CBÜ Beden Eğitimi ve Spor Bilimleri Dergisi
CBU Journal of Physical Education and Sport Sciences
Volume: 20, Issue: 1, 2025
E-ISSN: 2149-1046
DOI: 10.33459/cbubesbd.1487187
URL: https://dergipark.org.tr/tr/pub/cbubesbd

Relationship Between Exercise Behavior Change, Physical Activity Levels and Healthy Eating Attitudes in Individuals Using Mobile Phone Applications

Yağmur YILDIZ[1*]
[1]Aksaray University Sport Sciences Faculty

Research Article
Received: 20/05/2024 Accepted: 02/09/2024 Published: 31/01/2025

Abstract

This study aimed to examine exercise behavior change, physical activity levels and attitudes toward healthy eating among individuals who perform physical activity using HisApp mobile phone application. The present study was conducted with 246 participants (144 male and 102 female) using the HisApp application (mobile application of the Turkish Sport for All Federation). The weight, height, levels of physical activity and body mass index of the participants were recorded. An exercise behavior changes questionnaire, and a healthy nutrition attitude scale were administered to the participants through Google online survey. Findings showed that exercise behavior changes sub-dimensions and Health Attitude Scale sub-dimensions have a positive correlation. Physical activity positively affects healthy eating attitude sub-dimensions, while no effect was observed on knowledge about nutrition, feelings about nutrition, and malnutrition. The stages of exercise behavior change were related to the attitude scale toward healthy eating. There was a significant positive correlation between physical activity level and positive nutrition variables and a significantly negative correlation with malnutrition ($p<0.05$). This research concluded that positive attitudes towards healthy eating and encouraging people to make healthier choices can be attributed to a combination of education, accessibility, social norms, individual variables, and environmental factors. Additionally, it was found that individuals using the HisApp physical activity mobile application on their phones showed positive improvements in exercise behavior changes.

Keywords: Mobile phone application, Exercise behavior change, Physical activity, Nutrition

[*] **Corresponding Author:** Yağmur Yıldız, **E-mail:** yagmurryildiz@hotmail.com

INTRODUCTION

Being active is one of the most important activities that individuals of all age groups can do to improve their health. Physical activity is very important in maintaining well-being and maintaining general health. Planned physical activity provides many health benefits, such as increased muscle strength and endurance, improved cardiovascular health, better mental health, and a reduced risk of chronic diseases like obesity, certain types of cancer, and diabetes (Posadzki et al., 2020). The World Health Organization (WHO) recommends that individuals aged 18-64 engage in at least 150 minutes of moderate-intensity aerobic exercise and 75 minutes of vigorous-intensity aerobic exercise per week (Bull et al., 2020). Planned physical activity has been proven effective in reducing and preventing the risk of stroke, chronic heart disease, diabetes, and certain types of cancer, namely non-communicable diseases (Sabe et al., 2022). Additionally, it provides protective factors for mental health and supports maintaining a healthy body weight and living conditions. Physical activity, which is one of the most important activities for an individual's health, is indispensable. Today, inactivity has become a growing global problem (Bertram et al., 2019). In the past twenty years, there has been a significant increase in research on the health impacts of physical inactivity, and the list of non-communicable diseases strongly associated with physical inactivity has expanded considerably (Katzmarzyk et al., 2022). There is a need to develop cost-effective and feasible lifestyle interventions for individuals to lead a healthy life. In this context, changes should occur in the exercise change behaviors of individuals (Tarp et al., 2024).

In the Trans-Theoretical Model (TTM), which is the most common model for the change of exercise behaviors, the main target is that individuals exercise and have been exercising for more than 6 months. The model also states that process is an important factor in behavior change and it is appropriate to examine behaviors in terms of process rather than outcome. TTM is used as a guide in facilitating behavior change and ensuring progress in the exercise (Senna and Ünlü, 2021; Zare et al., 2020).

Regular physical activity and a healthy eating attitude can help improve general health and quality of life in all age groups. Factors influencing healthy eating habits include in-depth food knowledge and education, meal planning, participation in meal preparation, and physical activity (Sogari et al., 2018). The widespread usage of mobile health applications today is another aspect that influences people's regular physical activity and nutritional attitudes (Kim and Seo, 2020). Healthcare professionals widely use these applications to demonstrate health behavior change and improve health outcomes. Mobile health interventions seem to be an effective way to improve young people's health behaviors (Fedele et al., 2017). Although the use of mobile phone applications for physical activity is getting popular day by day, there is a limited amount of research examining the impact of such applications on exercise behavior change, physical activity levels, and attitudes toward healthy eating.

