

# Health-related fitness knowledge, physical activity attitude and physical activity in secondary school students: A mediation analysis

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## Abstract

*Study aim:* The aim of this study was to examine the mediating role of secondary school students' physical activity attitudes between health-related fitness knowledge (HRFK) and physical activity (PA).

*Materials and methods:* The research employed a quantitative research method, using the relational survey model. The participants of the study consisted of a total of 603 (female = 295, male = 308) secondary school students from six different secondary schools in Isparta and Burdur provinces in the fall semester of the 2023–2024 academic year. The data of the study were collected with a personal information form, the Turkish HRFK Test, the Physical Activity Attitude Scale for Secondary School Students and the Physical Activity Questionnaire for Older Children (PAQ-C). The analysis of the data was made using the Process Macro v3.3 plug-in with model 4 and 5000 resampling methods with a 95% confidence interval.

*Results:* It was found that students' HRFK had significant positive effect on their physical activity attitudes and physical activities. It was observed that physical activity attitudes also positively affected physical activity. Additionally, physical activity attitudes were found to have a mediating role between HRFK and physical activity.

*Conclusions:* To conclude, it was found that secondary school students' HRFK affected their participation in physical activity. However, our research showed that the effect of HRFK on physical activity of secondary school students may occur indirectly through physical activity attitudes. It can be concluded that the HRFK level of secondary school students is important for participation in physical activity.

**Keywords:** Health – Knowledge – Physical activity – Attitude

## Introduction

It is important for children to participate in the recommended amount of physical activity in their development and health and to make this a habit from an early age, because it can be effective in helping children and adolescents maintain a healthy body weight, improve cardiovascular, musculoskeletal and brain health, protect against chronic diseases, and improve cognitive, motor and social skills [7, 38, 40, 44, 47, 72, 77]. However, the amount of physical activity of children and adolescents is decreasing and sedentary behaviors are increasing [36, 37, 39, 81, 83]. For example, it was reported that 80% of adolescents aged 13–15 globally, and similarly 80.2% of adolescents aged 11–17 in Turkey, do not engage in sufficient physical activity [67, 84, 87]. However, the PA levels decline with age from late childhood and adulthood [38], with girls being less active than boys at all ages [64, 79, 80]. In fact, it has been described as a pandemic due to the prevalence

of physical inactivity [55]. As a result of low levels of physical activity, overweight, obesity and related chronic diseases may occur in older ages [11, 36, 43]. Therefore, there is a great need to determine the factors that may be effective in the formation of physical activity habits in childhood in order to protect people from chronic diseases and allow them to live healthily.

There are many factors that affect participation in physical activity during childhood and adolescence. These include biological and demographic factors such as gender, age, and socioeconomic level; behavioral factors such as physical activity intention; psychological factors such as self-efficacy and perceived physical competence; and sociocultural factors such as perceived social support [9, 13, 53, 57, 69, 82]. At this point, it is known that physical education classes have positive effects on these factors in terms of participation in physical activity [8, 30, 60, 62].

Although traditional sports-based physical education implemented in schools is a school-based program that should encourage physical activity, its inadequacy in

achieving these goals and objectives is obvious [17, 68]. Many curriculums on this subject have begun to adapt alternative curriculum models focused on health promotion instead of the traditional sports-based physical education model [6]. The goals of this type of model courses include courses that teach health and fitness concepts, fitness programming, and self-monitoring and evaluation curricula [17]. Thanks to these types of curriculum changes used in physical education, students have HRFK, are able to make informed decisions about exercise and conditioning, show positive improvements in physical activity attitudes, and prefer active sports [31]. Ennis [23] suggested that the most important factor affecting physical activity is HRFK in physical education.

