Original Article

doi: 10.16926/par.2025.13.04

Associations of Parental Support and Involvement in Sports with Overweight and Obesity among Children and Adolescents in Pakistan: An Empirical Cross-Sectional Study

Moazzam Tanveer [1 ABCDE], Alexios Batrakoulis [2 BC], Ejaz Asghar [3 BCD], Umar Tanveer [4 BCD], Nadeem Roy [5 BCD], Mohamed Abdelkader Souissi [6 CD], Luca Paolo Ardigò [7 CDE‡], Georgian Badicu [8 CDE‡]

[1] School of Physical Education and Sport Training, Shanghai University of Sport, Shanghai, China
[2] Department of Physical Education and Sport Science, University of Thessaly, Trikala, Greece
[3] Department of Allied Health & Sport Sciences, Health Services Academy, Islamabad, Pakistan
[4] Department of Mass Communication, University of Lahore, Lahore, Pakistan
[5] School of Physical Education, Shanxi University, Taiyuan, China
[6] Physical Activity, Sport and Health Research Unit, National Observatory of Sport, Tunis, Tunisia
[7] Department of Teacher Education, NLA University College, Oslo, Norway
[8] Department of Physical Education and Special Motricity, Faculty of Physical Education and Mountain Sports, Transilvania University of Brasov, Romania
‡ These authors share the last authorship

Authors' Contribution: A – Study Design, B – Data Collection, C – Statistical Analysis, D – Manuscript Preparation, E – Funds Collection

Abstract: This study examines the relationship between parental support and involvement in sports and the prevalence of overweight and obesity among Pakistani children and adolescents aged 9-17 years. Using a cross-sectional design, the study used a multistage random cluster sample from 62 schools with 4,200 students. Data from 4,108 participants (97.8%) were analysed, with 92 (2.2%) excluded due to incomplete information. Body weight status was assessed according to WHO guidelines. Results showed that among 3,371 students (mean age = 13.74 years, 58.2% boys), higher parental support and involvement in sports were significantly associated with healthier weight status. Descriptive statistics showed that 15.8% of the children were underweight, 57.1% had a healthy weight, 16.8% were overweight and 10.3% were obese. Significant associations were found between parental encouragement to exercise and weight status ($\chi 2 = 13.39$, $p = 0.005$). Logistic regression showed that parental encouragement ($B = 0.138$, $p < 0.001$) and financial support ($B = 0.099$, $p < 0.01$) were positively associated with healthier body weight. In contrast, lack of involvement was associated with higher rates of obesity.

Keywords: Overweight, Obesity, BMI, Family Support, Youth Sports, Parental Support

Corresponding author: Moazzam Tanveer, Email: moazzam12146@gmail.com; Georgian Badicu, Email: georgian.badicu@unitbv.ro; Luca Paolo Ardigò, Email: luca.ardigo@nla.no

Recevied: 12.02.2024; Accepted: 5.11.2024; Published online: 8.01.2025

Citation: Tanveer M, Batrakoulis A, Asghar E, Tanveer U, Roy N, Souissi MA, Ardigò LP, Georgian Badicu G. Associations of Parental Support and Involvement in Sports with Overweight and Obesity among Children and Adolescents in Pakistan: An Empirical Cross-Sectional Study. Phys Act Rev 2025; 13(1): 35-47. doi: 10.16926/par.2025.13.04

INTRODUCTION

Childhood obesity has emerged as a critical global public health problem, exacerbated by a decline in physical activity (PA) and an increase in sedentary behaviour among children and adolescents [1,2]. In Pakistan, this issue is particularly urgent, with increasing rates of overweight and obesity among school-aged children and adolescents [3]. Despite the well-documented health benefits of regular physical activity, many Pakistani children do not meet recommended PA levels [4]. Evidence suggests that parental support and involvement in sports play a key role in shaping children's engagement in physical activity [5]. Investigating how these parental factors relate to the prevalence of overweight and obesity provides valuable insights into effective interventions and strategies to promote healthier lifestyles among Pakistani youth [6]. Family characteristics such as parental role modelling, support for PA, motivation, family structure and socioeconomic status significantly influence children's participation in physical activity [7,8]. Participation in extracurricular activities, especially multiple sports, is beneficial in preventing overweight and obesity in adolescents. For example, research suggests that individuals participating in two or more sports are less likely to become overweight [9-10]. In addition, cross-training in different activities can help maintain a healthy weight. In addition, there is growing evidence that adolescents who frequently share meals with their families consume more nutrient-dense diets, contributing to healthier weight outcomes [11].

Physical inactivity and obesity among children and adolescents have become critical public health issues globally, significantly impacting their health, well-being and overall development [12,13]. Regular physical activity enhances not only physical health but also mental well-being [14]. Numerous studies have demonstrated the health benefits of physical activity, including reducing risk factors for chronic diseases, combating obesity and maintaining a healthy weight [15]. An inverse relationship exists between participation in physical activity and obesity and the risk of metabolic and cardiovascular diseases [14-16]. Despite these benefits, global physical activity levels among children and adolescents remain alarmingly low, with approximately 81% of adolescents reported to be physically inactive in 2016 [17,18]. Various factors influence physical activity participation, with parental support and involvement particularly crucial [9,19]. Parental encouragement facilitates children's participation in moderate to vigorous physical activity (MVPA). It fosters an environment that promotes healthy behaviours, helping to mitigate the risk of overweight and obesity among children and adolescents [16]. In this context, understanding the associations between parental support, sports involvement and obesity prevention in children is vital for developing effective interventions in Pakistan.

