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RESEARCH ARTICLE

Evaluation of the Relationship Between Socio-demographic Characteristics and Social Support with Adherence to Treatment in Patient with Multiple Sclerosis

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Abstract

Multiple sclerosis (MS) is a severe autoimmune illness that can be treated with a variety of medications. However, over a third of patients do not adhere to their treatment regimens. Drug compliance may be influenced by social support and demographic factors. This is a cross-sectional study that examines the association between Patient with MS socio-demographic characteristics and social support and their treatment adherence. We used the perceived social support scale and the treatment compliance scale to collect data on socio-demographic factors. We looked at the correlations between the scores on the three scales. We included 155 female, 45 male patients in our study. The mean age of the patients was 36.3±11.8 (±standard deviation). The rate of noncompliant patients was 15.5%. and 56.0% showed moderate-level compliance with their treatment. The mean multi-dimensional perceived social support score was 62.3±18.8. The only socio-demographic feature that impacts the social support and special person subscale scores was the marital status. We found that married patiens had significantly more social support and were significantly higher than divorced patient ($p<0.05$). This study found that PwMS compliance with their medicines is unaffected by socio-demographic characteristics or perceived social support. Larger patient groups with less perceived social support will need to be studied. On the other hand, this suggests that patient compliance is more influenced by personal factors such illness perception and beliefs than by social support.

Keywords
Multiple Sclerosis, Treatment Compliance, Perceived Social Support

INTRODUCTION

Compliance with the disease and treatment can be defined as the acceptance of the recommendations regarding lifestyle changes and regular drug use (Sabaté, 2003). Acceptance and sustainability of the treatments used in chronic diseases for a lifetime affect the success of the treatment. Non-compliance to treatment increases mortality and morbidity rates and causes an increase in the number of hospitalizations (Tavares et al., 2016).

According to a study in Brazil performed in 2016, 31% of patients with chronic disease have difficulty with compliance to their treatments. A study conducted by Cunnigham et al. in 2010 using 259 Patient with MS (PwMS) in Sweden found that only 31% of the patients used their treatments as recommended and 15% of the patients stopped early, and the rest changed their treatment (Cunningham et al., 2010). In a research with 198 patients, it was shown that 40.6% of the

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patients didn't adhere to their treatment plan (Erbay et al., 2020).

The non-compliance rate is higher in young, male patients (Tavares et al., 2016). A meta-analysis study determined that married patients showed compliance to treatment 30% more than single patients, that was associated with support and solidarity in the family(psychology & 2004, 2004). In 2012, according to a study conducted in Spain using 120 patients on interferon beta 1b treatment, 32% experienced problems in compliance with the drug (Fernández et al., 2012). When all forms of treatments were compared with fingolimod, which is an oral treatment, higher compliance was observed with the fingolimod treatment (Bergvall et al., 2014).

This study that was conducted by Köşkderelioğlu et al. in 2015, as the disease of diagnosis increase, treatment compliance decreases. Social support is defined as a physical and psychological aid provided by the family, friends, and institutions (Langford et al., 1997). The level of support on the patient significantly affects the treatment process(Üstünsoy Çobano Ğlu et al., n.d.). Another study revealed that people with high social support had 57% less anxiety than those who did not receive such support. There are several studies on factors affecting adherence to treatment in chronic diseases (Bergvall et al., 2014; ÖzdemİR & AŞİret, 2011; Tavares et al., 2016; Üstünsoy Çobano Ğlu et al., n.d.). However, the compliance of perceived social support to treatment in patients with MS has not been elucidated in Turkey. Therefore, we carried out this study to determine the relationship between the socio-demographic characteristics and perceived social support with the treatment compliance in PwMS to increase the awareness of the perceived social support.

MATERIALS AND METHODS

This study is a descriptive, cross-sectional study that inclued PwMS who were evaluated in the outpatient clinic of the Department of Neurology, Istanbul Faculty of Medicine, Istanbul University. We included 200 consecutive PwMS who were older than 18 years of age, consent to participate in the study, were on remission, and use a disease modifying treatment for more than six months. We employed the socio-demographic questionnaire, perceived social support, and Morisky treatment compliance scales using face-to-face interview method. Permission was obtained from the Ethics Committee at the Koç University (approval number: 2016289IRB2.146 and date: 10.03.2017). Additionally, written consent was obtained from the scales' patent-owners and informed consent from the patients who participate in the study.

Socio-demographic question form (SSF)

This form consists of eight-questions. and it includes questions about age, gender, marital status, working status, treatments, and the date of the MS diagnosis.

Multidimensional scale of perceived social support scale (MSPSS)

This scale was developed by Zimet et al. in 1988 to measure the social support perceived by patients (Zimet et al., 2010). The Turkish translation, validity and reliability studies were performed by Eker and Arkar in 1995 (Eker & Arkar, 1995). The scale consists of three sub-dimensions, i.e., family, friends, and a special person and each sub-dimension is comprised of four-items that inclued seven-point Likert scale. The maxium score of the MSPSS is 84 and the minimum is 12, and higher scores suggests better perceived social support.

Morisky Adherence Scale

This was developed by Morisky et al. in 1980 as a four-question survey to determine the adherence to long-term treatments (Morisky et al., 1986). According to this scale, participants who responded "no" to all of the questions were considered as "high", who responded "yes" to one or two questions were considered as "medium", who responded "yes" to three or four questions were considered "Low" compliant patients. Cronbach alpha-value of the original Morisky treatment compliance scale was 0.61. The Turkish validity and reliability studies were conducted by Vural et al. in 2012 (Bekir Vural et al., 2012).

Analysis of the Data

The data were analyzed using SPSS version 24.0 statistical software. Normality distributions of the data were examined with the Kolmogorov-Smirnov (K-S) test. Evaluation of the significance between the socio-demographic characteristics, and perceived social support score averages of the patients were analyzed with the Kruskall Wallis test. The relationship between multidimensional perceived social support scale mean scores and treatment compliance levels were analyzed by

One-way anova test. The statistical significance cut-off level was accepted as 0.05.

RESULTS

We included 200 MS (77,5% female, 22.5% male) patients. The mean age of the patients was 36.3±11.8, 62.0% were married, and 60.0% were unemployed. The mean disease duration was 7.1±4.9 and 57.5% were using oral treatment (Table 1).

Table 1. Distribution of socio-demographic features of individuals in the study (n= 200)

Sociodemographic and Professional Characteristics		n	%
Age (X±SD, Range)	36,34±11,83	18-62	
Gender	Male	45	22.5
	Female	155	77.5
Marital status	Single	76	38.0
	Married	124	62.0
Working status	Working	80	40.0
	Not working	120	60.0
Drug Form	Oral	115	57.5
	Injection	85	42.5
Duration of illness	≤1 year	13	6.5
	2-5 years	73	36.5
	6-10 years	53	26.5
	>10 years	61	30.5
Duration of preventive treatment use	≤1 year	23	11.5
	2-5 years	177	88.5
	TOTAL	200	100%

As for the treatment compliance, 28.0% of the patients was highly-compliant, 56.0% moderately-compliant, and 16% was noncompliant (Table 2).

Table 2. Treatment compliance levels of individuals participating in the study (N = 200)

Sub-Dimensions	N	%
High complince	57	28.5
Moderate compliance	113	56.0
Low compliance	30	15.5
Total	**200**	**100%**

The compliance was not affected by gender, age, and marital status. Employement, route of drug use, duration of disease, and treatments do not make a significant difference in the treatment compliance levels (P>0.05) (Table 3).

The mean of social support scale scores was 22.4±6.7 in the family sub-dimension, 19.3±8.7 in the friend sub-dimension, 20.57±7.44 in the special person sub-dimension. The total score mean was 62.3± 18.8 (Table 4).

MSPSS total mean score was 62.3±18.8 (Table 5). As expected, married patients had higher special person sub-dimension scores than single patients (p<0.02) despite similar total mean score. However, we did not find There was no statistically significant difference between MSPSS mean scores and sub-dimension averages of patients who showed high level of compliance, moderate compliance, and low compliance with the treatment used. (p>0.05) (Table 5).

Table 3. Comparison of treatment compliance of the individuals who participated in the study according to their socio-demographic characteristics (N = 200)

Socio-demographic and Professional Characteristics		Treatment compliance							
		Low compliance		Moderate compliance		High Compliance		X^2	p
		S	%	S	%	S	%		
Age	<35	18	9.0	52	26.0	24	12.0	2.627	0.269
	≥35	12	6.0	61	30.5	33	16.5		
Gender	Male	7	3.5	25	12.5	13	6.5	0.024	0.988
	Female	23	11.5	88	44.0	44	22.0		
Marital status	Single	14	7.0	42	21.0	20	10.0	2.204	0.900
	Married	16	8.0	71	33.5	37	18.5		
Education	Primary	3	8.8	24	70.6	7	20.6		
	High school	10	14.1	37	52.1	24	33.8	0.073	0.353
	University	17	17.9	52	54.7	26	24.7		
Working status	Working	12	6.0	47	23.5	21	10.5	0.356	0.837
	Not working	18	9.0	66	33.0	36	18.0		
Route of drug	Oral	17	8.5	67	33.5	32	16.0	0.180	0.914
	Injection	14	7.0	49	24.5	24	12.0	0.168	0.919
Duration of illness	≤1 year	0	0	8	4.0	5	2.5		
	2-5 years	14	7.0	40	20.0	19	9.5		
	6-10 years	12	6.0	26	13.0	15	7.5	9.66	0.142
	>10 years	4	2.0	39	9.5	18	9.0		
Duration of treatment use	≤1 year	2	1.0	13	6.5	8	4.0		
	2-5 years	28	14	100	50	49	24.5	1.049	0.592

Table 4. Perceived social support scale total and sub-dimension score average of the individuals participating in the study (N = 200)

Sub-Dimensions	$\overline{X}$ ± SD
Family	22.41±6.74
Friends	19.31±8.72
A special person	20.57±7.44
Total	62.28±18.75

Table 5. Perceived social support and treatment compliance comparison (n = 200)

	Perceived Social Support			
Level of Treatment Compliance	**Mean Family Support Score**	**Mean Friend Support Score**	**Mean Special Person Support Score**	**Mean Total Social Support Score**
High compliance	23.68±5.68	21.30±11.28	21.91±6.65	66.89±18.02
Moderate compliance	21.93±7.16	18.57±7.45	20.13±7.88	60.63±19.20
Low compliance	21.77±6.80	18.33±7.11	19.63±7.03	59.73±17.41
F	0.843	1.239	0.917	0.836
P	0.674	0.212	0.578	0.778

One way ANOVA test was used to compare groups.

DISCUSSION

This study was conducted to evaluate the relationship between socio-demographic features and perceived social support on treatment compliance in PwMS by employing two scales, i.e., MSPSS and MAS. In line with previous studies, only one third of the PwMS was highly compliant to their treatments. The adherence of patients with MS to the first-line immunomodulatory treatments (IMT) is estimated to be approximately 17%–46% in different series (McKay et al., 2018; O'Rourke et al., 2005; Portaccio et al., 2008; Río et al., 2005; Treadaway et al., 2009). Interestingly, almost half of the MS use their treatments less than 6 years(Evans et al., n.d.). According to a study by Klauer et al. discontinuation of treatment increases the risk of morbidity, mortality and unnecessary use of healthcare resources (D. Mohr et al., 2021).

Our study showed no difference between treatment compliance rates by gender. Contradictory to our findings, MSbasis study, which includes forty-four centers, found that treatment compliance was lower in females than males(Meyniel et al., 2012). Accordingly Arroyo et al. observed that women adhere to treatment at a higher rate (Arroyo et al., 2011). We found no difference in treatment compliance according to age similar to literature(Köşkderelioğlu et al., 2015). This indifference may be due to our participants was mostly between the ages of 20-40 and that they might find it easier to understand the drug treatment education.

Additionally, the marital status did not change the compliance level despite its positive effect on in perceived social support levels. This finding implies that the perceived social support does not influence the complience in patients with MS. We also found that the employement status did not change the compliance to treatment. The working conditions of PwMS can be regulated due to their illness.

On the other hand we could not find a relationship between previous treatment use and compliance, but in a study, it was found that previous treatment use increased the risk of non-adherence (Thach et al., 2018).

Interestingly, we did not find any change in the level of compliance to treatment, contrary to the literature(Popova et al., 2017). This may be because the clinic where the study was conducted was a university clinic. Patients who apply to tertiary care clinics can be expected to have higher drug adherence due to their advanced clinical conditions that require treatment.

In this study, social support of individuals was high. A study conducted by Mohr et al. showed high social support in PwMS with major depression was more effective than special therapy methods(D. C. Mohr et al., 2004). Social support increases the individual's ability to cope with stress and diseases, thereby increasing the level of welfare(Schwartz & Frohner, 2005). Acoording to another study conducted by Motl et al., high social support contributed to the increase of self-sufficiency levels(Motl et al., 2009). Social support increased the tolerance of the symptoms and increased the ability to cope with stress(Costa et al., n.d.). In this study, high levels of social support can be said to be a positive factor contributing to the disease and treatment of PwMS.

In the qualitative research conducted by Dutton et al. with 12 people in 2012, it was stated that the support of spouse, family and friends was a very important factor. Similarly, family support was observed as a common finding, and patients expressed that they accepted MS and felt much better because of their families(Mozo-Dutton et al., 2012). In a study conducted with individuals with a chronic disease, family support was found to be more likely to be seen than friend support(Lilympaki et al., n.d.).

Our study did not detect a relationship between perceived social support and treatment compliance. Its widely believed that high level of compliance could be the result of high level of social support. In a study conducted by Zamanzadeh et al., social support reduced side effects in chronic diseases and positively affected the patient's compliance to treatment(Aghaei et al., n.d.). In a study conducted by Costa et al., patients with high social support were found to have significantly higher levels of compliance to treatment(Costa et al., n.d.). These studies suggest that high social support positively affects compliance in the treatment of MS. Since the perceived social support levels are high in our study, it may not have made any significant difference over compliance with treatment.

The perception of social support is affected by personal factors. If nurses are aware of these sclerosis patients' medication therapy management is not just restricted to the clinical setting. patient care at home maintaining the medication schedule in the environment is crucial for managing the treatment with good compliance (Roper Knowles, 2011). The patient's adherence to therapy in home care is positively impacted by the patient education provided by nurses.

It is a technique that changes the course. It has been noted that follow-up (particularly in the first six months) is crucial for treatment compliance. Patient education should begin with the initial course of medication(Steinberg et al., 2010). Nurses: proper injection techniques connected to therapy; monitoring and management of potential side effects; empowerment of treatment expectations; handling of emergencies (e.g., experiencing an attack); and providing training to PwMS in their homes.

There are many limitations in our study. This study was conducted in a single referral MS center. Therefore, the disability level of the patients was higher than the general MS population. One might expect that the adherence to treatment may not be affected only by social support due to the higher disablity levels of our patients.

Declaration of Conflicting Interests

All authors declare no conflicts of interest.

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Ethical Aspect of the Study

Permission was obtained from the Ethics Committee at the Koç University (approval number: 2016289IRB2.146 and date: 10.03.2017). Additionally, written consent was obtained from the scales' patent-owners and informed consent from the patients who participate in the study.

Author Contributions

Study Design, GYY and AB; Data Collection, GYY; Data Interpretation, GYY and AB; Manuscript Preparation, GYY and AB; Literature Search, GYY and AB. All authors have read and agreed to the published version of the manuscript.

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factors, they can change them positively. Multiple

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RESEARCH ARTICLE

The Relationship Between Physical Activity Level and Quality of Life in Individuals with Bipolar Disorder

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Abstract
Bipolar disorder (BD) is a serious mental illness that leads to poor quality of life (QOL). Lack of physical activity (PA) and sedentary behavior are among the risk factors that cause this condition. This study explored the relationship between PA levels and QOL in individuals diagnosed with bipolar disorder. 27 individuals with BD who received service from a Community Mental Health Center (CMHC) participated to the study. Inclusion criteria were being 18-59 years of age, regularly using of medication, and being in remission. The individuals with psychiatric comorbidities such as intellectual disability, organic brain disease, alcohol/substance abuse, and circadian rhythm disorder were omitted. All participants filled out Sociodemographic Data Form, International Physical Activity Questionnaire-Short Form (IPAQ-SF), and World Health Organization Quality of Life Scale-Short Form (WHOQOL-BREF). Most participants were not physically active (77.8%), and 22.2% had low physical activity levels. The mean IPAQ-SF score (MET minutes per week) was 363.87±337.06. The QOL-general health mean score was 6.88±1.62. The IPAQ-total score was significantly positively correlated with WHOQOL-BREF Psychological ($p<0.05$) and WHOQOL-BREF General mean scores ($p<0.01$). The correlation between IPAQ-total score and physical, social, and environment subscales was not statistically significant. Study findings revealed that there was a need to increase the PA levels of individuals with BD. Also, it has been found that as PA increases, individuals' psychological QOL increases. For this reason, it is essential to implement healthy life groups and follow up in terms of metabolic syndrome and chronic disorders in CMHCs for improving QOL.

Keywords
Bipolar Disorder, Physical Activity, Quality of Life

INTRODUCTION

Bipolar disorder (BD) is a serious mental illness that include include emotional highs (mania or hypomania) and lows (depression). These extreme mood swings lead to impairment in the functionality and quality of life (QOL) of individuals. BD treatment requires the combination of pharmacological and psychosocial interventions (Goodwin et al., 2016). People with BD are at greater risk of a reduced life expectancy and developing metabolic syndrome compared to the general population. One of the factors that increase these risks is the unhealthy lifestyle behaviors of individuals (e.g., smoking, lack of physical activity) (Sylvia et al., 2013; Vancampfort et al., 2016; Bauer et al., 2016; De Hert et al., 2022). These risks can lead to poor health outcomes and negatively affect an individual's physical health (Bauer et al., 2016). National Institutes of Health guidelines (2013) refer to the significance of physical activity for improving overall health in the treatment of BD. In

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addition to beneficial effects of PA on physical health, adequate PA participation improves psychological well-being and quality of life (Thomson et al., 2015; Marquez et al., 2020).

Previous studies showed that individuals with BP were less physically active compared to healthy individuals in some research findings. Most of them did not meet the recommended 150 min of levels of moderate-vigorous PA per week and their observed sedentary behavior levels were high (Melo et al., 2016; Thomson et al., 2015; Vancampfort et al., 2016; Vancampfort et al., 2017). The mean amount of moderate or vigorous PA level of individuals with serious mental illnesses, including bipolar disorder was 38.4 minutes per day, their physical activity levels were lower than healthy controls (Vancampfort et al., 2017). In contrast, it was observed that there was no difference between individuals with BP and healthy individuals in terms of physical activity levels in some studies (Vancampfort et al., 2016). In literature, it has been shown that PA resulted in decreasing depressive symptoms and improvement in quality of life in individuals with BD (Sylvia et al., 2013a; Marquez et al., 2020; D'Angelantonio et al., 2022). Regular physical exercise was associated with lower depression and anxiety scores in people with affective disorders (D'Angelantonio et al., 2022). Although studies showed that physical activity led to positive results, they are criticized for being cross-sectional and not including a control group and also it is thought that the available data are not sufficient to show the effect of physical activity on quality of life of in individuals with BD (Melo et al., 2016; Ashton et al., 2020; Marquez et al., 2020). Studies on physical activity in bipolar individuals are limited. Bipolar disorder is a serious mental illness that impair people's quality of life. Outpatients with BD had a significantly lower physical and mental health-related QoL than healthy controls (Vancampfort et al., 2017). Recently, the focus has been not only on drug therapy in serious mental disorders, but also on personal recovery, taking into account well-being and quality of life. Hence, there has been a trend to treat BD in an integrative and holistic manner in community mental health services (Hoertel et al., 2021).

Studies showed that health promotion and wellness interventions positively affect the quality of life in individuals with BP. However, little is known about sedentary behavior in people with BD and the relationship between PA and QoL in Turkey. Although there were more studies evaluating the relationship between physical activity and quality of life in mental illness in literature, the study evaluating this relationship in bipolar patients is also limited, and the results can be contradictory (Sylvia et al., 2013; Rosenbaum et al., 2014). Since there are lower physical activity levels in North America and Asia compared to European studies, it has been suggested to investigate whether geographic differences are effective on physical activity and sedentary behaviors in individuals with BD (Vancampfort et al., 2016; Vancampfort et al., 2017). In this sense, this study investigates the relationship between physical activity levels and quality of life in individuals diagnosed with BD.

METHODS

Participants and procedure

Information about physical activity levels (International Physical Activity Questionnaire - IPAQ-SF scores) and quality of life (WHOQOL-BREF-TR scores) was achieved retrospectively from the patient records for analysis within scope of the study. The sample size was obtained with the help of the G * Power program by taking $(1-\beta) = 0.80$ and $\alpha = 0.05$. The total number of people to be taken to the study was calculated as 27, with an effect size of 0.50 as a medium effect. Twenty-seven individuals with BD who received service from a Community Mental Health Center (CMHC) were included in our study. Inclusion criteria were being 18-59 years of age, using their medication regularly, and being in remission. The individuals with psychiatric comorbidities such as intellectual disability, organic brain disease, alcohol/substance abuse, and circadian rhythm disorder were omitted. The center's psychiatrist evaluated the criteria for being in remission by evaluating the health data of the participants. The study protocol was approved by Ethics Committee (23.05.2022-138/05) and written informed consent was obtained before starting the study.

Measures

Sociodemographic Data Form

Information regarding basic socio-demographics, gender, age, educational level, and employment status and clinical variables such as duration of illness was obtained with this questionnaire.

International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The short form of the International Physical Activity Questionnaire (IPAQ-SF) was used to assess physical activity participation (Craig et al., 2003). The Turkish validity and reliability study of the scale was made by Sağlam et al. (2010). The items of the IPAQ-SF are structured to estimate weekly energy expenditure based on the frequency (number of days) and duration (minutes) of physical activity during the previous seven days for at least ten minutes. Physical activity intensity is categorized into vigorous activity, moderate activity, and walking. According to the scoring protocol of the questionnaire, by multiplying the metabolic equivalent task (MET) values with the duration and frequency of each activity level (vigorous: 8 METs, moderate: 4 METs, walking: 3.3 METs), a score is obtained as "MET-minute/week." The total score is calculated by summing MET-min/wk scores of three categories (Ashton et al., 2020).

World Health Organization Quality of Life Scale Short Form Turkish Version (WHOQOL-BREF-TR)

The WHOQOL-BREF scale was developed by the WHOQOL Group (1998), and its Turkish validity and reliability were made by Fidaner et al. (1997). The scale aim to assess how individuals perceive their own quality of life. It is a 5-point likert scale. Participants are asked to answer considering the last 15 days. The scale consists of 26 items. The WHOQOL-BREF include four domains: physical health, psychological, social relationships and environment. Two items from the Overall Quality of Life and General Health facet have been included. The WHOQOL-BREF scale does not have an overall score. Four different field scores are calculated with the scale. Higher scores in each area indicate higher quality of life. The values of Cronbach-Alpha, respectively, for the physical domain was 0.83, for the mental domain was 0.66, the social domain was 0.53, the environmental domain was 0.73. Pearson correlation coefficients for test-retest reliability ranged between 0.57 and 0.81.

Statistical Analyses

Data were analysed with the IBM SPSS 21 (IBM SPSS Inc, Chicago, IL) package program. Number and percentage are given as descriptors for categorical data, and deviation for continuous data. Descriptive statistics were used as mean ± standard for continuous data, and frequency and percentage for categorical data. The normality of data was checked by Kolmogorov-Smirnov test and graphically (box-line plot, Q-Q plots). The relationships between the variables were evaluated with the Spearman correlation coefficient. Level of significance was accepted at 0.05.

RESULTS

Participants were 27 individuals with BD, comprising 11 males and 16 females. The mean age of 27 participants was 39.85 ± 1.01 years. Most of the participants were married (51.9%), high school graduate (44.4%), unemployed (74.1%), and the mean duration of illness was 15.88 ± 15.00 years. The general characteristics of the participants are given in Table 1.

Table 1. General characteristics of the study participants

Demografic variables (n=27)	Mean±Sd
Age-years	39.85 ± 1.01
Duration of illness	15.88 ± 15.00
Gender	
Female	16 (59.3%)
Male	11 (40.7%)
Education	
Primary	6 (22.2%)
Secondary	2 (7.4%)
High school	12 (44.4%)
University	7 (25.9)
Employment status	
Employed	7 (25.9%)
Unemployed	20 (74.1%)
Marital status	
Married	14 (51.9%)
Single	9 (33.3%)
Divorced	4 (14.8%)

Most participants were not physically active (77.8%), and 22.2% had low physical activity levels. The mean IPAQ-SF score (MET minutes per week) was 363.87±337.06. The overall-QOL score was 6.88±1.62 (Table 2).

The IPAQ-total score was moderate significantly correlated with WHOQOL-BREF-TR Psychological (p=0.016), and WHOQOL-BREF-TR General health mean scores (p=0.006). IPAQ-total score and physical, social, environment

subscales of WHOQOL-BREF-TR were not significantly correlated (Table 3).

Table 2. The mean scores of IPAQ-total and WHOQOL-BREF-TR subscales

Variables	Mean ± SD
IPAQ-total score (MET min per week)	363.87±337.06
IPAQ Moderate (MET min per week)	16.94±4.44
IPAQ Walking (MET min per week)	359.42±3.37
WHOQOL-BREF-TR General health	6.88±1.62
WHOQOL-BREF-TR Physical	27.62±3.91
WHOQOL-BREF-TR Psychological	21.37±3.70
WHOQOL-BREF-TR Social	9.55±2.45
WHOQOL-BREF-TR Environment	29.37±3.66

Table 3. Correlations between IPAQ-total score and WHOQOL-BREF-TR subscales

	R	P
WHOQOL-BREF-TR General health	0.511	0.006**
WHOQOL-BREF-TR Physical	0.291	0.141
WHOQOL-BREF-TR Psychological	0.461	0.016*
WHOQOL-BREF-TR Social	0.224	0.262
WHOQOL-BREF-TR Environment	0.321	0.103

DISCUSSION

The current study investigated the relationship between physical activity levels and quality of life of individuals diagnosed with BD followed up at CMHC. Study findings showed that the physical activity levels of study participants were low, and even they were not physically active. In light with previous studies (Michalak et al., 2005; Akvardar et al., 2006), participants had poor scores in the general health quality of life and other all QOL domains. In addition, total score of physical activity level was moderately correlated with psychological QOL and general health quality of life.

Physical activity level is categorised as Physically Inactive <600 MET-min/week, Low Physical Activity 600-3000 MET-min/week, Sufficient Physical Activity >3000MET-min/week) (Erdoğan et al., 2011). According to this, our study participants were physically inactive. Previous studies demonstrated that people with serious mental illness had less physically active and more sedentary than the general population (Thomson et al., 2015; Vancampfort et al., 2017). The recommended weekly amount of physical activity for health is at least 150 minutes. It was found that approximately half of individuals with severe mental illness did not fulfill this criterion (Vancampfort et al., 2017). There are conflicting findings on this subject in the literature. For example, in another study by Vancampfort et al. (2016), it was observed that there was no significant difference between individuals with BP and controls in terms of total daily PA participation. In the light of this evaluation, the majority of our study participants were not physically active in accordance with the literature (Thomson et al., 2015). The possibility of bias of self-report scales may be one reason for these different results. Studies using objective measurement tools have shown that individuals' physical activity levels were lower than those using self-report scales. In studies where self-report scales were used, individuals reported themselves more physically active (Vancampfort et al., 2016). It is possible that there are more physically inactive individuals found in our study. Although there was evidence that different factors had effective on physical activity participation of individuals with BD, we could not examine the related factors due to our small sample size (Vancampfort et al., 2013; Vancampfort et al., 2016). This may be a limitation of our study.