The development of fitness technologies is expected to include beneficial behavior changes in society. Therefore, healthy behaviors such as increased activity, goal setting, self-monitoring, feedback, rewards, social support, and coaching strategies are important for changing exercise habits. More research is needed to determine the effectiveness of mobile health apps in preventing chronic diseases as their use is increasing. Many risk factors,

including stress, obesity, alcohol and tobacco use, physical inactivity, high blood pressure, and high cholesterol, play a significant role in the prevalence of chronic diseases (Chiu and Cho, 2021). Even while the paper may not specifically cover every risk factor contributing to the growth in the frequency of chronic diseases, it is crucial to remember that mHealth apps can have a wider impact on general health and chronic disease prevention than just physical activity and diet. Therefore, this study aimed to investigate exercise behavior change, physical activity levels, body composition, and attitudes toward healthy eating among individuals who use mobile phone applications for physical activity. We hypothesized that individuals who use mobile phone applications for physical activity could exhibit positive exercise behavior change, have higher physical activity levels, and show positive attitudes towards healthy eating. Additionally, there is expected to be a positive relationship between exercise behavior change and attitudes toward healthy eating, and regular exercise could be associated with positive body composition outcomes.

METHOD

Study Design and Participants

This research was conducted with a total of 246 people aged between 18-45 years (144 male and 102 female) who use the HisApp application, the mobile application of the Turkish Sports Federation for All (TSFFA). HisApp is free for all users and an open-source product available at no cost to subscribers. Participants have used the HisApp at least 3 times a week minimum of 60 minutes a day. They already downloaded to their mobile phones and only active users were included. Study permissions were obtained from TSFFA to implement the research questions. In addition, to reach individuals TSFFA backed up the research by providing the data. Participants complete the scales outside of the app interface via Google online survey. The criteria for participation included continuous use of the HisApp application, absence of any health issues, and voluntary participation. G*Power 3.1.9.4 software was used to determine the sample size. Power analysis was conducted based on existing data from similar studies. In the power analysis, the alpha significance level (Type I error) was set at $\alpha=0.05$, effect size=0.5, and the desired power value (Type II error) was $\beta=0.95$. An effective width of $|\rho|=0.1$ was accepted to ensure the validity of the study. Consequently, the minimum number of participants included in the study was determined to be 192.

Ethical Approval

Ethics approved by the Aksaray University Research Ethics Committee [E-34183927-000-00000640011]. The present research conforms to the standards of ethics outlined in the Declaration of Helsinki.

Data Collection Tools

Height and Body Weight/Body Mass Index (BMI): The weight, BMI, height with levels of physical activity of the participants were recorded via HissApp mobile application.

Physical Activity Level: The daily twenty-four-hour step count was measured through the pedometer program in the HisApp application, and the level of physical activity was determined. The study defined a step index concept for healthy adults as follows: 1) Daily <5,000 steps ('sedentary'); 2) Daily 5,000-7,499 steps ('low active'); 3) Daily 7,500-9,999 steps ('somewhat active'); 4) Daily ≥10,000-12,499 steps ('active'); and 5) Daily ≥12,500 steps ('highly active'). According to these definitions, activity levels can be categorized as 'sedentary', 'low active', 'somewhat active', 'active', and 'highly active' (Tudor Locke et al., 2011; Tudor Locke et al., 2008).

Exercise Behavior Levels of Change Questionnaire (EBCQ): Physical Activity Exercise Behavior Levels of Change Questionnaire (EDDBA) was first developed to determine exercise behavior steps (Marcus & Lewis, 2003). The Turkish version of validity and reliability study was adopted (Cengiz, 2007; Cengiz et al., 2010; Marcus & Lewis, 2003). Yes/No answers were given to 4 items in the questionnaire by the participants. The participants' habits of participating in exercise and their intention to exercise were divided into 5 different exercise behavior levels using algorithms according to their answers to these items. These stages are; pre-thinking, thinking, preparation, action and maintenance. (Cengiz, 2007; Marcus & Lewis, 2003). Subjects were also asked whether they had engaged in regular physical activity over three years at a level that could be characterized as continuity. In the survey, pre-contemplation is the first phase of exercise behavior change. This stage defines the person who does not perform the relevant behavior (such as exercise) and does not intend to do it in the future have no idea about exercising in the next six months. These individuals need support in perceiving the importance of physical activity in promoting their health and obtaining relevant information about what to consider when active. Individuals who can't spare time to exercise most of the time can be helped with time management. Individuals who can not spare time to exercise most of the time can be allowed with time management. Contemplation is the second phase. This stage defines the person who did not do the behavior of interest but plans to do the behavior in the near future. The individual should be encouraged to take the necessary action at this stage. (Çeker et al., 2013). The third phase is the Preparation phase. The preparation trend aims to create a weekly work program that is essential for increasing the physical activity level of the inactive individual. The person should be informed about the frequency, intensity, type, duration and level of development of physical activity. The fourth and fifth phases are the Action and Maintenance phase. The individual in the "Action" phase has been exercising for less than six months. The person in the "Maintenance" phase, on the other hand, has been exercising for more than 6 months and is determined and confident about exercising. (Gülşen, 2018).

