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Contextual Influences on Childhood Obesity: A Comparative Study Between Turkish and Portuguese Children

Tendencias de la masa corporal en la infancia: perspectivas de las poblaciones turca y portuguesa

Tendências do índice de massa corporal na infância: perspectivas das populações turca e portuguesa

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Resumen

La obesidad infantil constituye una creciente preocupación de salud pública a nivel mundial, con diversos factores contextuales que influyen en su prevalencia. Este estudio tiene como objetivo investigar y comparar el índice de masa corporal (IMC) en niños turcos y portugueses, explorando las posibles influencias de variables contextuales. Se realizó un análisis transversal con una muestra de niños en edad escolar (6 a 10 años) de ambos países. Se consideraron indicadores clave como el índice de masa corporal (IMC), la edad, el sexo y la participación en actividades físicas. El análisis reveló diferencias estadísticamente significativas en el IMC, la talla y el peso entre los dos grupos (p≤0,001), lo que subraya el impacto de factores culturales, ambientales y socioeconómicos en la salud infantil. Este estudio enfatiza las marcadas disparidades en los indicadores antropométricos (IMC, talla y peso) entre niños turcos y portugueses. Estas diferencias ponen de relieve la influencia de múltiples factores contextuales, incluidos los culturales, ambientales y socioeconómicos, en la obesidad infantil.

Palabras clave: ejercicio; niños; índice de masa corporal; influencias culturales; salud.

Abstract

Childhood obesity is a growing public health concern worldwide, with various contextual factors playing a role in its prevalence. This study aims to investigate and compare body mass index (BMI) in Turkish and Portuguese children, exploring the potential influences of contextual variables; A cross-sectional analysis was conducted with a sample of school-aged children (6 to 10 years old) from both countries. Key indicators such as body mass index (BMI), age, gender, and participation in physical activities. The analysis revealed statistically significant differences in BMI, height, and weight between the two groups (p≤0.001), underscoring the impact of cultural, environmental, and socioeconomic factors on children's health. This study emphasizes the significant disparities in anthropometric indicators (i.e., BMI, height and weight) between Turkish and Portuguese children. These differences highlight the influence of various contextual factors, including cultural, environmental and socioeconomic elements, on childhood obesity.

Keywords*:* Exercise, Children, Body mass index, Cultural influences, Health.

Resumo

A obesidade infantil constitui uma crescente preocupação de saúde pública em todo o mundo, com diversos fatores contextuais influenciando sua prevalência. Este estudo tem como objetivo investigar e comparar o índice de massa corporal (IMC) em crianças turcas e portuguesas, explorando as possíveis influências de variáveis contextuais. Foi realizada uma análise transversal com uma amostra de crianças em idade escolar (6 a 10 anos) de ambos os países. Foram considerados indicadores-chave como índice de massa corporal (IMC), idade, sexo e participação em atividades físicas. A análise revelou diferenças estatisticamente significativas no IMC, na estatura e no peso entre os dois grupos (p≤0,001), ressaltando o impacto de fatores culturais, ambientais e socioeconômicos na saúde infantil. Este estudo enfatiza as disparidades significativas nos indicadores antropométricos (IMC, estatura e peso) entre crianças turcas e portuguesas. Essas diferenças destacam a influência de múltiplos fatores contextuais, incluindo elementos culturais, ambientais e socioeconômicos, na obesidade infantil.

Palavras-chave: exercício; crianças; índice de massa corporal; influências culturais; saúde.

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Introduction

Childhood obesity is a growing public health problem worldwide, with significant impacts on the physical and psychosocial health and quality of life of children (Bailich Capistrano et al., 2022; Branquinho et al., 2024; Forte et al., 2022). Numerous studies have demonstrated that regular physical activity plays a crucial role in promoting health and controlling weight in children (Silva et al., 2024). Regular physical activity is inversely related to the prevalence of childhood obesity, highlighting the importance of encouraging healthy habits and lifestyles from childhood to adulthood (Monteiro et al., 2022). In addition to contributing to weight control, physical activity promotes the development of motor skills, improves quality of life, and helps prevent obesity-related diseases (Stodden et al., 2014).