There are findings in the literature that healthy promotion interventions including physical activity and healthy nutrition improved the quality of life as well as weight loss in individuals with BD (Van Citters et al., 2010; Sylvia et al., 2013b; Bauer et al., 2016). In line with literature, study

participants reported less satisfaction on general health quality of life and all quality of life domains. Research evidence suggests that the QOL of individuals with BD reported had poorer scores than that of physically ill or healthy individuals (Michalak et al., 2005; Akvardar et al., 2006; Anyayo et al., 2021). Furthermore, according to our study findings, total physical activity level was correlated with the Psychological-QOL and general health quality of life. In other words, physical activity increases, individuals' psychological well-being and general health QOL increase. Our findings are consistent with the literature. Vancampfort and colleagues (2017) demonstrated that 150 min/wk of physical activity had positive effects on physical, psychological, social, and environmental QoL in people with BD. Individuals with a diagnosis of BD who participated in physical activity reported less depression and better quality of life (Sylvia et al., 2011; Melo et al., 2016; Ashton et al., 2020). In a systematic review study by Marquez et al. (2020), the evidence showed that physical activity on well-being and quality of life in individuals with bipolar disorder is limited and cannot be attributed to only physical activity itself.

In addition to beneficial effects of PA on physical health, PA contributes to psychological well-being (Sylvia et al., 2013a). PA has buffering effects from stress and "feel good" effects on people. PA also helps to produce positive emotions and reduce more negative experiences (e.g., stress, depression) (Biddle & Mutrie, 2007). There is also good evidence to demonstrate that high PA levels produce improvements in both mental and physical well-being (Zayed et al., 2018). Furthermore, PA have benefits on mental health by reducing depressive symptoms and improving social and cognitive domains in people with severe mental illness (Rosenbaum et al., 2014; Melo et al., 2016). In a study, bipolar individuals who participated in the walking activity were found to have lower depression, anxiety and stress levels at the end of the program than those who did not (Ng et al., 2007). Therefore, our study findings suggest that an increase in PA has the potential to improve the psychological quality of life and mental health in people with BD. In this sense, it is important to carry out follow-up of metabolic values and healthy lifestyle and wellness programs for people with BD in CMHCs. However, since it was known that individuals with BD participated less physical activity than recommended (Thomson et al., 2015), it is also important to investigate the variables associated with low physical activity of individuals with BD. In the literature, being male, being single, low education, high body mass index, antidepressant and antipsychotic drug treatment, medical comorbidity, perceived stress and difficulty in accessing health services, and motivational issues are mentioned as the barriers for participating in regular PA among the individuals with bipolar disorder (Vancampfort et al., 2013; Vancampfort et al., 2017). In future studies, it may be recommended to investigate the reasons for the low PA levels of the individuals with BD.

Although it is reported in the literature that PA/exercise has benefits in individuals, it is recommended that it should be addressed carefully in bipolar disorder. In a qualitative study, it was found that people diagnosed with BD believed that the exercise was beneficial in regulating mood fluctuations, daily routines and internal rhythms, but they expressed that exercise may have harmful effects besides its benefits (Wright et al., 2012). Although a cross-sectional study, Sylvia et al. (2013a) showed that less exercise was associated with depression whereas more exercise was related with more mania in individuals with BD. Similarly, some evidence emphasized the relationship between vigorous exercises and mania (Melo et al., 2016). Therefore, careful determination of PA levels in individuals with bipolar disorder and follow-up the PA programs with an expert is important. Therefore, addressing these issues may be useful in designing and implementation of exercise programs.

The cross-sectional design of the study and collecting data in a single CMHC are the limitations. The data on PA were collected using a self-reported measure. Thus, recall bias may exist. More objective measurement tools such as the accelerometer could have been used but this was not possible due to the retrospective design of the study. The number of participants was low. We did not evaluate the drug treatment protocol that the participants received. Some drug side effects may have affected individuals' healthy life behaviors like PA. Future studies are recommended to include longitudinal data with larger sample sizes and with control group. Investigating the factors that contribute to low levels of PA in individuals

with BD is important in developing programs in future studies.

Conclusion

Current study findings showed that people with BD had low levels of PA and QOL. So, study findings revealed the need to promote the physical activity levels of individuals with BD. Interventions to increase PA levels of people with BP as a potentially modifiable factor may be beneficial in improving mental well-being and quality of life. As a result, we determined that physical activity increases the general health quality of life and psychological QOL. More work is needed in the future.

Conflict of interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Statement

The study protocol was approved by Ankara Diskapi Training and Research Hospital Ethics Committee (23.05.2022-138/05) and written informed consent was obtained from the participants before starting the study.

Author Contributions

Study Design, SED, AGG; Data Collection, SED; Statistical Analysis, SED, AGG; Data Interpretation, SED; Manuscript Preparation, SED; AGG; Literature Search, AGG. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

Comparison of Functional Movement Analysis (FMS) and Core Performance in Children Who Attended and Didn't Attend Karate Training

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Abstract

Karate athletes perform many high-intensity actions during matches. However, as with all sports disciplines, training can result in overload or injury. To minimize the risk, it is necessary to make a reliable assessment. The Functional Movement Screen (FMS ™) can be used as a reliable clinical tool to predict athletes' injury risk. The aim of this study is to examine the functional movement scores of school-age children attending karate sports training and to compare them with the control group. Secondly, core strength and core endurance parameters were evaluated. The research was conducted on children aged 8-11 who have been attending karate training for at least one year within the Ministry of Youth and Sports (n=14) and who have just started this education (maximum 2 weeks) (n=14). Among the children included in the assessment, the mean age of the group that received karate training was 9.35 ± 2.12 years, and the mean age of the group that new beginners were 9.78 ± 0.8 years. There was a significant difference in hurdle step (both sides), shoulder mobility (right side), trunk stability push-up, rotary stability (both sides) and total FMS score between groups ($p<0,05$). In addition, a significant difference was found between the groups in the core flexion endurance parameter ($p<0,05$). As a result, we can say that karate training improves physical fitness in school-age children.

Keywords
Children, Core, Functional Movement Screen, Karate, Performance.

INTRODUCTION

Modern karate has its roots in the Okinawa islands in Japan (Jansen et al., 2017). Karate consists of kihon, kata, and kumite training. Kihon includes basic techniques while kata and kumite are two types of competition (Ma and Qu, 2017). The discipline is complex and requires considerable physical and mental resources. It usually takes hard, long-term training to automatize and efficiently apply all the techniques (Jukic et al. 2017).

Karate training includes general development exercises, which create the basis for specialized training. Athletes display high explosive muscle strength, balance, and flexibility, which is of key importance in this discipline (Chaabene et al., 2012, Giampietro et al., 2003, Boguszewski et al., 2015). Muscle groups that need to be strengthened include abdominal and lower limb rim areas (Tabben et al., 2014, Gloc et al., 2012, Boguszewski et al., 2011) These muscles ensure stable posture during movements and fighting (Truszczynska et al., 2015). However, as with all sports disciplines, training may cause overload or injuries (Gloc et al., 2012, Boguszewski et al., 2011, Truszczynska et al. 2015).

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Functional movement is maintaining proper mobility and stability while performing functional movement patterns (Okada et al., 2011). These movement patterns include sport-specific activities. Flexibility, strength, passive range of motion, motor patterns, core stability, and proprioception have each been cited as possible risk factors for injury. However, the presence of only one risk factor is insufficient to be cited as a cause of injury (Frost et al., 2012, Bahr and Krosshaug).

In many cases, mobility, stability, strength, or neuromuscular control imbalances may not be identified during traditional screening and assessment. These problems, previously acknowledged as significant risk factors, can be identified using the Functional Movement Screen (FMS®). FMS is a battery of seven tests that assess fundamental movement patterns to identify dysfunctional, asymmetrical, and painful movements that could contribute to future injuries (Cook et al., 2014, Cook et al., 2014).

Studies investigating the effects of karate training on children's core performance and injury risks are insufficient in the literature. This study aims to investigate the effect of karate training on children's core performance and injury risk. The main hypothesis of this study is; that there is a difference in core performance and FMS® scores between participants.

MATERIALS AND METHODS

The study was designed as a prospective, single-blind, observational study with the approval of the University of Health Sciences Scientific Research Ethics Committee (21/640). Children between 8-11 years of age who have been attending karate training for at least 1 year (Group I) (n = 15) and who have just started this education (less than 2 weeks) (Group II) (n = 15) were included in the study. Children with any injuries affecting the musculoskeletal system in the last 6 months were excluded from the study. The voluntary consent form was taken from both the parent and the child. Demographic information (age, gender, height, weight) of the children was recorded. The tests were administered by an evaluator who did not know which group the children were in. The number of volunteers was determined by the G-Power analysis program (Faul et al., 2007). The required sample size was at least 16 individuals for each group, with 80% power and 5% error according to the study (n=32) (Chang et al., 2020).

Functional Movement Screen (FMS®)

The injury risk analysis of the participants was evaluated with FMS scores.

FMS® is a screening tool used to simultaneously evaluate multiple functional areas (balance, strength, range of motion) and increase the accuracy of risk identification in athletes. The subtests of FMS are deep squat, in-line lunge, hurdle step, shoulder mobility, trunk stability push-up, active straight leg raise, and rotary trunk stability. Each test is scored on a ranking scale of 0–3 to produce a composite score out of 21, with higher scores indicating better movement (Cook et al., 2014).

Core Strength

The core strength of the participants was evaluated using the Stabilizer device (Pressure biofeedback unit - Pressure Biofeedback Unit, Chattanooga Group Inc., Hixson TN37343 USA Chattanoga®). The stabilizer is a simple pressure transducer consisting of a three-chamber air-filled pressure bag, a catheter, and a sphygmomanometer gauge (Chattanooga, 2005). The test was performed on the mat in the prone position. For this, the participant lay in the prone position, arms on both sides, neck straight and head relaxed in the midline. First of all, the participant was taught how to contract the abdominal muscles (especially the participant’s body was hanging down from the table as the spina iliaca anterior superiors aligned with the table edge, the hands were crossed at the shoulders and the feet were in the supported position. The test was initiated when horizontality was achieved and the duration to maintain this position was recorded by using a stopwatch. In the flexion-rotation test, the participant lay on his/her back with the hips and knees flexed to 90 degrees, with his/her hands clasped and extended to the thighs. Both knees of the participant were supported by the physiotherapist. The participant did sideways combined trunk flexion and rotation, touching the outside of the physiotherapist's right hand first, then returning to the starting position, and then touching the opposite hand. He/she was asked to touch the maximum number of times in 90 seconds. Only correctly performed repetitions were counted (Moreau et al., 2001, Brotons-Gil et al., 2013). participant’s body was hanging down from the table as the spina iliaca anterior superiors

aligned with the table edge, the hands were crossed at the shoulders and the feet were in the supported position. The test was initiated when horizontality was achieved and the duration to maintain this position was recorded by using a stopwatch. In the flexion-rotation test, the participant lay on his/her back with the hips and knees flexed to 90 degrees, with his/her hands clasped and extended to the thighs. Both knees of the participant were supported by the physiotherapist. The participant did sideways combined trunk flexion and rotation, touching the outside of the physiotherapist's right hand first, then returning to the starting position, and then touching the opposite hand. He/she was asked to touch the maximum number of times in 90 seconds. Only correctly performed repetitions were counted (Moreau et al., 2001, Brotons-Gil et al., 2013).

Statistical Analysis

Descriptive statistics of the participants are given as mean and standard deviation. Statistical analysis is applied via SPSS version 21.0 (IBM Inc., Armonk, NY, USA) software. The normality of the data was investigated with the One-Sample Kolmogorov Smirnov test, and non-parametric tests were used to analyze the differences since the normal distribution was not achieved. Group comparisons are done with the Mann-Whitney U test.

RESULTS

The demographic data of the participants are presented in Table 1. Functional Movement Screen scores of the individuals are shown in Table 2. Group comparisons of FMS scores are presented in Table 3. There was a significant difference in hurdle step (both sides), shoulder mobility (right side), trunk stability push up and rotary stability (both sides) between groups. Additionally, a statistically significant difference was found in the total FMS scores of the groups. There was also a significant difference between the groups in the core flexion endurance parameter.

Table 1. Demographic data of the participants

Personal characteristics (n=28)	Group I (n=14)	Group II (n=14)
Gender (n)	7 female, 7 male	14 female
Age (mean, ±)	9.35± 1	9.78± 0.80
Height (mean, ±)	1.33± 0.07	1.42± 0.06
Weight (mean, ±)	39.14± 4.78	39.62± 5.59
Body Mass Index (mean, ±)	22.08± 1.4	19.63± 2.29

Group I: Karate Group, Group II: New Beginners

Table 2. Mean functional movement screen scores of the individuals

FMS Parameters	Group I		Group II	
	Left	Right	Left	Right
Deep Squat	1.5		1,21	
Hurdle Step	1.85	1.85	1.35	1.42
In-Line Lunge	1.42	1.35	1.5	1.71
Shoulder Mobility	2.71	2.85	2.5	2.42
Active Leg Raise	2.07	2.07	1.85	1.85
Trunk Stability Push-Up	1.42		1.07	
Rotary Stability	1.5	1.64	1.14	1.14
FMS TOTAL SCORE	12		10.21	

FMS: Functional Movement Screen Group I: Karate Group, Group II: New Beginners

Table 3. Group comparisons of FMS scores

FMS Parameters	Left		Right	
	z	p	z	**p**
Deep Squat	Z=-1.54 p= 0.121			
Hurdle Step	-2.054	0.04	-2.011	0.044
In-Line Lunge	-556	0.578	-1.684	0.092
Shoulder Mobility	-877	0.380	-1.742	0.082
Active Leg Raise	-836	0.403	-836	0.403
Trunk Stability Push-Up	Z=-2.143 P= 0.032			
Rotary Stability	-1.987	0.047	-2.660	0.008
FMS TOTAL SCORE	Z=2.097 p= 0.036			

FMS: Functional Movement Screen, Note: Mann Whitney U Test

Table 4. Group comparisons of core performance

Parameters				
	Group I	Group II		
	Mean± SD	Mean± SD	Z	p
Core Strength	6.14± 3.69	7.71± 4.33	-788	0.430
Core Flexion Endurance	49.41± 23.10	33.49± 14.84	-1.976	0.048
Core Extension Endurance	91.42± 34.31	76.05± 49.07	-1.378	0.168
Core Flexion-Rotation Endurance	31± 8.78	26.57± 10.32	-1.128	0.259

SD: Standard Deviation, Group I: Karate Group, Group II: New Beginners

DISCUSSION

As a result of our study, we determined that karate training improves core endurance and reduces the risk of injury in school-age children. FMS is a simple screening test that enables the determination of the functional deficiencies and asymmetry of the participants. The high repeatability of the test is an important advantage. It forms the basis for function-oriented rehabilitation planning. In this way, it is possible to reduce the risk of injury and eliminate the risk factors for the occurrence of injuries (Garrison et al., 2015, Boguszewski et al., 2013, Letafatkar et al., 2014).

The screen has been found to have high (Minick et al., 2010) to good inter-rater and moderate intra-rater reliability in the adult population (Teyhen et al., 2012). It has also been used in children to access functional fitness, to evaluate the relationship between FMS™, children's weight status, and physical inactivity, as well as athletic performance (Mitchell et al., 2015, Duncan and Stanley, 2012, Duncan and Stanley 2013, Yildiz, 2018). Similar to our study they stated that 23 karate athletes aged 10-12 had better FMS scores than the control group. In the study, in men, the highest result was obtained in shoulder mobility and the lowest result was obtained in push-ups in trunk stability. No significant differences were noted between the dominant and non-dominant sides for any group and any exercise (Boguszewski et al., 2015). Higher results on the FMS test in karate athletes may indicate smaller functional limitations that may result from training. Ma and Qu also stated that karate training contributes to the development of motor skills in primary school children (Ma and Qu, 2017).

In our study, we found that karate athletes achieved better core stabilization results than the

control group. Karate athletes use explosive movement patterns such as punching and kicking. Therefore, they need trunk stabilization to improve the quality of movement. Because during all these lower and upper extremity movements, trunk activation starts earlier, regardless of the speed of the extremities (Hodges and Richardson, 1997). Kamal in his study to investigate the effects of core strength training on the spinning wheel and some physical variables for young female karate athletes observed a significant increase in all these parameters in the core strength training group (Kamal, 2015). The increase in core stabilization can also improve sports performance in children, and this may lead to the development of self-confidence in the child. In our study, we found that FMS performed better in push-up and trunk stability tests in children doing karate. High core stabilization may have resulted in higher FMS scores. In this regard, Mitchell et al.'s study with school-age children supports our study with similar results. In this study, they stated that the FMS total scores of 77 children aged 8-11 were associated with core stability results (Mitchell et al., 2015)

Limitations of Study

The study could have been done with more participants, taking into account different age groups.

Conclusion

It may be a good option for school-aged children to be directed to karate training to improve their physical fitness and diminish sports-related injury risk.

Conflict of interest

The authors declare no conflict of interest.

No financial support was received.

Ethics Statement

The studies involving human participants were reviewed and approved by the University of Health Sciences Scientific Research Ethics Committee (Date: 15.11.2021; Decision / Protocol number: 21/640). Written informed consent to participate in this study was provided by the patients/participants.

Author Contributions

Study Design, ESA and GA; Data Collection, ESA; Statistical Analysis, ESA; Data Interpretation, ESA and GA; Manuscript Preparation, ESA and GA; Literature Search, ESA, and GA. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

Effect of Pranayama Exercise on Breath-Holding Capacity of Soccer Players

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Abstract
Objective: The purpose of the present study was to investigate the effect of Pranayama exercises on breath-holding capacity soccer players. **Method:** A total of thirty male soccer players (age 18 – 25 year) were selected from Manipur University, Canchipur, Imphal, Manipur (India) who participated in the national level competition. The subjects were randomly assigned into two equal groups, experimental group (n=15) and control group (n=15). The groups were measured before the intervention with the breath holding capacity. Breath holding capacity was assessed by Nostril clip method. The Pranayama exercises were carried out for the period of six weeks, five days training (Monday to Friday) and 60 minutes each session to the training group where no special exercise was administered to the control group. The pre and post-test scores were statistically examined by the Analysis of pair 't' test and Co-Variance(ANCOVA) for selected variables. **Results:** The experimental group showed improved scores in the breath holding capacity compared to the control group ($p<0.05$). The mean and standard deviation of the breath holding capacity for pre-test and post-test of the experimental group were 33.22±10.22 and 46.46±9.49 respectively. The mean and standard deviation of the breath holding capacity for pre-test and post-test of the control group were 33.17±11.64 and 33.09±11.33 respectively. **Conclusion:** It was concluded that the pranayama training group had shown significantly improved breath-holding capacity and the control group had insignificant improvement. İt was confirmed that a six weeks Pranayama training program was effective to improve the breath-holding capacity of soccer players.

Keywords
Yoga, Pranayana, Pranayama exercise, soccer players, Training, physical adaptation

INTRODUCTION

Soccer is the world's most popular team game. Modern soccer is very fast by its nature, the spectators and the players enjoy the game. Nowadays with the demand for "high sports performance" the concept of soccer has been changed. The concept of soccer has applied skill, technical, tactical development, development of all-important motor components and physiological parameters which are closely associated and contributes to performance in soccer . Not only technical, physiological development, the sports scientists are also making efforts to develop the intellectual ability of the soccer players. As in the literature, it has been shown that endurance, speed, agility, maximum leg strength, upper body strength, leg power, muscular endurance, flexibility, coordination and reaction time are important prerequisites for efficient soccerperformance (Singh et al., 2018; Singh et al., 2016).

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Soccer is a complex game of physical and mental challenges. It must execute skilled movements under generalized conditions of restricted space, limited time, physical and mental fatigue and opposite players (Luxbacher, 2013). The skills involved in the game are simple, natural and yet are highly stimulating and satisfying to anyone who participants in the game (Thomas, 1964). It is a game requiring a high level of fitness. It is one of those rare games which demands not only speed but agility, strength, power, and endurance along with skill. Training is essentially a preparation of the individual athlete so that he can withstand competition stress when he encounters and perform to maximum effectiveness. Soccer training process is partly designed to improve the capacities of individual players to ensure a capability to cope with the loads that competitive match play involves. A high level of match play, which involves kicking, short sprinting, throwing, catching, trapping etc. The activities of the game include short sprinting as well as casual recovery movements. As the players have to cover a big area in the ground during attack and defense therefore, the game demands for aerobic as well as anaerobic fitness (Reilly, 1996; Reilly et al., 2000, Singh et al., 2018).

The preparation of a sportsman represents a multifaceted process of purposeful activity. Yoga breathing (pranayama) is a renowned early exercise for breathing regulation, frequently executed in combination with meditation or yoga, for its spiritual and distinguished health improving effects. Many types of pranayama are present, for example nostril breathing (double, single or alternate), abdominal breathing, strong and forceful breathing and vocalised (chanting) breathing, which are carried out at altering rates and depths (Jerath, 2006). Yoga is called a skilful trick to calm down the mind. According to Swami Vivekananda, it is a conscious process to accelerate the evolution into a single life, a few years or just a few days by controlling the behavior internally as well as externally, this state can be achieved by following work or Karma Yoga, by worship or Bhakti Yoga, by knowledge or Jnana Yoga and by psychic control or Raja Yoga (Murthy, 2010).

Yoga is a physical and mental discipline that originated in Indian culture over 2000 years ago. The physical practice of postures (Asanas) was originally intended to prepare the body for meditation. In general, yogic practices are considered and commonly practice the Asanas as the development of health and fitness (Ganguly et al. 1989). It is a traditional science, and is becoming very popular all over the world day by day due to its scientific research. Yoga exercises with their varied types help to stabilize and balance the internal system of the body, thereby bringing about general physical fitness and physiological homeostasis. Yoga is mostly aerobic and anaerobic types of activities which have more impact on various physiological systems in the human body (Singh et al., 2016). Yoga is the ancient science of India, it is a conscious process for gaining mastery over the mind and body and thereby growing faster from the animal level to become normal human beings and reach the height of greatness (Singh et al., 2017).

The ancient Indian science of Yoga makes use of voluntary regulation of the breathing to make respiration rhythmic, and to calm the mind. This practice is called Pranayama. Pranayama is a Sanskrit word meaning "restraint of the prana or breath". The word is composed of two Sanskrit words, Prana, life force, or vital energy, particularly, the breath, and "ayama", to suspend or restrain. It is often translated as control of the life force (prana). Pranayama means control of breath and it involves three main phases which is much more important to keep strength of respiratory system and thus a whole of human body. These are best practiced in the early hours of the morning or after sunset (Kanniyan, 2014).

Breathing is a vital process that starts at the time of birth and stops when a person dies. During breathing, the life sustaining oxygen is provided to all the parts, organs and cells of the body. One can control the rhythm of panic energy with pranayama and attain a healthy body and mind. The ancient yogic developed many breathing techniques to maximize the benefits of Pranayama. It is also used in preparation and meditation of postures, to help maximize the benefit of the practice focus and mind (Xavier, 2006). Of course, yoga science of breathing is called pranayama. It is a systematic exercise of respiration, which makes the lungs stronger, improves blood circulation, makes the man healthier and bestows upon him the boon of a long life. It aids the respiratory system function at its best whereby the life force can be activated and regulated in order to go beyond one’s normal boundaries or limitations and attain a

higher state of vibratory energy (Iyengar,1981). breathe only through the nose. Breathing through the nose is great start to improve health. It is also important that breathing volume is normal and regular. The normal exhalation, approximately for 40 seconds, the urge to breathe increases enough to initiate inspiration. Nasal breathing during physical exercise allows for a work intensity great enough to produce an aerobic training effect (Chaudhary et al., 2021). The Pranayama practice makes use of the diaphragm fully by drawing into the lowest and largest part of the lungs. Due to the regular practice of the Pranayama, with each inhale to bring oxygen into the body and each exhale purges the body of carbon dioxide, a toxic waste. Breathing also affects the state of mind (Cooper et al., 2003; Danucalov, 2008).

Statement of the Problem

The researcher was interested in the study to determine the effect of Pranayama exercise of Soccer players. So, from the above literature the researcher decided to statement of the problem as entitled "Effect of Pranayama Exercise on Breath Holding Capacity of Soccer Players''

Objective of the Study

The main objective of the study was to investigate the effect of pranayama exercise on breath holding capacity of soccer players.

The foundation of Buteyko breathing method is to

METHODOLOGY

Selection of Subjects

For this study, thirty male soccer players were selected from Manipur University, Canchipur Imphal, Manipur (India) who participated in national level competition. The age of subjects ranged between 18-25 years. To determine the sample demographic of experimental group (n=15) and control group (n=15), the researcher extracted skewness coefficient for age, height, weight, body mass index (BMI) and experience, after extracting mean, standard deviation, median and skewness for each items.

The participants of this study are humans. The study was approved by the Institutional Human Ethical Committee of Manipur University, Canchipur, Imphal (India) with Ref. No.MU/IHEC/2021/022 and informed consent was obtained from the participants. Participants who volunteered for the study were informed with a written informed consent form.

The results showed a sample demographic because it was between ±5 as shown in table 1.

Table 1: Sample properties, statistics features and demographic values

Tests	M±SD		Median		Skewness coefficient	
	EG (n=15)	CG (n=15)	EG (n=15)	CG (n=15)	EG (n=15)	CG (n=15)
Age (years)	21.20±1.31	20.74±1.49	20.00	20.00	0.08	0.00
Height(m)	1.57±0.07	1.56±0.05	1.56	1.58	0.89	1.15
Weight (kg)	53.70±4.13	53.30±2.86	52.50	54.50	0.78	0.58
BMI (kg/m2)	21.07±1.50	22.01±1.40	21.50	21.65	1.11	0.43
Experience (years)	2.08±0.96	2.01±0.69	2.50	1.50	0.11	0.78

Values of the experimental group (EG) and control group (CG) are presented as mean (M), standard deviation (SD), median, body mass index (BMI) and skewness coefficient.

The graphical representation of sample demographic values of the experimental group and control group was shown at figure 1.

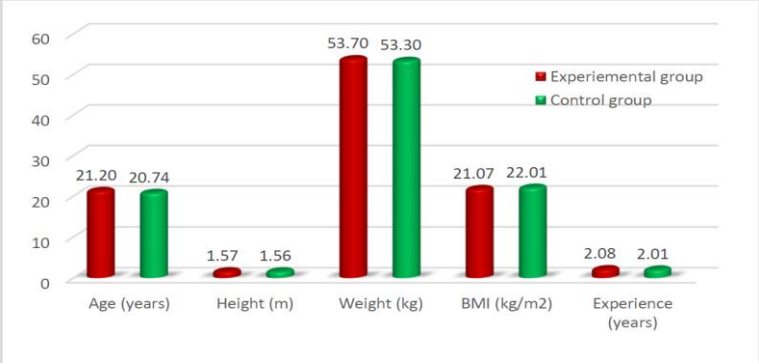

Figure 1: The graphical representation of demographic values of the experimental group and control group

Selection of the Test

To measure the breath holding capacity by using the breath holding capacity (Manual Nostril Clip Method) was selected as a test administered.