Attitude Scale for Healthy Nutrition (ASHN): The scale consists of four sub-dimensions: Knowledge on Nutrition (KN), Emotion for Nutrition (EN), Healthy Nutrition (HN), and Malnutrition (M). Confirmatory factor analysis has shown that the scale has good fit indices. The reliability of the scale was examined through internal consistency coefficient and test-retest method, and it was determined that the calculated reliability coefficients were within

acceptable limits. Item analysis revealed that all items in the scale were distinctive (Demir & Cicioğlu, 2019).

Analysis of Data

Statistical analysis was conducted using SPSS software (version 23). The Shapiro-Wilk (S-W) test was used to assess normality, and skewness/kurtosis coefficients of -1.5,+1.5 (Tabachnick and Fidell, 2013) and -2,+2 (George and Mallery, 2010) were referenced. It was determined that the data exhibited a normal distribution in the applied tests ($p>0.05$). Descriptive data were generated for all variables. Comparisons according to physical activity level, exercise behavior change, and attitude towards healthy eating were made by crosstab and k-square analysis. Correlation analysis was conducted to determine the relationship between the variables. A p-value <0.05 was considered significant.

FINDINGS

Table 1. Physical characteristics of the participants

Variables	Gender	n	Mean±S.D.
Age (years)	Male	144	24.36±4.88
	Female	102	24.56±5.10
Height (m)	Male	144	1.78±0.06
	Female	102	1.66±0.05
Weight (kg)	Male	144	73.00±11.16
	Female	102	57.35±7.40
BMI (kg/m^2)	Male	144	22.96±2.97
	Female	102	20.67±2.33
Physical Activity Level (Steps/day)	Male	144	7446.52±4179.32
	Female	102	7580.04±5697.78

In Table 1, male participants' age is 24.36±4.88 years, the average height is 1.78±0.06 m, the weight is 73.00±11.16 kg, BMI is 22.96±2.97 kg/m^2, and physical activity level is 7446.52±4179.32 steps/day. Female participants' mean age 24.56±5,10 years, height 1,66±0,05m, body mass 57,35±7,40 kg, BMI 20,67±2,33 kg/m^2 and physical activity level 7580,04±5697,78 steps/day.

Table 2. Stages of exercise behavior change questionnaire results of participants

EBCQ *	n	% of subjects in stage	EBCQ *
1. I currently do not exercise, and I do not intend to start exercising in the next 6 months	19	7.7	Pre-Contemplation
2. I currently do not exercise, but I am thinking about starting to exercise in the next 6 months	53	21.5	Contemplation
3. I currently do not exercise, but I intend to start exercising in the next 30 days.	52	21.1	Preparation
4. I currently do exercise, and I've been doing exercise for less than 6 months.	42	17.1	Action
5. I currently do exercise, and I've been doing exercise for over 6 months	80	32.5	Maintenance

EBCQ: Exercise behavior change questionnaire

According to Table 2, 19 (7.7%) of the participants in the research sample were "pre-contemplation",53 (%21,5) " contemplation ", It is seen that 52 (21.1%) of them are in “preparation”, 42 (17.1%) of them are in the “action” and 80 (32.5%) of them are in the “maintenance” stage.

Table 3. Classification of the physical activity levels of the participants

Physical Activity Level	n	%
Sedantary	96	39.0
Low Active	36	14.6
Somewhat Active	80	32.5
Active	19	7.7
Highly Active	15	6.1

Classification of the physical activity level is presented in Table 3. The study found that 39% of the participants were sedentary, 14.6% were low active, 32.5% were somewhat active, 7.7% were active, and 6.1% were highly active.