Some researchers stated that one of the most important factors preventing participation in physical activity in children and adolescents is HRFK, which is not taught sufficiently in physical education classes [20, 21, 27, 52]. In this context, students' HRFK is an area that has not been studied sufficiently and needs to be constantly improved [22, 27, 52, 58, 76]. HRFK includes basic physical fitness concepts (physical activity relationships and health relationships), components of physical fitness (cardio-respiratory, muscle strength, endurance, flexibility, body composition), effects of exercise on chronic disease risk factors, exercise prescription (frequency, intensity, duration, type, personal assessment), nutrition and injury prevention. [91]. In another definition, it is expressed as the information one must have in order to perform physical activity and protect against chronic diseases [27]. In this case, students' knowledge of the important effects of physical activity on health can enable them to make conscious decisions about participating in physical activity as a result of knowing how and how much physical activity to do. Thus, it can positively affect students' attitudes, motivations and intentions towards physical activity, and ultimately their participation in physical activity [14, 26, 31, 41]. Similarly, people who do not know the benefits of physical activity as a result of incomplete HRFK and who are inadequately knowledgeable about how to do physical activity are less likely to engage in physical activity. It is emphasized that HRFK may be the reason for low physical activity [27, 50, 51]. When the relevant literature is examined, studies indicate that HRFK is positively related to physical activity. Additionally, it has been reported that interventions aimed at HRFK can increase physical activity [5, 22, 23, 59, 65, 76, 81, 91].

However, some studies conducted in various age groups have found that there is no relationship between HRFK and physical activity [27, 41, 49, 85, 86]. In this case, HRFK can be considered as the first step in gaining physical activity habits [12]. The gap between theoretical understanding and the lack of supporting data about the role of HRFK in participation in physical activity hinders

the promotion of physical activity. Therefore, it is recommended to investigate the relationships between these variables in depth. [51, 76]. At this point, it should be taken into consideration that different variables, in addition to HRFK, may be effective in gaining physical activity habits for a healthy life. It emphasizes that the relationship between HRFK and physical activity should be investigated more deeply and the factors that may mediate this relationship should be focused on [21, 41]. Thus, one can gain in-depth knowledge about the role of HRFK in promoting physical activity [49].

A possible variable that may mediate the relationship between HRFK and physical activity is physical activity attitude. Attitude towards physical activity expresses people's positive or negative evaluations about participating in physical activity and affects their decisions regarding physical activity [19, 32]. Attitudes towards physical activity may be positively influenced by HRFK and may influence physical activity. This situation can be explained by the theory of planned behavior (TPB) [3, 4, 49]. According to the TPB, intention is the most important factor that determines the performance of behaviors and there are three main factors (attitude towards behavior, subjective norm and perceived behavioral control) that also affect the intention. Regarding the first of these, affective tendency is liking or disliking physical activity, cognitive tendency is awareness that physical activity may be harmful or beneficial, and psychomotor tendency is attitude towards behavior such as participating or not participating in physical activity. The second is the subjective norm, which consists of the social pressure felt to participate or not participate in physical activity. The third is perceived behavioral control, which refers to perceiving participation in physical activity as difficult or easy. In this case, the effect of HRFK on physical activity can be explained by the attitude towards behavior in the TPB [1, 2, 31, 75], because information can positively affect the attitude towards behavior [25], which can lead to behavioral intention and behavior [49, 75]. For example, people's high level of HRFK enables them to know the benefits of physical activity and how to do physical activity to protect against chronic diseases. This may increase physical activity intention and participation in physical activity by positively affecting people's physical activity attitudes in their cognitive, affective and psychomotor sub-domains. In this context, relevant studies have found that training performed to improve HRFK has an impact on people's physical activity attitudes and physical activities [1, 10, 31, 66, 67, 74]. There are also studies indicating that physical activity attitudes are related to and effective in physical activity [32, 34, 54, 61, 74].

In summary, in line with the theoretical explanations and research findings in the literature, a theoretical model can be put forward in which physical activity attitude will

have a mediating role in the relationship between HRFK and physical activity. Therefore, the aim of the study is to examine whether secondary school students' physical activity attitudes have a mediating role between HRFK and physical activity. For this purpose, the following hypotheses were tested.

