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NUTRITIONAL STATUS OF CHILDREN AND ADOLESCENTS: ANTHROPOMETRIC ASSESSMENT AMONG SCHOOLCHILDREN FROM ADVENTIST SCHOOLS

ESTADO NUTRICIONAL DE CRIANÇAS E ADOLESCENTES: AVALIAÇÃO ANTROPOMÉTRICA EM ESCOLARES DA REDE ADVENTISTA

ESTADO NUTRICIONAL DE NIÑOS Y ADOLESCENTES: EVALUACIÓN ANTROPOMÉTRICA EN ESCOLARES DE LA RED ADVENTISTA

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Abstract: The aim of this study was to assess the nutritional status (NS) and anthropometric assessment data of children and adolescents aged 4 to 17 years, enrolled in Adventist schools located in the southern region of the city of São Paulo, Brazil. This exploratory, descriptive, cross-sectional, population-based study evaluated body mass index (BMI), waist circumference (WC), waist-to-height ratio (WtHR), and triceps skinfold thickness (TSF) in 9,649 schoolchildren, of whom 52% were female. Agreement among the different diagnostic methods ranged from 72% to 89%, and Kappa indices (κ) varied from moderate ($\kappa = 0.45$) to substantial ($\kappa = 0.75$). The prevalence of overweight (OVW) and obesity (OBE) assessed by BMI was 11% and 25%, respectively, while excessive adiposity (EA) and obesity assessed by TSF were 20% and 17%. The prevalence of abdominal obesity measured by WC was 31%, and the prevalence of cardiovascular risk related to abdominal obesity assessed by WtHR was 24%. Obesity prevalence was significantly higher among boys ($p < 0.05$), and prevalences did not differ significantly between Adventist and non-Adventist students, except at ages 5, 6, and 7 years according to BMI, at 10 years according to TSF, and at 6 years according to WtHR. These findings are comparable to those observed in the Brazilian pediatric population and reinforce that overweight, obesity, and central adiposity remain a major public health concern, demanding urgent administrative, educational, and preventive strategies aimed at promoting healthy lifestyles from childhood and adolescence.

Keywords: Nutritional status. Obesity. Overweight. Anthropometric Assessment. Religion.

Resumo: O objetivo deste estudo foi avaliar o estado nutricional (EN) e os dados antropométricos de crianças e adolescentes de 4 a 17 anos, matriculados em escolas adventistas localizadas na região sul da cidade de São Paulo, Brasil. Este estudo exploratório, descritivo, transversal e de base populacional avaliou o índice de massa corporal (IMC), a circunferência da cintura (CC), a relação cintura-estatura (RCE) e a espessura da prega cutânea tricipital (EPT) em 9.649 escolares, dos quais 52% eram do sexo feminino. A concordância entre os diferentes métodos diagnósticos variou de 72% a 89%, e os índices Kappa (κ) variaram de moderados (κ = 0,45) a substanciais (κ = 0,75). A prevalência de sobrepeso (SP) e obesidade (OB) avaliada pelo IMC foi de 11% e 25%, respectivamente, enquanto a adiposidade excessiva (AE) e a obesidade avaliadas pela EPT foram de 20% e 17%. A prevalência de obesidade abdominal medida pela circunferência da cintura foi de 31%, e a prevalência de risco cardiovascular relacionado à obesidade abdominal avaliada pela relação cintura-quadril foi de 24%. A prevalência de obesidade foi significativamente maior entre os meninos ($p < 0,05$), e as prevalências não diferiram significativamente entre estudantes adventistas e não adventistas, exceto aos 5, 6 e 7 anos de idade de acordo com o IMC, aos 10 anos de idade de acordo com a circunferência da cintura e aos 6 anos de idade de acordo com a relação cintura-quadril. Esses achados são comparáveis aos observados na população pediátrica brasileira e reforçam que o sobrepeso, a obesidade e a adiposidade central continuam sendo uma importante preocupação de saúde pública, exigindo estratégias administrativas, educacionais e preventivas urgentes voltadas para a promoção de estilos de vida saudáveis desde a infância e a adolescência.

Palavras-chave: Estado nutricional. Obesidade. Sobrepeso. Avaliação antropométrica. Religião.

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1. Introduction

1.1. Childhood and Adolescent Overweight and Obesity as a Global and National Public Health Problem

Overweight (OVW) and obesity (OBE) among children and adolescents have increased steadily over recent decades, reaching alarming levels worldwide (IBGE, 2010; Ng et al., 2014). Globally, the prevalence of excessive body weight (EW = OVW + OBE) rose from 27.5% in 1980 to 47.1% in 2013 (Ng et al., 2014). More recent global evidence indicates that this upward trend has continued through 2022, affecting countries across all income levels and reinforcing childhood obesity as a major and persistent public health challenge (Jebeile et al., 2022; NCD Risk Factor Collaboration, 2023; WHO, 2023). Projections suggest a substantial increase in obesity-related morbidity and mortality in future adult populations if effective preventive strategies are not implemented early in life (NCD Risk Factor Collaboration, 2023).