In this regard, previous studies have demonstrated significant differences in body mass indicators between children of different ethnic origins and countries, highlighting the need to understand the cultural, socioeconomic, and health influences of each context (Duncan et al., 2012). In this sense, previous investigations (Duarte et al., 2022; Zhang et al., 2019) identified significant differences in body mass indicators when comparing children who lived in the countryside or urban areas. In addition, acculturation also seems to influence children's eating habits and weight, highlighting the importance of cultural contexts in child health. Therefore, it seems important to continue comparing body mass indicators considering possible differences

in dietary patterns, physical activity, and other factors that may contribute to variations in body mass index (BMI) in different types of child populations.

A study carried out by Padez et al. (2004), suggested that Turkish children appeared to have a distinct tendency to be overweight and obese compared to Portuguese children, suggesting the influence of genetic, environmental and cultural factors on this disparity. Furthermore, the association between socioeconomic level and BMI in Portuguese children has been investigated, highlighting the complexity of the interactions between social determinants and health indicators. Understanding these differences is essential for developing effective prevention and intervention strategies to combat childhood obesity. Considering the importance of BMI as a widely used indicator in the assessment of nutritional status and risk of diseases associated with obesity (Freedman & Sherry, 2009; Walczyk, 2021), the comparative analysis between Turkish and Portuguese children can provide valuable insights for promoting healthy habits and health policies aimed at these populations. These two countries present unique cultural, dietary, and socioeconomic profiles, which makes the m relevant for this type of comparison. For example, dietary patterns in Turkey often include traditional high-calorie foods, while Portugal has a Mediterranean diet known for its health benefits.

Childhood obesity is a growing global health concern, with rising prevalence linked to numerous physical, psychological, and social consequences. Understanding how contextual factors such as culture, environment, and lifestyle influence body composition in children is essential for developing effective prevention strategies. By examining these distinct contexts, this study aims to investigate and compare body mass indicators in Turkish and Portuguese children, exploring the possible influences of contextual variables and expanding knowledge about health disparities in these ethnic groups and provide support for implementing effective prevention and intervention strategies to combat childhood obesity, aiming to promote the health and well-being of future generations. Furthermore, the age range of 6 to 10 years was chosen as it represents a critical period for the development of healthy habits and the early identification of weight-related health risks.

Meterial and methods

Subjects

A total of 2,714 children (1352 male and 1362 female) aged between 6 and 10 years participated in the study (mean ± SD; 7.9 ± 1.3 years). The sample included children of two nationalities: 1,150 Turkish and 1,564 Portuguese. All individuals participated in the study voluntarily. The selected schools were chosen based on convenience sampling. The schools were from regional capitals (xxxxx and xxxx municipalities). Their parents or guardians were informed in writing about the study's genesis and signed an informed consent form certifying their children's participation.

To participate in the study, students needed to be healthy and regularly attend physical education classes. Th participants were randomly selected, ensuring a diverse representation of participants. No specific exclusion criteria were applied, and no health screenings were performed to assess the participant's health status beyond the inclusion criteria. All procedures were performed following the recommendations of the Declaration of Helsinki for human studies.

Procedures

A cross-sectional analysis was conducted throughout the 2021 to 2023 school years during physical education classes in several Turkish and Portuguese schools (6,7,8,9 and 10 years old). All individuals who participated in the classes were evaluated concerning BMI. The BMI was calculated using the formula: Body Mass Index (BMI: kg/m²)(Anchuelo et al., 2019). In addition, at the end of the session, an adult assisted all students in completing a binary response questionnaire (yes or no) regarding their involvement in regular physical activity (i.e., sports modality with or without competition) outside the school context. Subsequently, intra- and inter-group comparisons were carried out concerning countries, gender, age, and participation in sports activities outside the school context.