### Hypothesis

- H<sub>1</sub>: HRFK of secondary school students positively affects their physical activities.
- H<sub>2</sub>: Physical activity attitudes mediate the relationship between secondary school students' HRFK and physical activity.

## Materials and methods

### Study model

This research was conducted via a quantitative research method using the relational survey model. The survey model is a research model used to describe a situation that existed before or continues to exist. This research model aims to determine the existence of a relationship between two or more variables and, if any exists, the degree of this relationship [48].

### Participants

The participants in this research were determined according to "easily accessible case sampling", which is a purposeful sampling method. The research participants consisted of a total of 603 (female = 295, male = 308) secondary school students from six different secondary schools in Isparta and Burdur provinces in the fall semester of the 2023–2024 academic year. They joined the study by having their parents confirm the Parental Permission Form. We followed the principles outlined in the Declaration of Helsinki and the research was approved by the ethics committee.

**Table 1.** Characteristics of participants

	Groups	Frequency	Percentage [%]
Gender	Female	295	% 48.9
	Male	308	% 51.1
Age	12 years	210	% 34.8
	13 years	206	% 34.2
	14 years	187	% 31.0
Grade	6 <sup>th</sup> grade	210	% 34.8
	7 <sup>th</sup> grade	202	% 33.5
	8 <sup>th</sup> grade	191	% 31.7

## Procedures

### Data collection tools

*Personal information form.* In this form prepared by the researchers, 3 questions were asked about the participants' ages, grades and gender.

*Turkish Health-Related Fitness Knowledge Test.* The Turkish Health-Related Fitness Knowledge Test (THR-FKT) was used to measure students' HRFK. It was developed by Mott et al. [63] and Hünük and İnce [45] under the name Superkids-Superfit Knowledge Test and adapted into Turkish according to the Physical Education and Sports course curriculum. This test includes Cardiovascular Endurance (10 questions), Muscular Strength Endurance (4 questions), Flexibility (4 questions), Body Composition (3 questions), Training Principles (6 questions) and General, consisting of 6 sub-dimensions such as Health Information (9 questions), and has a total of 36 questions. Increasing scores from the test indicate that students' HRFK has increased. Validity and reliability analyses of the test were conducted on 420 secondary school students. As a result of the analysis, it was found that the reliability of the test was 0.68, item difficulty was 0.24–0.90, p-value was 0.60 and discrimination was 0.40–0.54. According to these data, the test is considered valid and reliable. Within the scope of the research, the KR-20 reliability coefficient was calculated as 0.62 for the total test.

*Physical Activity Questionnaire for Older Children (PAQ-C).* The Physical Activity Questionnaire for Older Children (PAQ-C), which was developed by Kowalski, Crocker and Donen [56] and later used by Erdim et al. adapted to Turkish by [24], was used to determine students' physical activity participation. This measurement tool is a self-report questionnaire answered by the child to recall the last 7 days to determine children's physical activity participation levels. The survey consists of a total of 10 questions in 2 sub-dimensions: "In School (3 items)" and "Out of School (6 items)". The average physical activity score is calculated by taking the average of the scores of the first 9 questions, except for the 10th question, which asks whether there is a disease or a condition that prevents physical activity. The survey is scored between 1 and 5; the lowest physical activity level is "1" and the highest physical activity level is "5". Validity and reliability analyses of the test were performed. As a result of the confirmatory factor analysis conducted for the validity of the test, it was found that the fit index values were  $\chi^2/df = 2.174$ , RMSEA = 0.054, NNFI = 0.95, CFI = 0.97, GFI = 0.97, SRMR = 0.037 and AGFI = 0.95. For the reliability of the test, the Cronbach alpha internal consistency coefficient was calculated and was 0.77 for the general sample (girls  $\alpha = 0.76$ ; boys  $\alpha = 0.77$ ). Therefore, it was determined that the test is a valid and reliable measurement tool to measure

the participation of children aged 9-14 in physical activity [24, 56]. Within the scope of the research, the Cronbach alpha internal consistency coefficient was calculated as .75 for the total scale.

