

## Exploring the effect of the clothes used in physical education class on some physical fitness parameters Exploración del efecto de la ropa utilizada en clase de educación física sobre algunos parámetros de la forma física

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**Abstract.** Clothing used in physical education class can affect physical fitness. Therefore, the aim of this study was to explore the effect of clothes used in physical education class on some physical fitness parameters (anthropometric characteristics, muscular endurance, flexibility, explosive strength). 34 secondary school student were recruited for this study. After the baseline assessments, the students were randomly divided into two groups: one group wearing shorts and T-shirts and the other wearing school uniforms. The analysis revealed baseline differences in the sit-and-reach, standing long jump, sit-up and 20 m sprint tests in within-group comparisons. Girls performed better when wearing shorts and T-shirt in the 20 m sprint test ( $Z(-3.622)=4.45$ ,  $p<0.01$ ), sit-and-reach test ( $Z(-3.668)=27.41$ ,  $p=0.01$ ), SLJ ( $Z(-3.635)=124.02$ ,  $p=0.01$ ) and sit-up test ( $Z(-3.534)=18.82$ ,  $p<0.01$ ). Similarly, boys performed better when wearing shorts and T-shirt in the 20 m sprint test ( $Z(-3.574)=4.68$ ,  $p<0.01$ ), sit-and-reach test ( $Z(-3.657)=24.64$ ,  $p=0.01$ ), SLJ ( $Z(-3.667)=141.14$ ,  $p=0.01$ ) and sit-up test ( $Z(-3.537)=22.91$ ,  $p<0.01$ ). In conclusion, the results revealed that wearing shorts and T-shirts in physical education class had a positive effect on some physical fitness parameters. This underlines the advantages of wearing appropriate clothing in physical education class to promote physical fitness.

**Keywords:** clothing in physical education; physical education; physical fitness; secondary school students; sport

**Resumen.** La ropa utilizada en clase de educación física puede afectar a la forma física. Por lo tanto, el objetivo de este estudio era explorar el efecto de la ropa utilizada en clase de educación física sobre algunos parámetros de la forma física (características antropométricas, resistencia muscular, flexibilidad, fuerza explosiva). Para este estudio se reclutó a 34 estudiantes de secundaria. Tras las evaluaciones iniciales, se dividió aleatoriamente a los alumnos en dos grupos: uno con pantalones cortos y camisetas y otro con uniforme escolar. El análisis reveló diferencias basales en las pruebas de sentarse y alcanzar, salto de longitud de pie, sentadilla y sprint de 20 m en las comparaciones dentro del grupo. Las chicas obtuvieron mejores resultados cuando llevaban pantalones cortos y camiseta en la prueba de sprint de 20 m ( $Z(-3,622)=4,45$ ,  $p<0,01$ ), la prueba de sentarse y alcanzar ( $Z(-3,668)=27,41$ ,  $p=0,01$ ), la prueba de SLJ ( $Z(-3,635)=124,02$ ,  $p=0,01$ ) y la prueba de sentarse ( $Z(-3,534)=18,82$ ,  $p<0,01$ ). Del mismo modo, los chicos obtuvieron mejores resultados cuando llevaban pantalón corto y camiseta en la prueba de sprint de 20 m ( $Z(-3,574)=4,68$ ,  $p<0,01$ ), la prueba de sentarse y alcanzar ( $Z(-3,657)=24,64$ ,  $p=0,01$ ), la prueba SLJ ( $Z(-3,667)=141,14$ ,  $p=0,01$ ) y la prueba de sentarse ( $Z(-3,537)=22,91$ ,  $p<0,01$ ). En conclusión, los resultados revelaron que llevar pantalones cortos y camisetas en clase de educación física tenía un efecto positivo sobre algunos parámetros de la forma física. Esto subraya las ventajas de llevar ropa adecuada en clase de educación física para fomentar la forma física.

**Palabras clave:** ropa en educación física; educación física; forma física; estudiantes de secundaria; deporte

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### Introduction

Within the modern understanding of education, the concepts of physical education and sports are complementary concepts. Physical education is an activity that contributes to the balanced development of the physical and mental health and the whole structure of the human power, which is the most basic element of sociocultural and economic development (Yetim, 1998). The physical education and sports curriculum aims to develop students' movement skills, health and active life skills, concepts and strategies, self-management skills, social skills and intellectual skills that they will use throughout their lives and prepare them for the next level of education (MoNE, 2018). With goals that go beyond physical education, such as physical fitness, healthy personal development and social skills, it has raised awareness about the inclusion of these parameters in school curricula (Brandes et al., 2019).