Standardized equipment was used across all schools to ensure consistency in measurements. Weight was measured using a Seca 803 digital scale (Seca GmbH, Hamburg, Germany), and height was measured with a Seca 213 portable stadiometer (Seca GmbH, Hamburg, Germany), following the standard procedures outlined in the Fitnessgram protocol (Welk & Meredith, 2017). All evaluators were trained to minimize potential measurement biases, ensuring reliability and validity in the data collection process. Factors such as dietary habits, family history of obesity, and screen time were not discussed or controlled in the analysis.

Statistical Analysis

Descriptive statistics were presented as mean ± standard deviation (SD) with 95% confidence interval (CI). The Shapiro-Wilk and Levene tests were used to determine the normality and homogeneity of the data. The independent samples t-test (samples from two groups) was used to compare the variations between the two groups. To explore the effects of country (Portugal vs. Türkiye), sex (male vs. female), and age (6–10 years) on body mass index (BMI), height, and weight, a three-way factorial ANOVA (country × sex × age) was conducted for each dependent variable. This approach allowed for the identification of both main effects and interaction effects between the independent variables. Where significant effects were observed, post hoc comparisons were carried out using Tukey's HSD test, and Bonferroni correction was applied to control for Type I error due to multiple comparisons. Effect sizes (ES) were calculated based on Cohen's d and classified as: 0.2–0.6 (trivial); 0.6–1.2 (small); 1.2 (large); and greater than 2.0 (very large) (Hopkins, 2019). Statistical significance was set at $p < 0.05$. Statistical analyzes were performed in SPSS for Windows version 26.0 (SPSS Inc., Chicago, IL, USA).

Results

The results revealed the existence of statistically significant differences in inter-group comparisons when comparing countries in relation to the variables BMI, height and weight ($p \leq 0.001$) with a trivial effect (table 1 and figure 1). Other intergroup comparisons were carried out for the same dependent variables in relation to gender and regular participation in physical activity, but no differences were found (tables 2 and 3 and figure 1).

Table 1. Intergroup comparisons for BMI, Height, weight related to Country

	t	df	p	Mean Difference	Cohen's d	95% CI for Cohen's d	
						Lower	Upper
BMI	3.239	2712	< 0.001 *	0.415	0.126	0.050	0.202
Height	8.287	2712	< 0.001 *	3.083	0.322	0.245	0.399
Weight	6.580	2712	< 0.001 *	2.367	0.256	0.179	0.332

Table 2.Intergroup comparisons for BMI, Height, weight related to Gender

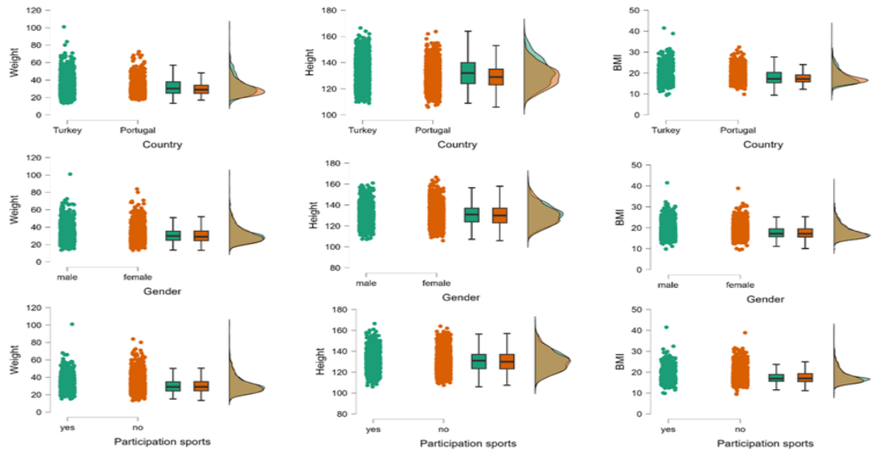
	t	df	p	Mean Difference	Cohen's d	95% CI for Cohen's d	
						Lower	Upper
BMI	1.250	2712	0.211	0.158	0.048	-0.027	0.123
Height	0.567	2712	0.571	0.211	0.022	-0.053	0.097
Weight	0.796	2712	0.426	0.285	0.031	-0.045	0.106