Globally, obesity is a significant concern, with Pakistan being no exception [13]. As a low- and middle-income country (LMIC) [17], Pakistan faces a dual burden of overnutrition and poor nutrition despite having 54% of its population under the age of 19 [20]. Ranked ninth globally for overweight and obesity prevalence, over 50% of Pakistan's population falls into these categories [15]. This rising trend is alarming, as being overweight is associated with increased early mortality in both genders [3,5]. By 2030, an estimated 5.4 million school-age children in Pakistan are projected to be obese [21]. Despite these troubling statistics, Pakistan lacks comprehensive policies targeting overweight, obesity and physical inactivity, as highlighted by the World Health Organization's (WHO) Diabetes country profiles [17]. Research on obesity among Pakistani school-aged children and adolescents remains limited, underscoring the need for baseline data to assess prevalence [22]. Childhood obesity, which affects around 10% of school-aged children worldwide, is linked to numerous health issues such as insulin resistance, hypertension, type 2 diabetes and psychological problems [10]. Schools provide a critical intervention setting by influencing physical activity levels, dietary habits

and attendance [1,4]. However, current literature may not fully capture the situation in Pakistan [9,23]. To bridge this gap, comprehensive population-based studies using standardised measurements and diagnostic criteria are essential for understanding the scale of the issue and guiding evidence-based policies and interventions [20-23]. Regular surveillance is also necessary to monitor trends in overweight and obesity, enabling the development of tailored strategies for local contexts.

This study aims to assess the associations between parental support and involvement in sports and the prevalence of overweight and obesity among school-aged children and adolescents (9–17 years old) in Pakistan, using a nationally representative sample. The objective is to develop evidence-based guidelines for managing and preventing overweight and obesity in this population by identifying how parental behaviours influence children's physical activity levels and body weight. The findings are expected to inform targeted interventions, policy-making and public awareness campaigns, with the potential to reduce the rates of overweight and obesity not only in Pakistan but also globally.

MATERIAL AND METHODS

Study design and participants

A population-based cross-sectional survey was conducted during the summer of 2023, targeting school-aged children and adolescents (ages 9 to 17) in seven randomly selected districts of Punjab, Pakistan. The study invited 4,200 students from 62 schools to participate through a stratified multistage random cluster sampling method. Of these, 92 students (2.2%) were excluded due to incomplete information, leaving 4,108 students (97.8%) who provided valid responses. The study also gathered data from parents, with 3,371 (82.05%) completing the parent questionnaire. The remaining 737 parents either did not respond or submitted incomplete answers. Each student's data was matched with their corresponding parent's responses using a unique serial number, resulting in a 3,371 complete parent-child pairs dataset. The sampling included children and adolescents aged 9-17 from grades 4 to 12, excluding grades 1 to 3. Approval for the selection of public schools was obtained from the Punjab School Education Department (PSED), whereas private schools were included with consent from their administrators following site visits. To ensure representation across socioeconomic backgrounds, PSED provided a list of urban and rural schools, with public schools charging a minimal fee of 50 PKR and private schools charging up to 15,000 PKR. If a selected institution was unavailable, an alternative was randomly chosen. The survey was conducted with the support of the Education and Rescue-1122 Departments.

Ethics

The study was approved by the Institutional Ethics Committee of Shanghai University of Sport (Approval Number: 1816111009-2022). Consent for conducting the study was obtained from the principals and instructors of the participating schools. Additionally, the Punjab School Education Department issued a letter of permission. All participants provided written informed consent voluntarily and their information was collected and maintained anonymously.

Overweight and Obesity Status of Children and Adolescents

Professionals from Rescue-1122 visited the selected schools on pre-arranged days to collect anthropometric measurements of students' height and weight within the classroom setting. To ensure the confidentiality of the data, students provided their measurements directly while maintaining anonymity. We recorded body weights to the nearest 0.1 kg and heights to the nearest 0.5 cm. Accurate measurements were obtained using scientifically validated devices, including the digital CERTEZA weight scale and the SECA scale [3]. Students were instructed to stand barefoot and without headwear, dressed

in light school attire. Measurements were conducted in the morning or evening to reduce the impact of daily variations. Body weight status was determined according to the World Health Organization's 2007 child growth standards, which define obesity as a body mass index (BMI) exceeding +2 standard deviations (SD) and overweight as a BMI exceeding +1 SD [23]. These criteria apply to individuals aged 5 to 19 years, corresponding to the grade levels in the study. Throughout the data collection process, all participant information was kept strictly confidential.

Parental Support & Involvement in Sports

The surveys and participant demographics were integral components of the data collection instrument. Each metric used for the groups had been previously validated in a study conducted in Pakistan [17,23]. Demographic information was collected through a student-completed questionnaire administered during school hours. The questionnaire included items on sex (boy or girl), age (9 to 17 years), age category (child or adolescent), religion (Muslim or non-Muslim), place of residence (urban or rural), school type (public or private) and education level (primary, middle, secondary or higher secondary). These methods were based on approaches outlined by Mushtaq et al. [23], Chen et al. [24] and the Pakistan GSHS Questionnaire [25].

Parental Involvement, and Sports Related Financial Support Parameters: The questionnaire regarding parental involvement and sports-related financial support parameters focuses on understanding the level of parental support and engagement in their children's physical activities. In this study, we defined the term “parent” to include any guardian who was responsible for the welfare of the child (i.e., “parent” was not limited to biological parents). The questionnaire consists of the following items:

1. Do you support your children's participation in sports? (Reliability coefficient = 0.72) [9,19]. This question assesses how much parents support their children's involvement in sports activities.
2. Would you be interested in watching your children play sports? (Reliability coefficient = 0.81) [26]. This item seeks to understand the parent's interest in watching their children participate in sports events.
3. Do you explain to your children the advantages of sports for their health? (Reliability coefficient = 0.81). This question assesses whether parents discuss the benefits of sports activities with their children [19,26].
4. Are you planning to participate in sports with your children? This item determines if parents plan to engage in sports activities with their children [19].
5. Do you go to sporting events or school plays with your children? (Reliability coefficient = 0.74). This question assesses whether parents attend sporting events or school plays with their children [9,19].
6. Do you and your family members participate in sporting activities to unwind and have fun together? (Reliability coefficient = 0.82). This item aims to understand whether parents and family members engage in sports activities together for relaxation and enjoyment [19,25,27].
7. Will you offer assistance if your child requires money to participate in sports-related activities? (Reliability coefficient = 0.77). This question assesses the willingness of parents to provide financial support for their children's participation in sports, such as paying for sports fees, training or purchasing sports equipment [19,26].
8. Do you make an effort to care about your child's school-based physical education? (Reliability coefficient = 0.81). This item aims to determine if parents are actively involved and concerned about their child's physical education classes in school [9,26].