In Brazil, national surveys consistently demonstrate a marked increase in EW among children and adolescents over time. Between 1974–1975 and 2008–2009, EW increased from 8.6% to 32.0% among girls and from 10.9% to 34.8% among boys aged 5 to 9 years. Among adolescents aged 10 to 19 years, EW increased from 7.6% to 19.4% in females and from 3.7% to 21.7% in males. During the same period, obesity prevalence increased approximately five- to tenfold across age and sex groups (IBGE, 2015). More recent national data confirm persistently high prevalences of OVW and OBE among Brazilian schoolchildren and adolescents, particularly among students attending private schools, highlighting the growing burden of excess body weight in socioeconomically advantaged groups as well (IBGE, 2021; IBGE, 2020).

1.2. Health Consequences of Excess Body Weight in Childhood and Adolescence

The rising prevalence of OVW and OBE in childhood and adolescence is especially concerning due to its strong association with non-communicable diseases (NCDs), also referred to as lifestyle-related diseases. NCDs account for approximately 70% of global deaths and are characterized by long latency periods, chronic clinical evolution, irreversible organ damage, and substantial disability (WHO, 2017; WHO, 2022). Evidence indicates that excess body weight early in life substantially increases the risk of cardiometabolic disorders, type 2 diabetes, and premature mortality in adulthood, emphasizing the importance of early-life prevention and continuous monitoring of nutritional status (Swinburn et al., 2019; Jebeile et al., 2022; UNICEF, 2025).

1.3. Anthropometric Assessment in Pediatric Populations

Schools represent a strategic setting for the assessment of nutritional status and the implementation of food and nutrition education initiatives. Anthropometric assessment is a simple, objective, low-cost, and feasible approach for population-based studies, allowing the monitoring of growth patterns and body composition in children and adolescents. This assessment typically includes measurements of height, body mass, and body mass index (BMI), interpreted according to sex and age. However, because BMI does not provide information on body fat distribution, its combined use with additional indicators—such as triceps skinfold thickness (TSF), waist circumference (WC), and waist-to-height ratio (WtHR)—is recommended to enhance diagnostic accuracy and cardiometabolic risk identification (Pinto et al., 2010; Ashwell & Gibson, 2016).

1.4. Adventist Educational Context and Study Rationale

The Adventist Education Network (AEN) is the second largest confessional educational system worldwide, surpassed only by the Catholic educational network. The educational philosophy of the Seventh-day Adventist (SDA) Church is grounded in biblical principles and emphasizes health-promoting behaviors, including regular physical activity, predominantly plant-based dietary patterns, abstinence from tobacco and alcohol, and other protective practices associated with the prevention of NCDs (Banta et al., 2018; Fraser, 2003). Within the school environment, the AEN actively promotes adequate water intake and a diet rich in whole grains, fruits, vegetables, legumes, and nuts (Matthews et al., 2011; Craig et al., 2017).

Evidence suggests that students enrolled in Adventist schools exhibit distinctive lifestyle and nutritional characteristics. A recent systematic review including 14 studies reported that AEN students generally presented lower body weight and lower prevalences of OVW and OBE compared to students from public schools and the general population, in addition to lower engagement in health-risk behaviors (Portes et al., 2023). Other studies have demonstrated better diet quality among SDA students (Fuentes et al., 2017), as well as reduced sedentary behavior and screen time compared to non-Adventist peers (Craig et al., 2018; Acosta Enríquez et al., 2019). However, most available evidence originates from the United States and Australia, with limited data from Latin America. Notably, the only Brazilian study involving Adventist students did not include anthropometric assessments or a comprehensive evaluation of nutritional status (Fuentes et al., 2017).

To date, no studies have comprehensively evaluated the nutritional status of Brazilian schoolchildren enrolled in the Adventist Education Network using multiple anthropometric indicators. Therefore, the present study aimed to assess the nutritional status of children and adolescents attending AEN schools in the southern metropolitan region of São Paulo, Brazil. We hypothesized that Brazilian AEN students would present a more favorable nutritional status profile, assessed through different anthropometric indicators, compared to children and adolescents from the general population.

2. Theoretical Framework

The increasing prevalence of overweight and obesity among children and adolescents is the result of complex interactions between biological, behavioral, environmental, and social factors. Changes in dietary patterns, characterized by higher consumption of ultra-processed foods and energy-dense products, combined with reduced intake of fruits, vegetables, and whole foods, have been strongly associated with excess body weight in pediatric populations. In parallel, declining levels of physical activity and increasing sedentary behaviors, particularly screen time, have contributed substantially to the global rise in childhood and adolescent obesity (Monteiro et al., 2019; Louzada et al., 2022; Guthold et al., 2020).

The school environment plays a central role in the development of health-related behaviors during childhood and adolescence. As children spend a considerable portion of their daily lives at school, this setting represents both a potential risk environment for the development of unhealthy habits and a strategic opportunity for the implementation of preventive actions. Evidence indicates that supportive school environments that promote healthy eating and regular physical activity may reduce the risk of excess body weight, whereas obesogenic school environments may contribute to the persistence of unhealthy behaviors (Filgueiras et al., 2023).

Anthropometric assessment is widely used in epidemiological and public health research due to its simplicity, low cost, and feasibility in large populations. Body mass index is the most commonly applied indicator for evaluating nutritional status in children and adolescents and is recommended by the World Health Organization for population-level surveillance. However, BMI does not distinguish between fat mass and lean mass and does not provide information on fat distribution, which limits its ability to identify cardiometabolic risk when used alone (WHO, 2007).