It can be said that the importance of the physical education course in the school curriculum has increased even more due to the effects of the technological age we live in on children in the developmental age. The modern

lifestyle has led to the fact that obesity is a problem not only for adults but also for children. Moderate physical activity in physical education classes plays an important role in preventing and eliminating this problem (Mijanovic, 2022). In terms of improved physical activity, it is emphasized that physical fitness in children and adolescents provides important benefits such as cardiometabolic health, bone health, cognitive outcomes, mental health and obesity reduction (WHO, 2020). In a study conducted by Yalçın and Balcı (2013), it was reported that students who regularly participated in sports activities had more organized school lives, improved discipline levels, increased sense of responsibility, improved team spirit, participated more in in-class and out-of-class activities, and increased their desire to go to school.

School uniforms are common in many schools around the world and have an important social context (Baumann & Krskova, 2016; Mandic et al., 2018).

When the research on the subject is examined, it can be said that the relationship between school uniforms and academic achievement and social behaviors is quite limited and the results are inconsistent. Furthermore, various

studies have claimed that school uniforms eliminate socioeconomic inequalities, increase safety, reduce school violence, improve school atmosphere and discipline, encourage social responsibility, and enhance academic success (Mitchell & Knechtle, 2003; Sanchez et al., 2012). However, as far as we have examined, we have not come across a study examining the effects of the use of clothing in physical education classes on physical fitness (Ansari et al., 2022; Cristi-Montero et al., 2022; Gentile & Imberman, 2012).

Based on these results, it is thought that it is very important to participate in the class with appropriate clothing (shorts, t-shirts, tracksuits, sneakers), which is one of the most basic requirements of physical education and sports lessons.

Many factors are effective in the delivery of physical education and sports lessons in accordance with the purpose of teaching, including adequate facilities, equipment, physical education and sports teachers, and appropriate clothing for the lesson. If any of these factors are missing, it is not possible for the physical education and sports course to fully achieve its aims and objectives (Özener, 1988).

The weight of the clothes used in sportive activities, the technical properties of the fabric used in the production (sweat absorbency, air permeability, etc.), cut form, technical sewing features, suitability to the body, seasonal suitability, color and many other features can be considered as points to be considered. Clothes that are not suitable for the body structure of both students and athletes, where the seams that restrict their movements disturb the skin, and where textile surfaces that are not specific to the sport are used, increase the risk of injury as well as decreasing performance (Çivitci & Dengin, 2016). Furthermore, running shoes are designed to improve foot comfort, enhance running-related performance and reduce potential injuries (Sun et al., 2020). Sports compression garments' functional needs vary depending on the sport, season of use, climatic circumstances, and level of physical activity (Shishoo, 2005). Tennis, soccer, running, and jumping are examples of highly active sports, which are games performed for short periods of time with high levels of physical activity. Sports performance compression garments can influence a player's performance, making them one of the most significant quality requirements. Özşarı (2017) examined the attitudes of 10-12 year old students studying in private and public schools towards physical education course through various variables, and obtained positive results in the attitudes of students studying in private schools because they had more tracksuits and sneakers than those studying in public schools. It can be said that one of the most important issues that make physical education lessons attractive for children is that while they participate in other lessons in school uniforms, they participate in physical education lessons in shorts, tracksuits, t-shirts, etc. This situation is thought to be important in terms of the efficiency of physical education lessons. We hypothesized that there is a significant

difference in physical fitness parameters between girls and boys wearing school uniforms and girls and boys wearing shorts and t-shirts, in favor of those wearing shorts and t-shirts.

When the relevant literature is examined, it is seen that studies on the effects of clothing on physical fitness in physical education classes are quite limited. Therefore, this study aimed to examine the effect of the clothes used in physical education class on some physical fitness parameters. For this purpose, answers to the following questions were sought:

- Is there any difference between girls wearing school uniforms and girls wearing shorts and t-shirts in terms of physical fitness parameters?
- Is there any difference in physical fitness parameters between male students wearing school uniforms and male students wearing shorts and t-shirts?

## Materials and Methods

### Study Design and Participants

This research was an experimental study using pre-test-post-test control group design. The research population consists of secondary school students who continue their education in public schools in Istanbul. 34 secondary school student (boys n=17; girls n=17) were recruited for this study through by convenience sampling (body mass:  $53.07 \pm 15.00$  kg; height:  $156.18 \pm 9.22$  m Table 1). The participants only attended the school's physical education classes and did not participate in any other sports activities. Before the study, participants, their families and teachers were informed about the research protocol and the possible risks and benefits of participating in the study. They then signed an informed consent form. The study was carried out in accordance with the Declaration of Helsinki and approved by the Haliç University Non-Interventional Clinical Research Ethics Committee (28.03.2023; ref no: 078). The following criteria were required for inclusion: Being a 7th grade student, not having any physical disability that would prevent participation in physical education class, actively participating in physical education classes for at least three months and to participate in the study voluntarily.