Criterion Measures

The Criterion measures for the administration of tests for breath holding capacity of the subjects the breath holding capacity (Manual Nostril Clip Method) was used and measure of recorded in seconds.

Design of the Study

The selected thirty male soccer players subjects were randomly assigned into two equal groups, as Experimental group (n=15) and control group (n=15). The specific selected test item was breath-holding test. The groups were measured in the breath-holding test before intervention of the Pranayama exercise training program. After the initial test, the subjects of the experimental group participated in a supervised Pranayama exercise training program, control group was given only soccer practice, where no special exercise was administered. The Pranayama exercise training program was carried out for the period of six weeks, five days training (Monday to Friday) and 60 minutes each session. And this research will proceed from 25th January to 25th March 2022.

Training Program

The objects from this study have been training followed by the Pranayama exercise training program. These training program by following the recommended exercise allowance which was suggested in Thompson et al. (2013), we have processed total 60 minutes work out with warm-up exercise for 10 min, main exercise for 40 min, warm-down exercise for 10 min. The exercise was applied for 6 weeks with 5 times a week. With increasing the scale and number of exercise movements which increases the intensity of exercise (Santosh, 2018), we have composed a routine that does not get out of the previously set maximum exercise intensity. And also when practicing each move, we have focused on safety more than accuracy so we suggested a bit changed movement in parts which was tough to follow. The specific contents are composed as table 2.

Table 2: Six weeks pranayama exercise training program for exercise group

Weeks	Pranayama exercise	Repetition	Set	Volume of Contact	Total no. of Contact
1 -2 Weeks	Anulom vilom (Alternate Nostril Breathing) Bhastrika (Bellow's Breath) Ujjayi (Victorious Breath) Bhramari (Humming Bee Breath) Kapalbhati (Skull-Shining Breath)	10	2	20	200
3 -4 Weeks	Anulom vilom (Alternate Nostril Breathing) Bhastrika (Bellow's Breath) Ujjayi (Victorious Breath) Bhramari (Humming Bee Breath) Kapalbhati (Skull-Shining Breath)	10	3	30	300
5 -6 Weeks	Anulom vilom (Alternate Nostril Breathing) Bhastrika (Bellow's Breath) Ujjayi (Victorious Breath) Bhramari (Humming Bee Breath) Kapalbhati (Skull-Shining Breath)	10	4	40	400

Statistical Analysis

The collected data were entered into an excel sheet and statistical analyses were conducted using the IBM SPSS software (version 22.0; SPSS Inc., Chicago, IL, USA). Normality of statistical distribution was tested by using descriptive statistics, paired t-test and ANCOVA was applied to examine differences among groups. The level of significance used in the statistical analyses was 0.05.

RESULTS

The result of the study showed that there was significant improvement of breath holding capacity of selected subjects of the experimental group. The descriptive analysis of pre-test and post-test of the experimental group was presented at table 3.

Table 3: Pre-test and post-test means of breath holding capacity for experimental group

Variable	Group	Mean	N	Std. Deviation	MD	SE	df	t-value
Breath holding capacity	Pre-test	33.22	15	10.22	14.25	1.77	14	8.05*
	Post-test	46.46	15	9.49				

*Significant at level of confidence 't' 0.05 (14) = 2.145

Table 3 reveals that the mean and standard deviation of the breath holding capacity for pre-test and post-test of the experimental group were 33.22±10.22 and 46.46±9.49 respectively. In addition, the mean difference and standard error of pre-test and post-test was also found as 14.25 and 1.77 respectively. There was a significance difference as the value obtained was 8.05*, whereas the tabulated value was 2.145 at 0.05 level of significance.

The graphical representation of pre-test and post-test mean comparisons for breath holding capacity of the experimental group was shown at figure 2.

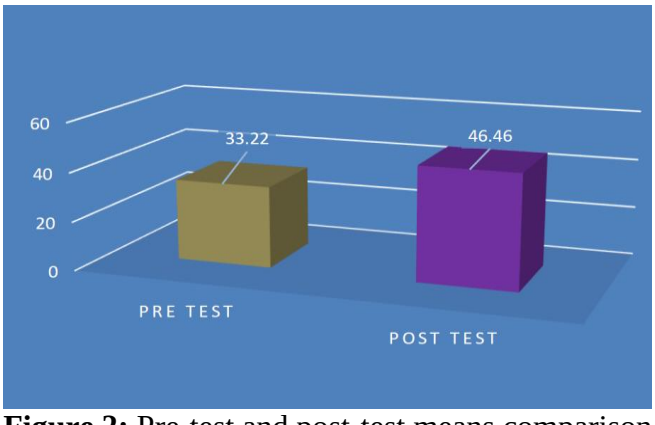

Figure 2: Pre-test and post-test means comparison of breath holding capacity for experimental group

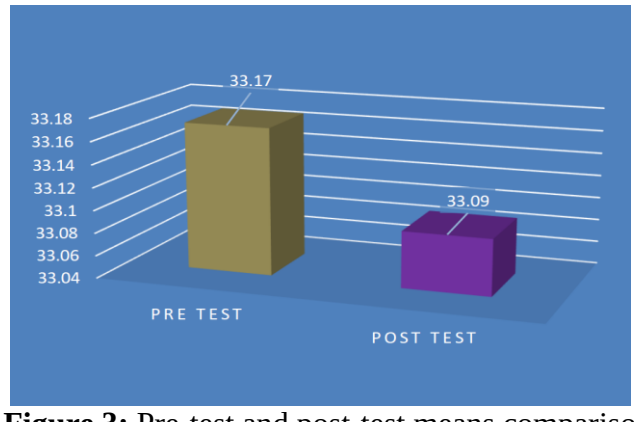

Figure 3: Pre-test and post-test means comparison of breath holding capacity for control group

The descriptive analysis of pre-test and post-test of control group for breath holding capacity was presented at table 4.

Table 4: Pre-test and post-test means of breath holding capacity for control group

Variable	Group	Mean	N	Std. Deviation	MD	SE	df	t-value
Breath holding capacity	Pre-test	33.17	15	11.64	0.087	0.23	14	0.38
	Post-test	33.09	15	11.33				

Significant at level of confidence 't' 0.05 (14) = 2.145

Table 4 reveals that the mean and standard deviation of the breath holding capacity for pre-test and post-test of the control group were 33.17±11.64 and 33.09±11.33 respectively. In addition, the mean difference and standard error of pre-test and post-test was also found as 0.087and 0.23 respectively. There was an insignificant difference as the value obtained was 0.38, whereas

the tabulated value was 2.145 at 0.05 level of significance. The graphical representation of pre-test and post-test mean comparisons for breath holding capacity of the control group was shown at figure 3.

The analysis of co-variance (ANCOVA) of pre-test and post-test between experimental group and control group for breath holding capacity was presented at table 5.

Table 5: Pre-test and post-test means comparison between experimental and control groups For breath holding capacity test

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Group	1508.88	1	1508.8		
Error	600.69	27	22.25	67.838*	.000
Total	51866.60	30			

*Significant at 0.05 level of confidence F (1, 27) = 4.21 (N=30)

Table 5 reveals that there was found significant difference between pre-test and post-test means comparison score of the experimental group and control group for breath holding capacity test by analysis of co-variance (ANCOVA) as the obtained critical value of F=67.838* was less than the tabulated value of F=4.21, therefore, it was confirmed that six weeks Pranayama exercise training program was effective to improve the breath holding capacity of soccer players.

DISCUSSION

Soccer is the world's most popular game and requiring a high level of fitness. Pranayama exercise training program and the fact that this group received proper breathing techniques to improve breath holding capacity and resulted in the development of more functional and relevant motor programs that control the complex intramuscular coordination. The purpose of the present study was to investigate the effect of Pranayama exercises on breath holding capacity soccer players by giving the Pranayama exercise training program that was carried out for the period of six weeks, five days training (Monday to Friday) and 60 minutes each session. The findings of the study also revealed that there were significant effects of Pranayama exercise training program on breath holding capacity, which were proved by the application of appropriate statistical techniques as the descriptive analysis, paired t-test and ANCOVA was employed.

On the basis of the finding, an experimental group of soccer players has shown the significant effect on Pranayama exercise training program compared with the control group of soccer players of Manipur University. In the finding, the mean and standard deviation of the breath holding capacity for pre-test and post-test of the experimental group were 33.22±10.22 and 46.46±9.49. And the control group were 33.17±11.64 and 33.09±11.33 respectively. The significant improvement on breath holding capacity of soccer players of the experimental group might be due to the nature of exercises for six weeks and a quick physical adaptation of the soccer players. The result of breath holding capacity revealed significant improvement among the swimmers as a result of pranayama exercise training ($F= 67.838$, $p < 0.00$). Thus, daily pranayama exercise training was found better in improving breath holding capacity which is an essential factor to improve soccer performance.

The results of this study indicate that pranayama training is effective in improving breath holding capacity of soccer players. Soccer players are considered as one of the best exercises and its competition is organized from school to university level as well as from subdivision to international level. Depending on the popularity and importance of swimming events, many strategies and advanced techniques have been developed by the scientists from the field of physical education and sports. Previous research indicates that yogic breathing exercise of six weeks has shown significant improvement in breath hold capacity of women soccer players (Subramani et al., 2016). Especially, during competition, a soccer player needs a good start to win and, for this, he/she must possess a study of respiratory rate to the official's signal to control the body and mind. Although there are many factors involved behind a soccer player's winning, breath holding capacity during the competition is also an

important issue. The present investigation, therefore, considered an important variable, namely, breath holding capacity for elite soccer players. While in search of a new strategy to enhance breath holding capacity, the literature of yoga during the recent past revealed that yoga indicates significant improvement in cardiorespiratory function (Bera et al., 1993; Bera et al., 1990). It was realised, these studies indicate that along with other components of yoga almost all the training interventions are composed of different types of pranayama. Therefore, pranayama training may be of immense use in improving fitness abilities of the soccer players. Similar study found a significant improvement in all pulmonary function with a significant decrease in RR could be mainly due to regulated, slow, deep and controlled breathing for prolonged period during pranayama practice leading to increase in the strength and endurance of expiratory as well as inspiratory muscles and contributing to enhanced voluntary control of breathing. As a technique, pranayama can assume rather complex forms of breathing, but the essence of the practice is slow and deep breathing. Such breathing is economical because it reduces dead space ventilation. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs (Rajesh et al., 2004). Some similar research has confirmed that the pranayama practices training group had shown significantly improved breath holding time (Sugumar C. et al., 2010). The similar type of results of the study showed that the VO2 max was significantly improve due to the combined practice of asana pranayama and SAQ training (Muktamath et al., 2013). Some study indicates that there is a huge impact of yogic practices on Physical variables. Experimental group resembles high elevation rather than control group. Football Players who have undergone yogic practices like Asana, Pranayama's and Meditation before their usual soccer training regime show better performance than players who have not undergone the yogic practices (Sathiyamoorthy et al., 2019; Acharya et al., 2010). On the other hand, pranayama practices group improved the selected dependent variables such as speed and agility better than skill training soccer players of Manipur University for their positive contribution, help, and cooperation. without pranayama practice and control groups (Paramanandam et al., 2019; Kumar et al., 2018; Hollingshead, 2002). The effects of the study indicate that the experimental group namely game yogic training group (asanas and pranayama) had shown significant enhancement in flexibility and vital capacity among the college level football players (Chochalingam et al. 2022; Shukla, 2020; Selvaraja et al., 2018).

On the basis of the results, it was considered that the Pranayama exercise training program has produced significant improvement of breath holding capacity of soccer players in the experimental group than control group. Therefore, the six weeks Pranayama exercise training program had a significant effect on the breath holding capacity of soccer players. In this study were selected from male soccer players were selected as subjects, so further attempts can use female and different age groups of soccer players also and future research should use larger samples to be better generalizability. And, similar studies may also recommend other games and sports in order to enhance the performance of the players.

Conclusion

Pranayama is a traditional yoga practice of controlling breathing technique. The regular practice of Pranayama integrates the mind and the body. It was concluded that the pranayama practices training group had shown significantly positive improvements in breath holding capacity. However, the control group had not shown any significant improvement on any of the selected variables such as breath holding capacity. The similar studies were concluded that the pranayama practices training group had shown significantly improved in breath holding time. However, the control group had not shown any significant improvement on any of the selected variable such as breath holding (Vigneshwaran, 2015). It was confirmed that a six weeks Pranayama exercise training program was effective to improve the breath holding capacity of soccer players.

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Conflict of interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Statement

The participants of this study are humans. The study was approved by the Institutional Human Ethical Committee of Manipur University, Canchipur, Imphal (India) with Ref. No.MU/IHEC/2021/022 and informed consent was obtained from the participants. Participants who volunteered for the study were informed with a written informed consent form.

Author Contributions

Study Design, LSS, SOS; Data Collection, LSS; Statistical Analysis, LSS, OPD; Data Interpretation, WJS; Manuscript Preparation, WJS, SSS; Literature Search, LSS, SSS. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

The Relationship Between Weight Status, Vital Signs and Physical Fitness in Children with Simple Obesity: A Cross-Sectional Observational Study

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Abstract
Background: Obesity is considered to impact physical fitness in children. There is scarce data on indices of physical fitness in Indian children with simple obesity We aimed to determine the effects of weight status on indices of physical fitness in North Indian children with simple obesity. **Methods:** Vital parameters such as blood pressure, pulse rate, respiratory rate, and rate of perceived exertionwere measured before and after the six-minute walk test (6MWT) in obese children (BMI ≥95th percentile) (Group 2, n=70) aged 5-15 years and were compared to non-obese children (BMI 25th to 75th percentile) (Group 1, n=70). President's Challenge Fitness test was used to measure the physical fitness of each subject. **Results:** The mean age, weight and BMI of children in Group 1 and Group 2 were 9.07±2.88 and 8.93±3.13, 27.42±12.08 and 48.87±17.89 and 16.54±4.26 and 27.30±5.2, respectively. The mean blood pressure recorded before 6MWT was similar in the two groups but pulse rate, respiratory rate, and BORG scale values were higher in Group 2. Children in Group 2 also showed significant elevation of vital parameters compared to Group 1 after the 6MWT. Additionally, children in Group 2 performed poorly in all the physical fitness parameters compared to those in Group 1 following the President's Challenge Fitness test. **Conclusions:** Children with obesity showed several alterations in vital parameters and indices of physical fitness. Further studies are required to access the effect of interventions aimed at improving the physical fitness in children with obesity.

Keywords
Childhood obesity, Body mass index, Physical fitness, Vital parameters, 6-minute walk test.

INTRODUCTION

Obesity is described as a body weight greater than a person's average or standard weight for their height and age and is evaluated in clinical practice by the body-mass index (BMI) (Johnston et al., 2022) . The prevalence of pediatric obesity has significantly increased in the past few decades (Ogden et al., 2014). At the same time the physical fitness of children and adolescents has deteriorated (Malina 2007) . The increased prevalence is related to several factors that include genetics, environmental factors, energy intake and expenditure. (Blüher, 2019).

Obesity in childhood raises the likelihood of obesity during adolescence and adulthood (Reinehr ,2018). It is linked to several co-morbid conditions such as cardiovascular disease, gallbladder disease, osteoarthritis, hypertension, dyslipidemia, sleep apnea, type 2 diabetes, and thyroid dysfunction (Koliaki et al., 2019; Pogorelic et al., 2019; Pacca et al., 2018; Dayal et al., 2014; Jehanet et al., 2018; Yadav et al., 2018 ; Dayal and Kumar 2019). Maintaining physical fitness holds its

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significant place in obesity prevention.(Chen et al., 2020).The most effective prevention strategies include therapeutic lifestyle modifications, maintaining high levels of physical activity, and maintaining a healthy weight (Johnston et al., 2022).

The BMI cut-off for obesity is ≥30 kg/m2 in the Western populations whereas in Asian populations it is considered to be ≥25.0 kg/m2 (Singh et al., 2008). As compared to Caucasians, Asians have higher body fat percentage for a given BMI and the health risks related to obesity also occur at lower BMI (Goda and Masuyama, 2016; Singh et al., 2008). Prevention of obesity is therefore important during childhood to avoid metabolic complications and the related morbidity during adulthood.

Over the past few years, researches have focused on the relationship between obesity and physical fitness. Although several researches have linked BMI to blood pressure and physical fitness.(Chen et al., 2020; Bi C et al., 2019; Köchli et al., 2019; Dumith et al., 2010; Farah et al., 2018; Palmeira et al., 2017; Rodríguez-Colón et al., 2011) few have looked at the effect of BMI on respiratory rate and pulse rate, in children.(Farah et al., 2018; Dixon et al., 2018)

One of the studies assessed vital respiratory parameters (forced expiratory volume in 1 s , forced vital capacity ,the peak expiratory flow and forced expiratory volume) in obese adolescents but didn't focus on the subjective assessment of respiratory parameters (Dixon et al., 2018) Kochli S. et al. correlated obesity and hypertension but measurements were confined to resting state not after exertion.(Kochli et al., 2019) Another study by Mohan B. et al. also worked on hypertension in obese children but age group included was above 11 years and blood pressure measurements after exertion/activity were not taken into consideration.(Mohan et al., 2004) On contrary this study assesses vital parameters of children between 5-15 years of age at rest as well as on exertion. Physical fitness decline with increased BMI was concluded by many studies. None of them used all the components of presidents fitness challenge test as a reflection of physical fitness.(Chen et al., 2020; Bi et al., 2019; Dumith et al., 2010; Farah et al., 2018; Palmeira et al., 2017;) In this study we focused on physical fitness as a whole and included all the components of president's fitness challenge test. Studies focusing on combined relationship between vital parameters and physical fitness in obese children are very scarce. So, this study aimed to determine cross-sectional relationship between obesity, physical fitness, and vital indicators in Indian children, as well as to compare them to normal weighed children. Additionally, there is limited data on physical fitness in Indian children who are at a raised risk for obesity-related metabolic problems at lower BMI than their Western counterparts. We thus planned to study physical fitness in children with simple obesity by assessing a range of parameters including all components of the President's Challenge Fitness test.

METHODS

This cross-sectional study, conducted between October 2021 and March 2022, aimed to assess the fitness profile and vital parameters of obese children as compared with non-obese children. Purposive sampling was used to identify participants for the study, which included children between the ages of 5 and 15 years enrolled in tertiary care hospital's outpatient clinic. Sample size calculation was done using a formula given below (Charan and Biswas, 2013) .

$$Z_{1-\alpha/2}{}^2 \, P \, (1-p) \, / d^2$$

$$Z1-a/2 = 1.96 \text{ at } P<0.05$$

d = 8% Absolute error or precision as per previous study (Dumith et al. 2010).

Sample size calculations indicated that a sample of 114 would provide over 80% power at a 5% significance level to detect an 8% absolute error or precision among groups. This was based on the difference observed in the previous study (Dumith et al. 2010) . The study protocol was approved by the Institute Ethics Committee (INT/IEC/2021/SPI-1550) on 25th October 2021. Prior to the inclusion of the children in the study, informed consent from parents and assent from the children was obtained. All children underwent weight and height measurements to calculate BMI. Children with simple obesity, defined as BMI ≥95th percentile on standard Indian growth charts were recruited as cases (Group 2) whereas near age-matched children with BMI between 25th to 75th percentiles were recruited as controls (Group 1) (Khadilkar et al. 2012). Children with any congenital, structural abnormalities, physical or mental developmental disorders, endocrinopathies,

and any systemic illness were excluded from the study.

Vital parameters such as blood pressure, pulse rate, respiratory rate, and rate of perceived exertion were measured before and after the Six-Minute Walk Test (6MWT). Sphygmomanometer was used to measure blood pressure in upright position and classified according to a previous study (Krishna 2006).The examiner observed the rise and fall of the abdomen to determine the respiratory rate. The rate of breathing was measured for 30 seconds and then multiplied by two. By placing the finger on the radial artery and counting the pulsations, the pulse rate was determined. The rate was calculated by counting the pulse for 30 seconds and multiplyingthe result by two. The 6MWT was carried out according to a set of guidelines (Fell et al. 2021). The individuals were asked to rate their perceived exertion level before beginning the 6MWT. The subjects were then told to walk up and down a measured hallway for six minutes, covering as much ground as possible in this 6-minute timeline. The test is self-paced, so the participants could take a break if they choose, but the clock kept ticking. At the end of the test, the distance walked, the Borg scale measured by rate of perceived exertion, the pulse rate, respiratory rate, and blood pressure was recorded (Del Corral et al. 2022).

The President's Fitness Challenge test evaluates aerobic capacity, strength, and flexibility (Hale and Franks, 2001).It's components include Shuttle run testing forleg strength/power/agility, V-sit testing for lower back/hamstring flexibility**,** Curl-up or partial curl-ups forabdominal strength/endurance, pull-ups or right angle pushups for upper body strength/endurance, and one-mile walk/run for heart/lung endurance.

One mile walk test evaluated the shortest possible time for completing one mile walk. Shuttle test time was measured as the fastest time to complete two shuttles between 30 feet distant parallel lines. Correctly performed curl-ups in one minute were noted. Sit and reach test distance was measured in sitting position with legs shoulder width apart. The distance from the measuring line was recorded in centimeters. Right angle pushups were measured as maximum number of pushups a child could perform without exhaustion.

Statistical analysis

Statistical Package for the Social Sciences (SPSS version 26.0 Armonk, NY: IBM Corp) was used to analyze the data. Descriptive statistics with means, SDs, and percentages to record baseline demographics and clinical characteristics were tabulated. The Shapiro-Wilk test was used to analyze data normality, and parametric tests were used based on the findings. The t-test and independent t-test were used for within-groups and between-groups analyses. A significance level of 5% was used for all data analysis.

RESULTS

One hundred and forty children, 70 in each group, were recruited into the study. Their demographic characteristics are shown in Table 1.

Table 1: Demographic characteristics of subjects in the two groups.

Variable		Group 1 (n=70) Mean (SD)	Group 2 (n=70) Mean (SD)	P-value
Age (yr)		9.0 (2.8)	8.9 (3.1)	0.77
Weight (Kg)		27.4 (12.0)	48.8 (17.8)	<0.001
Height (cm)		127.7 (21.4)	133.1 (14.7)	0.08
BMI (Kg/m^2)		16.5 (4.2)	27.3 (5.2)	<0.001
BMI percentile		42.5 (34.3)	95.0 (0.0)	<0.001
Sex	Boys	41 (58.6%)	44 (62.9%)	<0.001
	Girls	29 (41.4%)	26 (37.1%)	<0.001

Vital parameters before and after 6MWT

The SBP and DBP recorded before 6MWT were similar in the two groups (p-values 0.08 and 0.32, respectively). In contrast, there were significant differences between the cases and controls in pulse rate, respiratory rate, and rate of perceived exertion recorded before the 6MWT (p-value <0.001) (Table 2).

The two groups also showed significant differences in all the vital parameters recorded after the 6MWT, i.e., Group 2 showed significant elevation of vital parameters compared to Group 1 (P<0.001) (Table 3).

Table 2: Change in vital parameters within the study groups after the 6-minute walk test

Group	Parameter	Before test	After test	P value
Group 1 (n=70)	Systolic BP	106.5 (6.0)	112.9 (5.4)	<0.001
	Diastolic BP	70.4 (3.6)	74.4 (3.9)	<0.001
	Pulse rate	70.3 (3.6)	77.1 (3.4)	<0.001
	Respiratory rate	17.4 (2.3)	20.4 (2.1)	<0.001
	ROPE	0.0 (0.0)	0.3 (0.3)	<0.001
Group 2 (n=70)	Systolic BP	108.6 (7.8)	123.5 (7.2)	<0.001
	Diastolic BP	69.6 (5.7)	79.1 (5.3)	<0.001
	Pulse rate	75.0 (5.5)	93.2 (12.0)	<0.001
	Respiratory rate	21.2 (13.2)	26.5 (2.6)	0.0018
	ROPE	0.1 (0.2)	3.2 (1.4)	<0.001

Abbreviations: BP, blood pressure; ROPE, rate of perceived exertion

Table 3: Comparison of the studied vital parameters before and after the 6-minute walk test between the two groups

Parameter	Timing	Group 1 (n=70) Mean (SD)	Group 2 (n=70) (Mean (SD)	Mean change	P value
Systolic BP (mm Hg)	Before	106.5 (6.0)	108.6 (7.8)	2.0	0.08
	After	112.9 (5.4)	123.5 (7.2)	10.6	<0.001
Diastolic BP (mm Hg)	Before	70.4 (3.6)	69.6 (5.7)	0.8	0.32
	After	74.4 (3.9)	79.1 (5.3)	4.7	<0.001
Pulse rate (per minute)	Before	70.3 (3.6)	75.0 (5.5)	4.7	<0.001
	After	77.1 (3.4)	93.2 (12.0)	16.1	<0.001
Respiratory rate (per minute)	Before	17.4 (2.3)	21.2 (13.2)	3.7	0.02
	After	20.4 (2.1)	26.5 (2.6)	6.1	<0.001
ROPE	Before	0.0 (0.0)	0.1 (0.2)	0.1	<0.001
	After	0.3 (0.3)	3.2 (1.1)	2.8	<0.001

Abbreviations: BP, blood pressure; ROPE, rate of perceived exertion

Physical fitness parameters

Children in Group 2 performed poorly in all the physical fitness parameters compared to those in Group 1 following the President's Challenge Fitness test (P<0.001) (Table 4).

Table 4: Comparison of fitness parameters between the two study groups during the President's Challenge Fitness Test

Parameter	Group 1 (n=70) Mean (SD)	Group 2 (n=70) (Mean (SD)	Mean change	P value
Curl-ups (Reps per minute)	19.9 (2.6)	7.5 (2.3)	12.3	<0.001
Shuttle run test (Seconds)	11.7 (1.2)	19.8 (2.7)	8.0	<0.001
V-sit reach (Centimeters)	5.5 (1.9)	0.5 (0.5)	5.0	<0.001
Push ups (Repetitions)	12.7 (2.8)	4.5 (1.3)	8.2	<0.001
One mile test (Minutes)	10.6 (3.1)	20.3 (3.2)	9.7	<0.001

DISCUSSION

The vital indicators of the obese and non-obese children post 6MWT showed significant difference in our study indicating that presence of obesity affects the cardiovascular health of obese children. The results are in line with earlier research on this subject. In a cross-sectional study by Pathare et al. obese children were found to have higher SBP following the 6MWT (Pathare et al., 2012). Another study demonstrated hypertension in obese children even without exertion (Rajet et al., 2007). A derangement of cardiovascular and pulmonary functions was also determined in obese adolescents (Nageswari et al. 2007). Several other studies have also documented adverse effects of obesity on cardiac autonomic modulation and respiratory functions (Farah et al., 2013; Dixon and Peters 2018; Rodríguez-Colón et al., 2011; Freitas et al. 2014;Farah et al. 2018; Palmeira et al. 2017). Reassuringly, previous research has also indicated that in obese youngsters, increased physical activity during leisure time improves lung and heart health. (Farah et al., 2018; Palmeira et al., 2017) .All the above mentioned studies strengthen our conclusion that vital parameters are altered in obese children more than normal weighed ones after 6minute walk test.