*Physical Activity Attitude Scale for Secondary School Students.* The Physical Activity Attitude Scale for Secondary School Students scale, developed by Yıldız et al. [88], was used to measure students' physical activity attitudes. This scale consists of 5 sub-dimensions and 25 items: "Love" (5 items), "Willingness" (7 items), "Benefit (4 items)", "Socialization (5 items) and Self-Confidence (4 items). The scale is designed as a 5-point Likert type (1 = strongly disagree, 5 = strongly agree). There is a reverse coded item in the scale. Increasing scores from the scale indicate that students' attitudes towards physical activity have increased positively. Validity and reliability analyses of the scale were performed. As a result of the confirmatory factor analysis conducted for the validity of the test, the fit index values were found to be  $\chi^2/df = 1.96$ , RMSEA = 0.048, NNFI = 0.927, CFI = 0.937, IFI = 0.937, GFI = 0.909. Cronbach's alpha internal consistency coefficient was calculated for the reliability of the scale. It was found that the total scale of the scale was 0.92, and the values for the sub-dimensions were: willingness 0.85, love 0.83, benefit 0.75, socialization 0.82 and self-confidence 0.70. Therefore, it is stated that the scale is valid and reliable for secondary school students in the 6th, 7th and 8th grades.

### Collection of data

Permission to use the scales was obtained from the authors before starting the study. Then, a voluntary consent form was obtained from the students' families for participation in the study. Before starting the application, the purpose of the study was explained to the students and participation in the study was voluntary. The measurement tools were applied in a single session by the researcher in the students' physical education and sports classes. Participants completed the measurement tools in 50 minutes.

### Statistical analysis

SPSS version 23.0 was used to analyze the data. For all analyses, the significance level was considered as  $p < 0.05$ . Before data analysis, it was checked whether there were any

missing or incorrect answers. Descriptive and inferential statistics were used to analyze the data. The data showed a normal distribution, and parametric tests were used [78]. Within the scope of inferential analyses, correlation analysis and mediator variable analysis were performed. For the first purpose of the research, Pearson correlation analysis was used; 0.00–0.30 is reported as low, 0.30–0.70 as medium and 0.70–1.00 as large [16, 29]. For the mediation analyses for the second purpose of the research, instead of traditional methods, a modern approach was preferred; regression analysis based on the bootstrapping method was performed, and indirect effects were reported in line with the binary confidence interval (CI) values. In these analyses, age, grade and gender variables were kept under control. The analyses were carried out with model 4 using the Process Macro v3.3 plug-in developed by Hayes [42]. The analysis was carried out with 5000 resampling methods with a 95% confidence interval (CI). In this context, the significance of the mediation role was evaluated according to the criterion that the bootstrapping results did not include the (0) value of the lower (BootLLCI) and upper (BootULCI) binary confidence interval [33, 42].

## Results

The relationships between secondary school students' HRFK, physical activity attitudes and physical activities are presented in Table 2.

As shown in Table 2, there was a positive, moderately significant relationship between secondary school students' HRFK, physical activity attitudes ( $r = 0.337$ ,  $p < 0.01$ ) and physical activities ( $r = 0.325$ ,  $p < 0.01$ ). Additionally, there was a moderate positive relationship between secondary school students' physical activity attitudes and physical activities ( $r = 0.375$ ,  $p < 0.01$ ).