For this reason, the combined use of BMI with additional anthropometric indicators has been recommended. Triceps skinfold thickness provides an estimate of subcutaneous fat and contributes to a more accurate assessment of adiposity in pediatric populations. Waist circumference and waist-to-height ratio are reliable indicators of central adiposity and have been consistently associated with cardiometabolic risk factors, including insulin resistance, dyslipidemia, and hypertension, even in childhood and adolescence. The waist-to-height ratio, in particular, has been proposed as a practical and age-independent screening tool for cardiometabolic risk (Daniels et al., 2005; Ashwell & Gibson, 2016).

Central adiposity represents a critical component of cardiometabolic risk, as abdominal fat accumulation is metabolically active and strongly associated with adverse health outcomes later in life. Longitudinal evidence suggests that children and adolescents with excess abdominal fat are more likely to maintain unfavorable metabolic profiles into adulthood, reinforcing the importance of early identification and monitoring of central obesity (Swinburn et al., 2019; WHO, 2022).

The health philosophy of the Seventh-day Adventist Church emphasizes behaviors that are protective against non-communicable diseases, including predominantly plant-based diets, regular physical activity, and abstinence from tobacco and alcohol. These principles are incorporated into the Adventist Education Network, which actively promotes healthy lifestyle practices within the school environment. International studies suggest that students attending Adventist schools often exhibit healthier dietary patterns and lower engagement in risk behaviors compared to their peers; however, hypotheses such as dilution, erosion, and delayed manifestation of these protective behaviors have been proposed, particularly among younger generations (Harris et al., 1981; Banta et al., 2018; Fraser, 2003; Portes et al., 2023).

Despite growing international evidence, Brazilian data on the nutritional status of Adventist schoolchildren remain limited, particularly regarding comprehensive anthropometric assessment using multiple indicators. This gap in the literature supports the relevance of the present study and highlights the importance of evaluating nutritional status and cardiometabolic risk in this specific educational and cultural context.

3. Methodology

This exploratory, descriptive, cross-sectional population-based study sought to evaluate all students aged 4 to 17 years old, regularly enrolled in the 14 schools administered by the Regional Office of the Seventh-Day Adventist Church for the Southern Region of São Paulo, one of the eight Regional Offices that integrate the Brazilian Central Union (São Paulo state) of the Seventh-Day Adventist Church, in February 2017. The study was approved by the local Research Ethics Committee (protocol number 1.870.543/2016), and all procedures were conducted in accordance with Resolution 466/2012 of the Brazilian National Health Council and the Declaration of Helsinki. The methodological approach is consistent with current recommendations for observational studies involving pediatric populations and nutritional assessment (WHO, 2022).

Participants

All students regularly enrolled were invited to participate in the study. Of these, 1,307 were students from Early Childhood Education (10%), 5,406 from Elementary School I (1st to 5th grades, 43%), 4,243 from Elementary School II (6th to 9th grades, 34%) and 1,637 from High School (13%), totaling 12,593 students. Students with physical limitations, those whose parents or legal guardians refused participation, those without valid height or body weight measurements, and those who did not provide information regarding date of birth, ethnicity, or religious affiliation were excluded from the analysis.

Procedures

Height was measured once using a portable stadiometer, graduated to 0.1 cm, with students barefoot, standing upright, arms relaxed alongside the body, heels together, feet parallel, and head positioned in the Frankfurt plane (Must et al., 1991; Eston & Reilly, 2001). These procedures are consistent with current international anthropometric standardization guidelines (International Organization for Standardization, 2023)

Body weight was measured once using a calibrated digital scale (Speedo®, accuracy 0.1 kg), with students wearing light clothing (shorts and T-shirt), following standardized field protocols (Eston & Reilly, 2001).

Body mass index (BMI) was calculated as weight divided by height squared (kg/m²). Nutritional status classification was based on age- and sex-specific WHO growth reference curves (WHO, 2007), which remain the international standard and are supported by updated WHO methodological documents (WHO, 2022). Z-scores were calculated using the WHO AnthroPlus software (version 3.0.1). Height and weight were classified as: low ($Z < -1.881$), adequate ($Z \geq -1.881$ to ≤ 1.881), or high ($Z > 1.881$). BMI categories were defined as: low weight for height ($Z < -1.64$), eutrophic ($Z \geq -1.64$ and < 1.04), overweight ($Z \geq 1.04$), and obesity ($Z \geq 1.64$), as previously described (Must et al., 1991; WHO, 2007).

Triceps skinfold thickness (TSF) was measured using a Slim Guide® caliper (Harpenden model), with precision of 0.1 mm. Three consecutive measurements were taken vertically on the posterior surface of the right arm, at the midpoint between the acromion and the radial head, and the median value was used for analysis (Eston & Reilly, 2001). For children aged 4 and 5 years, WHO reference values were adopted (WHO, 2007), whereas for older children and adolescents, reference percentiles from the NHANES I were used (Must et al., 1991). Excess adiposity was defined as TSF values at or above the 85th percentile.

Waist circumference (WC) was measured with the participant standing, abdomen relaxed, arms alongside the body, using a non-elastic measuring tape positioned horizontally at the midpoint between the lower margin of the last rib and the iliac crest. Abdominal obesity was defined using age- and sex-specific cut-off points corresponding to the 80th percentile, as proposed by Taylor et al. (2000), a method still widely applied in pediatric epidemiological studies.