Table 3. Intergroup comparisons for BMI, Height, weight related to Participation on Sports

	t	df	p	Mean Difference	Cohen's d	95% CI for Cohen's d Lower	Upper
BMI	-1.479	2299	0.139	-0.209	0.063	-0.146	0.021
Height	-0.136	2299	0.892	-0.057	0.006	-0.089	0.078
Weight	-1.133	2299	0.257	-0.455	0.048	-0.132	0.035

This figure 1 illustrates the mean values of BMI, height, and weight for children from Türkiye and Portugal, disaggregated by gender (male, female) and regular participation in physical activity outside of school (yes, no). The visual representation helps highlight differences between national groups, as well as the apparent lack of significant variation related to gender and physical activity levels. Error bars represent standard deviations.

Figure1. Intergroup comparisons regarding weight, height and BMI under different contextual conditions (country, gender, participation in sporting activities)



Inter-group comparisons for the variables countries, age, gender, and regular participation in physical activity demonstrated differences only in the comparison between country and age, $p \leq 0.001$ (table 4 and figure 2). Specifically, significant differences ($p \leq 0.001$) were identified when comparing Turkish male children and Portuguese female children. In addition, significant differences were found between Portuguese male children, Portuguese female children, and Turkish female children (Table 5).

Table 4. Inter-group comparisons for BMI x Country x age x gender x participation in sports

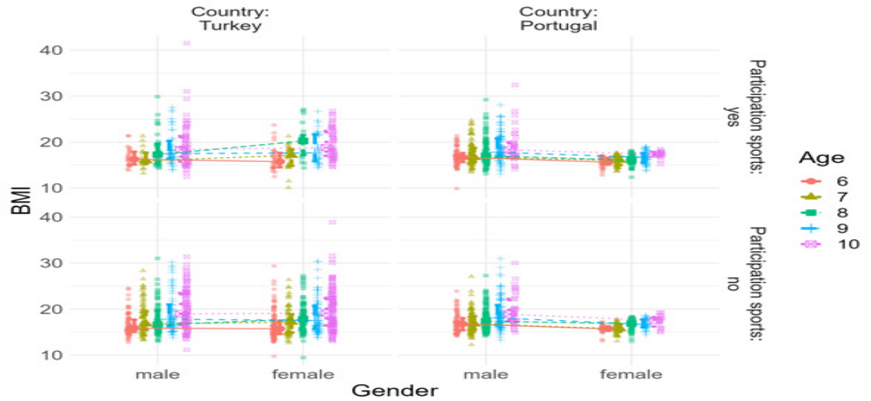
	F	p
Country ✻ Age	2.300	0.057
Country ✻ Gender	38.152	< .001***
Country ✻ Age ✻ Gender	1.103	0.353
Country ✻ Participation sports	0.031	0.860
Age ✻ Participation sports	1.299	0.268
Gender ✻Participation sports	1.080	0.299
Country ✻ Age ✻ Participation sports	2.169	0.070
Country✻ Gender ✻ Participation sports	0.923	0.337
Age ✻ Gender ✻ Participation sports	0.063	0.993
Country ✻ Age ✻ Gender ✻ Participation sports	0.474	0.755

Table 5. Post Hoc Comparisons - Country ✻ Gender

		Mean Difference	SE	t	ptukey
Turkey male	Portugal male	-0.007	0.191	-0.036	0.910
	Turkey female	-0.127	0.211	-0.604	0.931
	Portugal female	1.736	0.234	7.406	< .001***
Portugal male	Turkey female	-0.120	0.192	-0.628	0.923
	Portugal female	1.743	0.217	8.030	< .001***
Turkey female	Portugal female	1.863	0.235	7.943	< .001***

This figure 2 presents BMI comparisons across different age groups (6 to 10 years), stratified by country (Türkiye, Portugal), gender (male, female), and participation in physical activity outside of school. It visually demonstrates how BMI varies across these interacting factors and highlights significant differences between subgroups, particularly between Turkish males and Portuguese females. Error bars represent standard deviations.