The reliability coefficients indicate the internal consistency of the items within each construct. The references cited, including Kiyani et al. [9], Yang Liu et al. [19] and Callahan-Myrick K et al. [27], indicate the sources from which these questions were adapted or inspired. The overall Cronbach's coefficient (0.82 in previous studies and 0.84

in this study) indicates the internal consistency of all eight items combined in this research.

Statistical Analysis

The study utilised Epi Info 6.04d to determine the sample size with a confidence level (1-α) of 95%, an estimated prevalence of 5% and a margin of error of ±1%. Data from the US Centers for Disease Control and Prevention (2004) were used. For this investigation, a sample size of 3,371 was sufficient, exceeding the projected minimum sample size of 3,246 [23].

IBM SPSS Version 26 was utilised to analyse the data. Age was accurately calculated by subtracting the birthdate from the date of examination. Body Mass Index-for-Age z-scores were constructed using the World Health Organization's (WHO) AnthroPlus software to assess the growth of children and adolescents [23]. According to the WHO Child Growth Standards (2007), overweight was defined as a BMI-for-age z-score exceeding +1 standard deviation (SD) and obesity was defined as a BMI-for-age z-score exceeding +2 SD. Frequency distribution analysis was performed to determine the prevalence of different body weight statuses. The relationship between body weight status (the dependent variable) and Parental Support & Involvement in Sports parameters (the independent variables) was examined using bivariate analysis and the chi-square test for trends. The Pearson correlation coefficient (r) was employed to assess the strength of the relationship between independent factors and body weight status. Linear regression analysis explored the predictive ability of sociodemographic and socioeconomic parameters on body weight. Additionally, logistic regression analysis was used to evaluate the simultaneous impact of multiple factors on the dichotomous outcome, with odds ratios (OR) and 95% confidence intervals provided. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 summarises family characteristics across primary, middle, secondary and higher secondary school levels, focusing on parental support and involvement in sports. The table shows that the sample size decreases from primary (21.3%) to higher secondary (10.8%) schools. The average age of children increases with school level, from 10.87 years in primary to 16.78 years in higher secondary. Body weight status reveals that obesity and overweight are more prevalent in higher school levels, with 42.7% of secondary school students and 18.6% of higher secondary students classified as obese or overweight, respectively. Most children have siblings, with a higher proportion in primary and middle schools. Parental education levels show a higher percentage of low education in primary and middle schools, whereas higher education levels increase in higher secondary schools. Parental occupation is predominantly in business or jobs across all school levels. Socioeconomic status indicates a majority in the low SES category, with a slight increase in middle SES as students progress to higher secondary. Family living arrangements are mostly single-family households, with a higher proportion of joint families in lower school levels. Finally, the mean BMI increases with school level, from 16.86 kg/m^2 in primary to 22.03 kg/m^2 in higher secondary, reflecting a gradual rise in body weight status with age and school progression.

Table 2 presents the results of a chi-square test examining the association between various forms of parental support and involvement in sports and the weight status of children and adolescents, stratified by urban and rural residence. For each characteristic, the table shows the percentage distribution of children and adolescents across different weight status categories (underweight, healthy, overweight and obesity) and the chi-square test statistics (χ^2) with associated p-values. The results indicate significant associations for several parental support factors. Encouraging children to participate in sports is significantly related to weight status in urban areas (p=0.005) but not rural areas. Similarly, liking to watch children participate in sports shows a significant association in

urban (p=0.028) and rural areas (p=0.001). Providing funds for sports participation is also significantly associated with body weight status in urban (p=0.001) and rural (p=0.005) areas. Other factors, such as telling children the benefits of sports and participating in sports activities together, show varying significance levels. Overall, the data reveal that parental support and involvement in sports significantly influence the weight status of children and adolescents, with notable differences between urban and rural settings.

Table 3 displays the correlations between body weight status and various family-level and parental support parameters. Positive correlations indicate that as the level of parental involvement and support increases, body weight status also tends to increase, suggesting a higher likelihood of being overweight or obese. For example, parental encouragement to participate in sports (r = 0.050) and providing funds for sports activities (r = 0.061) show a modest positive relationship with body weight status. Conversely, negative correlations, such as with watching children in sports activities (r = -0.091), suggest that greater parental observation may be associated with lower body weight status. Overall, the table highlights significant relationships between parental support activities—such as involvement in sports, encouragement and financial support—and body weight status, with implications for addressing obesity through increased family engagement in sports and physical activities.

Table 4 presents the results of a linear regression analysis examining the relationship between various forms of parental support and involvement in sports and students' body weight status. The results reveal that encouraging children to participate in sports (β = 0.082, p < 0.001) and providing financial support for sports activities (β = 0.058, p = 0.001) are positively associated with body weight status, indicating that such support might be linked to increased body weight. Conversely, parents who enjoy watching their children in sports activities are associated with lower body weight status (β = -0.147, p < 0.001). Other forms of involvement, such as participating in sports activities with children, attending sports competitions or discussing the health benefits of sports, did not show significant associations with body weight status. These findings suggest that specific forms of parental support, particularly financial support and engagement in sports, play a role in influencing children's body weight. However, the nature of these relationships varies.