The waist-to-height ratio (WtHR) was calculated by dividing WC (cm) by height (cm). Values <0.50 were considered adequate, and values ≥0.50 indicated increased cardiometabolic risk, according to Pereira et al. (2011). This indicator has been reaffirmed in recent systematic reviews as a robust and practical screening tool for cardiometabolic risk in children and adolescents (Ashwell & Gibson, 2016).

Statistical Analysis

All statistical analyses were performed using SPSS software version 24.0 for Windows. Categorical variables (sex, ethnicity, and school unit) were expressed as absolute and relative frequencies and compared using the chi-square test. Continuous variables were expressed as means ± standard errors and analyzed using Student's t test or two-way ANOVA, as appropriate.

Pearson's correlation coefficients (r) were calculated to assess associations between anthropometric indicators. Correlation strength was interpreted according to Cohen's criteria, as adapted by Mukaka (2012): very weak ($r < 0.20$), weak ($r < 0.40$), moderate ($r < 0.60$), strong ($r < 0.80$), and very strong ($r \geq 0.80$).

For agreement analysis, classifications of body weight, BMI, TSF, WC, and WtHR were dichotomized into adequate and inadequate categories. The Kappa index (κ) was used to assess agreement between diagnostic methods, following the interpretation proposed by Landis and Koch (1977): poor ($\kappa < 0.20$), fair ($\kappa < 0.40$), moderate ($\kappa < 0.60$), substantial ($\kappa < 0.80$), and almost perfect ($\kappa \geq 0.80$). This approach remains consistent with contemporary recommendations for reliability analysis in health research. Statistical significance was set at $p \leq 0.05$.

4. Results and Discussion

A total of 9,649 schoolchildren and adolescents aged 4 to 17 years were evaluated, corresponding to 77% of the eligible population. Females accounted for 52% of the sample, and the distribution by sex was relatively balanced across the participating schools (Table 1). Most participants self-identified as White (57.4%), followed by Brown (35.1%) and Black (6.0%), with no significant differences in the prevalence of overweight or obesity according to ethnicity. This finding suggests that, in this population, excess body weight is more strongly associated with environmental and behavioral factors than with ethnic background.

Table 1: Distribution of students according to gender and ethnicity, by school.

Schools	All n (%)	Girls n (%)	Boys n (%)
1	541 (5)	280 (52)	261 (48)
2	740 (8)	386 (52)	354 (48)
3	486 (5)	235 (48)	251 (52)

4	836 (8)	467 (56)	369 (44)
5	1.033 (11)	543 (53)	490 (47)
6	1.180 (12)	647 (55)	533 (45)
7	601 (6)	332 (55)	269 (45)
8	717 (7)	370 (52)	347 (48)
9	295 (3)	140 (48%)	155 (52)
10	661 (9)	339 (51)	322 (49)
11	170 (2)	93 (55)	77 (45)
12	813 (8)	406 (50)	407 (50)
13	864 (9)	439 (51)	425 (49)
14	712 (7)	338 (48)	374 (52)
Total	9,649 (100)	5,015 (52)	4,634 (48)
Ethnicity	All n (%)	Girls n (%)	Boys n (%)
White	5,535 (57.4)	2,895 (52)	2,640 (48)
Brown	3,382 (35.1)	1,749 (52)	1,633 (48)
Black	577 (6.0)	295 (51)	282 (49)
Yellow	105 (1.0)	51 (49)	54 (51)
Indigenous	23 (0.2)	12 (52)	11 (48)
Not stated	27 (0.3)	13 (48)	14 (52)
Total	9,649 (100)	5,015 (52)	4,634 (48)

Source: the authors (2026).

The agreement among the different nutritional status assessment methods ranged from 72% to 89%, with Kappa coefficients varying from moderate to substantial (κ = 0.45 to 0.75), as shown in Table 2. These levels of agreement are consistent with previous pediatric studies that recommend the combined use of anthropometric indicators to improve diagnostic accuracy and cardiometabolic risk screening (Pinto et al., 2010; Ashwell & Gibson, 2016). The highest agreement was observed between waist circumference (WC) and waist-to-height ratio (WtHR), while BMI and triceps skinfold thickness (TSF) also demonstrated satisfactory concordance. These results indicate good consistency among the anthropometric indicators and reinforce the methodological robustness of using multiple measures to assess nutritional status and cardiometabolic risk in pediatric populations.

Table 2: Measures of total percentual concordance and Kappa index (κ) among parameters of nutritional status assessment.

	Weight % (κ)	BMI % (κ)	TSF % (κ)	WC % (κ)
Weight				
BMI	81 (0.547)***			
TSF	77 (0.446)***	80 (0.578)***		
WC	84 (0.597)***	86 (0.687)***	81 (0.583)***	
WtHR	85 (0.560)***	72 (0.580)***	80 (0.518)***	89 (0.749)***

BMI: body mass index. TSF: triceps skinfold (mm). WC: waist circumference (cm). WtHR: waist to height ratio. ***p < 0,001.
Source: the authors (2026).