Obese children in our study performed worse on indices of physical fitness compared to non-obese children. Such deterioration in physical fitness with increasing BMI has been observed in previous studies. The BMI and six measures of physical fitness were shown to have non-linear associations in a cross-sectional study of 8548 college students in China. Subjects in the normal weight category had better performance in indices of physical fitness compared to underweight, overweight or obese subjects (Chen et al., 2020). A Taiwanese study on normal weight and obese children, also showed that the physical fitness index declined in a curvilinear manner with increasing BMI (Huang and Malina, 2007). Poor physical fitness assessed by five fitness indicators was also observed in children having BMI >25kg/m2 by other authors (Bi et al., 2019; Köchli et al., 2019; Xu et al., 2020; Huang and Malina, 2007 ; Mak et al., 2010). Obese children were seen to be lacking in ability to take on sports skills because of decreased performing capabilities (Ceschia et al., 2016). A recent study has also shown that higher BMI is associated with lower working memory, cognitive flexibility, planning, attention in children which lowers their sprint performance and muscular strength. This supports our findings that obese children are less physically fitness than normal weighed children. It is therefore desirable that adequate levels of physical activity to maintain physical fitness is advised to obese children to avoid harmful effects of obesity on cognitive and motor skills.

Our study has some limitations. It was conducted during the COVID-19 pandemic times in our region which could have some impact on the results of fitness parameters (Dayal et al., 2020) .Recent data indicates that pandemic restrictions affected fitness of children in addition to the body composition changes (Rúa-Alonso et al., 2022). We also did not quantify the daily physical activity to understand if it had some effect on fitness parameters.

In conclusion, our study demonstrates alterations in vital parameters in obese children compared to their non-obese peers. Children with obesity also performed poorly in indices of physical fitness. There is need to conduct larger studies on modifiable biological and behavioral factors to improve physical activity and fitness in children with simple obesity.

Conflict of interests

The authors have no conflict of interests to declare. No financial support was received for this study.

Ethics Statement

The study protocol was approved by the Institute Ethics Committee (INT/IEC/2021/SPI-1550) on 25th October 2021. Prior to the inclusion of the children in the study, informed consent from parents and assent from the children was obtained.

Author Contributions

Study Design, SP, SB; Data Collection, SB, APS,SP; Data Interpretation, SP, PG; Manuscript Preparation, SP,PG,SB; Literature Search, SP,PG,SB,APS. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

The Effect of Kinesiological Taping on Pain, Function, and Disability in Subacromial Impingement Syndrome - A Randomized Controlled Study

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Abstract

Objective: Subacromial Impingement Syndrome (SIS) is one of the most common shoulder pathologies that cause pain and lose of function. This study aimed to compare the effects of kinesiological taping and conventional physiotherapy (CP) on pain, functionality, and disability in SIS patients.

Materials and Methods: The study was completed with 54 patients aged 18-60 years. By randomization, the participants were divided into two groups: The Intervention Group (IG) and the Control Group (CG). While the CP was performed for ten sessions, kinesiological taping was repeated every three days for the IG. The CG was taken to only ten sessions of CP. The CP was applied for 60x5x2 minutes/day/week. Pain severity, function, and disability were assessed before and after the treatment.

Results: There was no difference between the groups in pain severity (p=0.074), function (p=0.565), and disability (p=0.315) scores. On the other hand, there were significant improvements in pain (p=0.001), function (p=0.001), and disability (p=0.005) scores of IG according to intra-group analysis. Similar results were obtained in the CG. However, when the effect sizes of these treatment methods were examined, they did not create a clinically significant superiority compared to each other.

Conclusion: Kinesiological taping has been widely used in patients with orthopedic problems. According to our results, kinesiological taping did not have a clinical effect in reducing pain, improving function and disability when applied with CP compared to CP alone. We think that only kinesiological taping may not be sufficient be an alternative to traditional methods in the early term.

Keywords
Subacromial Impingement Syndrome, Taping, Pain, Function, Disability

INTRODUCTION

Subacromial Impingement Syndrome (SIS) is one of the most common shoulder pathologies that causes pain and dysfunction (Östör, Richards, Prevost, Speed, & Hazleman, 2005). Although the exact etiology is unknown, biomechanical factors that increase the compression force in the subacromial arch are generally emphasized (Turgut, Duzgun, & Baltaci, 2017). Especially the tension of the structures in the posterior shoulder region causes the humeral head to slide both forward and upward in the glenoid fossa, reducing the subacromial space and increasing the compression force on the structures in this region (McClure et al., 2007). The pathophysiological process resulting from increased compression force on anatomical structures and repetitive functional activities causes functional limitations by triggering pain and restriction of movement (Kromer, De Bie, & Bastiaenen, 2010).

Different conventional treatment modalities such as transcutaneous electrical nerve stimulation (TENS), cryotherapy, ultrasound, and exercise are used in the standard treatment of SIS in clinics (Juárez-Albuixech et al., 2021). While

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electrophysiological agents aim to affect the pain and inflammation process directly, the primary purpose of exercise programs is to control the pain and inflammation process by providing biomechanical alignment (Macías-Hernández & Pérez-Ramírez, 2015). In particular, exercise programs are the cornerstone of the treatment plan for pain control and disability relief (Turgut et al., 2017). Exercise programs include scapular stabilization, strengthening of the rotator cuff muscles, range of motion, and stretching exercises (Ravichandran et al., 2020). Studies show that satisfactory results can be obtained in 70-90% of patients after conservative treatment of SIS (Consigliere, Haddo, Levy, & Sforza, 2018). In addition to exercise and electrophysical modalities, another method is taping techniques commonly used in clinics (Şimşek, Balki, Keklik, Ozturk, & Elden, 2013).

Kinesiological taping aims to reduce pain with neural connections, increase their function by supporting weak muscles, and reduce muscle spasms by repositioning the joint (Artioli & Bertolini, 2014). Kinesiological taping helps pain control by reducing inflammation and edema, activating the gate control system and descending inhibitory mechanisms with sensory stimuli, and regulating superficial and deep fascia functions. Therefore, the study's primary aim is to examine the effect of kinesiology taping on pain in patients with SIS. The second goal is to investigate out what effect taping has on disability and functional status.

MATERIALS AND METHODS

Study design and blinding

The randomized controlled study was completed with 54 patients aged 18-65 and the study universe consisted of individuals residing in Istanbul diagnosed with SIS. Before the treatment program and at the end of the 10-session rehabilitation program, the patients were evaluated.

The online randomization software (www.randomizer.org) was used for group distributions, and the patients were divided into two groups: the Implementation Group (IG) and the Control Group (CG). In group CG, only the conventional physiotherapy program (CPP) was applied, but in group IG, the CPP was used along with kinesiology taping.

Due to the nature of the study, blinding could not be done in the treatment practices. All physiotherapy applications were performed by the same physiotherapist.

Participants

The inclusion criteria were (1) having been diagnosed with Type I-II impingement (2) being between the ages of 18-65, and (3) having had no steroid injections in the shoulder region in the last 6 months. The exclusion criteria were: (1) the presence of previous shoulder surgery, (2) neurological and rheumatic disease, (3) Type-1 diabetes, (4) the presence of other orthopedic pathology in the shoulder region, (5) malignancy.

The Medipol University Ethics Committee approved the study with decision number 228. Written informed consent was obtained from all patients and the study was conducted under the Helsinki Declaration.

Interventions

- Conventional physiotherapy protocol (CPP)

All of the patients received CPP five times a week for two weeks, and each session lasted about 60 minutes.

Hot Pack: Hot packs filled with silicon dioxide and kept in special boilers at 65-90ºC were used for 20 minutes to increase local circulation. It was aimed at relaxing the muscles and decreasing the pain with hot pack application.

Transcutaneous Electrical Nerve Stimulation (TENS)

The conventional mode of TENS was used in the study for decreasing the pain. This mode frequency is 60-120 cycles/sec, and the current transition time is 50-100 μsec. The treatment time was applied as 20 minutes.

Ultrasound

Ultrasound was applied to the affected shoulder in a continuous mode at a dose of 1.2-1.5 W/cm2, with full contact technique and at right angles to the rotator cuff area for two weeks, five days a week, five minutes a day. It was aimed at reducing pain, increasing metabolism and using micromassage effects with ultrasound therapy.

Exercises: Codman exercises, pectoral muscle and posterior capsule stretching, wall push-ups, isoflex band exercises were performed under the supervision of a physiotherapist. The exercises were performed from simple to complex during the treatment, taking into account the patient's clinical condition.

Kinesiological taping protocol:

The taping application was performed by a physiotherapist with more than 15 years of clinical experience and trained in kinesiology taping, with more than 5 years of experience.

A 5 cm tape (Ares Kinesiology TAPE) was used for kinesiological taping. Taping was repeated every three days during the entire treatment period. Tapings to the deltoid, supraspinatus, and teres minor muscles were used with the insertio-origo muscle technique. The beginning of the strips was applied to the deltoid and supraspinatus without tension. Taping was performed for all three muscles with a tension of approximately 15-25% on the body of the bands.

The beginning of the Y strip used for taping for the deltoid was glued 3 cm below the tuberositas deltoidea of the humerus. The posterior end of the Y tape was placed on the pars spinalis of the spina scapula while the arm was at 45° flexion, horizontal adduction, and internal rotation. Then, the shoulder was placed in external rotation and hyperextension to place the anterior tail of the band. The lower end of the tape was adhered to the 1/3 lateral of the clavicle without stretching (Figure 1).

Figure 1. Demonstration of kinesiological taping

To provide Y strip tissue tension for the supraspinatus muscle, the shoulder was placed in extension, adduction, and internal rotation, and the head and neck were lateral flexed to the opposite side. Starting 3 cm below the tuberculum majus, taping was performed towards the fossa supraspinata.

The shoulder was placed in an abduction and internal rotation position for the tapping of the teres minor muscle. Then, approximately 15 cm of tape was applied as an I strip. The application site started from the lower part of the greater tuberculum and ended at the margo lateralis of the scapula.

No adverse events occurred during all treatment.

Assessments

Demographic data form

The demographic and social characteristics of the individuals (age, height, weight, gender, educational status, dominant extremity, presence of trauma, stage of pathology) were questioned in the assessment form.

Visual analog scale (VAS)

This scale is the most commonly used scale to describe the severity of pain. Patients are asked to mark the paint severity on a 10 cm line on the scale. 0 represents no pain, and 10 illustrates unbearable pain (Bijur, Silver, & Gallagher, 2001). In this study, rest, activity, and night pain were questioned separately.

Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH)

This is a self-administered questionnaire for patients with upper extremity pathology. The questionnaire shows the pain and functional status of the patients during activities of daily living, and its Turkish validity and reliability have been proven (Düger et al., 2006). The first part of Quick-DASH consists of 11 questions and the scoring is 5-point Likert type. The scoring for each section is between 0-100. A high score indicates high disability.

Shoulder Disability Questionnaire (SDQ)

The score is a 16-item disability questionnaire used in patients with shoulder problems. Based on the last twenty-four hours, patients answer each item in the questionnaire as yes, no, or not applicable. 0 points indicates maximum well-being and 100 points indicates the worst issue (Ozsahin, Akgun, Aktas, & Kurtais, 2008).

Statistical analysis:

The Statistical Package for Social Science (SPSS) 21.0 software package program was used to analyze the data obtained from the study. The normal distribution was determined by Shapiro Wilks and histogram curves. The mean, standard deviation, and percentage were used to express data from parametric variables. While the Independent Sample T-Test was used in the group comparisons, the Paired Sample T-Test was used for intra-group analysis. Statistical significance was accepted as $p<0.05$ in all analyses.

The power of the study was calculated using G*Power 3.1.9.1 software (Faul, Erdfelder, Lang,

& Buchner, 2007). The VAS score of the IG was context, Cohen's effect size was calculated as 1.12. When the alpha error was accepted as 5%, the power of the study was 80% and the allocation ratio of the groups was 1.16, the post-hoc power of the study was 83.15%.

RESULTS

Fifty-four patients included in the single-center study were randomly divided into two groups. There was no difference between the groups in terms of gender distribution (p=0.983), educational status (p=0.151), dominant extremity (p=0.530), presence of trauma (p=0.172), disease stage (p=0.343) and demographic characteristics with categorical variables at baseline. Apart from this, the mean age of the IG was 51.36±7.64 years, while it was 44.20±10.63 years in the CG (p=0.007). The mean body mass index (BMI) of the groups was similar (p=0.411). Demographics are shown in Table 1.

Table 1. Comparison of the demographic characteristics of the participants

Variables	Groups		*p*
	IG	CG	
Gender, *n (%)*			
Female	12 (48.00)	14 (48.00)	0,983[a]
Male	13 (52.00)	15 (52.00)	
Educational Status, *n (%)*			
Uneducated	2 (8.00)	4 (13.80)	
Primary Scholl	14 (56.00)	15 (52.00)	
High School	6 (24.00)	6 (21.00)	0,608[a]
Bachelor Degree	2 (8.00)	3 (10.00)	
Master's Degree	1 (4.00)	1 (3.00)	
Dominant Extremity, *n (%)*			
Right	23 (92.00)	28 (97.00)	0,530[a]
Left	2 (8.00)	1 (3.00)	
Having Trauma, *n (%)*			
Yes	10 (40.00)	17 (59.00)	0,172[a]
No	15 (60.00)	12 (41.00)	
Stage, *n (%)*			
I	6 (24.00)	8 (28.00)	0,343[a]
II	19 (76.00)	21 (72.00)	
	Mean (SD)	**Ort (SD)**	
Age (years)	51.36 ± 7.64	44.20 ± 10.63	0.007
BMI (kg/cm^2)	26.36 ± 4.71	27.56 ± 5.77	0.411

[a]: Fisher'ın Exact Chi Square Test; SD: Standard Deviation; IG: Intervention Group; CG: Control Group; BMI: Body Mass Index

The VAS score was used to assess the severity of pain before and after treatment. Baseline values for night pain (p=0.124), movement pain (p=0.508) and rest pain (p=0.270) were similar between the groups. After the treatment programs, a statistically significant decrease was observed in all the pain scores of both groups according to intra-group analysis (p<0.05) but no superiority over each other in reducing pain intensity (p>0.05) (Table 2).

The results for Quick-DASH scores were similar to the VAS score. According to the results of the inter-group analysis; While Quick-DASH scores of both groups were similar before treatment (p=0.919) and after treatment (p=0.565), significant improvements were observed in Quick-DASH scores of both groups in intragroup analyzes (p<0.05 for both) (Table 2).

The SDQ was used to assess shoulder disability. Accordingly, no significant difference between the groups in the pre-treatment (p=0.655) and post-treatment (p=0.315) SDQ scores were found. However, improvements were observed in the SDQ scores in the IG (p=0.001) and the CG (p=0.001) (Table 2).

Table 2. Comparison of pain, function, and disability status between the groups

Variables	Timeline	Groups		p[a]	ES (*d*)
		IG	CG		
Pain-Night	**T_0**	5.28 ± 3.18	6.69 ± 3.40	0.124	0.03
	T_1	2.32 ± 2.23	3.62 ± 2.90	0.074	
	p[b]	0.001	0.001	-	-
Pain-Movement	**T_0**	7.72 ± 2.03	8.07 ± 1.81	0.508	0.18
	T_1	4.36 ± 2.21	5.14 ± 2.47	0.232	
	p[b]	0.001	0.001	-	-
Pain-Rest	**T_0**	2.96 ± 3.29	3.97 ± 3.31	0.270	0.17
	T_1	1.08 ± 1.75	2.45 ± 2.78	0.330	
	p[b]	0.005	0.031	-	-
Quick-DASH	**T_0**	51.26 ± 14.65	51.79 ± 23.09	0.919	0.13
	T_1	33.08 ± 16.21	36.35 ± 24.79	0.565	
	p[b]	0.001	0.001	-	-
SDQ	**T_0**	76.41 ± 18.44	74.16 ± 18.24	0.655	0.44
	T_1	51.60 ± 25.73	59.17 ± 28.70	0.315	
	p[b]	0.001	0.001	-	-

[a]: Independent Sample T-test; [b]: Paired Sample T-test; ES: Effect Size; IG: Intervention Group; CG: Control Group; Quick-DASH: Quick-Disabilities of the Arm, Shoulder and Hand; SDQ: Shoulder Disability Questionnaire; T_0: First Assessment; T_1: Second Assessment

DISCUSSION

This study investigated the effects of kinesiological taping on pain, function, and disability in patients with SIS. A 10-session CPP was applied to all patients for this aim and every sessions consisted of 60 minutes. In addition, the kinesiological taping that renewed every three days was performed to IG. The most important result of the study is that either kinesiological taping applied in addition to the CPP or conventional physiotherapy reduces the pain intensity of the patients at night, during activity and rest. However, this decrease did not indicate the clinical superiority of the treatment programs compared to each other. According to the different study results, although there was a decrease in both groups' Quick-DASH and SDQ scores, no difference was detected between the groups. When the effect sizes were examined, it was seen that both programs did not create clinical superiority over each other.

The rehabilitation process in SIS patients is mainly maintained with conventional techniques using electrophysiological agents and exercise programs, which are the gold standard (Calis, Berberoglu, & Calis, 2011; Kuhn, 2009). TENS and US, which are the most commonly used electrophysiological agents, and an exercise program were applied to all patients in this study. It is known that ultrasound is used as a pain reliever just like TENS in the treatment of SIS and has positive effects on activities of daily living (Akin, Caglar, Burnaz, & Kesmezacar, 2013). In addition, it was reported that the exercise program effectively reduced pain (Celik, Akyuz, & Yeldan, 2009). For this reason, the CPP of our study consisted of electrophysiological agents and exercise programs. Six of the eleven articles in a systematic review examined the effect of exercise on pain, and five of these studies reported that exercise reduced the pain of patients with SIS (Kuhn, 2009). In the same review, it was reported that exercise also increases functional capacity.
Dilek et al. also observed that the traditional physiotherapy program, which they applied three days a week for six weeks, caused a decrease in the severity of pain in SIS patients (Dilek et al., 2016). Çelik et al. also stated that there is a relationship between shoulder girdle muscle weakness and pain parameter in patients with a diagnosis of SIS (Çelik, Sirmen, & Demirhan, 2011).

In the same study, it was emphasized that SIS might occur due to muscle weakness and muscle weakness may occur due to reflex inhibition. For this reason, strengthening exercises for the shoulder girdle and upper thoracic region constitute one of the most essential pillars of the rehabilitation process. In our results, both treatment methods caused a decrease in pain at night, movement, and rest. However, it was seen that kinesiological taping was not superior to conventional techniques in pain control. We think

that pain reduction in both groups is due to the effectiveness of electrophysiological agents and exercise modalities. TENS, one of the electrophysical agents, is the most widely used analgesic agent that provides pain control by using the gate control mechanism in physiotherapy clinics. Apart from this, improvements in patients' pain control may have been observed due to the thermal effects caused by the applied hot packs and continuous mode ultrasound therapy. In addition, supervised resistance exercises cause improvement in the soft tissues of the shoulder, and this situation increases the stabilization skills of the shoulder. In this way, the narrowing of the distance between the greater tubercle of the humerus and the acromion is prevented. This way, compression of the tendons is prevented and the shoulder moves in normal anatomical positions within the glenoid fossa. In addition, the shoulder girdle muscles wrap the area like a corset, resulting in increased stabilization. Apart from strengthening exercises, stretching exercises also play an essential role in relieving tension in the shoulder capsule and muscles and in reducing pain caused by pressure. We think that the direct effects of both electrophysiological agents and exercise programs on soft tissue may have positively shaped the results of our study.

Kinesiological tapes can maintain their elasticity for 3-7 days (Kase, Wallis, & Tsuyoshi, 2013). In the literature, it is possible to come across studies in which kinesiological bands are changed at different time intervals. For example, in the study of Akbaş et al., taping was repeated every four days, whereas in the study of Pekyavaş et al., banding was changed every three days (Akbaş, Atay, & Yüksel, 2011; Özünlü Pekyavaş, 2013). In another study, the kinesiological tape was changed every two to three days (Thelen, Dauber, & Stoneman, 2008). The kinesiology tape application, which was applied with the insertio-origo technique, was repeated every three days, and Y tape was used for supraspinatus and deltoid muscles, and I tape taping type was used for teres minor muscles in our study. Our results showed a decrease in pain severity in the IG as in the CG, but this decrease was not clinically significant. Şimsek et al. reported that kinesiological taping combined with exercise therapy in SIS was more effective than exercise alone (Şimşek et al., 2013). Patel et al. also compared shoulder stabilization exercises with kinesiological taping, and better results were obtained in the shoulder pain and disability values in the scapular stabilization exercises group compared to the CG (Patel, Bamrotia, Kharod, & Trambadia, 2013). Shakeri et al. also compared kinesiological tape with its placebo effect in pain and pain-free range of motion in patients with SIS (Shakeri, Keshavarz, Arab, & Ebrahimi, 2013). It was concluded that kinesiological taping reduces night pain and instant pain. According to our results, the pain scores of the IG were similar to the CG. Under normal conditions, various mechanisms have been proposed to explain the pain control mechanisms of kinesiological taping. First of all, considering that increased intramuscular pressure causes pain by stimulating the nociceptors, the lifting force created by kinesiological taping on the skin contributes to the reduction of pain by reducing the pressure on the nociceptors. Secondly, it is thought that its neurophysiological effect may prevent the passage of pain at the spinal level with the gate control mechanism. The third is that, as a result of supporting a painful joint with appropriate technique, pain reduction, and functional mobility can be increased. In this study, kinesiological taping used for pain control showed similar results to conventional methods. This may be related to the fact that most of our cases were Stage II SIS and the high number of participants with a history of trauma. On the other hand, the fact that the mean age of the IG was significantly higher than the subjects in the CG may also have contributed to the high perception of pain, which is a subjective emotion.

The pain caused by impingement syndrome in the shoulder girdle impairs daily life activities and physical functions (Gunay Ucurum, Kaya, Kayali, Askin, & Tekindal, 2018). Marzetti et al. also reported improvements in both Quick-DASH and the American Shoulder and Elbow Association Score, which assesses functionality, in patients with stage I impingement syndrome who received conventional physiotherapy (Marzetti et al., 2014). A study comparing traditional physiotherapy, functional shoulder straps, and exercise programs in patients with SIS observed that all three groups had a reduction in pain and improvements in functional status (Walther, Werner, Stahlschmidt, Woelfel, & Gohlke, 2004). Johanson et al. also stated that continuous mode ultrasound application increases the functionality of patients with SIS (Johansson, Adolfsson, & Foldevi, 2005).

According to Yılmaz et al., electrophysiological agents and exercise programs applied five days a week for three weeks are effective treatment methods for patients with SIS (Yılmaz & Tuncer, 2015).

There is a relationship between shoulder pain and functionality and disability level (Hill, Lester, Taylor, Shanahan, & Gill, 2011). Our study found similar improvements in Quick-DASH and SDQ scores after kinesiological taping. Frazier et al. observed positive results in pain, function, and disability parameters with kinesiology taping in their case series with a diagnosis of shoulder pain, subacromial impingement syndrome of the shoulder, rotator cuff tear, and acromioplasty, and they stated that kinesiology taping could be an adjunct treatment to a comprehensive physiotherapy program (Jaraczewska, Long, Frazier, Whitman, & Smith, 2006). Kaya et al. compared a home exercise program with a two-week treatment program consisting of kinesiological taping and physiotherapy modalities. It was observed that kinesiology taping significantly reduced pain after the first week, but at the end of the second week, there was a significant decrease in pain and functionality in both groups (Kaya, Zinnuroglu, & Tugcu, 2011). Shaheen et al. investigated the effects of rigid and elastic taping techniques on scapular kinematics. It has been reported that both taping methods have no impact on scapular kinematics but are effective in movements in the scapular plane (Shaheen, Bull, & Alexander, 2015). Our results showed improvements in the functional levels and disability status of both groups, but this improvement did not differ between the groups. The positive developments observed in both groups at the end of the treatment can be attributed to the effects of TENS treatment on pain, the effect of US treatment on edema and inflammation, and the positive effects of exercises on scapula biomechanics.

According to the results of this study, kinesiological taping, performed in early period of physiotherapy program, did not have a significant clinical effect in reducing pain and improving functional status and disability when applied in addition to CPP compared to CPP alone. In patients with SIS, kinesiological taping alone may not be sufficient as an alternative treatment to conventional methods. However, we think that the effects of banding and different treatment combinations should be evaluated based on the stages of SIS. Changing the taping technique and tension force in future studies may also contribute to the literature.

The study had some limitations. Our research includes the short-term effects of treatment programs. There is a need to investigate the effectiveness of combinations of taping, conventional therapy and different manual therapy applications in the long term.

Declaration of Conflicting Interests

All authors declare no conflicts of interest.

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Ethical Aspect of the Study

The Medipol University Ethics Committee approved the study with decision number 228. Written informed consent was obtained from all patients and the study was conducted under the Helsinki Declaration.

Author Contributions

Study Design: AYO, YB; Data Collection: YB; Statistical Analysis, EŞ, AYO; Data Interpretation: EŞ, AYO; Manuscript Preparation: EŞ, YB; Literature Search: AYO, YB, EŞ. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

Burnout, Anxiety and Coping Attitudes in Parents of Children with Autism Spectrum Disorder

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Abstract
Objective: In this study, the relationship between burnout level, anxiety and coping attitudes of parents with children diagnosed with autism spectrum disorder (ASD) was examined together with demographic variables. **Methods:** Relational model was used in the research. The research was conducted with the parents of 180 children diagnosed with ASD. Data were obtained using the Beck Anxiety Inventory (BAI), Maslach Burnout Inventory (MBI), and the Coping Attitudes Rating Scale (COPE). T Test, One Way Analysis of Variance (ANOVA) and Pearson correlation analysis were used in the analysis of the data. **Results:** In the research findings, it was observed that the burnout level of the parents differed according to the age groups of the autistic children, the number of siblings and the psychiatric disease history of the parents. In addition, it was observed that the anxiety level and coping methods of the parents differed significantly according to the psychiatric illness history of the parents. A strong positive correlation was found between parents' anxiety and burnout levels. A moderate positive relationship was also found between the emotional burnout levels of the parents and their coping levels. **Conclusion:** It was observed that the levels of anxiety and burnout were lower in parents who used the problem-focused coping method. In addition, it has been observed that parents overcome problems by using problem-focused coping methods and this situation affects their lives positively. In addition, it was observed that parents with high levels of anxiety and burnout used dysfunctional coping methods more.

Keywords
Autism Spectrum Disorder, Diagnosis, Parents, Anxiety, Burnout, Coping, Attitude

INTRODUCTION

When every family receives the news of a new born baby, they begin to dream on the basis that the baby will be perfect. However, the birth of a baby with a disability or the emergence of disability in the child in the following years cause the dreams of parents about their children to be destroyed (Varol, 2005) and the existing order in the family to change. In the new arrangement made according to the disabled child, the roles of the parents also change, a troublesome process begins and the parents face many difficulties (Dicle, 2012). Providing care for a child with a disability is a frustrating situation, but it also causes emotional, financial and social difficulties for parents (Dereli and Okur, 2008). Disorder (ASD) is a lifelong developmental disorder that affects not only the individual but also the family. When a child is diagnosed with ASD, parents experience a tremendous sense of loss. The assumption that they are raising a "normal child" is no longer a reality (Norton and Drew, 1994).