Figure 2. Inter-group comparisons regarding BMI under different conditions (country, gender, age and participation in sporting activities)



DISCUSSION

This study provides valuable insights into the comparative body mass indicators of Turkish and Portuguese children, highlighting key disparities in BMI, height, and weight between the two groups. The findings reveal that Turkish children in our sample exhibited higher BMI values compared to their Portuguese counterparts; however, as BMI does not distinguish between fat and lean mass, this difference should be interpreted with caution. It may reflect variations in body composition, potentially influenced by genetic, cultural, or environmental factors, which warrant further investigation through more precise body composition assessments. These differences are influenced by various contextual factors, including dietary habits, physical activity levels, and environmental and socioeconomic conditions (Stodden et al., 2014).

For instance, traditional diets in Turkey may include higher consumption of calorie dense and fat-rich foods, such as fried foods and meat-based dishes (World Health Organization, 2018). On the other hand, Portuguese children have access to a more balanced diet that includes more fruits, vegetables, and fish, with moderate consumption of processed foods, which may contribute to a lower prevalence of obesity (Gülü et al., 2022).

Moreover, the study emphasizes the influence of socioeconomic and environmental factors. Children in urban areas, for instance, are likely to have better access to organized sports and recreational activities, which may contribute to healthier weight and height outcomes. Conversely, children in rural areas might face limited access to such resources, influencing their overall health. (Duarte et al., 2022; Zhang et al., 2019). Additionally, socioeconomic factors, including parental education and income levels, play a crucial role, with higher parental education and income often correlating with better nutritional choices and access to health-promoting resources (Bu et al., 2021; Van Rossem et al., 2014). Previous studies have shown that economic development and SES significantly impact childhood obesity rates (Houle, 2013; Pampel et al., 2012).

Additionally, the findings reveal significant differences within gender and age groups, with Turkish male children and Portuguese female children exhibiting notable variations in body mass indicators. These results suggest the importance of considering gender-specific approaches in addressing childhood obesity. Promoting physical activity among girls and encouraging healthier dietary choices for boys could be effective strategies to mitigate gender-related disparities in obesity risk (Molina-Garcia et al., 2021; Sweeting, 2008). Moreover, addressing body image and self-esteem, particularly among children with obesity, is essential to avoid potential psychological consequences (King et al., 2020; Myers & Rosen, 1999; O'Dea, 2004).

In terms of physical activity, while no direct correlations were found between regular sports participation and BMI, height, or weight, the broader health benefits of physical activity remain evident. Physical activity is crucial in preventing obesity and promoting long-term health, regardless of the immediate effects on body mass (Bull et al., 2020; Faienza et al., 2012). Socioeconomic factors and family structure also play critical roles in obesity risk behaviors (Iguacel et al., 2021; McCormack et al., 2011).

Furthermore, body image and self-esteem remain closely tied to physical health, especially in adolescents. Body dissatisfaction can lead to unhealthy eating behaviors and psychological issues, which reinforces the need to address these concerns in obesity prevention strategies (Coelho et al., 2013; Collins, 1991). Therefore, addressing body image issues and promoting a healthy self-image are essential to obesity prevention strategies (Stice & Shaw, 2002; Zitzmann & Warschburger, 2020).

Lastly, the study advocates more accurate methods of body composition assessment beyond BMI, such as bioelectrical impedance analysis (BIA), anthropometric measurements performed by certified anthropometrics, and dual-energy X-ray absorptiometry (DEXA), which provide better insights into fat and lean mass. These techniques are particularly valuable for pediatric populations, where body composition changes rapidly during growth and development [30–35].