Regarding growth indicators, more than 93% of the students presented adequate height-for-age, and only 2% exhibited height deficit (Table 3), a prevalence considerably lower than that reported in

national surveys of Brazilian children and adolescents. This favorable growth pattern likely reflects better socioeconomic conditions and access to health resources typically observed in private educational networks, as reported in national surveys and previous Brazilian studies involving private school populations (IBGE, 2015; Vieira et al., 2008; IBGE, 2020). In contrast, 19% of the students presented high body weight for age, with a significantly higher prevalence among boys compared to girls ($p < 0.001$), indicating early deviations toward excess body mass.

According to BMI classification (Table 3), 11% of the students were classified as overweight and 25% as obese. Although the prevalence of overweight did not differ significantly between sexes, obesity was significantly more frequent among boys (26%) than girls (24%). These findings are consistent with Brazilian epidemiological data and confirm that excess body weight remains highly prevalent among children and adolescents, even in populations with favorable socioeconomic characteristics (IBGE, 2015; IBGE, 2019).

Adiposity assessment based on TSF revealed that 20% of the students presented excessive adiposity and 17% were classified as obese (Table 3). Obesity defined by TSF was significantly more prevalent among boys, suggesting greater accumulation of body fat in males. Compared with earlier Brazilian studies, these prevalences are markedly higher, indicating a worsening trend in body fat accumulation over recent decades (Duquia et al., 2008; Silva et al., 2011; Bloch et al., 2016; IBGE, 2020).

Indicators of central obesity further emphasized the magnitude of cardiometabolic risk in this population. Elevated WC was observed in 31% of the students, with significantly higher prevalence among boys (Table 3). Similarly, 24% of the participants presented increased cardiometabolic risk according to WtHR, again with higher proportions among males. These findings are in line with evidence that boys tend to accumulate more abdominal fat during childhood and adolescence, a pattern strongly associated with future cardiometabolic disorders (Goran & Kaskoun, 1995; Daniels et al., 2005; Christofaro et al., 2014).

Table 3: Anthropometry (classification) of students aged 4 to 17 years old from the Adventist Education Network.

Variables	All	Girls	Boys
Height§	n 9,677	n 5,015	n 4,632
Low	190 (2%)	98 (2%)	92 (2%)
Adequate	9,001 (93%)	4,692 (94%)	4,309 (93%)
High	486 (5%)	225 (4%)	231 (5%)
Body weight§	n 9,647	n 5,014	n 4,633
Low	34 (0%)	15 (0%)	19 (0%)
Adequate	7,811 (81%)	4,136 (82%)	3,675 (79%)***
High	1,802 (19%)	863 (17%)	939 (20%)***
BMI	n 9,746	n 5,014	n 4,732
Low	98 (1%)	38 (1%)	60 (1%)
Eutrophic	6,168 (63%)	3,210 (64%)	2,958 (63%)***
Overweight	1,076 (11%)	586 (12%)	490 (10%)
Obesity	2,404 (25%)	1,180 (24%)	1,224 (26%)***
TSF	n 9,570	n 4,975	n 4,595
Thinness	56 (1%)	35 (1%)	21 (0%)
Adequate	6,017 (63%)	3,304 (66%)	2,713 (59%)***
Excessive	1,874 (20%)	968 (19%)	906 (20%)

Obesity	1,623 (17%)	668 (13%)	955 (21%)***
WC	n 6,910	n 3,556	n 3,354
Low risk	4,744 (69%)	2,494 (70%)	2,250 (67%)**
High risk	2,166 (31%)	1,062 (30%)	1,104 (33%)**
WtHR	n 6,908	n 3,556	n 3,352
Low risk	5,237 (76%)	2,793 (79%)	2,444 (73%)***
High risk	1,671 (24%)	763 (21%)	908 (27%)***

§Height and body weight adequacy for gender and age, BMI: body mass index. TSF: triceps skinfold (mm). WC: waist circumference (cm). WtHR: waist to height ratio. *p < 0,05, **p < 0,01 e ***p < 0,001: comparisons between genders.
Source: the authors (2026).

Age-specific analyses revealed important variations in nutritional status across developmental stages. As shown in Table 4, BMI-based overweight and obesity were particularly prevalent during late childhood and early adolescence, with distinct peaks differing by sex. TSF classifications also demonstrated age-related differences, with higher proportions of excessive adiposity and obesity observed at specific ages, especially among boys. These results highlight critical periods for intervention and reinforce the importance of continuous monitoring throughout growth and development, as recommended by international public health agencies and recent epidemiological reviews (WHO, 2022; Jebeile et al., 2022; UNICEF, 2025).

Table 4: Prevalence in the categories of BMI and TSF of students aged 4 to 17 years old [n (%)].