### Procedures

After determining the demographic information of the participants, in the first week before the study, pre-test measurements were applied to the study group on two different days: in school uniform and in shorts and t-shirts. Then, the study group continued the activities in physical education classes in the national education program for 4 weeks. Post-test measurements were applied at the 5th week. All test sessions were performed at the same time of the day and in a sports hall. Participants attended pre-tests and physical education classes for the next two weeks in school uniform. They attended the last two weeks and the post tests wearing shorts and t-shirts.

## Measurements

### Body mass and height measurements

Body mass and height were measured to the nearest 0.1 cm and 0.1 kg, respectively, using a digital scale.

### Sit-up test

Participants were told to lie on their back, put their hands together at the nape of their neck, place their soles of their feet completely on the mat with their knees slightly pulled towards their abdomen (knees 90 degrees), and while moving upwards, their elbows should come forward and touch their knees at the end of the movement. Participants' ankles were held by an assistant. The movement had to be long enough to allow the shoulders to touch the mat during the return to the starting position. Participants tried to repeat this movement as many times as possible within a 30-second period. The sit-ups performed and completed correctly within 30 seconds were counted and the result was recorded (Reiman & Manske, 2009; Volbekiene & Gricilte, 2007).

### Sit-and-reach test

The flexibility of the participants in the hip and waist areas was evaluated by the sit-and-reach test. A box (30.5x30.5 cm) was used to evaluate flexibility. Participants had to be shoeless and rest their feet on the box. Participants were informed and shown that they should fully extend their knees and place their ankles on the floor in neutral dorsiflexion against the sit-and-reach box. Additionally, participants were told that after placing their hands on the surface of the box, they should reach forward, trying to reach as far forward as possible along the top surface of the box. It was recorded in centimeters down to the point where the tips of the middle fingers touched. Each participant performed the test three times and the highest result obtained was taken into account for evaluation

purposes (Council of Europe, 1987).

### Standing long jump test

Participants are required to stand on a meter whose starting and finishing points are marked and fixed in a certain place, with their toes slightly at shoulder level and not exceeding the starting line, then to jump as far as possible by pushing the ground strongly with both feet, and to wait motionless by falling with both feet. It was said. Two attempts were made and the distance between the starting line and the closest point of the back of the foot was measured and the best result was recorded in centimeters (Dello Iacono et al., 2022).

### 20 meter run test

Participants were asked to cover the 20-meter distance, with clearly visible starting and ending points, as quickly as possible after placing their feet on the starting line, accompanied by the sound of a whistle. Running time was measured with a stopwatch. The test was administered twice so that participants could rest, and the best of two trials was considered (Mackenzie, 2005).

## Statistical Analysis

SPSS 22 package program was used to analyze the data. In the analysis of the obtained data, minimum, maximum, arithmetic mean and standard deviation values were calculated. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine whether the data conformed to normal distribution. As a result of the analysis, it was seen that the data did not comply with normal distribution. In this regard, the Wilcoxon Signed Rank test was used to determine whether there was a difference within the group. In the analyses, the confidence interval was determined as 95% and the statistical significance level was determined as  $p < .05$ .

## Results

Table 1.

Characteristics of participants (mean  $\pm$  SD)

Girls (n)	Boys (n)	Body Mass (kg)	Min.	Max.	Height (cm)	Min.	Max.
17	17	53.07 $\pm$ 15.00	30,10	92.50	156.18 $\pm$ 9.22	30,10	92.50

Table 2.

The results of the Wilcoxon signed-rank test for the comparison of physical fitness parameters between girls wearing school uniforms and girls wearing shorts and t-shirts

	n	Clothing Type	Mean	SD	z	p
Sit-and-reach (cm)	17	Uniform <sup>a</sup>	25.44	3.73	-3.668	.00
		Shorts – T-shirt <sup>b</sup>	27.41	3.41		
Standing long jump (cm)	17	Uniform <sup>a</sup>	121.85	8.12	-3.635	.00
		Shorts – T-shirt <sup>b</sup>	124.02	7.93		
Sit-up (repeat)	17	Uniform <sup>a</sup>	17.38	4.50	-3.534	.00
		Shorts – T-shirt <sup>b</sup>	18.82	4.35		
20 m. run (sec)	17	Uniform <sup>a</sup>	4.95	.452	-3.622	.00
		Shorts – T-shirt <sup>b</sup>	4.45	.448		

a = pre test; b = post test

Table 3.