This study has several limitations that should be considered. BMI was used as the sole indicator of adiposity, which does not distinguish between fat and lean mass, potentially misclassifying children's nutritional status. Genetic and physiological factors, such as differences in muscle mass or maturation, were not accounted for and may influence BMI variations between groups. The cross-sectional design limits causal inferences, and important confounding variables (such as diet, screen time, family background, and socioeconomic status) were not controlled. Physical activity was assessed with a simple binary self-report, lacking detail and precision. The sample may not fully represent all children in Türkiye and Portugal. However, a key strength of this study is its large, bi-national sample of over 2,700 children, allowing for meaningful comparisons between Turkish and Portuguese populations. The use of standardized measurement protocols across all schools ensured consistency and reliability in data collection. Additionally, the inclusion of age, sex, and physical activity variables provides a broader understanding of contextual influences on BMI in childhood.

In conclusion, the results of this study underscore the need for prevention and intervention strategies tailored to the cultural, environmental, and socioeconomic contexts of different populations. Public health policies should focus on promoting healthy dietary habits, reducing processed food consumption, increasing opportunities for physical activity, and addressing socioeconomic disparities that contribute to childhood obesity. Additionally, promoting a positive body image and improving self-esteem should be essential components of any prevention strategy, as these issues are closely linked to both psychological and physical well-being. Understanding the contextual influences on children's health can help develop more effective and target-ed approaches to improve the well-being of future generations [12,36,37].

Practical Applications

Public health strategies to combat childhood obesity should be culturally and socially tailored, promoting healthier eating habits and increased physical activity among Turkish children, reinforcing positive behaviors and addressing new challenges in Portuguese children. Interventions must also be gender-sensitive, encouraging physical activity in girls and guiding parents on healthy dietary choices for boys. Ad-dressing socioeconomic disparities is essential, ensuring that all children (regardless of background) have access to nutritious food and safe opportunities for physical activity. Schools and communities are vital in expanding access to organized sports, especially in urban areas. Finally, broad public health campaigns should educate families on the importance of balanced diets and regular exercise, using accessible media platforms to support long-term healthy behaviors. Public health strategies to combat childhood obesity should be culturally and socially tailored, promoting healthier eating habits and increased physical activity among Turkish children, reinforcing positive behaviors, and addressing new challenges in Portuguese children. Interventions must also be gender-sensitive, encouraging physical activity in girls and guiding parents on healthy dietary choices for boys. Addressing socioeconomic disparities is essential, ensuring that all children—regardless of background—have access to nutritious food and safe opportunities for physical activity. Schools and communities are vital in expanding access to organized sports, especially in urban areas. Finally, broad public health campaigns should educate families on the importance of balanced diets and regular exercise, using accessible media platforms to support long-term healthy behaviors.

Conclusion

This study highlights significant disparities in body mass indicators such as BMI, height, and weight between Turkish and Portuguese children. These differences underscore the influence of various contextual factors, including cultural, environmental, and socioeconomic elements, on childhood obesity. Turkish children displayed higher BMI values compared to their Portuguese counterparts, potentially due to variations in dietary habits, physical activity levels, and genetic predispositions.

Additionally, significant differences in height and weight point to the impact of environmental factors such as urbanization and socioeconomic status. Gender-specific disparities in body mass indicators further emphasize the need for tailored interventions to address childhood obesity effectively. The results underscore the importance of understanding and addressing the unique influences on children's health in different cultural settings to develop more targeted and practical approaches to promote the well-being of future generations.

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Conflicts of Interest

The authors declare no conflicts of interest.

Contribución de Autoría

Conceptualization, B.E.O. and L.B; methodology, B.E.O. and L.B; software, J.E.T and L.B; validation, B.E.O. and L.B; formal analysis, B.E.O., N.V. and L.B; investigation, B.E.O., N.V. and L.B; resources, B.E.O. and L.B; data curation, L.B.; writing—original draft preparation, B.E.O., N.V. and L.B; writing—review and editing, B.E.O., N.V., P.F., U.C., A.K., C.M., S.H., J.E.T., P.A., R.F., and L.B; visualization, L.B.; supervision, L.B.; project administration, B.E.O. and L.B; funding acquisition, L.B., and R.F.