BMI	Low		Eutrophic		Overweight		Obesity	
Age	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
4	2 (2)	4 (4)	55 (56)	70 (64)	11 (11)	14 (13)*	31 (31)	21 (19)*
5	8 (3)	10 (3)	189 (62)	208 (66)	35 (11)	33 (11)	73 (24)	63 (20)*
6	6 (1)	4 (1)	278 (66)	291 (60)	36 (9)	41 (8)	99 (24)	152 (31)*
7	3 (1)	2 (0)	324 (62)	297 (65)	50 (9)	45 (10)	145 (28)	113 (25)*
8	6 (1)	3 (1)	322 (62)	268 (57)	72 (14)	56 (12)*	122 (23)	139 (30)*
9	3 (1)	1 (0)	261 (56)	234 (57)	59 (13)	48 (12)	140 (30)	129 (31)
10	0 (0)	3 (1)	282 (62)	268 (56)	50 (11)	49 (10)	120 (27)	154 (33)*
11	2 (0)	4 (1)	325 (66)	249 (58)	55 (11)	55 (13)*	110 (23)	118 (28)*
12	2 (0)	6 (1)	266 (63)	236 (57)	54 (13)	44 (11)*	100 (24)	131 (31)*
13	4 (1)	8 (2)	291 (65)	226 (61)	55 (13)	48 (13)	95 (21)	86 (23)
14	0 (0)	7 (3)	246 (70)	196 (70)	46 (13)	26 (9)*	60 (17)	49 (18)
15	1 (0)	4 (2)	150 (66)	143 (74)	39 (17)	15 (8)	38 (17)	30 (16)
16	0 (0)	2 (1)	158 (74)	124 (77)	19 (9)	10 (6)	36 (17)	26 (16)
17	1 (1)	2 (3)	63 (79)	48 (69)	5 (6)	6 (9)	11 (14)	13 (19)*
Total	98 (1)		6,068 (63)		1,076 (11)		2,404 (25)	
TSF	Thinness		Adequate		Excessive		Obesity	
Age	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
4	1 (1)	2 (2)	69 (71)	77 (71)	16 (16)	14 (13)	12 (12)	15 (14)
5	3 (1)	10 (3)	221 (73)	216 (69)	57 (19)	46 (15)	23 (7)	39 (13)*
6	1 (0)	0 (0)	305 (73)	291 (60)	55 (13)	76 (16)*	56 (14)	118(24)*
7	0 (0)	2 (0)	323 (62)	299 (66)	95 (18)	61 (14)*	101 (20)	91 (20)
8	12 (2)	1 (0)	325 (63)	264 (57)	87 (17)	90 (20)	90 (18)	106 (23)
9	3 (1)	0 (0)	247 (54)	217 (53)	115 (25)	91 (22)	94 (20)	104 (25)
10	3 (1)	2 (1)	278 (62)	240 (51)	91 (20)	111 (24)	79 (17)	118(25)*
11	0 (0)	3 (1)	330 (68)	230 (54)	103 (21)	98 (23)	52 (11)	91 (22)*
12	0 (0)	0 (0)	282 (67)	218 (53)	86 (21)	112(27)*	51 (12)	83 (20)*
13	6 (1)	0 (0)	304 (69)	219 (60)	87 (20)	74 (21)	43 (10)	70 (19)*
14	2 (1)	1 (0)	239 (69)	181 (66)	73 (21)	47 (17)*	35 (10)	45 (17)
15	0 (0)	0 (0)	155 (68)	123 (64)	54 (24)	37 (19)	19 (8)	32 (17)*
16	3 (1)	0 (0)	158 (75)	100 (62)	40 (19)	33 (20)	11 (5)	29 (18)*
17	1 (1)	0 (0)	68 (85)	38 (56)	9 (11)	16 (24)	2 (3)	14 (20)

Total	56 (1)	6,017 (63)	1,874 (20)	1,623 (17)

BMI: body mass index. TSF: triceps skinfold. Age (years).
Source: the authors (2026).

Analysis of central obesity by age and sex (Table 5) showed that boys consistently presented higher prevalences of elevated WC and WtHR at several ages, reinforcing sex-related differences in fat distribution. These indicators provide complementary information to BMI and TSF and strengthen the evidence of increased cardiometabolic risk among male students.

Table 5: Prevalence in the categories of waist circumference and waist to height ratio, in students aged 4 to 17 years old [n (%)], from the Adventist Education Network, according to gender.

	Waist Circumference				Waist-to-Stature Ratio			
	Low Risk		High Risk		Low Risk		High Risk	
Age	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
4	34 (43)	61 (67)	45 (57)	30 (33)	45 (57)	48 (53)	34 (43)	43 (47)
5	155 (66)	154 (72)	80 (34)	59 (28)	166 (71)	158 (74)	69 (29)	55 (26)
6	229 (71)	248 (68)	92 (29)	118(32)*	246 (77)	260 (71)	75 (23)	107(29)*
7	271 (68)	259 (73)	130 (32)	94 (27)	303 (76)	278 (79)	98 (24)	75 (21)*
8	255 (67)	223 (64)	123 (33)	124 (36)	291 (77)	243 (70)	87 (23)	104 (30)
9	224 (66)	186 (60)	113 (34)	123 (40)	245 (73)	205 (66)	92 (27)	104 (34)
10	215 (65)	211 (63)	114 (35)	124 (37)	247 (75)	227 (68)	82 (25)	108(32)*
11	233 (70)	188 (61)	98 (30)	122(39)*	273 (82)	221 (71)	58 (18)	88 (29)*
12	197 (66)	179 (62)	100 (34)	111 (38)	241 (81)	203 (70)	56 (19)	86 (30)*
13	224 (75)	161 (65)	74 (25)	87 (35)	254 (85)	184 (74)	44 (15)	64 (26)*
14	161 (80)	144 (73)	40 (20)	54 (27)*	173 (86)	166 (84)	28 (14)	32 (16)
15	119 (84)	107 (84)	23 (16)	20 (16)*	125 (88)	114 (90)	17 (12)	13 (10)
16	131 (84)	97 (80)	24 (16)	24 (20)	135 (87)	103 (85)	20 (13)	18 (15)
17	46 (88)	31 (69)	6 (12)	14 (31)*	49 (94)	34 (76)	3 (6)	11 (24)
Total	4,744 (69)		2,166 (31)		5,237 (76)		1,671 (24)	

Source: the authors (2026).