Compared to the normally developing child, many behaviours of the child with ASD related to the features of autism cause constant stress to the family and may threaten the general health of the family (Lecavalier et al., 2006). Delays in social and language development, health problems (frequent illness, allergies, etc.), inability to play

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games like their peers, or sleep problems (sleeping in the same bed with their parents, going to bed late) are just a few of these behavioural patterns. Due to socialization and communication problems that may arise from various reasons with the environment (Roxane and Carmen, 2020), having a child with ASD, especially for mothers who are usually in the leading role in child care, causes them to take on much more responsibility and therefore a sense of helplessness, increased anxiety level and stress (Dale et al., 2006). In addition, it is stated that the children of mothers with OSD children are exposed to more stress since they cannot control their children's behaviors despite their physical and mental development (Cahit et.al., 2018).

Just as every child with ASD is unique, each parent's response to a diagnosis of ASD is also unique. However, many parents whose child is diagnosed with a developmental delay are worried about their children and their own lives because they do not have full information about the changes that the diagnosis will cause. The basis of these concerns is the fear of the families against the unknown and uncertain (Üstüner Top, 2009). Mothers with disabled children have stated that their children's dependence on them causes more stress (Uğuz et al., 2004). Although parents know that every child has the right to education, they are aware that the child with ASD does not even have the opportunity to receive distance education without going to a special education institution, and for these reasons, they have a large share in the care of their children (Stambekova et al., 2021). In addition, the presence of additional health problems in the child who needs special care causes parents to experience more stress (Batu, 2011).

Studies show that the disability level of the child with ASD is related to the mother's level of depression, hopelessness and burnout (Benson and Karlof, 2009; Falk et al., 2014; Firth and Dryer, 2013; Kim et al., 2016; Machado et al.,2016). Şengül and Baykan (2012) stated that there is an increase in mothers' rates of, been diagnosed with depression and anxiety disorders in proportion to the decrease in the intelligence level of children. Montes and Halterman (2007) similarly state that the severity of ASD symptoms and the behavioural characteristics of the child are strongly related to parenting stress. A mother with a disabled child may experience constant anxiety about whether or not her child will be able to lead a life alone due to uncertainties about the future of the child and especially if she is unable to care for the child or she dies (Üstüner Top, 2009). It has been stated that it is also related to the child's level of the problem behaviour, level of alienation from social life, dependence on the caregiver throughout his life, anxiety level and financial problems of the family (Benderix et al., 2006; Benson, 2006; Montes and Halterman, 2007).

Although difficulties may occur in the care of the child with developmental delay, developing appropriate coping attitudes can play a role in protecting parents from the consequences of negative situations (Essex et al., 1999; Seltzer et al., 1995). Hasting et al. (2005) stated that the use of problem-focused coping styles by parents of children with ASD enabled them to have a higher level of well-being compared to those who used emotion-focused coping (Hasting et al., 2005). On the other hand, Gona et al. (2016) states that emotional coping with faith or prayer is a prominent approach in some cultures, such as Africa, and parents find solace in the belief that the presence of a child with autism in the family is planned by God.

The effects of having a child with ASD on parents and other family members are as versatile as ASD itself. Raising a child diagnosed with ASD is difficult due to the possible aggression, inattention and impulsivity they may display (Kaminski et al., 2008). It takes a lot of time, effort and patience to meet the high care demands of children with ASD (Vohra et al., 2014). However, parents of children with ASD face high financial burden such as heavy health expenditures, unemployment or job loss (Cidav et al., 2012; Lee et al., 2008). Today, the most important research question about children with ASD revolves around the identification of factors that may contribute to reducing the stress and burden on these families (Hayes and Watson, 2013).

OSD, which is the most common of the pervasive developmental disorders and therefore attracting the attention of researchers, is a long-studied area in the literature. When the studies in this area are examined, it is noteworthy that the concepts of depression, stress, anxiety and coping strategies are frequently studied, especially in parents and teachers with whom the child with OSD is in contact (Al-Oran and Al-Sagarat, 2016; Acar and Karaaslan, 2022; Agyapong et al., 2022;

Al-Farsi et.al, 2016; Ang and Loh, 2019). When studies involving the concept of OSD and burnout are examined, it is particularly striking that teachers are addressed (Aydemir et. al., 2014; Cahit et. al. , 2017; Park and Shin, 2020; Sarıçam & Chios, 2014). However, apart from the difficult educational processes of these children, it was thought that it would be very likely that the diagnosis of OSD could be made at an early age and that their families would experience burnout in the process of caring for the child financially and morally. Anxiety, burnout and coping strategies were discussed together in this study, since it is thought that burnout is not only a concept specific to the field of education, but that parents as well as teachers can feel burnout as much as they can feel anxiety in this process

As in this study, comprehensive knowledge of these factors will facilitate the development of more targeted interventions to assist families. It is thought that with the support given to parents of children with autism, the level of anxiety and burnout will decrease and their negative effects on both other family members and their work lives will be minimized. It is foreseen that the study will also help to identify the deficiencies in the field and to obtain data that will contribute to the realization of new research. Therefore, this study aimed to determine the burnout levels, anxiety and coping attitudes of parents of children with ASD according to some demographic variables as well as the relationship between the variables. In accordance with this aim, answers to the following questions were sought in the study:

- Do the anxiety, burnout levels and coping approaches of parents with an ASD child differ according to the age of the child, the number of siblings and birth order?
- Do the anxiety, burnout levels and coping approaches of parents with children with ASD differ depending on whether the parents have a psychiatric history or not?

Is there a significant relationship between the anxiety levels, burnout levels and coping approaches of parents who have children with ASD?

MATERIALS AND METHODS

Research Model

In this study, it was aimed to examine the anxiety, burnout and coping approaches of parents who have children with ASD. For this reason, the correlational model, one of the quantitative research methods, was used. This model is a research model conducted to determine the relationship and change between two or more variables (Senthilnathan, 2017). Ethical permission for the study was approved by the Near East University Social Sciences Ethics Committee with the licenced no YDÜ/SB/2018/319. Before the study, the consent form was read to the participants, the voluntary basis was stated and signed.

Sample

It was sought for the parents to have a child between the ages of 3-18 and the child to be diagnosed with ASD according to the DSM-V diagnostic criteria. For this reason, it was selected by the criterion sampling method, which is one of the sampling types for sampling purposes. In the criterion sampling method, the sample is formed from people with the characteristics determined on the subject (Büyüköztürk et al., 2022). The sample of the study is a total of 180 parents of children with ASD who attend Special Education and Rehabilitation Centers in Izmir. General information about the children participating in the study is given in Table 1, and descriptive information about the parents is given in Table 2.

Data Collection Tools

Research scales were applied to the parents who voluntarily participated in the study and signed the consent form. In the study, Beck Anxiety Inventory was used to obtain parents' anxiety level data, Maslach Burnout Inventory to obtain burnout data, and Coping Strategies Form to obtain coping attitude data. In addition, a Personal information form was applied to obtain more information about the child diagnosed with ASD and their parents.

Beck Anxiety Inventory (BAI)

This scale, developed by Beck et al. in 1988 and developed to measure the level of anxiety, consists of 21 items. Each item is graded between 0 and 3 points. In this scale, 8 to 15 points indicate mild anxiety, 16 to 25 points moderate anxiety, and 26 to 63 points indicate severe anxiety. The adaptation study of the scale to Turkish culture was carried out by Ulusoy et al. (1998), and it was determined that the Cronbach Alpha reliability coefficient was “0.93” and the test-retest reliability coefficient was “0.57”. Item and score correlations are between “0.45” and “0.72” values (Ulusoy et

al., 1998). In this study, the Cronbach's Alpha reliability coefficient of the scale was found to be 0.93 in the statistical analysis of the 21-item BAI reliability applied to the parents. This value indicates that the scale was applied within the limits of reliability.

Table 1. Distribution of general information about the children participating in the study

	n	%		n	%
Age			Diagnosed age		
3-6 age	63	35	Until 3	118	65.6
7-11 age	92	51.1	Between 4-6	54	30
12-18 age	25	13.9	After 7	8	4.4
Sibling			Additional diagnostic		
None	50	27.8	Yes	50	27.8
1-2	117	65	None	130	72.2
3andabove	13	7.2			
Birth order			Duration of special education		
First	100	55.6	0-2 years	66	36.7
Middle	35	19.4	3-5 years	60	33.3
Last	45	25	More than 6 years	54	30

Table 2. Distribution of parents' relevant general information

	n	%
Age		
20-30 age	21	11.7
31-40 age	100	55.6
Above 41	59	32.8
Gender		
Women	156	86.7
Men	24	13.3
History of psychiatric illness		
Yes	15	8.3
None	165	91.7

Maslach Burnout Inventory (MBI)

The scale developed by Maslach and Jackson (1981) to determine the level of burnout in mothers of mentally retarded children consists of 22 items and 3 sub-dimensions (emotional exhaustion (9), depersonalization (8) and lack of personal achievement (5). The coefficient was determined as 0.93 (Maslach and Jackson, 1981) The first adaptation of MBI to Turkish culture was carried out by Ergin (1992). It has been determined that it contains two factors, namely, personal success. It has been determined that the items belonging to the 'Depersonalization' factor belong to the 'emotional burnout' dimension (Duygun and Sezgin, 2003).

When the reliability analysis of the 22-item MBI Scale applied to the parents in this study was evaluated, it was determined that the Cronbach's Alpha Value was 0.767. The Cronbach's Alpha Value for the emotional burnout sub-dimension of the scale was 0.863, and the Cronbach's Alpha Value for the personal achievement sub-dimension was 0.768. Cronbach's Alpha Values obtained in terms of both the overall scale and the sub-dimensions of Emotional Burnout and Personal Achievement indicate that the scale was applied within the limits of reliability.

Coping Attitudes Evaluation Scale (COPE)

The scale developed by Carver et al. in 1989 was adapted to Turkish culture by Ağargün et al. in 2005. With this scale, it is aimed to evaluate the reaction of individuals when they encounter difficult or overwhelming situations or problems in their daily lives. The scale is in the form of a self-report and consists of 60 questions and 15 sub-dimensions. Active coping, planning, suppression of other occupations, holding back, use of useful social support subscales is classified as problem-focused coping. The use of emotional social support, positive reinterpretation and development, acceptance, joking, and religious coping subscales are defined as emotion-focused coping. Focusing on the problem and revealing emotions, behavioral disengagement, substance use, denial, and mental disengagement subscales is expressed as the least useful dysfunctional coping attitude.

In this study, Cronbach's Alpha Value was calculated as .89. The Cronbach's Alpha Value for the "Problem-focused coping" sub-dimension of the scale was determined as .92, the Cronbach's

Alpha Value for the "Emotion-focused coping" sub-dimension was .76, and the Cronbach's Alpha Value for the "Dysfunctional coping" sub-dimension was determined as .85.

Personal Information Form

In the form developed by the researcher, there are 9 open-ended questions about socio-demographic information about the child with ASD and parents.

Data Collection

The research data were collected from the parents of individuals with ASD between the ages of 3 and 18, who were registered in the Special Education and Rehabilitation Centers in the Buca district of İzmir. Three centers gave permission for data collection. Before the scales were applied in the center, the families were informed about the study and the scales, and the families who wanted to participate voluntarily signed the consent form and the data were collected. Due to the large number of scale items, the applications were made face-to-face with the parents, 2 days a week.

Statistical Analysis

IBM SPSS 24.0 package program was used for data analysis. First of all, the conformity with the data to the normal distribution was determined by the skewness and kurtosis values. The skewness and kurtosis values between +1.5 and -1.5 indicate that the data are normally distributed (Tabachnik and Fidell, 2013). It was determined that the skewness and kurtosis values of the study data were distributed between +1.5 and -1.5 and were in accordance with the normal distribution at the 5% significance level. For this reason, T Test, which is one of the parametric analysis methods, was used in the analysis of the data consisting of two groups. One-way Analysis of Variance (Anova) and Bonferroni multiple comparison analysis were used to compare measurements of more than two groups. Pearson correlation test was applied for parent burnout, anxiety and coping attitudes.

RESULTS

In the light of the demographic information obtained from the participants, there was no significant difference between the parents' anxiety, burnout and coping attitudes depending on the gender of the child, the age group at which he was diagnosed, the status of being diagnosed with an additional disease and the duration of special education. In addition, no significant difference was found, according to the age group, education level, employment status or monthly income of the parents (p>.05). Demographic variables that make a significant difference are indicated in the tables below.

Table 3. ANOVA results according to the age groups of children

Scales	Sub-dimensions	Source of Variance	Sum Sq	df	Mean Sq	F	p
BAI		Btw	412.387	2	206.193	1.597	.205
		Wth	22859.6	177	129.15		
MBI	Emotional burnout	Btw	744.686	2	372.343	3.244	**.041***
		Wth	20318.3	177	114.793		
	Personal success	Btw	87.31	2	43.655	1.312	.272
		Wth	5889.89	177	33.276		
COPE	Problem-foc. cop.	Btw	312.612	2	156.306	1.504	.225
		Wth	18394.6	177	103.924		
	Emotional focus. cop.	Btw	11.448	2	5.724	0.024	.976
		Wth	41603	177	235.045		
	Dysfunctional cop.	Btw	239.216	2	119.608	1.244	.291
		Wth	17021.7	177	96.168		

When the anxiety, burnout and coping attitudes of the parents according to the age status of the children were compared with the one-way analysis of variance (ANOVA) for the unrelated

sample, a a statistically significant difference was found between the groups in the emotional burnout sub-dimension of the MBI according to the age of the children [F(2-177) =3.24, p≤. 05, eta squared (η2) = 0.03]. As a result of the Bonferroni multiple comparison analysis emotional burnout levels of parents with 7-11 years old children ($\bar{X}_{7\text{-}11years}$=34.93) with ASD were found higher than those with 12-15 years old children ($\bar{X}_{12\text{-}18years}$=30.36).

Table 4. ANOVA results according to the number of the siblings

Scales	Sub-dimensions	Source of Variance	Sum Sq	df	Mean Sq	F	p
BAI		Btw	58.037	2	29.019	0.221	.802
		Wth	23213.94	177	131.152		
MBI	Emotional burnout	Btw	122.463	2	61.231	0.518	.597
		Wth	20940.52	177	118.308		
	Personal success	Btw	243.52	2	121.76	3.759	.025*
		Wth	5733.68	177	32.394		
COPE	Problem-foc. Cop.	Btw	247.143	2	123.572	1.185	.308
		Wth	18460.1	177	104.294		
	Emotional focus. Cop.	Btw	1178.541	2	589.27	2.579	.079
		Wth	40435.9	177	228.451		
	Dysfunctional cop.	Btw	11.497	2	5.749	.059	.943
		Wth	17249.45	177	97.455		

As can be seen in Table 4, when the anxiety, burnout, and coping attitudes of the parents according to the number of siblings of the children were compared with the ANOVA analysis, a significant difference was found between the groups in the personal achievement sub-dimension of the MBI [F(2-177)=3.75, p≤ .05, eta squared (η2)= 0.04]. As a result of the Bonferroni multiple comparison analysis the personal achievement levels of the children with no siblings ($\bar{X}_{none}$=35.92) were found to be higher than those with 3 or more siblings ($\bar{X}_{3\text{-}above}$=31.69).

Table 5. ANOVA results according to the birth order

Scales	Sub-dimensions	Source of Variance	Sum Sq	df	Mean Sq	F	p
BAI		Btw	114.357	2	57.178	0.437	.647
		Wth	23157.621	177	130.834		
MBI	Emotional burnout	Btw	231.896	2	115.948	0.985	.375
		Wth	20831.081	177	117.69		
	Personal success	Btw	14.714	2	7.357	0.218	.804
		Wth	5962.486	177	33.686		
COPE	Problem-foc. cop.	Btw	218.769	2	109.384	1.047	.353
		Wth	18488.476	177	104.455		
	Emotional focus. cop.	Btw	1103.852	2	551.926	2.411	.093
		Wth	40510.593	177	228.873		
	Dysfunctional cop.	Btw	814.817	2	407.409	4.385	.014*
		Wth	16446.133	177	92.916		

As can be seen in Table 5, a statistically significant difference was found between the groups as a result of the ANOVA analysis in the dysfunctional coping sub-dimension of the COPE scale according to the birth of the ASD child [F(2-177)=4.38, p≤ .05, eta squared (η2)= 0.04]. As a result of the Bonferroni multiple comparison analysis the last child ($\bar{X}_{last}$=39.93) uses dysfunctional coping strategies more than the first child ($\bar{X}_{first}$=35.39) and median child ($\bar{X}_{median}$=34.31) groups.

Table 6. T-Test results of scale scores according to the psychiatric illness history of the parents

Scales	Sub-dimensions	Psychiatric illness	N	$\bar{X}$	SS	sd	t	p
BAI		Yes	15	44.07	17.08			
		None	165	33.10	10.34	178	3.691	.000*
MBI	Emotional burnout	Yes	15	37.40	15.67			
		None	165	27.68	9.98	178	3.421	.001*
	Personal success	Yes	15	31.80	7.06			
		None	165	34.49	5.62	178	1.736	.084
COPE	Problem-foc. cop.	Yes	15	59.60	12.51			
		None	165	63.04	9.99	178	1.251	.213
	Emotional focus. cop.	Yes	15	48.00	18.80			
		None	165	48.61	14.95	178	0.147	.883
	Dysfunctional cop.	Yes	15	44.73	13.27			
		None	165	35.55	9.12	178	3.58	.000*

Table 6 shows the results of the t-test for unrelated samples, which were conducted to determine whether the parents' history of psychiatric illness had a significant effect on anxiety, burnout, and coping attitudes. Accordingly, the anxiety level is found higher in the parents with a history of psychiatric illness ($\bar{X}_{yes}$=44.07) than the without psychiatric illness group ($\bar{X}_{no}$=33.10) [t(178)=3.69, p≤.05]. At the same time, emotional burnout found higher in the parents with a history of psychiatric illness ($\bar{X}_{yes}$=37.40) than the without psychiatric illness group ($\bar{X}_{no}$=27.68) [t(178)=3.42, p≤.05]. And lastly dysfunctional coping strategies usage found higher in the parents with a history of psychiatric illness ($\bar{X}_{yes}$=44.73) than the without psychiatric illness group ($\bar{X}_{no}$=35.55) [t(178)=3.58, p≤.05].

Table 7. Correlation analysis

			MBI		COPE		
			Emotional burnout	Personal success	Problem-foc. cop.	Emotional foc. cop.	Dysfunctional cop.
BAI		r	**.688****	**-.197****	**-.158***	-0.007	**.329****
		p	.000	0.008	0.034	0.930	.000
	Emotional burnout	r		**-.185***	**-.185***	-0.005	**.425****
		p		0.013	0.013	0.950	.000
MBI	Personal success	r			**.356****	-0.041	-0.119
		p			.000	0.585	0.113
	Problem-foc. Cop.	r				**.179***	0.034
		p				0.016	0.655
COPE	Emotional focus. Cop.	r					**.252****
		p					0,001

As seen in Table 7, the relationship between anxiety, burnout, and the scores they got from coping attitudes was evaluated with the Pearson Correlation test. According to the table, while there is a positive and significant relationship between parents' anxiety scores and the emotional burnout sub-dimension of the MBI (r=0.68, p≤.05), there is a negative and significant relationship between them and the personal achievement sub-dimension (r=0.19, p). ≤.05). On the other hand, there was a negative and significant relationship between parents' anxiety scores and the problem-focused coping sub-dimension of the COPE (r=0.15, p≤.05), while a positive and significant relationship was found between the dysfunctional coping sub-dimension. (r=0.32, p≤.05).

A statistically negative and significant relationship was found between the two sub-dimensions of the MBI (r=0.18, p≤.05). While there was a negative and significant relationship between the emotional burnout sub-dimension of the MBI and the problem-solving sub-dimension of the COPE coping attitude scale (r=0.18, p≤.05), a positive and significant relationship was found between the dysfunctional coping sub-dimension. (r=0.42, p≤.05). A positive and significant relationship was also found between the personal achievement sub-dimension of the MBI and the problem-solving sub-dimension of the COPE coping attitude scale (r=0.35, p≤.05).

While there was a statistically positive and significant correlation between problem-focused coping sub-dimension and emotion-focused coping sub-dimension of COPE coping attitude scale (r=0.17, p≤.05), emotion-focused coping sub-dimension and dysfunctional coping A positive and significant correlation was found between the sub-dimensions (r=0.25, p≤.05).

DISCUSSION

In this study, it was aimed to investigate whether burnout, anxiety and coping attitudes of parents with autistic children differ depending on the age of the child, the number of siblings, the age of the autistic child, and whether the parent has a history of psychological illness. The study also aimed to determine the relationship between coping attitudes, burnout level and anxiety. According to the results obtained, it was determined that the approaches of mothers and fathers to cope with anxiety and burnout levels differ in varying proportions according to some of the socio-demographic characteristics.

Socio-demografic characteristics and variables relations

After the diagnosis of autism, parents face the loss of expectations of having a child with normal development, and this causes them to face uncertainties not only about the future of the child but also about the future of the family (Dale, Jahoda et al., Knott, 2006; Poslawsky, Naber, Van Daalen, and Van Engeland, 2013). In the study, emotional burnout levels of parents with autistic children in the 7-11 age group were found to be higher than those in the 12-18 age group. Similarly, parents with autistic children in the 7-11 age group were found to have higher anxiety levels, although it was not statistically significant. These results show that in families with a child diagnosed with ASD in the 7-11 age group, the anxiety about the future of the child is the highest, and as the acceptance of the disease increases, both the level of anxiety and emotional burnout decrease over time. In the literature it is also shown that diagnosing a child allows parents to cope with this diagnosis and eliminates the guilt associated with attributing the child's behaviour to bad parenting (Mulligan, MacCulloch, Good, and Nicholas, 2012). In addition, parents focus on what they can do for the child as a parent after accepting the diagnosis and the child as it is (Woodgate, Ateah, and Secco, 2008; Dale, Jahoda, and Knott, 2006).

Akarsu & Akgün Kostak (2021) stated that with the increase in the number of children, the responsibility of the mother increases and this may reflect on burnout. Consistent with their study, although the difference was not found to be significant, the level of emotional exhaustion was determined at most in parents with three or more children. In addition, in this study, dysfunctional coping methods were mostly seen in these parents. Based on this result, it can be argued that the parents participating in the study could not develop effective coping strategies due to higher emotional burnout.

Mothers with children with ASD report that their relationships with their children, especially those who do not have a diagnosis of ASD, are of lower quality and inefficient (Nealy, O'Hare, Powers, and Swick 2012). The reason for this situation is that they do not spare enough time for

the normally developing child, do not plan out-of-home social activities for the child, and force the child to grow faster than he or she is ready (Nealy et al, 2012). Consistent with these findings in the literature, in this study, although not at the level of significance, the lowest anxiety level was found only in single-child mothers with children with ASD. In addition, the level of personal achievement was found to be higher in this group of mothers compared to other groups. The fact that the level of anxiety was found to be higher in mothers with more children can be explained by the anxiety of these mothers because they do not spare enough attention and time to their other children, and their anxiety levels increase.

Having a child with ASD leads to either improvement or deterioration in spouse and extended family relationships. In families with a good marital relationship, it is expected that the spouses support each other both emotionally and in daily life for the care of the child, but it is also accepted as an important coping method. It has been observed that receiving support from the extended family in both emotional and daily life is also valuable for parents. The benefits of having family support are supported by the relationship with increased family support with decreased parental stress level and increased psychological well-being found in studies in the literature (Benson and Kersh, 2011; Hartley, Barker, Baker, Seltzer, and Greenberg, 2012). In another study conducted with mothers who have a child with ASD, it was found that with the support provided by grandparents or individuals/organizations that provide special education support, mothers got rid of daily problems and their behavioral problems decreased (Dyches et al., 2016). On the other hand, mothers who describe the worsening of spousal relations attribute this to both the tendency of spouses to blame each other due to the diagnosis, the time and energy they cannot spare for each other for the needs of the child with ASD, and more importantly, the lack of support provided by the fathers in this process (Ooi, Ong, Jacob. and Khan, 2016).

Psychiatric disease history and the variables relations

It has been determined that parents who have a child with autism have increased stress levels or more psychiatric diseases than other families with a disabled or normally developing child. (Estes, Munson, Dawson, Koehler, Zhou, and Abbott, 2009; Ou, Cha, and Wang, 2010). In the literature, it is stated that mothers who are responsible for the care of disabled children are more exposed to stress and their psychological and physical health deteriorates compared to mothers with normally developing children without diagnosis (Lyons, Leon, RoeckerPhelps, and Dunleavy, 2010; Davis and Carter, 2008). In this study, a history of psychiatric illness was seen among the parents at a rate of up to 10%. This rate is very close to Şahin's (2017) rate of psychiatric illness found in mothers with children with ASD and specific learning difficulties. In addition, it was observed in the study that the level of anxiety and emotional burnout was higher in mothers with a history of psychiatric illness. Supporting this finding, Çandır (2015) found that most of the parents with children with ASD and Down Syndrome had a history of psychiatric treatment. In this study, it was observed that parents with psychiatric illness predominantly used dysfunctional coping strategies. Dysfunctional coping strategies play a role in the relationship between stressors and mental disorders (Çandır, 2015).

The variables relations

When the relationship between anxiety and burnout levels and coping approaches of parents who have a child with ASD was examined, it was seen that there was a relationship between parents' anxiety, burnout levels and coping approaches in different directions and at different rates. In the study, emotional burnout levels of parents with high levels of anxiety were also found to be high. On the other hand, it was revealed that the anxiety levels of parents with high personal achievement levels were low. This finding is compatible with Tahincioğlu's (2016) study. According to the literature, anxiety accompanies 15-54% of psychological disorders in parents with a child with ASD (Hastings and Brown, 2002). When a child is diagnosed with autism, it is necessary to find suitable learning centres, which can be costly so that appropriate behavioural intervention can be performed. At this point, insufficient monthly income of the family may also cause an increase in the anxiety and emotional burnout levels of the parents (Tenerife et al., 2022). Bumin et al. (2008) determined that the depression and anxiety levels of parents with children with special needs were in the dimension of psychological support, but necessity, so this situation had negative effects on their quality of life. In addition, the chronic nature

of autism spectrum disorder negatively affects parents and exposes them to the risk of pessimism and burnout (Bristol, 1984; cited in Sivberg, 2002).

As the emotional burnout levels of parents increase, their depersonalization towards having a child with ASD will increase and they will try to cope with the situation by using dysfunctional coping methods. Emotional burnout in parents is an expected result due to the behavior and communication problems that are common in children with ASD (Darıca et al., 2000). The reason for this is that parents have various expectations for their children and if these expectations are not met, they go into emotional depression. This negative situation may lead parents to become desensitized to their children's problems, to see themselves as unsuccessful, and to use dysfunctional coping methods.

Approaches to working with parents who have a child with ASD have changed significantly over the past two decades. Marcus, Kunce, and Schopler (1997) pointed out that there is a link between this change and the recognition of ASD as a developmental disorder rather than an emotional disorder. As part of this shift, parents have become more directly involved in their children's treatment (Harris, 1994). Parents are no longer seen as the cause of their child's problem, but are instead identified as partners in their child's treatment. Parents need functional coping strategies to achieve this new role (Sivberg, 2002).