Table 4. Correlation results between variables

		Age	Weight	BMI	Level of income	Smoking	Alcohol	Regular exercise	Chronic Disease	Physical activity level	Nutrition knowledge	Attitudes toward nutrition	Healthy nutrition
Weight	r	.269											
	p	.000*											
BMI	r	.379	.874										
	p	.000*	.000*										
Level of income	r	.400	.084	.144									
	p	.000*	.190	.024*									
Smoking	r	-.095	-.105	-.097	-.053								
	p	.138	.102	.130	.406								
Alcohol	r	-.113	.138	-.118	-.044	.299							
	p	.076	.031*	.066	.495	.000*							
Regular exercise	r	-.082	-.043	-.031	-.085	-.009	.056						
	p	.199	.501	.625	.183	.893	.384						
Chronic Disease	r	.245	-.046	-.075	-.087	.118	.045	.022					
	p	.000*	.472	.244	.174	.065	.482	.737					
Physical activity level	r	-.041	.037	-.065	-.064	-.035	.102	.268	.063				
	p	.521	.568	.309	.317	.583	.111	.000*	.322				
Nutrition knowledge	r	.190	.080	.098	.172	-.052	-.094	.276	-.057	.087			
	p	.003*	.209	.125	.007*	.421	.143	.000*	.375	.172			
Attitudes toward nutrition	r	.095	-.024	-.065	.074	.161	.079	-.134	.005	.076	.089		
	p	.138	.714	.313	.250	.011*	.216	.030*	.932	.233	.166		
Healthy nutrition	r	.146	.004	.031	.188	.043	-.069	.298	-.115	.147	.492	.081	
	p	.022*	.956	.632	.003*	.500	.280	.000*	.072	.021*	.000*	.207	
Malnutrition	r	.123	-.105	-.106	.101	.203	.034	-.159	.023	.050	.225	.474	.198
	p	.054	.101	.096	.114	.001*	.598	.012*	.719	.437	.000	.000*	.002*

* p<0.05; EBC: Exercise behaviour change

Table 4 shows a significantly positive connection among them body weight and age, BMI, income level, chronic disease, knowledge about nutrition, and healthy nutrition variables ($p<0.05$). A significant positively connection was found among them body weight and BMI, Alcohol ($p<0.05$). A significant positive correlation was found between BMI and income level, income level and knowledge about nutrition, and healthy nutrition variables ($p<0.05$). A

significantly positive connection was found among them smoking, alcohol, attitude towards nutrition and malnutrition ($p<0.05$). There is a positive correlation between physical activity level, healthy nutrition, nutrition knowledge, and regular exercise ($p<0.05$), and a significant negative relationship between regular exercise and attitude towards nutrition ($p<0.05$). With malnutrition ($p<0.05$). A significantly positive connection was found among them physical activity level with healthy nutrition at $p<0.05$ level. A significant positively connection was found at $p<0.05$ level between knowledge about nutrition and healthy nutrition and malnutrition.

Table 5. Participants' stages of exercise behavior change and the health nutrition attitude scale sub-dimensions

	Variables	**Beta (ß)**	**S.Error**	***t***	***F***	***p***	**R^2**
IV- DV	SEBC»*ATHE*	0.694	0.159	4.357	18.982	*<0.05*	0.072
IV- DV	SEBC »ETN	0.452	0.218	2.079	4.321	*<0.05*	0.017
IV- DV	SEBC »HN	1.041	0.174	5.965	35.582	*<0.05*	0.127
IV -DV	SEBC »M	0.398	0.201	1.981	3.923	*<0.05*	0.016

*p<0.05; IV: Independent Variable; DV: Dependent Variable; SEBC: Stages of Exercise Behavior Change, ATHE: Attitudes towards healthy eating, ETN: Emotion towards nutrition, HN: Healthy nutrition, M: Malnutrition

It was determined that the subjects physical activity level and the sub-dimensions of the healthy eating attitude scale had an effect between healthy nutrition and each other ($p<0.05$). No effect was found on knowledge about nutrition, emotion about nutrition and malnutrition (Table 5).

Table 6. Physical activity level and the sub-dimensions of the Healthy Eating Attitude Scale

Variables	**Beta (ß)**	**S. Error**	***t***	***F***	***p***	**R^2**
PAL»KN	0.212	0.180	1.178	1.389	0.240	0.006
PAL »EN	0.382	0.239	1.600	2.559	0.111	0.010
PAL »HN	0.439	0.202	2.170	4.710	0.031*	0.015
PAL »M	0.241	0.221	1.089	1.186	0.277	0.005

*p<0.05; IV: Independent Variable; DV: Dependent Variable; PAL: Physical activity level; KN: Knowledge on nutrition; EN: Emotion for nutrition, HN: Healthy nutrition, M: Malnutrition

Table 6 indicates an effect between the steps of exercise behavior change and the attitude scale towards healthy eating ($p<0.05$). Significant effect was found between the level of physical activity and the attitude scale towards healthy eating.

