the model was found to be marginally fit, the chi-square value was not significant (p-values < 0.05), but the other criteria representing each GoF category were met. In other

words, the model developed and tested is assumed to meet the criteria that are good enough to be interpreted.

***Hypothesis Testing***

Furthermore, to answer and prove the research hypothesis, the results of the analysis can be seen in the moderation diagram and the significance of the parameter values of the maximum likelihood estimates output summary (table 4).

**Table 4.** Summary of Output maximum likelihood estimates for the variables of emotional intelligence, self-regulation, and quality of life in all categories of participants.

| **All University Student Participants** | | | | |
|---|---|---|---|---|
| | | Standarized Regression | Weight | P |
| University student quality of life | <--- | University student's_Emotional Intelligence | 0.610 | 0.000 |
| University student quality of life | <--- | University student's_Self-regulation | 0.109 | 0.233 |
| University student quality of life | <--- | Interaction | 0.000 | 0.985 |
| **Non-Sport University Student Participants** | | | | |
| | | Standarized Regression | Weight | P |
| University student quality of life | <--- | University student's_Emotional Intelligence | -0.090 | 0.420 |
| University student quality of life | <--- | University student's_Self-regulation | 0.181 | 0.341 |
| University student quality of life | <--- | Interaction | -0.029 | 0.416 |
| **Sport University Student Participants** | | | | |
| | | Standarized Regression | Weight | P |
| University student quality of life | <--- | University student's_Emotional Intelligence | -0.045 | 0.570 |
| University student quality of life | <--- | University student's_Self-regulation | -0.013 | 0.523 |
| University student quality of life | <--- | Interaction | 0.005 | 0.969 |

For all university student participants, the parameter coefficient is 0.610 and is very significant at p-values $0.00 \leq 0.05$. This means that the hypothesis is accepted, in other words emotional intelligence has a very significant direct effect on the quality of life of students. In contrast to the results with the influence of the moderator variable self-regulation, the parameter coefficient is 0.00 and is not significant at p-values $0.985 \geq 0.05$. Thus, the hypothesis is rejected, and it can be interpreted that self-regulation does not affect the quality of life of university students based on the level of emotional intelligence.

In non-sport university student participants, it was found that emotional intelligence did not have a significant direct effect on the quality of life of non-sport university student participants (p-value $0.420 > 0.05$ and parameter coefficient -0.090), also the interaction between self-regulation moderator variables and emotional intelligence was proven did not have a significant effect on the quality of life of non-sport university student participants (p-value $0.416 > 0.05$ and parameter coefficient 0.029). Although in fact, if interpreted from the coefficient value of the parameter of emotional intelligence on quality of life before entering the interaction variable it shows an increase from -0.10 to -0.86, meaning that self-regulation can actually strengthen the relationship between emotional intelligence and quality of life in non-sports university students, even though statistically it is not significant.

The same results were found for sport university student participants, it was proven that the quality of life of sport university student participants was not directly affected by emotional intelligence (p-value $0.570 > 0.05$ and the parameter coefficient was -0.045), nor was it affected by the interaction between the moderator variable self-regulation and emotional intelligence (p-value $0.523 > 0.05$ and parameter coefficient -0.013), in other words the hypothesis is rejected. Even if it is interpreted from the coefficient value of the emotional intelligence parameter on quality of life before entering the interaction variable it shows a decrease from -0.3 in the initial design to -0.45 in the final design. This means that self-regulation can weaken the relationship between emotional intelligence and the quality of life of sport student participants, even though it is not statistically significant.

## DISCUSSION

The purpose of this study was to examine the role of self-regulation moderator variables in the relationship between emotional intelligence and the quality of life of university students, both for all university student participants as a whole, as well as for non-sport university student participants and sport university student participants. To achieve this goal, data collection was carried out on 560 students from 5 (five) universities. In general, the results show that the quality of life of students is affected by emotional intelligence, but not in the categories of non-sport university student participants and sport university student participants. Self-regulation variables were found not to moderate the effect of emotional intelligence on quality of life, both for all university student participants, non-sport university student participants, and sport university student participants.