As the number of children diagnosed with ASD increases all over the world, parents of a child with ASD should be provided with resources to support their use of helpful coping strategies that will help their particular situation and reduce their anxiety and stress levels (Hall and Graff, 2012). Işıkhan (2005) stated that adequate coping resources can reduce the effect of factors that cause potential stress. Problem-focused coping methods are generally used in the presence of positive expectations (Durukan et al., 2010). In this study, in accordance with Işıkhan (2005) and Durukan et al. (2010), it was observed that the levels of anxiety and emotional burnout, which were positively related to each other, were lower in parents who used problem-focused coping. In addition, it was observed that my parents with high levels of anxiety and emotional exhaustion used dysfunctional coping methods more. In parallel with the findings of the study, Işıkhan (2005) stated that when compared to other parents, parents who experienced a great deal of distress used less problem-focused coping methods.

Conclusion and Suggestions

The results of the study reveal once again that ASD affects the whole family and family relationships. For this reason, it is extremely important to address the problems of parents and to give them all the support they need. On the other hand, the development of functional coping skills of parents will contribute to their having sufficient strength in their struggle with this difficult situation. At this point, parents' realizing that their own health is important for them to take better care of their children will cause their anxiety and emotional burnout levels to decrease.

The data obtained in this study are especially important in terms of examining psychological symptoms in terms of effectively exhibiting the necessary psychosocial approaches to parents with a child with ASD. However, in order to test the validity of the data, it is recommended that this study be tested in a larger sample group, including other family members. Another suggestion for future research is to investigate which of the functional coping strategies used by parents of autistic children helps to reduce the level of anxiety more. In addition, studies that can be done by evaluating more factors will help to determine the causes of the problems.

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Conflict of interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

(Date: 10.12.2018; Decision/ Protocol number: YDÜ/SB/2018/319). Participants who volunteered for the study were informed with a written informed consent form.

Author Contributions

Study Design, EU, GK; Data Collection, GK; Statistical Analysis, EU; Data Interpretation, EU; Manuscript Preparation, EU; Literature Search, EU, GK. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

The Relationship Between Clinical Motor and Communication Levels of Children with Cerebral Palsy, And Competencies From Parents' Perspectives

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Abstract
In this study, it was investigated whether there is a relationship between the clinical motor and communication levels of children with CP in terms of physiotherapy and the perceived competency levels from the parents' perspective. The Gross Motor Function Classification System (GMFCS) was used for motor ability level; the Communication Function Classification System (CFCS) was preferred for communication level. The children' communication levels from the parent's perspective were evaluated with the Visual Analog Scale (VAS) and the Katz Index was used for measuring the children' activities of daily living. A total of 110 children with CP (mean age: 6.74±3.48 years) and their caregivers participated in the study. Communication levels were good for 30.6% of the children, and motor levels were good for 27.9% of them. The mean activity of daily living was 9.11±8.52. The child's proficiency level, according to the perspective of the parents, was found to be 6.22±3.29 on average. Positive correlations were found between the level of child communication skills as perceived by the parents, the CFCS level ($r = 0.770$; $p<0.001$), GMFCS ($r = 0.652$; $p<0.001$) and the Katz scale ($r = 0.636$; $p<0.001$). Adherence to treatment and continuity to rehabilitation regularly are important in the physiotherapy and rehabilitation process of children with CP. At the end of our study, it was determined that there was a good correlation between the communication competency. Within the scope of education programs, training parents to follow the development of their children and increase their awareness can increase their treatment adherence.

Keywords
Cerebral Palsy, Motor Level, Communication Skills, Parent Perspective

INTRODUCTION

Cerebral Palsy (CP); Surveillance of Cerebral Palsy in Europe (SCPE) defined it in 2004 as "The condition that develops with brain damage due to any reason before, during or after birth, which is non-progressive but hinders general life activities, in posture and motor development, permanent disorder" (Krageloh-Mann & Cans, 2009). CP; It is a common motor developmental disorder seen in childhood, often accompanied by other medical conditions such as sensory and cognitive dysfunctions. Persistent motor disability and posture disorders are characterized by abnormal muscle tone and movement. This situation limits the activities of daily living of children with CP (Kakooza-Mwesige et al., 2017; Stavsky et al., 2017).

The incidence of CP is 1.5-2.5/1000 in developed countries, and it is among the most common causes of motor disability in childhood (Drougia et al., 2007). In our country, the

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incidence of CP has been reported as 4.4/1000 (Serdaroğlu et al., 2006).

Many risk factors can come to the fore in CP. With the new studies on CP, new risk factors are defined and existing risks are better understood. In the light of current information, general risk factors for CP are defined as premature birth, fetal growth restriction, multiple pregnancies, infections in the fetal or neonatal period, birth asphyxia, perinatal stroke, and congenital developmental disorders (Wood, 2006). In addition, related risk factors are classified as prenatal, perinatal and postnatal (Hankins and Speer, 2003).

Motor developmental delay is prominent in children with CP. However, in addition to motor dysfunction in these children; Communication problems, mobility difficulties, vision and hearing problems, learning difficulties, mental problems, language and speech pathologies, seizures and other health problems are also common (O'Shea, 2008). When SCPE data is examined; It is reported that 31% of children with CP have mental problems, 11% have severe visual disturbances and 21% have epilepsy (Cans et al., 2008).

Motor deficits, communication problems and additional problems that limit daily living activities that can be seen in children with CP affect the quality of life negatively. Thus, it is not only the problem that creates a problem in the child with CP, but also negatively affects the quality of life of the family and/or caregiver, who are primarily responsible for the care of the child. Rehabilitation approaches in CP, a neurodevelopmental disorder; plays an important role in the treatment in terms of the child's motor skills, functional capacity, communication level and participation in life. It is common to use classification systems and scales with clinical validity and reliability tested in the evaluation of these parameters. The Gross Motor Function Classification System (GMFCS) is widely used for defining motor function level and disability level in CP. The GMFCS E/R is easy to use and categorizes children into <2 years, 2–4, 4–6, 6–12, and 12–18 years age groups. So it is preferred by the clinicians. On the other hand, the Communication Function Classification System (CFCS) is a method used to categorize a cerebral palsy patient's everyday communication into one of five categories based on its efficacy. It has five levels that indicate a person's ability to communicate on a daily basis. A person who is familiar with the individual's communication in typical contexts makes the classification on the CFCS. The efficacy of communication between a sender and a receiver of information determines classification. At this point, the most important handicap is the necessity of providing training to this person (caregiver) about the system in advance. Lack of education can lead to under-appraisal. We think that simpler, understandable numerical grading tools can help families and physicians in this regard. In the success of the physiotherapy and rehabilitation process, the family's perspective on treatment, acceptance of the effectiveness of the treatment; treatment adherence and continuation are key points (Leung et al., 2003; Lim and Wong, 2009). To be able to see the effect of the applied treatment and rehabilitative method on the child; Experiencing the motor level developments of the child in daily life can be considered as one of the most important factors that have a facilitating effect on the continuation and compliance with the treatment for the family and the caregiver.

In this study, it was investigated whether there is a relationship between the clinical motor levels and communication levels of children with CP in terms of physiotherapy and rehabilitation, and the perceived competence levels that classified numerical, from the parents' eyes.

MATERIALS AND METHODS

This study was carried out with the participation of 110 children with the diagnosis of cerebral palsy, who were referred to the physiotherapy and rehabilitation unit and volunteered for the study, and their parents responsible for their care.

This study pertains children with CP, aged between 1.5 years and 18 years older. Children with mental retardation, who have additional hearing and speech problems, and who have previously received oral motor therapy were excluded from the study.

The study has been carried out in accordance with the “Helsinki Declaration” and ethically approved by “Clinical Research Ethics Committee” of Marmara University (protocol code: 09.2018.337).

Demographic information such as age (year), gender, and disease-specific data such as cerebral

palsy type and spasticity were recorded before the evaluation of the individuals included in the study. The evaluations to be made of all individuals were explained in detail before they were included in the study.

Children's communication levels were assessed using the Visual Analogue Scale (VAS) (Carlsson, 1983) from the parents' perspective. According to this scale, children's communication level was defined as 0: unable to communicate and 10: no problem in communicating, on a 10 cm horizontal line, including with strangers. Parents were asked to mark their child's communication skills on this 10 cm line. Afterwards, the distance between the marked point and the leftmost point (0 point) was measured with the help of a ruler and recorded.

The Katz Activities of Daily Living (ADL) Scale was created in 1963 by Katz et al. The Katz index was designed to assess children's everyday activities. The Katz index assesses a patient's capacity to do everyday tasks. This scale is the most well-known of the non-disease-specific measures that may be used by a variety of disability groups. It assesses six fundamental activities. The Katz ADL scale is the most well-known non-disease-specific measure that may be utilized by a broad variety of impairment groups. This scale assesses the patient's ability to undertake tasks that he or she must conduct on a daily basis. It assesses the patient's reliance on others in the tasks at hand. It is made up of six questions. If the patient creates each thing independently, he or she receives 1 point; if the patient makes it dependent, he or she receives 0 points. A total score of 6 shows that the patient is self-sufficient, while a score of 0 indicates that the patient is completely reliant (Katz et al., 1963).

The Gross Motor Function Classification System (GMFCS) was developed to categorize children's motor abilities. To define a child's ability level, the GMFCS employs gross motor abilities such as head control, movement transition, walking, running, leaping, and navigating on slopes or uneven terrain. The goal is to demonstrate that a kid can be self-sufficient at home, school, and both inside and outdoors. The GMFCS has levels (level V) that indicate skills ranging from unconstrained walking (level I) to significant head and trunk control impairments that need assistive technology, physical support, and substantial wheelchair usage. The essential condition is that the distinctions between levels be significant in everyday life. The distinctions are based on functional constraints, hand-held mobility, the use of assistive equipment (walker, crutches, or cane), or wheeled mobility devices, and less on movement quality (Palisano ve ark., 1997).

The Communication Function Classification System was used to assess the individuals' communication level/performance in the research (CFCS). The goal of CFCS is to categorize everyday communication performance in people with CP ranging from I to V. The performance of the sender and receiver roles, the communication flow, and the kind of communication partner all influence level separation. The CFCS is based on the World Health Organization's (WHO) worldwide categorization of function, disability, and health, which defines degrees of activity and involvement. When determining the CFCS level, all aspects of communication performance are considered. In CFCS, low values are considered strong communication performance (Hidecker ve ark., 2011).

Statistical Analysis

The SPSS 15.0 (Statistical Package for Social Sciences; SPSS Inc., USA) program was used to analyze the data in the study. For the analysis of the data, the normal distribution characteristics were examined with the Shapiro-Wilk test. Non-parametric data were expressed as percentages and numbers; parametric data were expressed as mean and standard deviation. Spearman correlation was used for investigating the relationship between the parameters. A statistically significant level of $p<0.05$ was accepted.

The sample size was estimated using the G*Power 3.1 software. Using with effect size=0.3, a sample size estimation with 85% power ($\alpha=0.05$) was performed. Assuming 15% drop out, min 107 patients were calculated to be included in study.

RESULTS

Within the scope of our study, 110 children with CP and their caregiver parents were evaluated.

The demographic data of the children included in the study are shown in Table 1.

Table 1. Demographic data of children

Demographic Data	n=110
Age (year) (mean ± sd)	6.74 ± 3.48
Female n (%)	51 (46.4%)
Male n (%)	59 (53.6%)

Most of the children participating in the study had a diagnosis of hemiplegic CP (36.4%). Diagnoses of diplegia and quadriplegia CP followed.

The distribution of 110 children evaluated within the scope of the study by CP types is shown in Table 2.

Table 2. Distinctions of children according to CP types

CP Types	n=110
Diplegic	27 (24.5%)
Hemiplegic	40 (36.4%)
Quadriplegic	22 (20%)
Dyskinetic	3 (2.7%)
Hypoton	12 (10.9%)
Other	6 (5.5%)

Approximately half of the children (48.2%) included in the study had spasticity. Communication level/performance of 30.6% of children; the motor level of 27.9% of them was at a good level. The mean activity level of daily living was 9.11±8.52 (min-max: 0 26).

The child's proficiency level was found to be 6.22±3.29 on average from the perspective of the parents.The CFCS, GMFCS, Katz and VAS evaluation results of the children are shown in Table 3.

Table 3. Children's CFCS, GMFCS, katz and vas results

Scales	Mean ± sd
CFCS (min.-max.; 1-5)	2,54 ± 1,36
GMFCS (min.-max.; 1-5)	2,97 ± 1,54
Katz (min.-max.; 0-26)	9,12 ± 8,53
VAS (min.-max.; 0-10)	6,22 ± 3,29

GMFCS: Gross Motor Function Classification System, CFCS: Communication Function Classification System, VAS: Visual Analog Scale

There is a positive correlation between the parent's perceived communication competence (VAS) and the CFCS level based on clinical evaluation (r=0.770; p<0.001), GMFCS (r=0.652; p<0.001) and Katz scale (r=0.636; p<0.001). relationship was found. The relationship between age, VAS, CFCS, Katz and GMFCS results is indicated in Table 4.

Table 4. Relationship between children's age, CFCS, GMFCS, katz and vas results

	Age	**VAS**	**CFCS**	**Katz**	**GMFCS**
Age	NS	r_s =0,548 p<0,001	r_s =0,632 p<0,001	r_s =0,783 p<0,001	r_s =0,650 p<0,001
VAS	r_s =0,548 p<0,001	NS	r_s =0,770 p<0,001	r_s =0,636 p<0,001	r_s =0,652 p<0,001
CFCS	r_s =0,632 p<0,001	r_s =0,770 p<0,001	NS	r_s =0,719 p<0,001	r_s =0,682 p<0,001
Katz	r_s =0,783 p<0,001	r_s =0,636 p<0,001	r_s =0,719 p<0,001	NS	r_s =0,858 p<0,001
GMFCS	r_s =0,650 p<0,001	r_s =0,652 p<0,001	r_s =0,682 p<0,001	r_s =0,858 p<0,001	NS

NS: Not significant, GMFCS: Gross Motor Function Classification System, CFCS: Communication Function Classification System, VAS: Visual Analog Scale

DISCUSSION

In our study, the relationship between motor and communication levels in children with CP and perceived competence levels from the perspective of parents was investigated. It was determined that there was a positive correlation between the level of communication competence perceived by the parents and the CFCS level based on clinical evaluation.

"Communication" refers to verbal or non-verbal expressions. This includes how easy or hard it is for the child with CP to make decisions, talk about how they feel, or share details about their own experiences. Parents describe their children's ability to express their frustration in various ways when they are unable to use language or express their needs. There are also those who report that their children enjoy being with others and listening to their conversations. Speech and hearing problems are among the problems seen in children with CP, and this may also affect the quality of life of the parents (Yildiz et al., 2016). Coleman et al. In their study with children with CP, they evaluated with CFCS and GMFCS and reported that there is a relationship between motor skills and communication skills in children with CP (Coleman et al., 2015). In addition, the positive effects of including exercises that can affect speech-related oropharyngeal structures in the rehabilitation program were emphasized (Ejraei et al., 2021). The correlation between CFCS, GMFCS, Katz and VAS results in our study supports the literature. Because motor disorders such as spasticity and muscle imbalance seen in children with CP; it restricts activities of daily living such as sitting-standing, walking, dressing, eating. Thus, the evaluation results in those parameters also change in parallel with each other.

Mutlu et al. in their study, the distribution of GMFCS and CFCS according to the different body involvements of children with spastic CP and their relationship with each other were examined. In the retrospective cross-sectional study, 327 children were examined, and it was reported that all classification systems were in a significant relationship with each other (Mutlu et al., 2017). Considering the relationship between CFCS, GMFCS, Katz and VAS in our study, we can say that our data support the literature (Mutlu et al., 2017; Ejraei et al., 2021). Because motor disorders in children with CP affect the functional level of oral motor muscles and cervical mobility. In addition, overcoming the limitations in motor functions or motor development achieved with a normal growth also plays a role in gaining childhood experience and increasing the quality of life. This explains the relationship between the communication skills of children with CP and the level of motor function. As a result, in our study the existence of correlation between classification systems, the level of motor performance and age expresses the skills gained over time with the effect of rehabilitative approaches.

Adherence to treatment and regular continuation of rehabilitation programs are important in the physiotherapy and rehabilitation process of children with CP. At the end of our study, it was determined that there was a good correlation between the communication competence levels obtained from the parents and the clinical motor levels of the children.

The importance of the trainings to be given to caregivers and parents as well as the applications to be made to the patient during the rehabilitation process is known. Having a sick child and knowing the need for support for an unknown period of time also negatively affect parents of children with CP mentally and psychologically. None of the caregiving parents who agreed to participate in this study had a diagnosed psychological problem, however, one of our limitations may be that we did not evaluate the psychological status of the parents. In addition, detailed analysis could not be performed in terms of CP subtypes and age groups. This issue can be investigated with larger sample groups in future studies.

Along the rehabilitation process, being able to support the family and addressing their needs and concerns, as well as raising their awareness of the positive effects of therapeutic approaches on the child, may positively affect the family's continuation of the treatment process and their adherence on rehabilitation. This may be particularly important for families with limited access to rehabilitation centers. Because of the modernization of health systems, some of these families will tend to prefer telerehabilitation applications. The correct guidance of rehabilitation specialists and the correct and healthy completion of the evaluation process will play an important role in the success of the treatment. Of course, we cannot expect parents and caregivers to know

motor assessment methods. However, the relationship of the child's communication skills with the motor gains can be used as a support in this direction.

Based on the relationship we found between the child's communication skills and motor acquisitions, we think that it would be beneficial to inform parents about children's communication skills within the scope of education programs. According to our findings, the Visual Analog Scale (VAS), a simple numerical scale, correlates with the Communication Function Classification System (CFCS), the Gross Motor Function Classification System (GMFCS), and the Katz scale, all of which are valid and reliable clinic assessment tools. With this positive interaction, the VAS can be used as a secondary clinical assessment tool for information from parents. Moreover, gaining the ability to evaluate the achievements obtained in communication with simple numerical scales can also increase the family's awareness of the child's development. Thus, during the rehabilitation process, the child-family-health professional relationship can progress in a healthy way and increase the success of the rehabilitation. In addition, it may contribute to reducing the psychological burden of caregivers with a positive psychological effect.

Conflict of interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

Clinical Research Ethics Committee" of Marmara University (protocol code: 09.2018.337). Participants who volunteered for the study were informed with a written informed consent form.

Author Contributions

Study Design, OA, GEG; Data Collection, GEG, NE; Statistical Analysis, OA, AYÖ; Data Interpretation, OA; Manuscript Preparation, OA, NE; Literature Search, OA, GEG, NE, AYÖ. All authors have read and agreed to the published version of the manuscript.

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RESEARCH ARTICLE

The Investigation of musculoskeletal disorders, sleep quality, and fatigue of frontline healthcare workers during the COVID-19

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Abstract
The purpose of the study is to compare musculoskeletal system complaints, fatique, and sleep quality in front-line and second-line healthcare worker trating COVİD-19 patients. 152 healthcare worker between the ages of 18 and 65 who worked in outpatient clinics, services, COVİD-19 units, or administrative management were included in this study. Healthcare worker who had mission in the diagnosis, treatment, and isolation of patients diagnosed with COVİD-19 were determined as front-line workers (26F, 45M) and healthcare worker who didn't have this kind of mission were defined as second-line workers (40F, 41M). After the collection of the participants "demographic data" the Nordic Musculoskeletal Questionnaire (NMQ), the Fatique Severity Scale (FSS), and the Jenkins Sleep Scale (JSS) were used to assess the participant musculoskeletal pain, fatique, and sleep quality, respectively. A significant difference was found in the training time, job experience, and number of weekly shifts of healthcare workers working on the front-line healthcare workers compared to operating the second-line healthcare workers ($p \leq 0.05$). Front-line healthcare workers reported more neck and back pain, while second-line healthcare workers reported more lower back pain. It was found that front-line healthcare workers had higher levels of fatique severity ($t(150)$: 4.264, $p \leq 0.001$, Cohen's d:0.69), lower levels of sleep quality ($t(150)$: 4.479, $p \leq 0.001$, Cohen's d:0.72). Shift programs should be arranged to reduce fatique and sleep problems of front-line healthcare workers, and protective neck and back muscles exercise programs should be given for front and second-line healthcare workers.

Keywords
COVID-19, Health Workers, Pain, Sleep, Fatigue

INTRODUCTION

In Wuhan, China, cases of pneumonia with an unknown etiology which is now known as COVID-19 have been reported since December 2019 (Li et al., 2020). COVID-19 outbreaks were recorded in the following weeks, and on March 11, 2020, the World Health Organization (WHO) declared the COVID-19 epidemic a global pandemic (Preti et al., 2020). The COVID-19 pandemic led to an excessive hospital overload, a severe shortage of healthcare resources, and an increase in professional workload (Miller et al., 2020). People have been affected due to the pandemic's psychosocial and physical factors. These factors, particularly for healthcare workers, can lead to musculoskeletal disorders.

In the development of low back, neck, and shoulder musculoskeletal disorders, physical and psychosocial workplace factors are crucial (Oude Hengel et al., 2011). Neck and back problems are the most prevalent musculoskeletal system complaints, and individuals who are front-line health workers experience more discomfort than

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others (Arca et al., 2021). Additionally, prolonged workdays and demanding workloads may cause high levels of mental stress and fatigue at work, which may aggravate musculoskeletal disorders (Feng et al., 2016; Tan et al., 2014; Yan et al., 2013). Healthcare professionals report feeling extremely tired and stressed, in addition to worrying about getting sick (The Lancet, 2020). As a consequence of this circumstance, it can be seen sleep disturbances in healthcare workers.

The frequent night shifts, on-call duties, and stress experienced by healthcare workers were frequently known to trigger insomnia and exhibit symptoms of sleep deprivation (Geoffroy et al., 2020; Wu & Wei, 2020). Sleep problems, such as low sleep quality, are common in the healthcare workers because of to high level of workplace stress (Sagayadevan et al., 2017; Thichumpa et al., 2018). Sleep problems among healthcare workers were found between 34-36% during the COVID-19 pandemic (Zhang et al., 2021). Understanding the epidemiology and correlation among health professionals is essential before developing protective measures and alleviating the adverse effects of poor sleep quality (Buysse et al., 1989).

The Covid 19 outbreak has increased the workload of healthcare workers, and this increased workload has had a negative impact on them (Campbell et al., 2001; Chen et al., 2005; Nickell et al., 2004; West et al., 2011). There are few studies investigating the level of fatigue, pain, and sleep of healthcare workers treating Covid patients during the pandemic (Abbas et al., 2021; Dong et al., 2019; Kurtaran et al., 2022; Tengilimoglu et al., 2021). The present study has the potential to develop solutions to improve the conditions of front-line healthcare workers. The aim of the study is to analyze musculoskeletal pain, fatigue, and quality of sleep in healthcare workers who work in front-line and second-line during the pandemic.

MATERIALS AND METHODS

Participants and Procedures

This is a cross-sectional study carried out in private and public hospitals in Adana and nearby provinces. Healthcare workers between 22 to 65 years old who apply treatment, care, and rehabilitation to patients were enrolled in the study. Healthcare workers who are not actively working due to any leave and filling online forms incomplete are exclusion criteria. The study was found ethically appropriate with the decision numbered 61351342/June 2021-07 Non-Invasive Research Ethics Committee of Üsküdar University.

Study Development and Measurements

One Hundred fifty-two healthcare workers who were involved in the administration participated in the study as volunteers in an outpatient clinic, service, Covid-19 unit, or administrative center. They were divided into 2 groups based on their working conditions for this study. One group is front-line healthcare workers who treated, identified, and isolated diagnosed patients with COVID-19 and the other group is second-line healthcare workers who weren't involved in the diagnosis or treatment. There were 45 males and 26 females in the front-line group. There were 40 females and 41 males in the second-line group.

The Demographic Information Form, Nordic Musculoskeletal System Questionnaire (NMQ), Fatigue Severity Scale (FSS), and Jenkins Sleep Scale (JSS) were used to evaluate the participants for the study. Google Forms was used to create the evaluation form. The information was collected by reaching through social media, mail, or smartphone applications (such as WhatsApp, Beep, etc.) Online questionnaires were distributed from smartphone applications from June 2021 to December 2021.

1- Demographic Information Form (Independent Variables)

This form included questions for demographic information. With this form, we recorded gender, age, education, which department he/she works, how many shifts he/she has in a week, how many hours he/she works, which sector he/she works, weight, and height situation.

2- Nordic Musculoskeletal Questionnaire (Dependent Variables)

Nordic Musculoskeletal Questionnaire has Turkish validity and reliability (Kahraman et al., 2016). The NMQ includes standardized questions to evaluate generalized shoulder, neck, and waist musculoskeletal disorders. It evaluates nine different anatomical areas, including the neck, shoulder, elbow, wrist, upper body, lower body, hip, thigh, knee, and ankle/foot, as well as a subjective assessment (pain, discomfort, inconsistency). Scores range from "1-very light" to "10-unbearable" for each body region. If a patient's pain scale increases above a six-point

threshold, there may be a problem with the musculoskeletal system.

3- Fatigue Severity Scale (Dependent Variables)

The Fatigue Severity Scale has Turkish validity and reliability (Gencay-Can & Can, 2012). The cut-off value has been established as 4 and above for patients on a scale with 9 items that he can apply himself. Each item is scored on a range of 1–7 (1= strongly disagree, 7= strongly agree), and the total score is the average of the 9 items it is calculated by taking into account pathological fatigue. The less fatigue the lower the general score.

4- Jenkins Sleep Scale (Dependent Variables)

Jenkins Sleep Scale has Turkish validity and reliability (Duruöz et al., 2018). 4 questions make up this survey, which was performed over the past four weeks and evaluates sleep problems: A tough time falling asleep, a tough time staying asleep, a lot of nighttime awakenings, and an exhausted feeling when you wake up. The Likert scale has six categories: no = 0, 1-3 days = 1, 4-7 days = 2, 8-14 days = 3, 15-21 days = 4, 22-28 days = 5, and so on the total rating ranges from 0 to 20, and an increase indicates sleep disturbance.

Statistical Analysis

The data obtained was loaded into the SPSS v26.0 statistical package. Descriptive statistics were given by frequency, percentage, mean, standard deviation, minimum, and maximum scores. Normality distribution tests were used in the data analysis. The Kolmogorov-Smirnov test was used and the assumptions of normality were made as a result of the analysis, as parametric tests were used because they were provided. The pain scores of the participants were given as a percentage. The relationship between the 2 categorical variables chi-square test was used and to compare 2 independent groups the independent sample t-test was used. The p-value was accepted at a significance level of 0.05.

RESULTS

Participants were divided into 2 different groups (front-line n: 71, second-line n: 81) according to COVID-19 proximity levels at the time of working. The distribution of gender and the Body Made Index (BMI) (p>0.05) was similar in both groups. But, age, educational level, and experience were significantly different between the two groups. Front-line workers were older, experienced, and highly educated. The demographics of the groups are shown in Table 1.