Table 1. Descriptive Statistics of Family Factors Across School Levels

Characteristics		Primary School	Middle School	Secondary School	Higher Secondary school
Parental sample, n (%)		719 (21.3)	1208 (35.8)	1080 (32.0)	364 (10.8)
Age (year, mean ± SD)		10.87 ± 1.23	13.14 ± 1.37	15.29 ± 1.12	16.78 ± 0.55
Body weight status	Underweight	132 (24.7)	149 (27.9)	189 (35.4)	64 (12.0)
	Healty weight	452 (23.5)	764 (39.7)	550 (28.6)	158 (8.2)
	Overweight	90 (15.9)	178 (31.4)	193 (34.1)	105 (18.6)
	Obesity	45 (13.0)	117 (33.7)	148 (42.7)	37 (10.7)
Siblings, n (%)	Single child	56 (7.8)	69 (5.7)	36 (3.3)	29 (8.0)
	Two or more children	663 (92.2)	1139 (94.3)	1044 (96.7)	335 (92.0)
Parental education, n (%)	Low education level	462 (64.3)	753 (62.3)	653 (60.5)	197 (54.1)
	High education level	257 (35.7)	455 (37.7)	427 (39.5)	167 (45.9)
Parental occupation, n (%)	Own business or job	535 (74.4)	849 (70.3)	735 (68.1)	248 (68.1)
	Daily laborer	184 (25.6)	359 (29.7)	345 (31.9)	116 (31.9)
Socioeconomic status (SES), n (%)	Low SES	478 (66.5)	796 (65.9)	681 (63.1)	238 (65.4)
	Middle SES	217 (30.2)	316 (26.2)	275 (25.5)	93 (25.5)
	High SES	24 (3.3)	96 (7.9)	124 (11.5)	33 (9.1)
Family living, n (%)	Single family	410 (57.0)	718 (59.4)	708 (65.6)	199 (54.7)
	Joint family	309 (43.0)	490 (40.6)	372 (34.4)	165 (45.3)
BMI (kg/m^2, mean ±SD)		16.86 ± 3.18	19.00 ± 4.01	20.76 ± 4.70	22.03 ± 4.41

Table 2. Chi-Square Test to Assess the Association of Parental Support for Sports, Involvement, and Encouragement with Overweight and Obesity by Residence-Specific Trend

Characteristics		Residence	Body weight Status				χ^2	p
			Underweight	Healthy	Overweight	Obesity		
			n (%)	n (%)	n (%)	n (%)		
Encourage children to participate in sports	Yes	Urban	227 (18.5)	663 (54.0)	213 (17.4)	124 (10.1)	13.39	0.005
		Rural	103 (14.9)	432 (62.5)	100 (14.5)	56 (8.1)		
	No	Urban	117 (14.5)	458 (56.7)	128 (15.8)	105 (13.0)	6.44	0.092
		Rural	87 (13.5)	371 (57.5)	125 (19.4)	62 (9.6)		
Like to watch children participate in sports activities	Yes	Urban	197 (17.0)	607 (52.4)	215 (18.6)	140 (12.1)	9.11	0.028
		Rural	89 (12.3)	392 (54.4)	157 (21.8)	83 (11.5)		
	No	Urban	147 (16.8)	514 (58.7)	126 (14.4)	89 (10.2)	15.64	0.001
		Rural	101 (16.4)	411 (66.8)	68 (11.1)	35 (5.7)		
Tell to children the benefits of sports for his or her health	Yes	Urban	193 (16.6)	652 (56.2)	188 (16.2)	128 (11.0)	3.12	0.360
		Rural	119 (15.9)	445 (59.4)	119 (15.9)	66 (8.8)		
	No	Urban	151 (17.3)	469 (53.7)	153 (17.5)	101 (11.6)	12.03	0.007
		Rural	71 (12.1)	358 (61.0)	106 (18.1)	52 (8.9)		
Take part in sports activities with children	Yes	Urban	123 (18.6)	368 (55.7)	105 (15.9)	65 (9.8)	4.26	0.235
		Rural	72 (14.9)	287 (59.5)	84 (17.4)	39 (8.1)		
	No	Urban	221 (16.1)	753 (54.8)	236 (17.2)	164 (11.9)	8.13	0.040
		Rural	118 (13.8)	516 (60.4)	141 (16.5)	79 (9.3)		
Accompany to children their sports competitions or performances	Yes	Urban	179 (17.8)	546 (54.3)	171 (17.0)	109 (10.8)	7.87	0.049
		Rural	85 (14.5)	359 (61.4)	90 (15.4)	51 (8.7)		
	No	Urban	165 (16.0)	575 (55.8)	170 (16.5)	120 (11.7)	5.64	0.130
		Rural	105 (14.0)	444 (59.1)	135 (18.0)	67 (8.9)		
Family members take part in sports activities together.	Yes	Urban	117 (17.4)	392 (58.2)	108 (16.0)	57 (8.5)	6.47	0.091
		Rural	61 (15.2)	262 (65.2)	46 (11.4)	33 (8.2)		
	No	Urban	227 (16.7)	729 (53.6)	233 (17.1)	172 (12.6)	12.31	0.006
		Rural	129 (13.8)	541 (57.9)	179 (19.2)	85 (9.1)		
Provide funds to children to participate in sports activities	Yes	Urban	214 (16.9)	716 (56.6)	208 (16.4)	128 (10.1)	17.02	0.001
		Rural	119 (14.3)	546 (65.4)	101 (12.1)	69 (8.3)		
	No	Urban	130 (16.9)	405 (52.7)	133 (17.3)	101 (13.1)	12.76	0.005
		Rural	71 (14.2)	257 (51.3)	124 (24.8)	49 (9.8)		
Take initiative to care about child's physical education in school	Yes	Urban	185 (18.3)	536 (53.1)	168 (16.7)	120 (11.9)	13.36	0.004
		Rural	92 (13.5)	419 (61.7)	102 (15.0)	66 (9.7)		
	No	Urban	159 (15.5)	585 (57.0)	173 (16.9)	109 (10.6)	4.09	0.252
		Rural	98 (14.9)	384 (58.4)	123 (18.7)	52 (7.9)		
Total			534 (15.8)	1924 (57.1)	566 (16.8)	347 (10.3)	-	-