### *The Role of Emotional Intelligent*

*All University Student Participants.* In all university student participants it was found that quality of life was directly influenced by emotional intelligence. The results of this study corroborate the results of previous studies on Kuwait University student participants (Al-Huwailah, 2017). Students who have a high level of emotional intelligence show a better quality of life. Quality of life is a variable that can increase the life satisfaction of every student (Alibabaie, 2015). According to these findings, individuals who have high emotional intelligence are individuals who have the ability for themselves, adapt to their environment, manage the pressures and problems they face and regulate their moods by always assessing their best side. Humans are gregarious and sociable creatures, so emotional intelligence helps build closer relationships (Baloch et al., 2014). In addition, emotional intelligence becomes a more important ability in achieving life goals, both personal, academic and professional success (Para, 2022). Emotional intelligence can lead to success in life and increase satisfaction and quality of life levels. The higher the level of emotional intelligence, the higher the quality of life of students. Quality of life already exists in humans including the characteristics represented by the integration between self strengths (Redhwan Ahmed Al-Naggar et al., 2013). Quality of life is referred to as a multidimensional concept that covers all areas of life related to expectations, work, family, environment and other life situations (Redhwan Ahmed Al-Naggar et al., 2013).

*Non-sport university students participants.* Different results were found that in non-sport university student participants, quality of life was not directly affected by emotional intelligence. Lei & Wu (Lei & Wu, 2007) explained that the SEM technique is very sensitive to the number of participants. This requires a relatively large number of participants, which is at least 15 times the number of indicators. In this study there were 12 indicators, so the minimum number of participants was 180 person. Although the size of the participants greatly influences the level of accuracy of research results (Abt et al., 2020), the exact size of the participants is very difficult to determine, due to the many types and sizes of the population, the limitations of the researchers, the many rules and formulas available. One of the most likely explanations related to the results of this study is the diversity in the characteristics of the participants.

From the age characteristics, the 2007 Riskesdas survey, the prevalence of the Indonesian population aged 15 years or more, the level of quality of life is less than 31.9% (Muhaimin, 2010). The higher a person's age, the quality of life will decrease, because the physical condition decreases (Ramón-Arbués et al., 2022). This physical condition can be caused by a lack of self-regulation in carrying out movement activities and or a good lifestyle, causing psychosomatic health problems such as symptoms of panic, anxiety, stress and bad moods (Kruger & Sonono, 2016). As explained by Rohmah, Purwaningsih, & Bariyah (2012), Pradono et al., (2009), and Ramón-Arbués, et al., (2022), that the main causes that affect quality of life are psychological factors or mental emotional disorders and risky behaviors such as smoking, lack of physical activity, drinking alcohol or not eating enough fiber. This is very closely related to everyone's lifestyle which should be anticipated, one of which is through physical activity.

Participants in this study were aged 19-24 years, most likely rarely doing physical activity, both in the form of lectures and outside of lectures. There may even be no physical activity at all. Therefore, the quality of life of non-sports university students can be said to be in the low category. This can be proven by the average score of non-sports university students which is lower than that of sports university students with an average score of 82.7. Unlike the case with

emotional intelligence, the older a person is, the better his ability. The results of research show that emotional intelligence shows a gradual increase when it is in the late teens to the age of 40 and when it goes beyond the age of 50, it only shrinks slightly (Stein & Book, 2011). Therefore, this increase in emotional intelligence contrasts with the quality of life of non-sport university student participants which decreases in the age range of 19-24 years. As age increases, emotional stability improves, but goes hand in hand with a person's quality of life decreasing, because as the age group increases, the risk of suffering from disease and stress increases. This risk is due to decreased physical condition and worse health risks, namely unhealthy living and eating habits and drug consumption, drinking habits, sleeping late, smoking, and other bad habits (Muhaimin, 2010).