Table 1. Demographic characteristics of participants

		Front-line (n=71)		Second-line (n=81)		
		Mean ± SD	Min - Max.	Mean ± SD	Min - Max.	p
Education level (year)		17.14±2.57	5-21	15.89±2.74	5-21	**0.004****
Experience (year)		15.23±10.61	1-34	8.68±9.14	1-44	**0.000*****
BMI (kg/m^2)		25.47±3.53	20.9-40.4	24.90±5.55	18.3-63.8	0.461
		n	%	n	%	p
Gender	Men	45	63.4	41	50.6	0.113
	Women	26	36.6	40	49.4	
Age	18-25 years	7	9.9	28	34.6	**0.002****
	26-30 years	14	19.7	15	18.5	
	31-40 years	18	25.4	22	27.2	
	41-50 years	15	21.1	10	12.3	
	51-60 years	17	23.9	4	4.9	
	61-65 years	0	0.0	2	2.5	
Number of shifts for a week	Absent	21	29,6	68	84,0	**0,000*****
	Less than 3	43	60,6	9	11,1	
	Much than 3	7	9,9	4	4,9	
Working hours for a week	Less than 48 hours	33	46,5	44	54,3	0,335
	Much than 48 hours	38	53,5	37	45,7	

BMI: Body Made Index, * p value is significant at the 0.05 level, ** p value is significant at the 0.01 level.

Front-line workers had significantly more pain in all their joints for the past 12 months and the past 1 week ($p<0.05$). It was determined that 7-8 out of 10 front-line healthcare workers experienced neck, shoulder, back, and waist pain/discomfort in the last 1 year (table 2).

Table 2. Frequency of musculoskeletal pain and discomfort in joints

	Front-line (n=71)			Second-line (n=81)		
	Have you at anytime during the last 12 months had trouble (ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble?	Have you had trouble during the last 7 days	Have you at anytime during the last 12 months had trouble (ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble?	Have you had trouble during the last 7 days
	%	%	%	%	%	%
Neck	**81.7**	29.6	**59.2**	**51.9**	**24.7**	**29.6**
Shoulder	74.6	19.7	46.5	46.9	**24.7**	27.2
Elbow	46.5	21.1	25.4	27.2	17.3	16.0
Waist/Hand	52.1	19.7	35.2	34.6	19.8	17.3
Back	**80.3**	**31.0**	**63.4**	**64.2**	**35.8**	**46.9**
Low Back	**77.5**	**39.4**	**60.6**	**65.4**	**40.7**	**54.3**
Hip/ Thigh	59.2	22.5	42.3	34.6	18.5	16.0
Knee	59.2	23.9	45.1	37.0	23.5	17.3
Ankle/Foot	57.7	**32.4**	46.5	30.9	19.8	18.5

Front-line workers were found to have significantly more fatigue and sleep problems withth moderate effect size (Cohen's d: 0.69 and 0.72 respectively), (Table 3).

Table 3. Fatigue and sleep problem scores

	Front-line (n=71)		Second-line (n=81)		t	p
	$\bar{X}$	SS	$\bar{X}$	SS		
Fatigue	47.97	11.28	39.51	12.97	4.264	**0.000*****
Sleep Problems	10.94	5.45	7.19	4.89	4.479	**0.000*****

Independent Sample t-test. *p≤0.05. **p≤0.01. ***p≤0.001

DISCUSSION

The aim of the current study was to investigate musculoskeletal pain, fatigue, and quality of sleep in front-line and second-line health care workers. We found that both groups had musculoskeletal pain in particular areas. Front-line health care workers reported more neck pain and secondary care workers reported more back pain. Front-line healthcare workers had higher fatigue levels and worse sleep quality.

In our study, the front-line healthcare workers were older, had high professional training, and their work shifts were significantly higher than second-line healthcare workers. Old age and high shift count are independent risk factors for musculoskeletal problems, fatigue, and sleep problems (Bowey-Morris et al, 2011; Sagayadevan et al., 2017). In our study, the participants were divided into two groups based on their working conditions. Due to the nature of the study, no attempt was made to keep the demographic variables of the two groups similar. Responding to COVID patients requires advanced professional training. For this reason, front-line healthcare workers may be older and more experienced.

One of healthcare workers' occupational health hazards is musculoskeletal diseases

(Caillard & Iwatsubo, 2000). One of healthcare workers' occupational health hazards is musculoskeletal diseases (Caillard & Iwatsubo, 2000). In our research, neck pain was frequent among front-line healthcare workers, while second-line healthcare workers were likelier to experience lower back pain. Healthcare workers usually have musculoskeletal pain in the neck, shoulder, wrist, hand regions, and lower back (Feng et al., 2016; Palalı et al., 2021; Arca et al.,2021).

Associated factors for musculoskeletal disorders could be workload, heavy and awkward lifting, bending or twisting the neck, bending the trunk often, walking or standing a long time, and maintaining shoulder abduction (Dong et al., 2019). Because protective clothing restricts movement and adds weight, it's possible that wearing it while combating COVID-19 caused workers' back pain to worse (Kurtaran et al., 2022). In the current study front-line and second-line healthcare workers had pain in particular areas. Front-line workers had more pain around the neck and second-line health workers had more pain around the low back. Front-line health workers use their upper extremities more frequently during they serve COVID-19 patients. For this reason, they may have more neck problems.

In our study, front-line healthcare workers' fatigue level was higher. The literature shows that healthcare workers have apparently high levels of stress, fatigue, and depression symptoms (Belastungen & Beschäftigten, 2020; Lai et al., 2020; Sertel et al., 2022). In the current study, front-line healthcare workers were older, and have many weekly shifts. These factors may have caused front-line healthcare workers to feel more fatigued.

Our study indicated that front-line healthcare workers had worse sleep quality than second-line healthcare workers. According to the literature, front-line healthcare workers frequently had poorer sleep quality and a higher prevalence of sleep disturbance (Qi et al., 2020; Alshekaili et al., 2020). Chinese researchers reported that 47 out of 123 healthcare workers experienced sleep disturbances (Wang et al., 2020). In the current study, front-line healthcare workers' quality of sleep was bad. The possible reason for this could be excessive workload, weekly shifts, and fatigue level.

Limitations of the Study

Data were obtained from multiple hospitals via an online questionnaire. Health workers who had high complaints about the measurement tools of the study may have participated more. It is recommended to examine the musculoskeletal pain, sleep problems, and fatigue of front-line health workers at different working intensities.

Conclusion

Four out of 5 front-line workers and three out of 5 second-line workers reported experiencing neck, back, and low back pain. Front-line workers experienced higher levels of fatigue and worse sleep quality as a result of this study. The high number of weekly shifts may explain the high levels of pain, sleep disturbance, and fatigue experienced by front-line workers. A high weekly shift count is important as it is a modifiable factor.

Acknowledment

Authors thank all participants who participated in the study.

Conflict of interests

There is no conflict of interest in the present study.

Ethical Consideration

The research fieldwork was conducted with the online survey method after obtaining the ethics committee (Üsküdar University Non-invasive Clinical Research Ethics Committee, Number:06, Date:28/06/2021) approval and the institution's permission. Online consent was obtained from the participants.

Author Contributions

Study Design, TA, SG; Data Collection, SG; Statistical Analysis, TA, DD, SG; Data Interpretation, TA, DD, SG, AÖ; Manuscript Preparation, TA, AÖ, SG, DD; Literature Search, TA, AÖ, SG, DD. All authors have read and agreed to the published version of the manuscript.

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CASE REPORT

Return to Job of A Construction Worker by Comprehensive Functional and Vocational Rehabilitation

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Abstract

Background: Employees in the construction industry perform a variety of tasks. In order to accomplish this work, individuals must repeatedly lift and carry objects overhead. To perform this work efficiently complete shoulder range of motion anad strength of the rotator cuff muscles are important components. Here a patient with displaced two-part fracture of greater tuberosity and rotator cuff tear treated surgically has already reduced shoulder ROM and strength it is leading cause of absenteeism from work. This imposes a greater socioeconomic burden on patient. The purpose of this study was to improve range of motion and rotator cuff muscle strength as he has to resume his work as soon as possible. Case description: The patient was a 37 years old male, a construction worker by profession who sustained a shoulder injury as the result of fall. After the investigations, he was diagnosed with an isolated greater tuberosity fracture and rotator cuff tear. He was treated conservatively for 4 weeks, without success. Later, he was undergoing surgical treatment and referred for physiotherapy. Patient came with complaint of shoulder pain while performing shoulder movement and difficulty in initiating shoulder movement. Early Physiotherapy was given to reduce the pain, and improve strength of rotator cuff muscles and regain the range of motion and vocational rehabilitation.

Keywords
Overhead Activities, Rotator Cuff Tear, Muscular Imbalance, Gleno -Humeral Force Couple, Joint Stiffness.

INTRODUCTION

The occurrence of fracture of greater tuberosity either in the form of isolated fractures or in combination with anterior dislocation of glenohumeral joint. The mechanism of injury is commonly shows history of fall, direct blow to side of the shoulder results in comminuted fracture (Neer, 1970). This fracture subgroup according to Neer's classification system categories these fracture as one-, two-, three- or four-part fracture based on displacement and angulation of the parts which are head, shaft, greater tuberosity and lesser tuberosity (Bang and Deyle, 2000). Most common displacements are superiorly and/or posteriorly displaced. The typical displacement is posterosuperior. 20% of all proximal humerus fractures are caused by isolated fractures of the greater tuberosity. Although radiographs are frequently used in the evaluation of shoulder discomfort following a fall, they might miss an isolated, nondisplaced fracture due to bone overlap or poor alignment. The advanced practise practitioner in these situations must take into account sophisticated imaging of the shoulder to check for a fracture or rotator cuff injury.

With immobilisation and early mobilisation, more than 95% of these fractures can be effectively treated nonoperatively without surgery.

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case of the Displaced two-part fractures of greater tuberosity which are managed with surgical intervention, scarcity of literature exists regarding functional recovery (Green and Izzi, 2003). Surgery is the preferred course of treatment for displaced greater tuberosity fractures, however this may limit shoulder function. Motion restriction and impairment are primarily brought on by rotator cuff muscle dysfunction and impingement brought on by superior or posterior displacement. The purpose of larger tuberosity open reduction and internal fixation is to avoid the greater tuberosity from impinging on the acromion in the near future and to maintain the rotator cuff's physiological functioning. (Goti and Shinde, 2020; La Briola and Mohaghegh, 1975). According to previous research physiotherapy management after the surgical and conservative management of greater tuberosity fracture include joint range of motion exercise to elbow, wrist and fingers also mobilization to shoulder joint as pain permit. Some evidence suggests that friction massage and ultrasonic over the area of tendon helpful to treat the adhesion formation.

MATERIALS AND METHODS

Herein is a case, with associated imaging findings of a posteriorly displaced isolated greater tuberosity fracture of the right humerus.

History

37 years old male, a construction worker (daily wage labourer) with right-hand dominance presented to the orthopaedic clinic with a complaint of shoulder pain and limited range of motion after sustaining a fall, reported as a slip and fall on a door. He explained that he accidently struck his right shoulder on the door latch. He was conscious at that time and had immediate onset of shoulder pain, specifically to the proximal aspect of right humerus that resulted in the inability to raise his arm. So, he went to the orthopaedician where radiographs of right shoulder were taken and subsequently interpreted as a greater tuberosity fracture of the right humerus which was nondisplaced and there was no distal neurovascular deficit. Since it was nondisplaced fracture, he was treated conservatively for 3 weeks using sling and swath thereafter for follow-up, he again consulted an orthopaedician where radiographs were taken and doctor recommended him to continue wearing the sling for another week. After four weeks of conservative management sling and swath was removed. Despite removal of sling after 2 weeks the patient reported continuing lateral shoulder pain and weakness in right hand. Pain was mild and dull aching at rest. Symptoms aggravated with attempted movements of shoulder and difficulty in initiation of the activities with the right shoulder. This pain was described as sharp and focal to lateral shoulder. Patients consulted orthopaedician after the investigations were done, they found the displaced fracture fragment posteriorly (fig no 1,2). As per the advice he underwent for surgical intervention were with open reduction and internal fixation (fig no 3) and immobilized for 2 months.

Table 1. His examination revealed there was pain in right shoulder which was assessed by NPRS

	At rest	On activity Post Treatment
Pre Treatment	2/10	6/10
Post Treatment	0/10	0/10

Table 2. Range of motion – right shoulder

	Pre Treatment	**Post Treatment**
Right shoulder	**Active ROM**	**Active ROM**
Flexion	$0\text{-}15^0$	$0\text{-}170^0$
Extension	$0\text{-}10^0$	$0\text{-}30^0$
Abduction	$0\text{-}15^0$	$0\text{-}160^0$
Internal rotation	$0\text{-}15^0$	$0\text{-}60^0$
External rotation	0^0	$0\text{-}50^0$

Table 3. Manual muscle testing (Conroy And Hayes, 1998)

	Pre Treatment	Post Treatment
Right Shoulder	**Grade**	**Grade**
Shoulder flexor	I	V
Shoulder extensor	I	V
Shoulder abductor	I	V

Table 4. Physiotherapy intervention (Kim and Ha, 2000; Dvir, 1997; Shah and Shinde, 2018).

Early stage - week 1-4	
	Patient education
	Hot moist pack
	Gentle Maitland grade – I II
	Active assisted exercise within pain free range
	Isometric exercise, Desensitization program
	Wand exercise (fig no 8)
	Home exercise programme
Intermediate stage – week 5-8	
	Hot moist pack
	Maitland grade- III IV, Movement with Mobilization (MWM)
	Active exercise in side lying (gravity elimination) shoulder flexion and external rotation (fig no 5,6)
	Multiple angle isometrics – 5 sec holds at 30, 60, 120 degrees
	Shoulder range of motion exercises in scaption
	Grip strengthening exercise
	Home exercise program
Late stage – 8- 12 weeks	
	Above all intervention
	Scapular stabilization exercise – prone T
	Rowing
	Active assisted resisted exercise to shoulder flexors and abductors
	Strengthening of scapular stabilizers
	Grip strengthening exercises
	Endurance exercise for shoulder using low load with maximum repetition
	Home exercise program
Vocational rehabilitation – 12- 20 weeks (Goti and Shinde,2020)	
Work specific activities	
	1. Overhead activities of shoulder
	2. Manual handling of load
	3. Static posture
	4. Repetitive work

The Borg General Scale was utilised to keep track of training intensity. Before beginning the job, the patient was given a brief explanation of the scale. He was asked to rate the training session using the scale when it was over.

RESULTS

There was grade 1 tenderness overlying the greater tuberosity. Range of motion of elbow and wrist were complete. Grip strength was slightly reduced. He was screened for the functional assessment according to ICIDH2 with these findings there was significant impact on his activity limitation (E.g., right shoulder overhead activities, lifting loads and moving one place to another), participation limitations (limitations at work place), participation restriction it is leading cause of absenteeism from work. This imposes a greater socioeconomic burden on patient. Based upon these findings' physiotherapy management was started on 7th September 2021 which was continued for 12 weeks.

This pain was described as sharp and focal to lateral shoulder. Patients consulted orthopaedician after the investigations were done, they found the displaced fracture fragment posteriorly (fig no 1,2). As per the advice he underwent for surgical intervention were with open reduction and internal fixation (fig no 3) and immobilized for 2 months.

By 24 weeks post-surgery the patient demonstrated functional range of motion of right shoulder i.e., 160^0 of shoulder abduction (fig no 9), 170^0 of shoulder flexion (fig no 10) extension 30^0, internal rotation 60^0, external rotation 50^0. Strength (4/5) of his rotator cuff muscles. He was relatively pain free. Now, he can successfully perform overhead activities with necessary strength. In addition to meeting the criteria for returning to work.

Figure 1,2. Plane radiographs findings revealed a displaced fracture of the greater tuberosity.

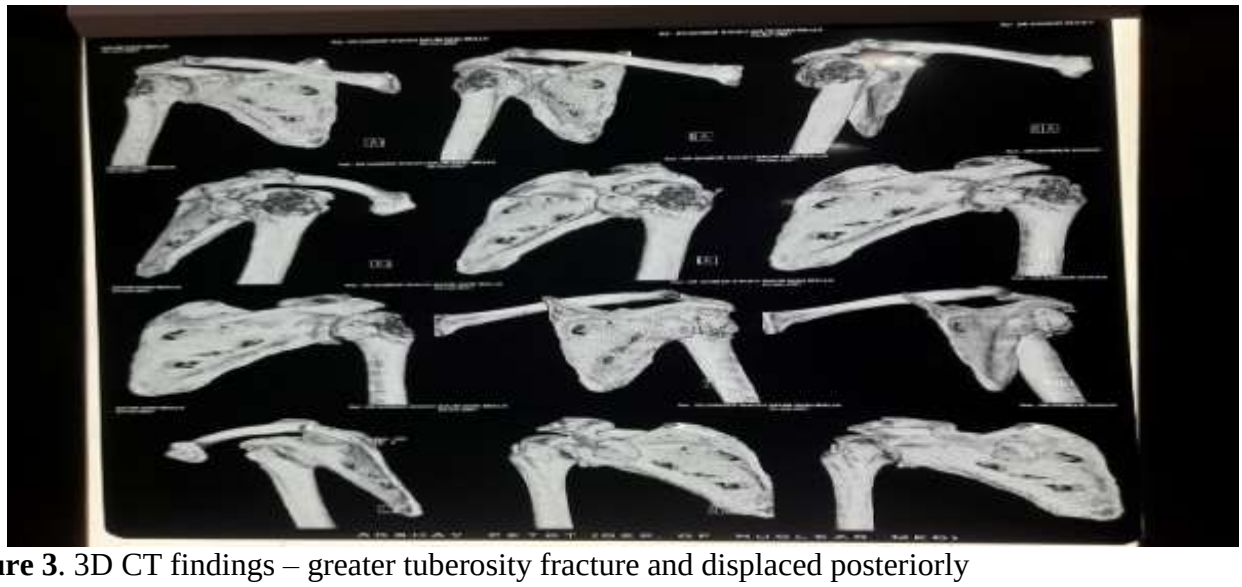

Figure 3. 3D CT findings – greater tuberosity fracture and displaced posteriorly

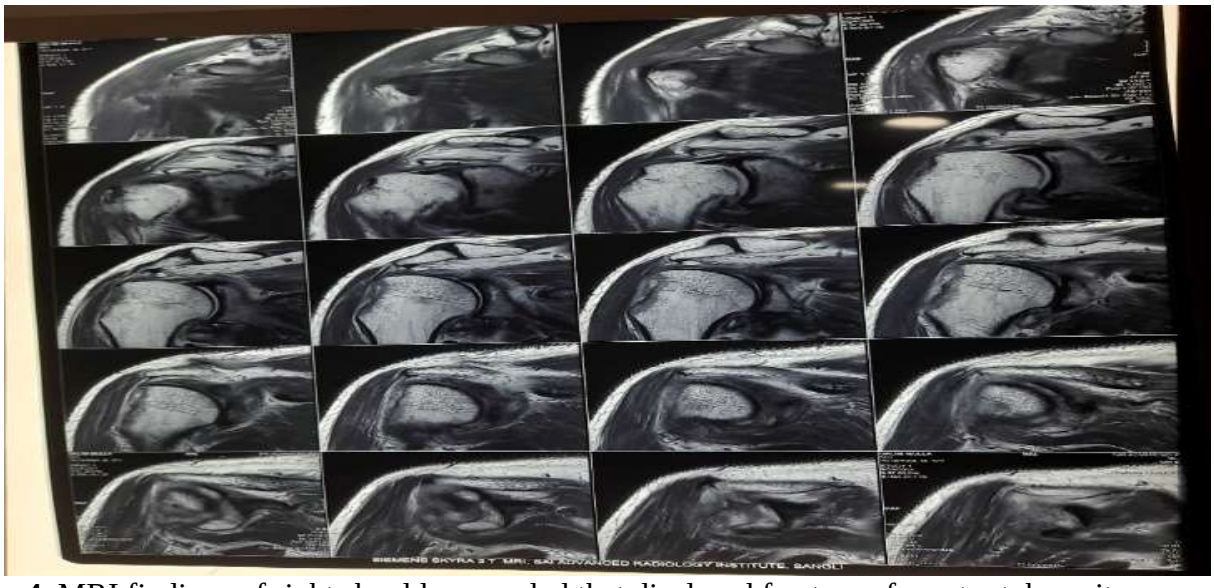

Figure 4. MRI findings of right shoulder revealed that displaced fracture pf greater tuberosity.

Figure 5

Figure 6

Figure 7

Figure 8

Figure 5,6. Active exercise in side lying (gravity elimination) shoulder flexion and external rotation
Figure 7,8. Home exercise program

Figure 9. Shoulder abduction

Figure 10. Shoulder flexion

F**igure 11**. Overhead activities using weight

DISCUSSION

A worker's readiness to work with work-related musculoskeletal disorders can be conceptualized as a complex behavioural change, including physical recovery, motivation, behaviour and being affected by a variety of medical factors, professional and personal as well as insurance systems. It is even more of a financial problem for the worker who is on long-term sick leave. There is evidence to suggest that to facilitate the return-to-work process, clinical interventions need to be linked to the workplace (Kim and Ha, 2000). Vocational rehabilitation program appeared to be more effective in facilitating the return-to-work process of the injured worker as assessed immediately following intervention. The results of our study revealed good functional outcome after physiotherapy intervention.

Generally, fractures of the greater tuberosity requiring surgical intervention are rare is depends upon the amount of displacement of fracture fragment and account for less than 2% of operatively treated proximal humeral fractures (Kim and Ha, 2000; Goti and Shinde, 2020). Only a few number of authors have up to this point provided follow-up information on the surgical treatment of displaced greater tuberosity fractures. At an average of 4.5 years following open reduction and internal fixation, Flotow et al. evaluated 12 patients. They reported on six good and six excellent functional outcomes within 6-8 weeks(La Briola and Mohaghegh, 19975). Radiographs may not reveal a larger tuberosity fracture if it is not displaced, as was the case with this patient. The correct identification of the displaced fracture made possible by the use of cutting-edge imaging techniques like PET CT and MRI let the orthopaedic surgeon design a surgical intervention that would allow for proper healing. The presence of soreness and pain on the lateral wall of the greater tuberosity and limited range of motion in the afflicted shoulder is the only non-imaging examination that has been documented as clinically helpful in diagnosing an isolated

nondisplaced greater tuberosity fracture (Jaju and Shinde, 2019). One could say that greater tuberosity tenderness could also be the result of inflammation of the supraspinatus and infraspinatus tendon at its attachment, either from overuse or as the result of a tear.

The presence of adhesive capsulitis, an anterior labral tear, glenohumeral arthritis, as well as the presence of a tumour may also cause tenderness in this region. Post- operative management for this patient, focusing on arthroscopic surgery for reduction of displaced fracture fragment, rest, maintenance of ROM, symptom-driven progression of rotator cuff strengthening, and a restoration of shoulder function, resulted in a good initial outcome. The patient had functional range of motion, no pain while at rest, and was able to perform all of his normal activities without incident. This programme demonstrated a considerable weakness in the strength of external rotation and abduction. Hence, strengthening exercises are important in improving the functions (Zanetti et al., 1999; Flatow et al., 1991).

The adoption of suitable treatment methods, communication with the referring surgeon's staff, and prompt and effective treatment plans contributed to a positive overall outcome. Workplace based rehabilitation program was done during the 12 to 16 weeks. After 16 weeks, the rehabilitation program was continued with a home exercise program 3-4 times/ week. He returned for reassessment after 24 weeks postoperatively. His range of motion was near normal and overhead movements were relatively pain free , also he had gained strength and he had started his work. Now he is fulfilling the criteria for doing his work at construction site successfully requiring repeated lifting heavy weight.

Conclusion

In this case report of a 37 years male, Construction worker with a displaced right greater tuberosity fracture and rotator cuff complete tear. Postoperatively the comprehensive rehabilitation program consisted of a functional and vocational physiotherapy rehabilitation that decreased its post-operative complications, improved shoulder mobility and strength. All this effects enhanced patients overall shoulder function. He was able to resume his routine pre- operative activities at construction work place successfully.

Conflict of interests

The authors have no conflict of interests to declare. No financial support was received for this study

Ethical Consideration

The study protocol was carried out in accordance with the Helsinki Declaration of 1975 and Written informed consent forms were obtained from all participants prior to the study.

Author Contributions

Sandeep Shinde and Pradnya Ghadage conducted literature review for this manuscript, developed introduction section of the manuscript together with the discussion of the study findings, collected data, and analyzed the data. All the authors read and approved the final manuscript.

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REVİEW

Effect of Physical Activity Interventions in Autism Spectrum Disorder

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Abstract
Autism spectrum disorder (ASD) is a pervasive developmental disorder with limited social and communication skills, and limited and repetitive movements. Motor skills in these individuals may differ compared to their peers. It is known that it creates a special risk group because it increases the risk of heart diseases, diabetes and obesity. It is thought that physical activity will also be effective on individuals with autism in terms of proving that it is an effective tool in reducing these risks in individuals with normal development. Despite the partial success of standard treatment methods for ASD, there has been an increase in recent years that physical activity can have positive effects on children with autism. According to the studies examined, it is stated that physical activity reduces the maladaptive behavior patterns of people with ASD as well as physical development. In the studies reviewed in the literature, it has been determined that participation in physical activity in children with autism reduces stereotypic behaviors. In addition, it has been found that physical activity has positive effects on communication skills, sensory skills and academic skills of children with communication autism. In this review, the effects of physical activity interventions on individuals with ASD are discussed.

Keywords
Autism Spectrum Disorder, Exercise, Motor Skill, Physical Activity

INTRODUCTION

Children with autism spectrum disorder (ASD) have social and behavioral difficulties, which make peer communication and interaction challenging and lower their levels of physical activity. (Siracusano et al., 2021). On the other hand, physical activity provides a crucial setting for enhancing one's health and social interactions. The development of personal health and social skills may therefore be aided by teaching children and adolescents with ASD good and consistent exercise habits. In these children, it may be beneficial to move the adaptation process to physical activity more slowly. In addition, motivation for the activity can be increased by using pictures and similar interests (Iliadis & Apteslis, 2020).

Due to the fact that there is no psychopharmacological treatment that has yet been proven effective to prevent or treat ASD, it is also important to investigate non-drug methods of controlling symptoms. The aim of this study is to review the effects of different physical activity initiatives in children diagnosed with ASD by scanning the related literature. January May 2021, PubMed, Scopus and Web of Science databases were searched for this purpose, and the studies that are available in the databases and examine the effects of physical activity in individuals diagnosed with ASD were reviewed. Review the order, the definition and epidemiology of ASD, autism symptoms, autism treatment practices for the physical and mental health and physical activity in individuals with autism with have been mentioned regarding the effects on physical activity and ASD.

Definition and Epidemiology

Autism is an organic damage that causes perceptual impairment and means "Autos" in

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Greek. Autism, which usually occurs in the first two years of life, is a developmental disorder that inhibits social and communication skills (Kundu et al., 2022). ASD; It is a neurodevelopmental disorder characterized by deviations in social and emotional interaction and communication, restricted and repetitive behaviors, and abnormalities in senses such as hearing, sight, taste, and touch (Klein et al., 2022).

Autism symptoms and their level in these children who have learning and perception difficulties may differ in each child (Leekam et al., 2007). In the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders-5) published by the American Psychiatric Association (APA) in 2013, autism severity levels were examined in 3 ways. These are as follows:

Level 1: Inflexibility in behavior causes significant impairment of functionality in one or more contexts. Has difficulty switching between activities. Editing and design issues prevent it from being independent. Support training is needed.