Table 5 presents the odds ratios (OR) for the association between various forms of parental support and involvement in sports and the likelihood of being overweight or obese among children and adolescents. For overweight versus non-overweight, the results indicate that parents who liked to watch their children in sports activities had a higher likelihood of their children being overweight (OR = 1.64, $p < 0.001$). Conversely, parental financial support for sports was associated with a lower likelihood of being overweight (OR = 0.68, $p < 0.001$). When analysing obesity versus non-obesity, parents who liked to watch their children in sports activities were also more likely to have obese children (OR = 1.48, $p < 0.01$), whereas financial support for sports and having family members involved in sports were associated with a lower likelihood of obesity (OR = 0.77, $p < 0.05$; OR = 0.72, $p < 0.05$, respectively). These findings suggest that whereas some forms of parental support are linked with lower obesity risk, others, like the mere observation of sports activities, might not be as beneficial and could be associated with higher obesity rates.

Table 3. Correlation between Body Weight Status and Family-Level, Parental Encouragement, Involvement, and Parental Sports-Related Financial Support Parameters (N = 3371)

Characteristics	Body weight-status	Encourage children#	Watching children in sports#	Sports for health#	Take part in sports with children#	Accompany to their sports#	Family take part in sports#	Provide funds to children
Encourage children#	0.050**	—						
Watching children in sports#	-0.091**	0.388**	—					
Sports for health#	0.020	0.323**	0.341**	—				
Take part in sports with children#	0.033	0.202**	0.235**	0.253**	—			
Accompany to their sports#	0.018	0.268**	0.256**	0.290**	0.276**	—		
Family take part in sports#	0.058**	0.171**	0.142**	0.196**	0.297**	0.247**	—	
Provide funds to children	0.061**	0.134**	0.129**	0.184**	0.094**	0.278**	0.171**	—
Take the initiative PA in school#	-0.001	0.180**	0.249**	0.250**	0.199**	0.286**	0.229**	0.202**

Sports for health = Tell the benefits of participating in sports for his or her health; Take part in sports with children = Take part in sports activities with your children; Encourage children = Encourage children to participate in sports; Watching children in sports = Like to watch children in sports activities; Accompany to their sports = Accompany to their sports competitions or performances; Family take part in sports = Family members take part in sports activities; Take the initiative PA in school = Take the initiative about child's physical education in school; $^{**}p < 0.01$.

Table 4. Linear Regression Analysis of Parental Financial Support and Involvement in Sports on Students' Body Weight Status.

Characteristics	*B*	SE	*β*	*t*	p
Constant	2.001	0.080		25.115	<0.001
Encourage children to participate in sports.	0.138	0.032	0.082	4.290	<0.001
Like to watch children in sports activities.	-0.247	0.033	-0.147	-7.571	<0.001
Tell the benefits of participating in sports for his or her health.	0.035	0.032	0.021	1.086	0.277
Take part in sports activities with children.	0.054	0.033	0.031	1.635	0.102
Accompany to their sports competitions or performances.	-0.008	0.032	-0.005	-0.243	0.808
Family members take part in sports activities.	0.081	0.033	0.046	2.465	0.014
Provide funds to children.	0.099	0.031	0.058	3.198	0.001
Take the initiative about child's physical education in school.	-0.019	0.031	-0.011	-0.604	0.546

B = Unstandardized Coefficients; *β* = Standardized Coefficients; SE = Standard error.

Table 5. Odds Ratios from Two Logistic Regression Analyses of Parental Financial Support and Involvement in Sports Factors Associated with Overweight and Obesity

Characteristics		Overweight vs. Non-Overweight Unadjusted OR (95% CI)	Obese vs. Non-Obese Unadjusted OR (95% CI)
Encourage children to participate in sport.	Yes	0.92 (0.77-1.10)	0.79 (0.63-0.99)*
	No	Ref.	Ref.
Like to watch children in sports activities.	Yes	1.64 (1.36-1.99)***	1.48 (1.17-1.86)**
	No	Ref.	Ref.
Tell the benefits of participating in sports for his or her health.	Yes	0.88 (0.74-1.06)	0.96 (0.77-1.20)
	No	Ref.	Ref.
Take part in sports activities with children.	Yes	0.97 (0.80-1.17)	0.81 (0.64-1.04)
	No	Ref.	Ref.
Accompany to their sports competitions or performances.	Yes	0.95 (0.79-1.13)	0.95 (0.76-1.19)
	No	Ref.	Ref.
Family members take part in sports activities.	Yes	0.76 (0.62-0.93)**	0.72 (0.56-0.93)*
	No	Ref.	Ref.
Provide funds to children for sports.	Yes	0.68 (0.56-0.81)***	0.77 (0.61-0.96)*
	No	Ref.	Ref.
Take the initiative about child's physical education in school.	Yes	0.89 (0.74-1.06)	1.17 (0.93-1.46)
	No	Ref.	Ref.

Level of significance *p < 0.05, **p < 0.01, ***p < 0.001, CI = Confidence Interval, OR = Odds Ratio; Ref. = Reference category (respectively)

DISCUSSION

The study associations of parental support and involvement in sports with overweight and obesity among Children and Adolescents reveal crucial insights into the impact of family-level factors on children's weight status. The analysis highlights that parental encouragement, involvement, and financial support for sports activities are associated with lower levels of obesity and being overweight. Specifically, encouraging children to participate in sports and providing financial support significantly correlate with reduced obesity risks, particularly in urban areas. Conversely, the study finds that parents' preferences for watching rather than participating in sports activities are associated with higher weight statuses among children. These findings emphasise the critical role of active parental involvement and support in fostering healthier weight outcomes in children and adolescents, suggesting that targeted interventions to enhance parental engagement in sports could be beneficial for combating overweight and obesity in this demographic.