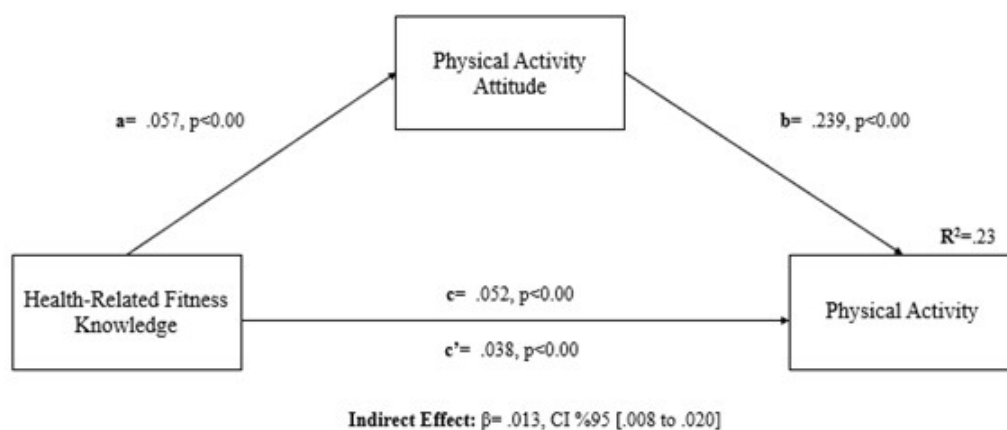
The mediating role of physical activity attitude in the relationship between HRFK and physical activity in secondary school students is presented in Figure 1.

As seen in Figure 1, HRFK was found to have a significant positive effect on physical activity attitude ( $a = 0.057$ ,  $SE = 0.006$ ,  $t = 8.8621$ ,  $p < 0.01$ ) and physical activity ( $c = .052$ ,  $SE = 0.005$ ,  $t = 8.8134$ ,  $p < 0.01$ ). It was determined that physical activity attitude significantly

**Table 2.** Descriptive statistics and correlations of variables

	M ± SD	a	b	c
a. HRFK (0–36)	22.57 ± 4.23	1		
b. Physical Activity Attitude (1–5)	3.81 ± 0.72	0.337**	1	
c. Physical Activity (1–5)	3.11 ± 0.67	0.325**	0.375**	1

\*\*  $p < 0.001$ ; \*  $p < 0.05$ .



**Figure 1.** The mediating role of physical activity attitude in the relationship between HRFK and physical activity in secondary school students

affected physical activity positively ( $b = 0.239$ , S. E = 0.036,  $t = 6.6504$ ,  $p < 0.01$ ). However, the total effect of HRFK and physical activity attitude on physical activity was found to be positively significant ( $c' = 0.038$ , S. E = 0.006,  $t = 6.3144$ ,  $p < 0.01$ ) and explained 23% of the total variance. All these results show that physical activity attitude may have a mediating role. When the mediating role of physical activity attitude in the relationship between HRFK and physical activity was evaluated according to the fact that the binary confidence interval did not include the value 0, it was found that physical activity attitude had a mediating role ( $\beta = 0.013$ , CI 95% [0.008 to 0.201]).

## Discussion

The first hypothesis of the research is that secondary school students' HRFK would have a positive and significant impact on their physical activities. As a result of the research, it was found that secondary school students' HRFK positively affected their physical activities. This finding shows that secondary school students' knowledge of HRFK increases their physical activity levels. According to researchers, there are limited studies in the literature investigating this relationship in secondary school students [15, 26]. At this point, it becomes difficult to discuss our research findings. Our research findings are supported by a limited number of studies conducted on students at different school levels [15, 17, 18, 22, 26, 81]. At this point, it provides significant support for the hypothesis put forward by Keating et al. [52]. However, studies in the literature on high school and university students indicate that there is no significant relationship between HRFK and PA [28, 41, 49, 85, 86]. There may be many reasons why our research findings differ from the literature. The first of these may be students' HRFK knowledge levels. Studies indicate that university and high school students do not have sufficient HRFK knowledge to participate in physical activity