Table 7. Regression analysis reflecting the effect between participants' stages of exercise behavior change and physical activity levels and attitudes towards healthy eating

Variables	**Beta (ß)**	**S.Error**	***t***	***F***	***p***	**R^2**
SEBC»ATHE	2.584	0.489	5.280	27.879	0.01*	0.103
PAL »ATHE	1.274	0.559	2.279	5.192	0.024*	0.021

p<0.05*, SEBC: Stages of Exercise Behavior Change, ATHE: Attitudes towards healthy eating, PAL: Physical activity level

According to Table 7, it was determined that the participants' exercise behavior change steps and all sub-dimensions of the Health Attitude Scale were influencing each other ($p<0.001$).

DISCUSSION AND CONCLUSION

This research examined exercise behavior change, physical activity levels, body compositions, and attitudes towards healthy nutrition of individuals who perform physical activity using mobile phone applications. In finally, the results of this study support the potential effectiveness of mobile applications in promoting exercise behavior change and healthy nutrition attitudes. Based on popularity, functionality, etc., the variety of mobile-based app types used by college students vary widely. Thus, the effects of mobile apps on lifestyle choices, exercise routines, and eating habits were investigated. The findings suggest that individuals using the HisApp physical activity mobile phone application can develop positive exercise behavior changes and increase their healthy nutrition attitudes (Tong et al., 2018). However, it should be noted that the sample size of this study was limited and the participants were recruited from a specific population, which may limit the generalizability of the findings. Therefore, future studies with larger and more diverse samples are needed to investigate further mobile applications' effectiveness in promoting healthy lifestyles. Based on the study's hypothesis, it can be concluded that there is a positive relationship between exercise behavior change and healthy nutrition attitudes among individuals who use mobile phone applications for physical activity. Therefore, the hypothesis is supported by the findings of the study. In addition, when the literature is examined, it is seen that there are studies showing similar results with the findings of the study (Sarcona et al., 2017; West et al., 2017).

Al-zandee and Ünlü (2019) stated in their research, on secondary school students that many students are at the stages of action and maintenance. Based on these data, the authors concluded that the student's physical activity exercise behavior changes were at the upper levels, and their physical activity levels were high. In our research, it is seen that the individuals using the HisApp application are in the majority in the maintenance, disposition, and preparation steps. This situation shows that the changes in the exercise behaviors of the individuals are in the upper steps, in line with the literature. It is thought that "sedentary individuals" tend to change their exercise behavior to protect themselves from non-communicable diseases such as high blood pressure, high blood sugar and obesity and to increase their quality of life. In contrast low active individuals believe in maintaining their current physical activity status.

In this study, it was observed that the sedentary participants were disposed to change their exercise behavior, and the somewhat active participants were at the maintenance level in their exercise behavior. In addition, it is seen that individuals with very active physical activity levels are in the disposed and pre-tendency stages to transition to a regular exercise program. According to the literature, individuals in the last stage of exercise (maintenance stage) tend to focus on the benefits of behavior, such as the positive effects of regular exercise on their physical and mental health. On the other hand, individuals in the contemplation stage tend to focus on the potential harms of the behavior, such as the perceived difficulty of starting and maintaining an exercise routine or the potential for injury or discomfort. This discussion refers to the Transtheoretical Model (TTM) of behavior change (Wilson et al., 216; Jiménez-Zazo et al., 2020). Therefore, this information can help design interventions to promote exercise behavior change, as different strategies may be more effective for individuals in different stages

of change. For example, individuals in the maintenance stage may benefit from reminders of the positive outcomes of their exercise routine. In contrast, individuals in the contemplation stage may benefit from education about strategies for overcoming barriers to exercise and addressing their concerns about potential harm. In the maintenance phase, it should not be concluded that the behavior change has taken place; the individual should be supported at regular intervals to maintain success (Kim, 2021).

It was observed that the healthy eating attitude is high in the steps of "maintenance, action, preparation, and contemplation, which is one of the steps of change in exercise behavior. Our study identified significant positive correlations between regular exercise, physical activity level, positive nutrition, and a significant negative correlation with malnutrition. Additionally, we found a positive correlation between physical activity level and positive nutrition and a meaningful correlation between knowledge about nutrition and positive nutrition/malnutrition. The findings of the study are in line with the literature (Schwarzer, 2008; Sakane et al., 2021).

These findings are similar to the results of the study conducted by Arı and Çakır (2021) which examined the relationship between university students' physical activity levels and their attitudes towards healthy eating. Additionally, the findings of the study are similar to studies conducted on university students (Demirbaş et al., 2023; Üstün et al., 2020).