When students were grouped according to religious affiliation, no consistent or clinically relevant differences were observed between Seventh-day Adventist (SDA) and non-Adventist (NSDA) students across most anthropometric indicators. Figures 1, 2, and 3 illustrate that although NSDA students tended to present slightly higher mean values of BMI, TSF, WC, and WtHR, statistically significant differences were sporadic and restricted to specific ages. These findings suggest that lifestyle-related protective factors traditionally associated with the Adventist population may be attenuated during childhood and adolescence, possibly due to dilution of behaviors, erosion of healthy practices, or delayed manifestation of health benefits, as previously hypothesized in studies involving Adventist youth populations (Harris et al., 1981; Sabaté et al., 1990; Craig et al., 2017; Portes et al., 2023).

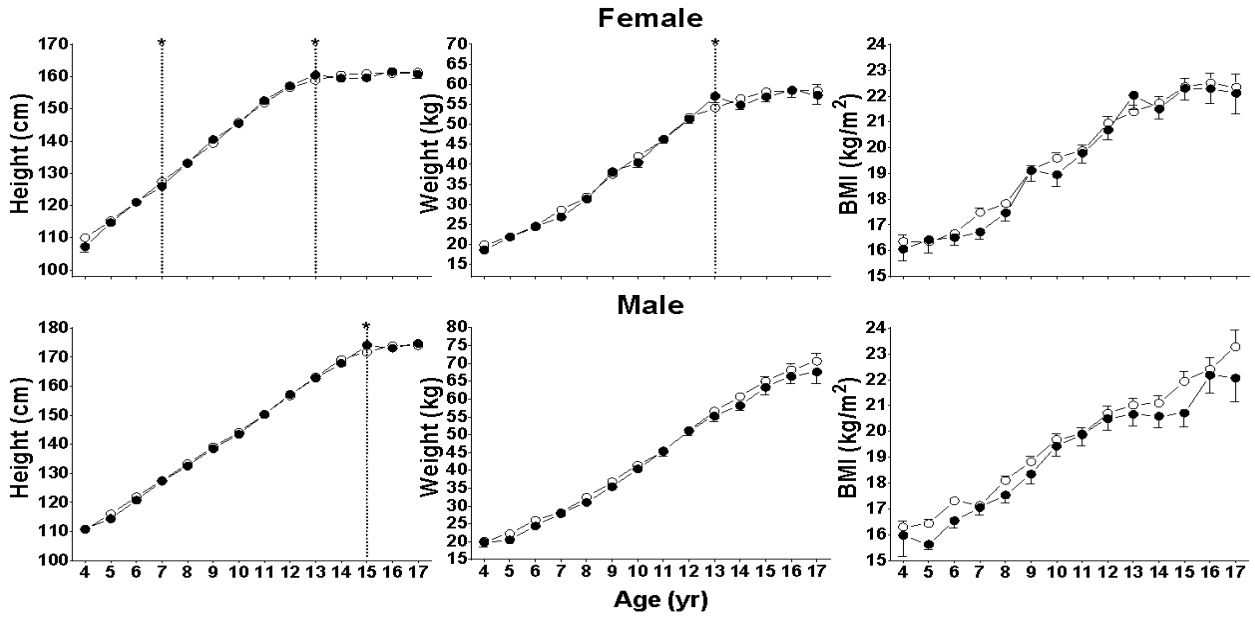

Figure 1: Height, body weight and BMI according to gender, age group and religious affiliation of students aged 4 to 17 years old (□SDA: Seventh-Day Adventists, ◯NSDA: non-Adventists): *p<0.05.
Source: the authors (2026).