The results of the Wilcoxon signed-rank test for the comparison of physical fitness parameters between boys wearing school uniforms and boys wearing shorts and t-shirts

	n	Clothing Type	Mean	SD	z	p
Sit-and-reach (cm)	17	Uniform <sup>a</sup>	22.85	5.52	-3.657	.00
		Shorts – T-shirt <sup>b</sup>	24.64	5.53		
Standing long jump (cm)	17	Uniform <sup>a</sup>	138.44	13.26	-3.667	.00
		Shorts – T-shirt <sup>b</sup>	141.14	13.04		
Sit-up (repeat)	17	Uniform <sup>a</sup>	21.41	6.61	-3.537	.00
		Shorts – T-shirt <sup>b</sup>	22.91	6.57		
20 m. run (sec)	17	Uniform <sup>a</sup>	4.68	.754	-3.574	.00
		Shorts – T-shirt <sup>b</sup>	4.28	.689		

a = pre test; b = post test

When the results of the Wilcoxon Signed Ranks test conducted to compare the physical fitness parameters between girls wearing school uniforms and girls wearing shorts and t-shirts were analyzed, flexibility ( $Z=-3.668$ ;  $p<.01$ ), standing long jump ( $Z=-3.635$ ;  $p<.01$ ), sit-up ( $Z=-3.534$ ;  $p<.01$ ) and running ( $Z=-3.622$ ;  $p<.01$ ) parameters, there was a statistically significant difference in favor of girls wearing shorts-shirt.

When the results of the Wilcoxon Signed Ranks test conducted to compare the physical fitness parameters between boys wearing school uniforms and boys wearing shorts and t-shirts were analyzed, flexibility ( $Z=-3.657$ ;  $p<.01$ ), standing long jump ( $Z=-3.667$ ;  $p<.01$ ), sit-up ( $Z=-3.537$ ;  $p<.01$ ) and running ( $Z=-3.574$ ;  $p<.01$ ) parameters, there was a statistically significant difference in favor of boys wearing shorts-shirt.

## Discussion

This research aimed to examine the effect of the clothes used by students in physical education classes on some physical fitness parameters. As a result of the research, it was seen that the physical fitness parameters of both boys and girls wearing shorts and t-shirts were generally better than those wearing school uniforms, and therefore the main hypothesis of our research was confirmed.

In hot situations, clothing naturally enhances insulation and forms a barrier against evaporative heat loss (Pascoe et al., 1994a-b; Havenith, 2002). However, sportswear seeks to lessen this insulating effect with breathable and lightweight designs composed of synthetic fabrics that aim to optimize moisture transport (i.e. sweat absorption) to encourage evaporative heat loss, maximise wearer comfort, and so improve performance (Bhatia & Malhotra, 2016; Kicklighter et al., 2011). Sports Medicine Australia (2021) guidelines recognize clothing selection as an important consideration to reduce the risk of heat stress during exercise in the heat. These concepts claim that reducing unneeded layers of clothing, decreasing skin covering, and wearing lightweight, breathable clothes will increase sweat evaporation and hence heat dissipation. Many research have been conducted to evaluate the efficiency of sportswear in terms of thermoregulation, comfort, and performance. These research mostly focused on studying a range of textiles, including natural fibers (De Sousa et al., 2014; Ueda et al., 2006; Laing et al., 2008), synthetic fibers (Abdallah et al., 2015; Scholler et al., 2020; Corbett et al., 2015), blends of natural and synthetic fibers (Laing et al., 2008; Davis et al., 2017; Kaplan & Okur, 2012), and chemically treated fibers (McFarlin et al., 2016; McFarlin et al., 2017).

Due to the effects of the technological age on children in their developmental age, the importance of physical education and sports courses in school curricula has gradually increased. Modern lifestyle leads to obesity becoming a problem not only for adults but also for children. Moderate-intensity physical activity within the