The findings of the systematic review and meta-analysis by Liana et al., indicate that the use of smartphone applications and activity trackers is associated with a significant increase in physical activity levels among adults. The meta-analysis reveals a positive effect of these technologies on physical activity outcomes, with a moderate effect size. However, the authors note that the effectiveness of smartphone applications and activity trackers may vary depending on factors such as study design, intervention characteristics, and participant characteristics. (Liliana et al., 2021)

This research has a number of limitations that should be acknowledged. First, the study relied on self-reported measures of exercise behavior change, physical activity levels, and attitudes toward healthy eating, which may be subject to bias or inaccuracies. Additionally, the study focused only on individuals who use the HisApp physical activity mobile application, limiting the generalizability of the findings to other populations or mobile applications. The study also did not collect data on other factors influencing exercise behavior change and healthy eating attitudes, such as social support or environmental factors.

The growing use of smart devices has resulted in the popularity of mobile health programs, with mobile applications designed to promote healthy habits such as weight loss, increased physical activity, and better nutrition (Lee et al., 2018). This study highlights that the HisApp physical activity mobile application positively influences exercise behavior changes and healthy nutrition attitudes. This research can contribute significantly to developing cost-effective and feasible lifestyle interventions for scientists, politicians, sports, and health scientists. Nevertheless, further studies are required to better understand the relationship between mobile phone applications and exercise behavior changes, physical activity levels, and nutritional attitudes. With the increasing health threat of obesity and a sedentary lifestyle, the

significance of mobile phone applications in creating health interventions cannot be overemphasized (Flores Mateo et al., 2015). Furthermore, addressing the health risks associated with obesity and sedentary lifestyles requires the creation of feasible and affordable lifestyle interventions. Due to their accessibility, affordability, and user-friendliness, mobile phone applications can be a practical solution in this respect. They can assist people in managing and monitoring their health and well-being.

The findings of this study support the potential effectiveness of mobile applications in promoting exercise behavior change and healthy nutrition attitudes. The primary technological advancement in this new era of technology is mobile-based apps. In order to reduce health problems, it may be crucial to use mobile health applications such as HisApp that motivates and encourage you to be physically active. HisApp mobile application that is helpful to live healthy for individuals may be a good option for sedentary individuals. Increased use of such applications may lead to more people engaging in healthy behaviors and using health-related services.

In order to promote health and prevent chronic diseases, healthy food and exercise are essential. Even if socioeconomic variables have a significant impact on one's health, programs that use mobile health apps to enhance nutrition and exercise may increase quality of life and longevity. Programs for health education and promotion must be creative, and leveraging technology that participants can access whenever they want may increase adherence. The study suggests that mobile applications have the potential to be effective in promoting behavior change and physical activity, and further research is needed to better understand the relationship between mobile applications and these parameters. To further understand the basic connection between mobile technology and health, more focused randomized controlled trials utilizing various mobile apps linked to health outcomes may be helpful.

Conflict of Interest: There is no conflict of interest in our study.

Researchers' Statement of Contribution Rate: Research Design YY, Statistical analysis YY; Preparation of the article, YY; Data Collection was carried out by YY.

Ethical Approval
Board Name: Ethics approved by the Aksaray University Research Ethics Committee. Aksaray.
Date: 26.08.2021
Issue/Decision Number: 2021/06-29

REFERENCES

Al-zandee, S. S. A., & Ünlü, H. (2019). Investigation of physical activity exercise change behaviors of secondary school students and their predisposition to physical education course. *Spormetre Journal of Physical Education and Sports Sciences, 17*(3), 100-118. http://dx.doi.org/10.33689/spormetre.521319

Arı, Y., & Çakir, E. (2021). Correlation between participation in physical activity and healthy nutrition: An Example of a sports science faculty. *Baltic Journal of Health and Physical Activity, 13*(3), 37-45. https://doi.org/10.29359/BJHPA.13.3.05

Bertram, M., Banatvala, N., Kulikov, A., Belausteguigoitia, I., Sandoval, R., Hennis, A., Webb, D., & Tarlton, D. (2019). Using economic evidence to support policy decisions to fund interventions for non-communicable diseases. *BMJ, 365(*16),1-4. http://dx.doi.org/10.1136/bmj.l1648

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J. P., Chastin, S., Chou, R., Dempsey, P. C., DiPietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., Willumsen, J. F. (2020). World health organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine, 54*(24), 1451-1462. https://doi.org/10.1136/bjsports-2020-102955

Çeker, A., Çekin, R., & Ziyagil, M. A. (2013). Stages of change in regular physical activity participation behavior of men and women in different age groups. *CBU Journal of Physical Education and Sport Sciences, 8(*1), 11-20.

Cengiz, C. (2007). *Physical activity and exercise stages of change levels of Middle East Technical University students*. Master thesis, Middle East Technical University, General Social Sciences, Ankara.

Cengiz, C., Aşçı, F. H., & İnce, M.L. (2010). Exercise stages of change questionnaire: Its reliability and validity. *International Journal of Sport Studies, 2*(1), 32-37.