*Sport university students participants.* The same results were found for sport student participants, it was proven that emotional intelligence did not have a direct effect on quality of life. The habits and activities of sports students are closely related to physical activities, while physical health is one of the factors that affect a person's quality of life. Physical health conditions greatly affect a person's functional condition in living his life. Research Jacob & Sandjaya (2024) states that the higher the perceived physical factors, the better the quality of life of the people in Karubaga Village, Karubaga District, Tolikara Regency. Declining health conditions will lead to activity limitations resulting in complaints on the person's quality of life. Based on the survey results, most of the habits of sports students are carrying out strenuous physical activities, such as athletic lectures, swimming, gymnastics, training activities and others. Physical activity and exercise are key factors on a person's perception of their quality of life, both in the area of physical and psychological health. This ultimately affects their quality of life. Therefore, the higher the physical condition and feel better, the better the quality of one's life will be. This finding is corroborated by several other research results (Jacob & Sandjaya, 2024; Morimoto et al., 2006; Rodríguez-Fernández et al., 2017).

If the physical condition decreases, it will pose a worse health risk (Stein & Book, 2011). If it is associated with the level of emotional intelligence, the results of the descriptive analysis show that the level of emotional intelligence in university students is in the medium category with a percentage of 44%. For this reason, the level of emotional intelligence of sports university students is not at the ideal level (very good) so that it does not produce a significant effect on the quality of life of sports and non-sports university students. Based on participation, the participants in this study were dominated by male students, even though several research results proved that the level of emotional intelligence of female students was higher than that of male students (Bahadir, 2018; Mathivanan, 2013). Therefore, the data distribution which is dominated by male students with a low level of intelligence is in contrast to the quality of life. Thus, if the emotional intelligence is low but active in movement or physical activity it will be able to improve the quality of life, because it has a better physical health condition.

**The Moderating Role of Self-Regulation**

*All university student participants.* This research is an initial study involving self-regulation as a moderator variable on the influence of emotional intelligence on the quality of life of students. The test results on the moderator variable are indicated by the interaction variable between emotional intelligence and self-regulation. These findings conclude that self-regulation does not affect the relationship between the level of emotional intelligence and quality of life, both for all university student participants, non-sport university student participants, and sport university student participants.

The results of the analysis show that self-regulation does not affect the relationship between the level of emotional intelligence and quality of life, both for all university student participants, non-sport university student participants, and sport university student participants. One of the indications of the non-significance of this finding includes the abilities possessed by individuals and the relatively homogeneous educational environment. According to (Fawait et al., 2020), factors that influence self-regulation are individual background related to knowledge abilities, such as a supportive environment (length of education, parental education, and individual education level). In addition, confirmed by Ratnasari & Suleeman (2017), that self-regulation is a tendency that is shaped by parenting, socialization and education. Activities at the university are very heterogeneous and numerous, all students are required to take part, both lecture activities and activities outside of

lectures (for example student activity units). Students jointly optimize the arrangement and organization of various activities on campus, so that students' self-regulation abilities are generally seen as quite standard. This is corroborated by data on descriptive statistics, it was found that the average self-regulation of all university student participants was only 26.7, so it did not moderate the effect of emotional intelligence on quality of life.

*Non-sport university students participants*. When elaborated on non-sport university student participants, the same results were found. Evidently, self-regulation does not strengthen the effect of emotional intelligence level on quality of life. As far as is known, this is an initial study that places the construct of self-regulation as a moderator variable on the effect of emotional intelligence on the quality of life of non-sport university student participants. This is the same as the research conducted by Morosanova & Fomina (2017) and Yaningsih & Fachrurrozie (2019), although the endogenous variables are different. Although the results of previous research proved that the quality of life of non-sport university student participants was not affected by emotional intelligence, when including self-regulation as a moderator variable and interacting with emotional intelligence, an increase in the parameter coefficient was found from -0.10 to -0.86. That is, the self-regulation variable causes a change in the value of the parameter coefficient and has the potential to strengthen the relationship between emotional intelligence and the quality of life of non-sport university student participants, although it is not significant in this study. For this reason, further discussion and study is needed, both conceptually and empirically. Even though the change in value is not statistically significant, conceptually it can be interpreted that non-sport university student participants can manage their own habits and are responsible for always being on a good path in accordance with their life goals.