[28, 49, 90]. On the other hand, in our study, secondary school students answered 22 questions correctly on average in the HRFK test, which consists of 36 questions, and their knowledge of HRFK is high. Another reason may be related to teachers' HRFK deficiencies and teaching. In the study conducted by Haslem et al. [41], it was found that the reason why HRFK did not positively affect PA in high school students may be related to the teaching of HRFK. The relevant literature also indicates that teachers' HRFK is lacking and HRFK teaching is insufficient [12, 71]. At this point, even though we did not measure the level of knowledge of teachers on HRFK in our findings, studies conducted in Turkey indicate that teachers' knowledge of HRFK is insufficient and teaching HRFK is insufficient [46, 89]. Additionally, in the research conducted by Yılmaz & Hünük, [89], it was determined that students with high HRFK did not obtain this information from physical education teachers, but rather obtained this information from their coaches. Therefore, the relationship between HRFK and PA in our findings may not arise from the school environment. It is clear that more research is needed to improve our understanding of this issue. At this point, the fact that HRFK does not have a positive effect on PA in the majority of studies conducted in the literature supports the suggestion that it may have effects on different variables [20, 21].

Our second research hypothesis was that secondary school students' physical activity attitudes would mediate the relationship between HRFK and PA. The results indicated that secondary school students' physical activity attitudes mediated the relationship between their HRFK and physical activities. This finding shows that secondary school students' knowledge of HRFK concepts, exercise principles, the positive effects of physical activity on health, and the volume and form of participation in physical activity positively affect their attitudes towards physical activity and therefore increase their participation in physical activity. At this point, being knowledgeable may

have a positive impact on attitudes in performing the behavior [25] because HRFK enables students to know the positive effects it has on their health and provides them with information and skills on how to structure their own physical activities and exercises. As stated in TPB, it can increase students' tendency towards physical activity (attitude towards behavior) by making them understand that physical activity is beneficial. Additionally, it may cause students to perceive their participation in physical activity as easy (perceived behavioral control) by improving their knowledge that they can design physical activities themselves. [3, 4]. Thus, it can encourage students to participate in physical activity by enabling them to develop positive attitudes towards physical activity. Studies in the literature support our findings. For example, in a study conducted by Haible et al. [35], it was reported that there was a positive relationship between HRFK and attitudes towards health, fitness and physical activity in high school students. However, it has been shown that conceptual physical education (CPE) interventions aimed at increasing the HRFK of students in different age groups increase the physical activity attitudes of these students [1, 10, 31, 66, 67, 74]. In addition, it was observed in our findings that increasing physical activity attitude also increased participation in physical activity. In this regard, the literature also supports our findings [32, 34, 54, 61, 70, 73]. Considering all these findings, physical activity attitude may support the relationship between HRFK and PA. It is thought that these findings will contribute to the literature with a model that can explain the relationship between HRFK and physical activity. For this reason, HRFK can be considered as the first step in gaining physical activity habits [12, 50].

## Conclusion

To conclude, it was found that secondary school students' HRFK affected their participation in physical activity. However, our research showed that the effect of HRFK on physical activity of secondary school students may occur indirectly through physical activity attitudes. We can conclude that the HRFK level of secondary school students is important in participating in physical activity.

## Strengths and limitations

There are also some limitations of our research. The first of these is that, since the research was designed in a relational screening model and the data were collected in a certain period of time, causality could not be established with the data obtained. Secondly, the generalizability of the study is limited because the participants in the study were identified through easily accessible case sampling. The last limitation is that data on physical activity

were obtained through a self-report questionnaire. In this method, the frequency, duration and intensity of physical activity, as well as the likelihood that participants will remember more or less the amount of physical activity, are not determined.

## Suggestions

- Future studies should improve the generalizability of the research results; it is recommended to conduct the study in different provinces and regions and to identify participants using probability sampling methods.
- The research was designed using a quantitative research method and relational survey model. It is recommended that subsequent research be designed as experimental and longitudinal studies in order to obtain more in-depth information about the relationships between variables.
- In this study, physical activity measurements were obtained using measurement tools based on participants' self-report. In subsequent studies, it is recommended that physical activity be measured using objective measurement methods (e.g. pedometer, accelerometer).
- Participants' physical activity intentions were not measured in the study. According to the TPB, physical activity attitudes may have an impact on physical activity intentions. Subsequent researchers could examine the relationships by including physical activity intentions in the model.

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