Chiu, W., & Cho, H. (2021). The Role of technology readiness in individuals' intention to use health and fitness applications: A Comparison between users and non-users. *Asia Pacific Journal of Marketing and Logistics, 33*(3), 807-825. https://doi.org/10.1108/APJML-09-2019-0534

Demir, G. T., & Cicioğlu, H. İ. (2019). Attitude scale on healthy eating (SBITÖ): Validity and reliability study. Gaziantep University Journal of Sport Sciences, *4*(2), 256-274. https://doi.org/10.31680/gaunjss.559462

Demirbaş, A. B., Kılıçaslan, A., Altınsöz, S., Aksakal, H. B., & Alphan, M. E. (2023). Determination of the relationship between healthy eating attitude, random blood glucose and anthropometric measurements in university students. *Atlas Journal of Medicine, 4*(10), 200-270. https://doi.org/10.54270/atljm.2024.54

Fedele, D. A., Cushing, C. C., Fritz, A., Amaro, C. M., & Ortega, A. (2017). Mobile health interventions for improving health outcomes in youth:Meta-analysis. *JAMA Pediatrics, 171*(5), 461-469. https://doi.org/10.1001/jamapediatrics.2017.0042

Flores Mateo, G., Granado-Font, E., Ferré-Grau, C., & Montaña-Carreras, X. (2015). Mobile phone apps to promote weight loss and increase physical activity: A Systematic review and meta-analysis. *Journal of Medical Internet Research, 17*(11), e253. https://doi.org/10.2196/jmir.4836

George, D., and Mallery, P. (2010). *SPSS for windows step by step: A Simple guide and reference*. Allyn & Bacon.

Gülşen, O. (2018). Investigation of exercise behavior changes of individuals undergoing imagery training. *Spormetre Journal of Physical Education and Sport Sciences, 16*(3), 48-60. https://doi.org/DOI:%2010.1501/Sporm_0000000375

Jiménez-Zazo, F., Romero-Blanco, C., Castro-Lemus, N., Dorado-Suárez, A., & Aznar, S. (2020). Transtheoretical model for physical activity in older adults: Systematic review. *International journal of Environmental Research and Public Health, 17*(24), 9262. https://doi.org/10.3390/ijerph17249262

Katzmarzyk, P. T., Friedenreich, C., Shiroma, E. J., & Lee, I. M. (2022). Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. *British Journal of Sports Medicine, 56*(2), 101-106. https://doi.org/10.1136/bjsports-2020-103640

Kim, H. N., & Seo, K. (2020). Smartphone-based health program for improving physical activity and tackling obesity for young adults: A Systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 17*(1), Article 15. https://doi.org/10.3390/ijerph17010015

Kim, Y. (2021). Relationships of physical activity with the transtheoretical model constructs among Korean adults. *International Journal of Health Promotion and Education*, *59*(5), 276-285. https://doi.org/10.1080/14635240.2020.1740608.

Kitiş, Y., & Gümüş, Y. (2015). Determination of 20 years and older women's physical activity levels, beliefs about physical activity and behavior stages. *Gümüşhane University Journal of Health Sciences*, *4*(3), 399-411.

Lee, M., Lee, H., Kim, Y., Kim, J., Cho, M., Jang, J., & Jang, H. (2018). Mobile app-based health promotion programs: A Systematic review of the literature. *International Journal of Environmental Research and Public Health, 15*(12), Article 2838. https://doi.org/10.3390/ijerph15122838

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., & Katzmarzyk, P. T. (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet, 20*(1),1-12. https://doi.org/10.1186/s12889-020-09855-3 219-229

Liliana, L., Ding, D., Bruno, H., Baki, K., Juan, C. Q., Huong Ly, T., Bahia, C., Ana Luisa, N., Elia, G., Kim Phuong, D., David, R., Gisela Costa, N., Maria, L. A., Enrico, C., & David, W. B. (2021). Do smartphone applications and activity trackers increase physical activity in adults? Systematic review, meta-analysis and metaregression. *British Journal of Sports Medicine*, *55*(8), 422-132. https://doi.org/10.1136/bjsports-2020-102892

Marcus, B. H., Lewis, B. A. (2003). Physical activity and the stages of motivational readiness for change model. *President's Council on Physical Fitness and Sports Research Digest, 10*(1), 1-10.

Posadzki, P., Pieper, D., Bajpai, R., Makaruk, H., Könsgen, N., Neuhaus, A. L., & Semwal, M. (2020). Exercise/physical activity and health outcomes: an overview of Cochrane systematic reviews. BMC public health, 20, 1-12.