The study reveals that different forms of parental involvement in sports have varied effects on children's body weight. Meanwhile, encouragement and financial support from parents are linked to higher body weight status, suggesting potential adverse outcomes. However, active family participation and enjoyment of watching children's sports activities are associated with healthier body weight. These findings highlight the complex role of parental support in influencing children's health and emphasise the need for a nuanced approach to understanding these dynamics. This study's findings align with and expand upon previous research. For example, one study observed that increased parental financial investment in sports did not always result in healthier weight outcomes, potentially due to a lack of focus on the quality of the physical activity or its overall health impact [28]. Similarly, research has found that whereas parental support could promote physical activity, it might not address underlying lifestyle issues contributing to obesity [29]. In contrast, other studies have demonstrated that parental participation in physical activities with children was linked to better weight management outcomes [30].

The variation in results across urban and rural settings is particularly noteworthy. In urban areas, where parental involvement and encouragement in sports showed significant associations with body weight status, these factors were less influential in rural settings. This finding is consistent with research noting that socioeconomic and environmental factors can mediate the effectiveness of parental support in promoting physical activity [31]. Moreover, the negative correlation between parental enjoyment of watching sports and body weight aligns with studies suggesting that active parental engagement and positive reinforcement enhance the effectiveness of physical activity [32].

The study also indicates that parental financial support for sports activities is linked to lower odds of obesity, echoing findings suggesting that such support might facilitate access to resources that promote physical activity and healthier weight outcomes [33]. The association between family involvement in sports and reduced obesity rates also aligns with research emphasising the role of family-based interventions in combating childhood obesity [34]. Nonetheless, the complexity of these relationships necessitates further research to understand how parental support influences body weight status entirely.

Research on family-based interventions has identified both advantages and challenges. Some interventions have led to positive behavioural changes, such as increased outdoor activities and reduced screen time [35]. Specific family-based therapies have been linked to a decreased risk of childhood overweight and obesity [36]. However, other interventions have struggled to effect behaviour change or reduce obesity rates among school-aged children and adolescents [37]. These failures are often attributed to difficulties engaging parents in the intervention process [38].

The built environment, including safety and access to recreational areas, also influences children's health behaviours. Unsafe environments or a lack of safe spaces for physical activity can lead to increased sedentary behaviour [9,16,39]. Access to parks and recreational facilities is essential; when such facilities are readily available, children are more likely to engage in physical activity [40]. Although sports and physical activities benefit children's health and development, potential risks such as injuries and excessive demands must be considered [4,9,16]. Proximity to parks or playgrounds has been associated with less sedentary behaviour and healthier food choices [41]. Thus, the built environment can support or hinder a child's health by encouraging or discouraging healthy eating and physical activity [40,41]. Whereas parental support and involvement in sports generally benefit children's health, the effectiveness of these factors varies by the type of support and context. This study underscores the need for targeted interventions considering the diverse forms of parental involvement and their varying impacts on children's health outcomes. Future research should focus on refining these interventions and exploring underlying mechanisms to address childhood obesity through comprehensive family-based approaches.

Strengths: This study contributes significantly to understanding health challenges related to parental support and involvement in sports among school-aged children and adolescents in Pakistan. Its strengths lie in its broad representation of Pakistan's diverse population, covering various school levels and geographic regions, enhancing the findings' generalizability. This is the first study in this region, filling a crucial gap in the literature. By providing empirical data on the associations between parental support, involvement in sports and obesity, the study offers valuable insights for developing targeted interventions and public health strategies. The study also highlights the importance of considering different sociodemographic factors, such as parental education, family income and family structure, in understanding obesity trends and creating effective policies.

Limitations: The study faces several limitations that impact its interpretation. The reliance on BMI as a measure of overweight and obesity may not fully capture body fat percentage or overall health status. Additionally, using self-reported data for physical activity and sports involvement can introduce recall bias, potentially leading to underestimating actual activity levels. The exclusion of younger children (Grades 1

through 3) limits the findings' applicability to the entire primary school-aged population. Furthermore, the representation of female students was affected by the reluctance of some school principals to allow measurements for older girls, which may skew the study's findings regarding gender differences. These limitations suggest a need for a cautious interpretation of the results and emphasise the importance of addressing these gaps in future research.

CONCLUSION

This study highlights the significant association between parental support and involvement in sports activities with the body weight status of children and adolescents in Pakistan. The results indicate that parental encouragement to participate in sports, financial support for sports activities and family involvement are positively linked to healthy weight outcomes. In contrast, the lack of participation increases the risk of overweight and obesity. Urban children whose parents were more supportive in these areas showed lower obesity rates. In contrast, rural children had a higher prevalence of weight issues, particularly in families with lower parental engagement in sports. These findings underscore the critical role of family-level interpersonal factors in addressing childhood overweight and obesity in Pakistan.

To address the increasing rates of childhood obesity in Pakistan, it is crucial to promote greater parental involvement in sports and physical activities. Schools and community programs should encourage parents to participate actively with their children in sports, provide financial support when needed, and create opportunities for family-based physical activities. Public health interventions should also focus on raising parental awareness about the benefits of physical activity and ensuring equitable access to sports facilities in urban and rural areas.

Acknowledgements: The authors thank the children, parents, guardians, and teachers for their invaluable participation in this study. Special thanks to the Department of Rescue-1122 for their generous grant support for facilitating data collection. Appreciation is also extended to the Education Department for granting permission for data collection. Furthermore, the authors acknowledge the School of Physical Education and Sport Training, Shanghai University of Sport, Shanghai, China, for approving the study, and the Department of Physical Education and Sport Sciences, Health Services Academy, Islamabad 44000, Pakistan, for providing partial financial support.

Funding: This research received no external funding.