Level 2: Behavioral inflexibility, difficulty with change, or other restricted/repetitive behaviors occur frequently enough to be seen by an ordinary observer and impair functioning in various contexts. Has great distress/difficulty in changing his focus and action. Intensive supportive training is required.

Level 3: Inflexibility in behavior, excessive difficulty in the face of change, or other restricted/repetitive behaviors significantly impair functionality in all areas. Has great distress/difficulty in changing his focus and action. Significant support training is needed (Diagnostic and statistical manual of mental disorders: DSM-5™, 5th ed, 2013).

Autism is an important neurobiological disorder that is most frequently encountered in clinics, especially after diseases such as cancer, down syndrome and childhood diabetes, which are seen at a high rate in early ages. About 1 in 100 children worldwide are diagnosed with autism spectrum disorder. The most recent estimates of the prevalence of ASD in the United States are 23.0 per 1000 (one in 44) 8-year-old children, and ASD is 4.2 times more common among boys than girls (Maenner et al., 2021).

Due to the interaction and communication disorders of individuals diagnosed with ASD, some problems arise in their behavior patterns (Siracusano et al., 2021). Children with autism typically lag behind their peers in the development of motor functions. Although it is stated by the American Psychiatric Association that individuals with Asperger's syndrome often have impaired motor function, these motor incoordination are commonly seen in all levels of autism.

In a study, it was shown that 41% of children with autism demonstrated clinically lower motor performance (Dewey et al., 2007). It has been stated that some children with Autism reach walking level longer than their peers and may be clumsy in gross motor movements (Gong et al., 2020). In this study, the importance of the participation of autistic children in physical activity on motor competence and problem behaviors in individuals was tried to be emphasized.

Clinical Symptoms of Autism

Especially 12-18 months are critical for early diagnosis in ASD. Recognition of symptoms can be noticed by nurses and doctors during the examination, with information from parents (Crais et al., 2014). Among these symptoms; different obsessions, lack of social communication and interaction in behaviors, stereotyped, limited and repetitive situations; Language used in social interaction and at least one of the deficiencies in symbolic play skills include delays or unusual functionality before the age of 3 (Hyman et al., 2020).

While the rate of manifestation of symptoms becomes more pronounced in 70% of children, it is seen in 30% of children with developmental delay at 18-24 months. According to the Autism and Developmental Disabilities Monitoring Network, the mean age at diagnosis was 50 months (Maenner et al., 2021). Mostly, ASD can be recognized at the end of 2-3 years after the symptoms start to be noticed. The definitive diagnosis cannot be determined by laboratory tests. Children have a very important place in diagnosis by observation method (Lord, 2012). The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) is widely used to aid in the clinical diagnosis of ASD and is currently considered the gold standard assessment tool for ASD. ADOS consists of 4 modules; Which module the case will take is determined by the level of language skill. ADOS-2 also has a baby module. ADOS ensures that the case is evaluated in a social environment as close to reality as possible. After the examination, which takes about 45-60 minutes,

there is an evaluation part of 15-20 minutes. The natural observation environment created between the examiner and the subject during ADOS, when combined with standard games, activities and social situations, allows for the standard evaluation of ASD symptoms. This is an extraordinarily important feature for ASD, whose symptoms are very complex. ADOS Modules 3 and 4 can be applied to adolescents and adults. This is very important in terms of standard evaluation in older individuals, especially in atypical cases (Kalb et al., 2022).

Social communication inadequacies of children are one of the important symptom features of ASD. Due to the inadequacy in social interaction, their imitation abilities are also limited (Kilroy et al., 2022). Diagnosed children have significant cognitive impairments, it is observed that their intelligence level is lower than 70, and they exhibit severe stereotypical movements and destructive behaviors. It is also stated that eating and sleeping problems can be encountered (Guller & Yaylaci, 2022). Although stereotypic situations in behavior are usually evident at the age of 4, they can be observed in some of the children in their second year (Alsayouf et al., 2021).

It is seen in literature reviews that children with autism are prone to gain weight. The prevalence of obesity in children with ASD was found to be 17%. The relative risk of obesity in these children compared to control children was estimated at 1.58 (Sammels et al., 2022). It is stated that the emotional states of children with ASD are more negative than their peers (Martínez-González et al., 2021). The first reports of ASD are generally made by the evaluations of parents and health professionals (Bhat et al., 2014). Unable to respond to voices and smiles, not making much eye contact, and not liking to be cuddled are observed. In language development, it has been observed that children with ASD have not yet developed in situations such as not being able to express meaningful words expected around the age of one, or being able to form a two-word sentence expected from a child who has reached the age of two, having a vocabulary appropriate for their age, and understanding the commands given (Peiris et al., 2022). Children's motor and non-verbal cognitive developmental retardation is accompanied by inadequate social and communication development. Reflecting and sharing emotions (smiling, looking at other people) are limited in facial expressions. The ability to play symbolic games, to make and execute games with each other is limited. Verbal and motor imitation skills are insufficient (Doğan & Çolak, 2022).

The most common behavior problems seen are; While behaviors such as crying, hurtful angry behaviors, tantrums, hair pulling, repetitive movements, clapping hands, running on fingertips, shouting are observed, certain movements in inappropriate situations are observed. At the end of the developmental period of children with normal development, loss of communication and social skills can be observed. Loss of communication and social skills is in 20-35% and usually 13-18. observed in months (Tager-Flusberg et al., 2009). Various psychiatric disorders such as bipolar disorder, hyperactivity, attention deficit, and depression are observed (Hsu et al., 2022).

Autism Treatment Process

Individuals with ASD and their parents require a tailored treatment plan. Intervention may differ depending on age, condition of the child, additional physical and mental disorders, and the treatment to be applied requires a multidisciplinary approach (Frye, 2022). Hormone and gene therapies have gained popularity in the fight against autism in recent years (Benger et al., 2018; Yamasue & Domes, 2018). Despite this, the most commonly used treatment method for autism today is a continuous and intensive special education and rehabilitation program (Migliore et al., 2012).

Treatment targets for autism in the National Institute for Health and Care Excellence (NICE) guidelines; To enable autistic individuals to reach their potential, to treat concurrent physical and psychological diseases that impair the adaptation and functionality of parents or individuals, to support caregivers, to provide education, environmental support and certain evidence-based treatment methods to individuals with ASD (Crowe & Salt, 2015).

Definitive treatment in autism is not possible today, but the most effective and promising approaches in reducing basic problems are educational, habit-forming approaches and rehabilitation programs that are started at an early age with the required time and intensity. Social and physical activities among individuals with special needs, especially for autistic individuals, have an important place in the formation of a more effective, healthy communication and social

development in the treatment and rehabilitation phase of these children (Memari et al., 2015).

ASD and Physical Activity

Physical activity (FA) has a wide range of definitions in the literature. Every movement that requires the use of skeletal muscles and the energy we need while these muscles are working is defined as a physical activity (Thompson et al., 2012). Baltacı et al., on the other hand, defined PA as activities that occur with energy expenditure by using muscles and joints in daily life, increase heart and respiratory rate and result in fatigue at different intensities (Baltacı et al., 2008).

Regular physical activity increases muscle strength and endurance, as well as increases capillary density (Rosenblat et al., 2022). Physical activity; It supports the individual to maintain proper posture, strengthens physical performance by increasing bone density and connective tissue density. In addition, it decreases the reflex-reaction time by increasing muscle flexibility and sensorimotor sensitivity and reflex-reaction ability, thus improving balance control skills (Filar-Mierzwa et al., 2021). Physical activity improves general health status and body composition, and improves cardiovascular, respiratory and Supports metabolic functions. It increases the volume of blood pumped to the body by regulating blood pressure (Lavie et al., 2015). It reduces the risk of early dementia and forgetfulness due to increased blood flow to the brain. It helps weight control by accelerating metabolism (Bek, 2008). Contributing to weight control in childhood and adolescence prevents the obesity problem that may be encountered in adulthood (Chin et al., 2016). Physical activity increases coordination between muscles and develops fine and gross motor skills (Hassani et al., 2022).

PA and exercise are necessary and important in healthy children as well as in children with chronic diseases (Smith et al., 2022). Healthy children should follow the daily 60-minute moderate-to-severe FA recommendations in line with the recommended guidelines. However, establishing the appropriate exercise prescription for children with chronic diseases involves more specialized studies and requires careful assessment of the risks and benefits. Clinicians have difficulties in determining the dose of PA or appropriate PA modes to prescribe to their patients. Similar to pharmacotherapy, the parameters of PA such as frequency, type, intensity and time vary depending on the existing chronic disease and the child's health and physical fitness levels (Shields et al., 2012).

In this period when even children with normal development prefer a more stable and sedentary life, it is an important issue for individuals with autism, who has an important place among individuals with special needs, to participate in and maintain physical activity. In addition to the deficiencies of children with autism in social areas, stereotyped interests and a more sedentary life combine, various negative consequences and disorders can occur in these individuals (Jones et al., 2017).

Children with ASD, who do not have enough strength to reach physical activity opportunities and rights equally or are disadvantaged in terms of resources, actually improve their gross and fine motor functions, healthy developments in the musculoskeletal system, as well as reductions in stereotypical repetitive behaviors and movements, with the exercise programs they participate in. Although they show positive improvement in many aspects such as social communication, it is known that these activities are neglected today (Menear & Neumeier, 2015).

Studies have reported that there are positive developments in the academic achievement and psychosocial aspects of children participating in physical activities. Participation in physical activity and exercise programs is of great importance in individuals with special needs as well as in individuals with normal neuromotor development. It is stated that with participation in physical activity programs and regular exercise programs in trainable mentally disabled individuals, their self-confidence increases again and they establish more effective and healthy social relations with their peers (Aydemir et al., 2020).

Obesity itself is the primary risk factor for heart disease for all ages. It is argued that controlled and gradual weight loss achieved with physical exercise programs gained at an early age in autism will be effective in reducing the risk associated with diabetes, hypertension, hyperlipidemia and cardiovascular disease-related complications (Flygare Wallén et al., 2018). Although success has been achieved with standard ordinary treatments in clinics and rehabilitation centers for the neuromotor development of individuals with autism and many different

treatment methods have been introduced, the idea that exercise and physical activity programs applied to individuals with autism have positive effects on the psychosocial and neuromotor functions of individuals with autism has become widespread day by day (Zoccante et al., 2021). It has been stated that exercise in individuals with autism not only has a positive effect on the musculoskeletal system in these children, but also significantly corrects abnormal stereotyped behavior disorders in these children (Ferreira et al., 2019). It has been reported that participation in physical activity at an early age in children with autism largely corrects the abnormal stereotyped behavior disorders encountered in these individuals. It has also been stated that there is a positive relationship between physical activity and exercises in the social communication skills of autistic children and their success in school (Hilton et al., 2020).

Participation in physical activity reduces stereotyped movements, especially in children with autism (Ferreira et al., 2019). Regular participation in physical activity reduces depression in children with autism, as in all individuals with special needs, and improves their quality of life by improving their psychology. In a program that showed strength and endurance training, nutrition education and stress reduction techniques to create a healthy lifestyle in young individuals with ASD, it was shown that participation in 90-minute classes twice a week for six weeks increased the motivation to participate in exercise and improved mood (Spratt et al., 2018).

When autistic individuals participate in physical activity programs as a group with their peers, there is a great improvement in social characteristics in this autism (Zhao & Chen, 2018). It is stated that exercise and sports activities are generally more beneficial than other fields in socializing and experiencing a sense of academic achievement in individuals with autism. Participation in individual or group-based physical activities is recommended, especially in children with autism, in order to ensure their physical and mental development and to establish good relations in the society (Howells et al., 2019). At this point, the main question is how physical activity should be performed. A meta-analysis comparing individual and group-based exercise programs showed that individual programs had a greater impact on social skills than group programs (Sowa & Meulenbroek, 2012). The disadvantage of individual programs is that they may not be motivational or practical. Another point that should be noted is that special classes consisting of only children with ASD have been shown to be more beneficial for social functionality, improvements in muscle strength and endurance, and motor skill development compared to mixed classes (Healy et al., 2018).

Participation in physical activity and sports activities allows individuals with autism to be in interaction with different people and different places by removing them from the family environment they are used to. Increasing physical activities with sports activities and exercises is a tool that enables individuals with autism spectrum disorder to get away from the family and home life they are used to, in a different environment, to establish new interactions and social relationships with their peers with whom they did not know and communicate before (Iliadis & Apteslis, 2020).

Although ASD is not one of the primary diagnostic categories, it is known that 79% to 83% of children with ASD struggle with age-appropriate motor abilities (Green al., 2009; Hilton et al., 2011). Throughout development and youth, these motor limitations are seen. Children with ASD have also been found to have delays in their fine and gross motor skills, though it is unclear if these delays can be distinguished from more general developmental delays in these kids. (Landa & Garrett-Mayer, 2006; Provost et al., 2007). Regardless of whether there is an intellectual handicap, children with ASD frequently have limitations in their motor activity (Bhat et al., 2011). 97 percent of children with ASD and intellectual disabilities and 70 percent of those with ASD and normal or near-normal intelligence were found to be unable to perform age-appropriate motor skills on a standardized motor test, according to Green et al.,'s cohort study of 101 school-age children with ASD (Green et al., 2009).

Participation in activities that promote the development of age-appropriate social, communicative, behavioral, and cognitive skills may be hampered by difficulty performing age-appropriate motor skills (Bhat et al., 2011). As well as this, motor impairments can reduce participation in physical activity, which is essential to support optimal health and fitness (Srinivasan et al., 2014). Individuals with ASD exhibit low levels

of physical activity. These individuals are more likely to be overweight or obese than their non-ill peers (McCoy et al., 2016).

Due to some motor impairments or variations in other areas that affect how they learn motor abilities, children with ASD may have trouble completing age-appropriate motor skills (Moraes ve et al., 2017). Children with ASD exhibit deficits in postural control, motor planning, and motor imitation, which may negatively impact their capacity to carry out motor activities that are age-appropriate (Hilton & Ratcliff, 2022). 90% of kids with ASD have sensory processing issues, such as tactile hypersensitivity and other sensory modulation abnormalities, which may make it difficult for them to continue participating in the motor activities needed for learning (Trudel et al., 2022). The desired level of age-appropriate motor development is not attained (Hebert et al., 2022). Children with ASD may learn motor skills differently than typically developing children due to social attention deficit (Hu et al., 2022), variations in observational learning (Drill & Bellini, 2022), and anomalies in executive function (Cavalli et al., 2022). It is advised to employ specific tactics, such as designing various workout programs, implementing, and providing feedback in children with ASD, to enhance the learning of motor skills. Strategies to assist the unique social communication, behavior, and interest patterns of children with ASD can be helpful. The use of exergames, hippotherapy, aquatherapy, and other motor activity and motor ability therapies in people with ASD has gained recognition as a particularly fascinating research field in recent years. The table presents studies looking at the impact of these interventions and motor learning variables on the acquisition, retention, and transfer of motor skills. (Table 1-6.)

Table 1. Outcomes of physical activity interventions (Motor Actıvity Intervention)

MOTOR ACTIVITY INTERVENTION								
Author(s) (year)	**Study design, level of evidence**	**Strength of the evidence**	**Participants (Age range and diagnosis)**	N	**Intervention Description**	**Ratio (Instructor : Child)**	**Frequency / Duration**	**Conclusion**
Arzoglou et al. (2013)	Non-randomized clinical trial/III	Weak	16y (mean), ASD	Total n=10 IG=5, CG=5	Traditional dance	1:1-2	34–45min, 3×/wk, 8wks	Children with ASD showed improvements in speed, agility, and body coordination after an 8-week traditional dance program.
Cei et al. (2017	Prospective cohort/IV	Weak	6–13y, ASD	IG=30	Football training program	NR	60min, 2×/wk, 24wk	Children with ASD showed increased balance, rolling, running, and other motor skills after participating in a 6-month football program.
Guest et al. (2017)	Prospective cohort/IV	Weak	8–11y, ASD	IG=13	Multi-sport camp: locomotor and object control skills, then translational sports	1: 3	Full day, 5 days	Girls with ASD had better locomotor and object control skills after attending a 5-day multisport camp.
Zamani et al. (2017	Non-randomized clinical trial/III	Weak	8–12y, ASD	Total n=30 IG=15, CG=15	Gymnastic exercises	NR	45min, 3×/wk, 16wks	Compared to controls, children with ASD showed improvements in bilateral coordination, balance, and upper limb speed and agility after a 16-week gymnastics program.
Sarabzadeh et al. (2019)	RCT/II	Weak	6–12y, ASD	Total n=18	Tai Chi Chuan training	NR	60min, 3×/wk,	A 6-wk Tai Chi training resulted in improved

				IG=9, CG=9			6wks	balance and ball skills of children with ASD, compared to a control group.
Tabeshian et al. (2021)	Non-randomized clinical trial/III	Weak	9.6 y (mean), ASD	Total n=23 IG=11, CG=12	Tai Chi Chuan Training	NR	60min, 3×/wk, 12wks	A 12-wk Tai Chi training resulted in improved non-Stereotypic behavior in the Tai Chi Chuan group. Since there was no discernible difference between the follow-up and the posttest, behavioral change was kept at that point.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

Table 2. Outcomes of physical activity interventions (Motor Skill Interventions)

MOTOR SKILL INTERVENTIONS

Author(s) (year)	Study design, level of evidence	Strength of the evidence	Participants (Age range and diagnosis)	N	Intervention Description	Ratio (Instructor : Child)	Frequency / Duration	Conclusion
El Shemy and El-Sayed (2018)	RCT/II	Weak	8–10y, ASD	Total n=30 IG=12, CG=15	Motor skills and gait training with auditory rhythmic cueing	NR	PT program: 60min, 3×/wk, 12wks; RAS program: 30min, 3×/wk, 12wks	Compared to a control group receiving only motor skill training, children with ASD had improved motor abilities after a 12-week motor skills and gait training intervention with rhythmic auditory stimulation.
Najafabadi et al. (2018)	RCT/II	Weak	5–12y, ASD	Total n=26 IG=12, CG=14	Sports, play, and active	1:3	40min, 3×/wk, 12wks	Compared to controls, children with ASD showed improved balance after a 12-week motor skills program.
Bhat et al. (2022)	Non-randomized clinical trial/II	Adequate	5–15y, ASD	Total n=20 IG=10, CG=10	Motor skill (locomotor, object control)	NR	40min, 2×/wk, 12wks	Gross motor skills were enhanced after a 12-week motor skills program. In kids with ASD, it was linked to social communication and functional deficits. ASD linguistic, cognitive, and functional impairments, as well as the intensity of repetitive behavior, were all correlated with five motor abilities.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

Table 3. Outcomes of physical activity interventions (Hippotherapy and Equine-Assisted Interventions)

HİPPOTHERAPY AND EQUİNE-ASSİSTED INTERVENTİONS								
Author(s) (year)	**Study design, level of evidence**	**Strength of the evidence**	**Participants (Age range and diagnosis)**	**N**	**Intervention Description**	**Ratio (Instructor : Child)**	**Frequency / Duration**	**Conclusion**
Borgi et al. (2016)	RCT/II	Weak	6–12y, ASD	Total n=28 IG=15, CG=13	Equine assisted	1:3-4	60–70min, 1×/wk, 24wks	When compared to a control group, a 6-month equine aided therapy program did not help children with ASD's motor abilities.
Gabriels et al. (2015)	RCT/II	Adequate	6–16y, ASD	Total n=116 IG=58, CG=58	Hippotherapy	1:2-4	60min, 1×/wk, 10wks	Compared to a control group, children with ASD did not exhibit improved motor skills or praxis after a 10-week hippotherapy program.
Rezapour-Nasrabad et al. (2022)	RCT/II	Weak	8–13y, ASD	IG=16	Hippotherapy	1:1-2	45-60min, 1×/wk, 10wks	Comparing children with ASD to a control group, a 10-week program simulating horseback riding led to improvements in visual-motor control, body coordination/balance, reaction speed, strength, speed, and agility.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

Table 4. Outcomes of physical activity interventions (Aquatic Interventions)

AQUATIC INTERVENTIONS								
Author(s) (year)	**Study design, level of evidence**	**Strength of the evidence**	**Participants (Age range and diagnosis)**	**N**	**Intervention Description**	**Ratio (Instructor : Child)**	**Frequency / Duration**	**Conclusion**
Caputo et al. (2018)	Non-randomized clinical trial/III	Weak	6–12y, ASD	Total n=26 IG=13, CG=13	Aquatic skills: emotional adaptation, swimming adaptation, social integration	1:1, then 1:3	45min, 1–2×/wk, 10mo	Children with ASD showed improvements in their motor and swimming skills after a 10-month aquatic program.
Alaniz et al. (2017)	Prospective cohort/IV	Weak	3–7y, ASD	IG=6	Aquatic skills	1:2	60min, 1×/wk, 8, 16, 24wk	Children with ASD had better swimming orabilities after an 8–24 week swim program.
Marzouki et al. (2022)	RCT/II	Adequate	6–7y, ASD	Total n=28 IG1=10, IG2=10, CG=8	Technical aquatic training, game-based aquatic training	1:2	50min, 2×/wk, 8wk	Compared to a control group, children with ASD showed improved stereotyped behaviors and gross motor skills after an 8-week aquatic exercise program.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

Table 5. Outcomes of physical activity interventions (Exergaming Interventions)

EXERGAMING INTERVENTIONS								
Author(s) (year)	**Study design, level of evidence**	**Strength of the evidence**	**Participants (Age range and diagnosis)**	N	**Intervention Description**	**Ratio (Instructor : Child)**	**Frequency / Duration**	**Conclusion**
Edwards et al. (2017)	Prospective cohort/IV	Weak	6–10y, ASD and Typically developing	Total n=30 ASD=11, TD=19	Sports video games (Xbox Kinect)	NR	45–60min, 3×/wk, 2wks	When compared to a control group, a 2-week active video gaming program did not help children with ASD's golf or motor skills.
Travers et al. (2017)	Prospective cohort/IV	Weak	7–17y, ASD	IG=29	Balance video game (Xbox Kinect, Nintendo Wii)	NR	60min, 3×/wk, 6wks	Children with ASD had better balance after participating in a 6-week biofeedback-based video game balance training program.
Lau et al. (2020).	Prospective cohort/IV	Weak	8–18y, ASD	Total n=203 IG=125, CG=78	Sports video games (Xbox Kinect)	NR	30min, 1×/wk, 12 wk	Children with ASD demonstrated increased strength, speed, and agility over a 12-week exergaming program.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

Table 1. Outcomes of physical activity interventions (Effects of Motor Learnıng Variables on Motor Skıll Acquısıtıon, Retentıon, And Transfer)

EFFECTS OF MOTOR LEARNING VARİABLES ON MOTOR SKILL ACQUISITION, RETENTION, AND TRANSFER								
Author(s) (year)	**Study design, level of evidence**	**Strength of the evidence**	**Participants (Age range and diagnosis)**	N	**Intervention Description**	**Ratio (Instructor : Child)**	**Frequency / Duration**	**Conclusion**
Taheri-Torbati and Sotoodeh (2019)	RCT/II	Weak	9–13y, ASD and TD	Total n=48 IG1: ASD=12, TD=12; IG2: ASD=12, TD=12	Throwing task with video versus live modeling instruction	1:1	17 training blocks in 2days with retention after 1wk	Children with ASD and children with typical development acquired and retained an arm coordination pattern similarly after a 2-day throwing activity that alternated between film and live modeling.
Tse (2019)	RCT/II	Strong	9–12y, ASD	Total n=65 IG1=22, IG2=22, CG=21	Throwing task with internal versus external attention of focus	NR	1× with retention/ transfer the next day	A throwing exercise with an internal attentional focus compared to an external focus and no focus produced similar skill acquisition across all groups, but the internal focus group saw better retention and transfer of ASD children than the other groups did.
Baniasadi et al. (2022)	RCT/II	Weak	16–19y, ASD	Total n=48 IG1=16, IG2=16, CG=16	Basketball-shooting task	NR	1× with retention/ transfer the next day	A modified basketball shooting task resulted in improved retention and transfer with instruction children with ASD.

ASD: autism spectrum disorder, CG: control group, IG: intervention group, min: minutes, mo: months, N: number, NR: not reported, RAS: rhythmic auditory stimulation, RCT: randomized clinical trial, TD: typically developing, wk(s): week(s), y: years.

DISCUSSION AND CONCLUSION

Participation in physical activity provides psychosocial improvements such as decreases in stress, anxiety and anxiety levels in individuals with autism, as well as increases in self-anxiety, socialization, self-confidence and sense of achievement (Menear & Neumeier, 2015). At the same time, participation in physical activity reduces the risk of death and disease in these individuals due to diseases such as diabetes, obesity, cardiopulmonary diseases; leads to increases in motor function, muscle strength and physical fitness levels (Zoccante et al., 2021). There is no one-size-fits-all approach to determining and implementing exercise programs for individuals with ASD. Each individual may have different interests, proficiency and understanding of exercise. It is important to understand the individual with ASD as well as possible before starting the program. For instance, interventions to improve strength should adhere to the prescribed frequency, intensity, and duration of resistance training (Sowa & Meulenbroek, 2012). When working with children who have ASD, it is also advised that educators and medical professionals follow exercise guidelines and education programs (Shields et al., 2012). The goal of the intervention should be to alter at least one of the body's structures and functions, and experts should recommend an exercise and physical activity regimen.

It is well recognized that the mechanisms behind the acquisition and generalization of motor abilities in kids and adults with ASD differ from those in healthy people, necessitating the employment of various learning techniques for the best results (Moraes et al., 2017). Our results support the use of verbal and visual instructions to enhance the development of motor skills in ASD kids (Table 1.).

It is suggested that future research should concentrate on the efficiency of the teaching technique and types of feedback given the disparities in social communication of children with ASD (Zhao & Chen, 2018). Certain motor learning strategies may perform better or worse depending on the individual. Participants in research studies with ASD should be accurately characterized. For planned activity practices, it is recommended that educators and clinicians take into account the principles of motor learning when providing Depending on the person, some motor learning techniques may work better or worse. For planned activity practices, it is advised that educators and clinicians take into account the principles of motor learning when providing interventions to children with ASD and document the child's reaction to determine the effectiveness of the intervention. Participants in research studies with ASD should be accurately characterized (Shields et al., 2012).

The literature has offered a variety of specific recommendations to encourage children with ASD to engage in exercise and physical activity programs (Srinivasan et al., 2014). It is crucial for future research that the methods utilized to support children with ASD be thoroughly documented. Future studies are required to determine the efficacy of these methods for encouraging children with ASD to engage in physical activity. It is important to carefully assess and record the methods educators and clinicians employ to maximize their engagement in physical activity and exercise treatments (Srinivasan et al., 2014).

Physical activity and exercise programs have been shown to enhance some motor outcomes in children with ASD, including activity, body structure, and body function. (Table 1.). The general quality of this evidence is, however, poor. The study population should be thoroughly described, the sample size should be adequate, the intervention and control conditions should be characterized using guidelines and protocols, and the major outcome measures should be clearly defined and predicted to change as a result of the intervention. The impact of motor learning strategies on the development and transfer of motor skills in children with ASD is becoming more and more clear. The impact of physical activity and exercise interventions on social, behavioral, and cognitive skills will be clarified by more research in this field.

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Conflict of interests

The authors have no conflict of interests to declare. No financial support was received for this study.

Author Contributions

The entire work plan was performed by the author (Study Design; Data Collection; Data Interpretation; Manuscript Preparation; Literature Search)

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