Based on the descriptive data, most of the participants were female students (73%). It was found in a study at the Jakarta State University, that the level of self-regulation of female students was higher than that of male students (Liu et al., 2021), and gender was one of the variables that influenced self-regulation. If related to this research, based on the author's survey of non-sport university student participants who were dominated by female students, they did not have more activities than male students apart from lectures and organizational activities. In addition, bad habits such as sleeping late, night sports, and other activities outside of campus until late at night are very rare. Non-sport university student participants focus more on their education on campus, for that reason, even though they have a moderate level of emotional intelligence, if their self-regulation is good, they can improve their quality of life.

*Sport university students participants.* In the sport university student participants category, based on the coefficient value of the emotional intelligence parameter on quality of life before entering the interaction variable it showed a decrease from -0.3 to -0.45, meaning that the construct of self-regulation can weaken the relationship between emotional intelligence and quality of life, although in this study it was found not have a significant effect. However, to prove this, discussions and studies from various literature are needed. One of the possible causes is the poor self-regulation ability of the participants, which weakens the influence of emotional intelligence on the quality of life of sports students. This also prompted the authors to calculate the data using the t-test on the self-regulation construct and produce a significance value of $0.024 \leq 0.05$ (1-tailed), meaning that non-sport university student participant self-regulation is higher than sport university student participant. Strengthened by the mean sport university student participant (26.2) which is smaller than no-sport university student participant (27.65), and male students have less self-regulation than female students (Liu et al., 2021; Stanikzai, 2019; Wijaya et al., 2020).

Associated with the findings of this study, even though the level of emotional intelligence is moderate and the ability to self-regulate is low, this condition will still affect a person's quality of life decline (Pachón-Basallo et al., 2022). Apart from lectures, sports university student participants carry out many training activities or train until late at night, become activity committees, and others. Sport university student participants have components of a trained physical condition and this can form a good quality of life. Conversely, without self-regulation and low self-control ability and emotional adjustment, it can lead to a decrease in quality of life. Thus, having good emotional intelligence and self-regulation is needed by every living human being in order to be able to deal with every good or bad condition efficiently and

effectively so that the quality of life will remain good (Boon How Chew et al., 2013; Cocq & Bosscher, 2018; Di Fabio & Kenny, 2016), especially because quality of life is a multidimensional construct (Hendrayana et al., 2022) which is influenced by various factors and reflects the totality of one's happiness and life satisfaction (Arpentieva et al., 2022; Minghat & Arpentieva, 2023).

## Conclusion

In general, the conclusion of this study is that the perspective of the quality of life of students is directly influenced by the level of emotional intelligence. However, this does not apply to no-sport university student participants and sports university student participants. The quality of life of no-sport university student participants and sport university student participants is not directly influenced by emotional intelligence. Self-regulation does not moderate the effect of emotional intelligence on quality of life, both in general and in the no-sport university student participant and sport university student participant categories. In order to obtain more accurate and maximum research results, several alternatives for further research development can be carried out with more participants, changing or adding other variables that can theoretically affect the quality of life of students, including moderator variables.

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## Conflicts of Interest

The authors have no conflicts of interest to declare.

## Ethical Statement

Permission to conduct research was obtained from Mınıstry of Educatıon, Culture, Research and Technology, Universitas Pendidikan Indonesia, numbered B-1040/UN40.PL/PJ.00.00/2022.

## Author Contributions

Study Design, YH, YH, WT, DS, AR; Data Collection, YH, YH, DT, DS, AR; Statistical Analysis, YH, YH UDU, RAL, DT, IGA; Data Interpretation, YH, YH UDU, RAL, DT, IGA; Manuscript Preparation, YH, YH UDU, RAL, WT, DT, IGA; Literature Search, YH, YH UDU, RAL, WT, DT, DS, AR, IGA. All the authors agreed on the final draft of the manuscript before submitting it for publication.

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