Ethics Approval and Consent to Participate: The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board of Shanghai University of Sport (December 2022; protocol code 1816111009-2022).

Data Availability Statement: The corresponding author can provide the data used in this work upon request.

Conflicts of Interest: The authors have declared that they have no competing interests.

REFERENCES

1. Cai Y, Zhu X, Wu X. Overweight, obesity, and screen-time viewing among Chinese school-aged children: National prevalence estimates from the 2016 Physical Activity and Fitness in China-The Youth Study. J Sport Health Sci, 2017; 6(4): 404–409. doi: 10.1016/j.jshs.2017.09.002
2. de Sousa Fernandes MS, Costa MR, Badicu G, et al. Can Environmental Enrichment Modulate Epigenetic Processes in the Central Nervous System Under Adverse Environmental Conditions? A Systematic Review. Cell Mol Neurobiol. 2024; 44(1): 69. doi: 10.1007/s10571-024-01506-0.
3. Tanveer M, Hohmann A, Roy N, Zeba A, Tanveer U, Siener M. The Current Prevalence of Underweight, Overweight, and Obesity Associated with Demographic Factors among Pakistan

School-Aged Children and Adolescents-An Empirical Cross-Sectional Study. Int J Environ Res Public Health. 2022; 19(18): 11619. doi: 10.3390/ijerph191811619
4. Tanveer M, Asghar E, Badicu G, et al. Associations of School-Level Factors and School Sport Facility Parameters with Overweight and Obesity among Children and Adolescents in Pakistan: An Empirical Cross-Sectional Study. Sports (Basel). 2024; 12(9): 235. doi: 10.3390/sports12090235.
5. anveer M, Tanveer U, Tanveer N, Roy N, Zeba A, Razzaq FA. Parental health attitudes and knowledge factors associated with body mass index among Pakistani school-aged adolescents. Pak J Med Health Sci. 2022; 16(9): 479-482. doi: 10.53350/pjmhs22169479
6. Tanveer M, Tanveer U, Zeba A, Siener M. Prevalence of Body Mass Index and Its Association With Interpersonal Family-Level Factors Among School-Aged Children and Adolescents in Pakistan. J Popul Ther Clin Pharmacol. 2024; 31(2): 10007-10013. doi: 10.53555/jptcp.v31i2.4576
7. Pelusi C, Altieri P, Gambineri A, et al. Behavioral, socio-environmental, educational and demographic correlates of excess body weight in Italian adolescents and young adults. Nutr Metab Cardiovasc Dis. 2019; 29(3): 279-289. doi: 10.1016/j.numecd.2018.11.009
8. Tanveer M, Asghar E, Tanveer U, Roy N, Zeba A, Al-Mhanna SB, Batrakoulis A. Community-Level Physical Activity Opportunities, Safe and Supportive Environment Factors, and Their Association with Overweight and Obesity Among School-Aged Children and Adolescents in Pakistan: A Cross-Sectional Study. Kurdish Studies. 2024; 12(2): 6425-6432. doi: 10.53555/ks.v12i2.2845
9. Kiyani T, Kayani S, Kayani S, Qi S, Biasutti M. A school-based multilevel intervention to increase physical activity of adolescents in Pakistan: from a social-ecological perspective. Sustainability. 2022; 14(10): 6024. doi: 10.3390/su14106024
10. Tanveer M, Tanveer U, Afzal M, Rana N, Nagra R, Anjum W, Haseeb M. Community-level factors associated with body mass index among Pakistani school-aged adolescents. Pak J Med Health Sci. 2022; 16(9): 463-466. doi: 10.53350/pjmhs22169463
11. Tanveer M, Asghar E, Badicu G, Roy N, Siener M, Tanveer U, Al-Mhanna SB, Batrakoulis A. Association of Physical Activity and Physical Education With Overweight and Obesity Among School-Aged Children and Adolescents in Pakistan: An Empirical Cross-Sectional Study. Adv Public Health. 2024;2024(1). doi:10.1155/2024/5095049
12. Jakubiak GK, Osadnik K, Lejawa M, et al. "Obesity and Insulin Resistance" Is the Component of the Metabolic Syndrome Most Strongly Associated with Oxidative Stress. Antioxidants (Basel). 2021;11(1):79. Published 2021 Dec 29. doi:10.3390/antiox11010079
13. Neuman M, Kawachi I, Gortmaker S, Subramanian SV. Urban-rural differences in BMI in low- and middle-income countries: the role of socioeconomic status. Am J Clin Nutr. 2013;97(2):428-436. doi:10.3945/ajcn.112.045997
14. Kim E, Hwang JY, Woo EK, Kim SS, Jo SA, Jo I. Body mass index cutoffs for underweight, overweight, and obesity in South Korean schoolgirls. Obes Res. 2005; 13(9): 1510-1514. doi: 10.1038/oby.2005.183
15. Al-Saeed WY, Al-Dawood KM, Bukhari IA, Bahnassy A. Prevalence and socioeconomic risk factors of obesity among urban female students in Al-Khobar city, Eastern Saudi Arabia, 2003. Obes Rev. 2007; 8(2): 93-99. doi: 10.1111/j.1467-789X.2006.00287.x
16. Li XH, Lin S, Guo H, et al. Effectiveness of a school-based physical activity intervention on obesity in school children: a nonrandomized controlled trial. BMC Public Health. 2014; 14: 1282. doi: 10.1186/1471-2458-14-1282
17. Tanveer M, Asghar E, Tanveer U, et al. Association of nutrition behavior and food intake with overweight and obesity among school-aged children and adolescents in Pakistan: a cross-sectional study. AIMS Public Health. 2024; 11(3): 803-818. doi: 10.3934/publichealth.2024040
18. Ford ND, Patel SA, Narayan KM. Obesity in Low- and Middle-Income Countries: Burden, Drivers, and Emerging Challenges. Annu Rev Public Health. 2017; 38: 145-164. doi: 10.1146/annurev-publhealth-031816-044604
19. Liu Y, Zhang Y, Chen S, Zhang J, Guo Z, Chen P. Associations between parental support for physical activity and moderate-to-vigorous physical activity among Chinese school children: A cross-sectional study. J Sport Health Sci. 2017; 6(4): 410-415. doi: 10.1016/j.jshs.2017.09.008
20. Tanveer M, Roy N, Zeba A, et al. Prevalence of body mass index and associated demographic factors among Pakistan school-aged adolescents. Pak J Med Health Sci. 2022; 16(6): 212-215. doi: 10.53350/pjmhs22166212
21. Tanveer M, Tanveer U, Zeba A, Siener M. Prevalence of body mass index and its association with interpersonal family-level factors among school-aged children and adolescents in Pakistan. J Popul Ther Clin Pharmacol. 2024; 31(2): 2365-2376. doi: 10.53555/jptcp.v31i2.4576