scope of physical education lessons plays an important role in preventing and eliminating this problem (Mijanovic, 2022). Improving physical activity in children and adolescents, physical fitness (cardio-respiratory and muscular fitness), cardiometabolic health (blood pressure, dyslipidemia, glucose and insulin resistance), bone health, cognitive outcomes (academic performance, executive function), mental health (reduced depression) and provides health-related benefits such as reducing obesity (WHO, 2020). In their study, Yalçın and Balcı (2013) concluded that children who regularly participate in sports activities become more organized in school life, their discipline levels increase, their sense of responsibility increases, they participate more actively in coursework with the motivation of their group coaches, and their desire to go to school increases. In order to fully benefit from these benefits, one of the basic requirements of physical education and sports class is to attend the class with appropriate clothing (shorts, t-shirt, tracksuit, sneakers). In order for physical education lessons to be taught in accordance with their purposes, a suitable area, adequate facilities, tools and equipment, physical education and sports teachers, the course, as well as students and appropriate clothing for this lesson are needed. It is emphasized that in the absence or deficiency of any of these needs, it will be difficult to achieve the goals and objectives of the course and the desired efficiency will not be achieved (Özener, 1988). This shows that wearing shorts and t-shirts in physical education class is more positive. The results obtained from our study are similarly similar to the study conducted by Özsarı (2017). In the study, the attitudes of 10-12 year old students studying in private and public schools towards physical education lessons were examined according to various variables. As a result, it was stated that students studying in private schools had positive results in their attitudes because the number of tracksuits and sneakers was higher than those studying in public schools. At the same time, it was concluded that the physical fitness parameters of students wearing tracksuits and sneakers were better than those who did not have appropriate clothes for physical education class. Another study by Sun et al. (2020) emphasized that running shoes should be designed to increase running-related performance and reduce possible injuries. With flexibility movements, the local stretching of the skin in certain areas of the elbow and knee reaches 50% along the arm, while when bending forward, the increase in the semi-grip of the hips was found to be 35% in the vertical direction (Shishoo, 2005). In the study conducted by Tyler and Venkatraman (2012), it was reported that the properties of the tissue materials used in the clothes worn by the athletes and also the design of the clothes had a significant effect on the flexibility and speed of the athletes. In another study by Atalie et al. (2021), the thermo-physiological comfort properties of sportswear with different inner and outer layer combinations were examined and it was reported that the inner and outer material properties of sportswear had an impact on sports

performance and the parameters such as flexibility associated with it. In the study conducted by Venkatraman (2016), it was concluded that fiber sports clothing has a positive effect on physical fitness parameters and increases flexibility and speed. In the study conducted by Jiang et al. (2023), it was evaluated that the performance of female swimmers was affected depending on body type and swimsuit type. In the study conducted by Hassan et al. (2012), the effect of fabric properties of sportswear on the health and performance of athletes was investigated and it was emphasized that fabric properties are related to sports performance.

## Conclusion

As a result, it can be said that the physical fitness levels of those wearing shorts and t-shirts are more positive than those wearing school uniforms, and the hypotheses are generally supported. Based on the current findings, it can be said that wearing shorts and t-shirts in physical education classes has a significant advantage compared to those who do not wear shorts and t-shirts in terms of some physical fitness parameters. Therefore, it may be recommended to encourage more comfortable clothing such as shorts and t-shirts in physical education classes, which may allow this sample group to increase their physical activity levels during the school day, not only in physical education classes but also outside of school.

Our findings suggest that wearing shorts and t-shirts in physical education classes promotes physical fitness. However, the opposite, i.e. school uniform policies, may restrict students' physical activity in physical education classes. Future studies could include studies on the duration of clothing worn at school during the week and the intensity of physical activity to provide a better assessment of the impact of school uniforms and wearing shorts and t-shirts in physical education classes on physical fitness.

## Recommendations

- Similar studies can be carried out on other classes and also at other levels of education.
- Studies can be carried out on the effects of clothing on sports performance.
- The intervention period can be extended by designing randomized studies.
- More comprehensive studies can be conducted using different test batteries and with larger samples.
- Clothes can be decided by taking the opinions of students, parents and teachers to determine what kind of clothes students are comfortable wearing in physical education class.

## Limitations

The study was limited to secondary school 7th grade

students. However, age, sport branch and socioeconomic factors were not specifically included. Repeating the study with a larger sample by including various variables may increase the possibility of generalizing the results. However, it is thought that purposive sampling strategies may provide more generalizable results for future research. This study only provides an idea about the effect of the clothes used by 7th grade secondary school students in physical education classes on physical fitness. In addition, it is thought that more research on this topic is needed to evaluate these findings in the context of the secondary school student population studied using longitudinal or experimental research methods. These parameters can be said to be an important aspect of this study for future research. Despite these limitations, it can be said that the findings of the study provide an up-to-date contribution to the literature on the effect of the clothes used by secondary school 7th grade students in physical education classes on physical fitness.

As a result, it was seen that the clothes used in physical education classes had a positive effect on physical fitness.

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