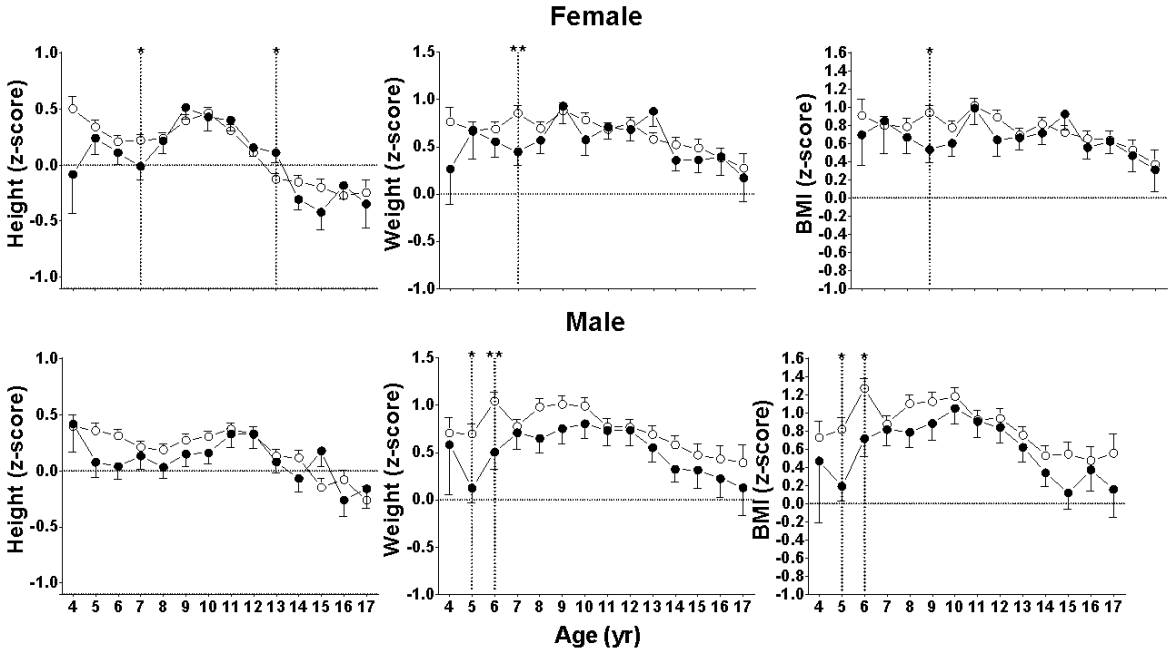

Figure 2: Z scores of height, body weight and BMI according to gender, age group and religious affiliation of students aged 4 to 17 years old (□SDA: Seventh-Day Adventists, ◯NSDA: non-Adventists): *p<0.05 and **p<0.01.
Source: the authors (2026).

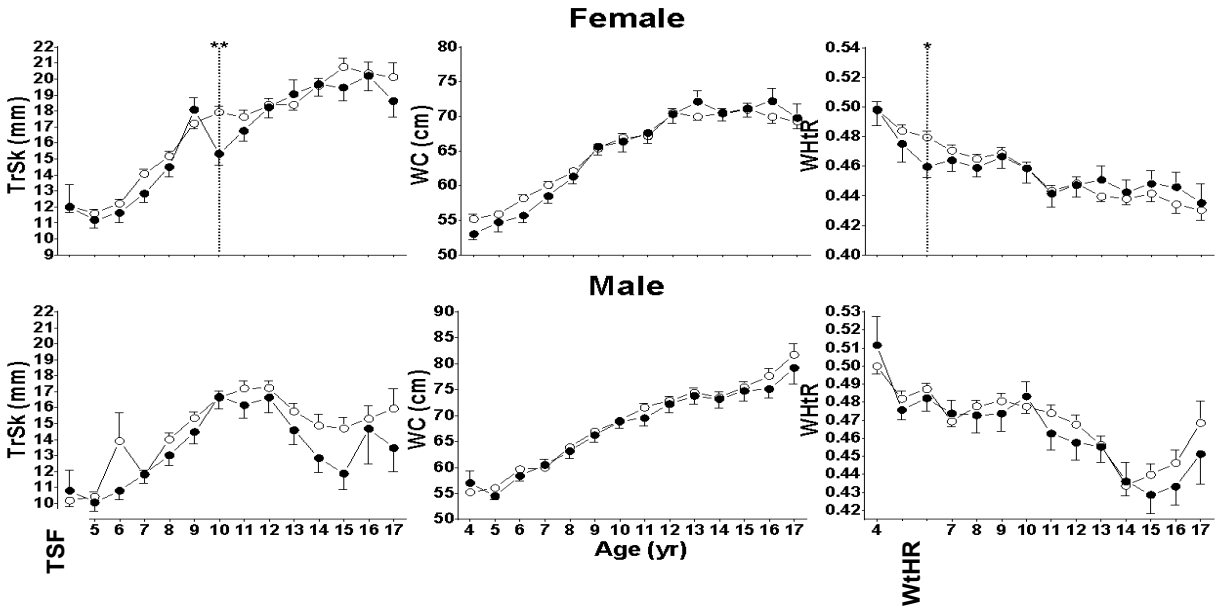

Figure 3: Triceps skinfold (TrSk), waist circumference (WC) and waist-to-height (WHtR) according to gender, age group and religious affiliation of students from 4 to 17 years old (□SDA: Seventh-Day Adventists, ◯NSDA: non-Adventists): *p<0.05 and **p<0.01.
Source: the authors (2^?6).

Taken together, the results demonstrate a high prevalence of overweight, obesity, and central adiposity among children and adolescents attending a private confessional educational network in São Paulo. Despite favorable growth patterns in terms of stature, the burden of excessive body weight and adiposity (particularly among boys) underscores the urgent need for comprehensive school-based and community-level strategies aimed at promoting healthy eating habits, increasing physical activity, and reducing sedentary behaviors from early life.

4. Conclusions

The prevalence of overweight and obesity assessed by different diagnostic methods was high among the students evaluated, particularly among males. These findings indicate a concerning burden of excessive weight and central obesity in school-aged children and adolescents, underscoring the urgent need for administrative, educational, and public health interventions aimed at promoting healthier dietary habits, increasing physical activity, and reducing sedentary behavior. Given current national and global trends, early preventive strategies are essential to mitigate long-term cardiometabolic risks in this population.

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