22. Mansoori N, Nisar N, Shahid N, Mubeen SM, Ahsan S. Prevalence of obesity and its risk factors among school children in Karachi, Pakistan. Trop Doct. 2018; 48(4): 266-269. doi: 10.1177/0049475518786664
23. Mushtaq MU, Gull S, Mushtaq K, Shahid U, Shad MA, Akram J. Dietary behaviors, physical activity and sedentary lifestyle associated with overweight and obesity, and their socio-demographic correlates, among Pakistani primary school children. Int J Behav Nutr Phys Act. 2011; 8: 130. doi: 10.1186/1479-5868-8-130
24. Chen ST, Liu Y, Tremblay MS, et al. Meeting 24-h movement guidelines: Prevalence, correlates, and the relationships with overweight and obesity among Chinese children and adolescents. J Sport Health Sci. 2021; 10(3): 349-359. doi: 10.1016/j.jshs.2020.07.002
25. World Health Organization. Global School-Based Student Health Survey. Pakistan GSHS Questionnaire. Available at: https://extranet.who.int/ncdsmicrodata/index.php/catalog/203. Accessed July 9, 2022
26. Kiyani T, Kayani S, Kayani S, Batool I, Qi S, Biasutti M. Individual, Interpersonal, and Organizational Factors Affecting Physical Activity of School Adolescents in Pakistan. Int J Environ Res Public Health. 2021; 18(13): 7011. doi: 10.3390/ijerph18137011
27. Callahan-Myrick K. Assessing the social and ecological factors that influence childhood overweight and obesity. [dissertation]. Johnson City (TN): East Tennessee State University; 2014
28. Rimmer JH. Promoting inclusive community-based obesity prevention programs for children and adolescents with disabilities: the why and how. Childhood Obes. 2011; 7(3): 177-184. doi: 10.1089/chi.2011.0300.pers
29. Kipp LE. Psychosocial aspects of exercise and physical activity in childhood. Pediatr Exerc Sci. 2015; 27(1): 26-29. doi: 10.1123/pes.2015-0031
30. Chai LK, Farletti R, Fathi L, Littlewood R. A Rapid Review of the Impact of Family-Based Digital Interventions for Obesity Prevention and Treatment on Obesity-Related Outcomes in Primary School-Aged Children. Nutrients. 2022; 14(22): 4837. Published 2022. doi: 10.3390/nu14224837
31. Biddle SJ, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. Br J Sports Med. 2011; 45(11): 886-895. doi: 10.1136/bjsports-2011-090185
32. Rhodes RE, Janssen I, Bredin SSD, Warburton DER, Bauman A. Physical activity: Health impact, prevalence, correlates and interventions. Psychol Health. 2017; 32(8): 942-975. doi: 10.1080/08870446.2017.1325486
33. Tam G, Yeung MPS. A systematic review of the long-term effectiveness of work-based lifestyle interventions to tackle overweight and obesity. Prev Med. 2018; 107: 54-60. doi: 10.1016/j.ypmed.2017.11.011
34. Tam G, Yeung MPS. A systematic review of the long-term effectiveness of work-based lifestyle interventions to tackle overweight and obesity. Prev Med. 2018; 107: 54-60. doi: 10.1016/j.ypmed.2017.11.011
35. Lindsay AC, Sussner KM, Kim J, Gortmaker S. The role of parents in preventing childhood obesity. Future Child. 2006; 16(1): 169-186. doi: 10.1353/foc.2006.0006
36. Ewald H, Kirby J, Rees K, Robertson W. Parent-only interventions in the treatment of childhood obesity: a systematic review of randomized controlled trials. J Public Health (Oxf). 2014; 36(3): 476-489. doi: 10.1093/pubmed/fdt108
37. Davison KK, Jurkowski JM, Lawson HA. Reframing family-centred obesity prevention using the Family Ecological Model. Public Health Nutr. 2013; 16(10): 1861-1869. doi: 10.1017/S1368980012004533
38. Langille JL, Rodgers WM. Exploring the influence of a social ecological model on school-based physical activity. Health Educ Behav. 2010; 37(6): 879-894. doi: 10.1177/1090198110367877
39. Kim KH, Linnan L, Campbell MK, Brooks C, Koenig HG, Wiesen C. The WORD (wholeness, oneness, righteousness, deliverance): a faith-based weight-loss program utilizing a community-based participatory research approach. Health Educ Behav. 2008; 35(5): 634-650. doi: 10.1177/1090198106291985.
40. Rundle A, Quinn J, Lovasi G, et al. Associations between body mass index and park proximity, size, cleanliness, and recreational facilities. Am J Health Promot. 2013; 27(4): 262-269. doi: 10.4278/ajhp.110809-QUAN-304
41. Gose M, Plachta-Danielzik S, Willié B, Johannsen M, Landsberg B, Müller MJ. Longitudinal influences of neighbourhood built and social environment on children's weight status. Int J Environ Res Public Health. 2013; 10(10): 5083-5096. doi: 10.3390/ijerph10105083