Sabe, M., Chen, C., Sentissi, O., Deenik, J., Vancampfort, D., Firth, J., & Solmi, M. (2022). Thirty years of research on physical activity, mental health, and wellbeing: A scientometric analysis of hotspots and trends. *Frontiers in public health, 10*, 943435. https://doi.org/10.3389/fpubh.2022.943435

Sakane, N., Oshima, Y., Kotani, K., Suganuma, A., Takahashi, K., Sato, J., Kuzuya, H. (2021). Impact of telephone support programme using telemonitoring on stage of change towards healthy eating and active exercise in people with prediabetes. *Journal of Telemedicine and Telecare*, *27*(5), 307-313. https://doi.org/10.1177/1357633X211010981

Sarcona, A., Kovacs, L., Wright, J., & Williams, C. (2017). Differences in eating behavior, physical activity, and health-related lifestyle choices between users and nonusers of mobile health apps. *American Journal of Health Education, 48*(5), 298-305. https://doi.org/10.1080/19325037.2017.1335630

Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology, 57*(1), 1-29. https://doi.org/10.1111/j.1464-0597.2007.00325.x

Senna, Y. E., Ünlü, H. (2021). Investigation of the relationship between exercise behavior change step and social appearance anxiety and self-efficacy in secondary school students. *Turkiye Klinikleri Journal of Sports Sciences*, *13*(1)100-130. http://dx.doi.org/10.5336/sportsci.2020-744424

Sogari, G., Velez-Argumedo, C., Gómez, M. I., Mora, C. (2018). College students and eating habits: a study using an ecological model for healthy behavior. *Nutrients, 10*(12), 1823. https://doi.org/10.3390/nu10121823

Tabachnick, B.G. & Fidell, L.S. (2013). *Using multivariate statistics.* Pearson.

Tarp, J., Luo, M., Sanchez-Lastra, M. A., Dalene, K. E., del Pozo Cruz, B., Ried-Larsen, M., Ding, D. (2024). Leisure-time physical activity and all-cause mortality and cardiovascular disease in adults with type 2 diabetes: Cross-country comparison of cohort studies. *Journal of Sport and Health Science, 13*(2), 212-221. https://doi.org/10.1016/j.jshs.2023.10.004

Tong, H. L., Coiera, E., Laranjo, L. (2018). Using a mobile social networking app to promote physical activity: A Qualitative study of users' perspectives. *Journal of Medical Internet Research*, *20*(12), e11439. https://doi.org/10.2196/11439

Tudor-Locke, C., Craig, C. L., Brown, W. J., Clemes, S. A., De Cocker, K., Giles-Corti, B., Hatano, Y., Inoue, S., Matsudo, S. M., Mutrie, N., Oppert, J.-M., Rowe, D. A., Schmidt, M. D., Schofield, G. M., Spence, J. C., Teixeira, P. J., Tully, M. A., Blair, S. N. (2011). How many steps/day are enough? for adults. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 1-17. https://doi.org/10.1186/1479-5868-8-79

Tudor-Locke, C., Hatano, Y., Pangrazi, R. P., Kang, M. (2008). Revisiting "how many steps are enough?". *Medicine and Science in Sports and Exercise*, *40*(7), 37-543. https://doi.org/10.1249/MSS.0b013e31817c7133

Üstün, N. A., Üstün, Ü. D., Işık, U., Yapıcı, A. (2020). Health belief regarding leisure time physical activity and nutritional attitude: Are they related in athletic and sedentary university students, *Progress in Nutrition*, *22(*1), 156–160. https://doi.org/10.23751/pn.v22i1-S.9810

West, J. H., Belvedere, L. M., Andreasen, R., Frandsen, C., Hall, P. C., & Crookston, B. T. (2017). Controlling your "app" etite: how diet and nutrition-related mobile apps lead to behavior change. *JMIR Health and Health*, *5*(7), Article e7410. https://doi.org/10.2196/mhealth.7410

Wilson, J. J., Kirk, A., Hayes, K., Bradbury, I., McDonough, S., Tully, M. A., Bradley, J. M. (2016). Applying the transtheoretical model to physical activity behavior in individuals with non-cystic fibrosis bronchiectasis. *Respiratory Care*, *61*(1), 68-77. https://doi.org/10.4187/respcare.04154

Zare, M., Tarighat-Esfanjani, A., Rafraf, M., Shaghaghi, A., Asghari-Jafarabadi, M., & Shamshiri, M. (2020). The Barriers and facilitators of self-management among adults with type 2 diabetes mellitus: A Trans theoretical model (TTM)-based mixed method study in Iran. *Diabetes, Metabolic Syndrome and Obesity*, *45*(2), 2687-2699. https://doi.org/10.2147/DMSO.S230083