Waist circumference and waist circumference to height ratios of Kaingáng indigenous adolescents from the State of Rio Grande do Sul, Brazil

Circunferência da cintura e circunferência da cintura/estatura entre adolescentes indígenas Kaingáng do Rio Grande do Sul, Brasil

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Abstract

The aim of this study was to describe the distribution of waist circumference (WC) and WC to height (WCTH) values among Kaingáng indigenous adolescents in order to estimate the prevalence of high WCTH values and evaluate the correlation between WC and WCTH and body mass index (BMI)-for-age. A total of 1,803 indigenous adolescents were evaluated using a school-based cross-sectional study. WCTH values > 0.5 were considered high. Higher mean WC and WCTH values were observed for girls in all age categories. WCTH values > 0.5 were observed in 25.68% of the overall sample of adolescents. Mean WC and WCTH values were significantly higher for adolescents with BMI/age z-scores > 2 than for those with normal z-scores. The correlation coefficients of WC and WCTH for BMI/age were r = 0.68 and 0.76, respectively, for boys, and r = 0.79 and 0.80, respectively, for girls. This study highlights elevated mean WC and WCTH values and high prevalence of abdominal obesity among Kaingáng indigenous adolescents.

Anthropometry; Abdominal Obesity; Indigenous Population; Health of Indigenous Peoples

Introduction

In recent decades, studies have shown a rapid and pronounced increase in the worldwide prevalence of obesity, including child and adolescent obesity, reaching epidemic proportions [1]. Studies have also shown a high prevalence of obesity in indigenous adolescents from certain ethnic groups [2,3,4,5] and have suggested that socioeconomic and cultural transformations resulting from contact with surrounding societies are the main cause [6,7,8].

In a previous publication [4], the population of the present study was characterized by a high prevalence of overweight, according to body mass index (BMI)-for-age, and low height/age index values [9]. The prevalence of overweight observed among male and female adolescents was 5% and 8.6%, respectively. Z-scores lower than -2 for height/age were observed in 21.2% of male adolescents and in 18.5% of all adolescents [4].

The literature indicates that obesity in adolescence may persist into adulthood, increasing the risk of cardiovascular and metabolic problems; however, consensus remains elusive about the most valid method of identifying overweight/obesity in these individuals [10]. BMI is the most widely used anthropometric method for assessing nutritional status in epidemiological studies due to its simplicity and low cost [11,12]. BMI has shown good agreement with adiposity indicators in the diagnosis of overweight and obesity [13] and in assessing the risk of cardiovascular disease [14]. Despite these advantages, the various BMI cut-off points used for diagnosis in empirical studies [9,15,16,17] have made it difficult to determine a baseline reference, and thus a consistent estimate of the magnitude and evolution of obesity.

Abdominal obesity, defined as the excessive accumulation of central subcutaneous and visceral fat, has emerged as an important predictor of metabolic complications and adverse health effects. It has been associated with metabolic syndrome, type 2 diabetes and cardiovascular disease in adults [18,19], as well as with increased cardiovascular and metabolic risks in children and adolescents [20,21,22]. Furthermore, the association between abdominal obesity and cardiovascular risk appears to hold true regardless of body weight status [23].

In line with these findings, waist circumference (WC) and waist circumference to height (WCTH) have been proposed as measures of obesity and central adiposity [23]. Studies have shown that these parameters are better predictors of cardiovascular risk than an assessment using BMI alone [19,24]. For example, one study of an Australian indigenous population described improvement of cardiovascular risk prediction using measurements of WC and WCTH [25]. Using WCTH has a specific advantage over using WC alone, because the height adjustment allows the establishment of a single cut-off point applicable to the general population, regardless of gender, age and ethnicity [22].

Few studies have evaluated patterns of abdominal obesity in Brazilian indigenous populations or indigenous populations of other countries. Notably, the few available studies have shown that obesity is an increasingly common outcome affecting indigenous adults, adolescents and children [4,26,27]. The lack of research on this topic combined with alarming results from existing studies highlights the relevance of the present research in building a broad epidemiological scenario for indigenous populations. The objective of this study therefore was to describe the distribution of WC and WCTH measurements among Kaingáng indigenous adolescents attending schools in the State of Rio Grande do Sul, Brazil in order to determine the prevalence of high WCTH values among adolescents and evaluate the correlation between WC and WCTH and BMI-for-age.

Methods

This study used a school-based, cross-sectional approach and was conducted in all 35 schools in the Kaingáng Indigenous Territories (ITs) in the State of Rio Grande do Sul whose land tenure had been recognised by the National Indian Foundation (Fundação Nacional do Índio – FUNAI) at the time of data collection. The study population consisted of all adolescents aged between 10 and 19 years [28] enrolled in the schools involved in the project. The Kaingáng people belong to the Macro-Jê linguistic trunk and have been in continuous contact with the non-indigenous population since the eighteenth century. They are one of the largest indigenous populations in the country, with approximately 30,000 individuals distributed throughout 30 ITs in the states of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul [29] recognized by the FUNAI in 2008, of which 12 are located in the State of Rio Grande do Sul. The 35 schools studied are distributed among these 12 ITs: Guarita, Iraí, Monte Caseros, Carreteiro, Ventarra, Nonoai, Cacique Doble, Carreteiro, Inhacorá, Ligeiro, Rio da Várzea and Serrinha.

A team was trained in the indigenous communities prior to data collection between July and December 2008. Information about students' sex and date of birth were obtained directly from school enrolment records. Data collection was conducted at the schools during a period of one to four days (situation observed in seven schools in one of the ITs) depending on the number of students enrolled at the school.

Anthropometric measurements were taken in duplicate, as recommended by the World Health Organization [30], and mean values were used in the analysis. Weight was assessed in kilograms (kg) using a portable electronic digital scale (Mars; Marte Balanças e Aparelhos de Precisão Ltda., Santa Rita do Sapucaí, Minas Gerais, Brazil, model PP200) with a capacity of 150kg and precision of 0.05kg. Height was measured in centimetres (cm) using an Alturexata stadiometer (Alturexata Ltda., Belo Horizonte, Brazil) with an accuracy of 1mm and capacity of 213cm. WC was assessed using anthropometric inelastic tape (Cardiomed; Cardiomed Ltda., Curitiba, Brazil) with a length of 2m and an accuracy of 1mm. Measurements were taken at the midpoint between the last rib and the iliac crest [31]. BMI was calculated using the following formula: weight/(height)^2 [30].

Z-scores were calculated for BMI-for-age using the program WHO ANTHRO Plus (Centers for Disease Control and Prevention, Atlanta, USA). Individuals were classified according to BMI-for-age in two categories: 1) normal (z-scores within -2 and +2) and obesity (z-scores above +2) [9]. Since only one individual was underweight (BMI-for-age z-score < -2) this category was excluded from the analysis. WCTH values > 0.5 were considered high [32,33].

Double data entry was performed using Epi Info software, version 6.04 (Centers for Disease Control and Prevention, Atlanta, USA). Data was analysed using Stata 10.0 (Stata Corp., College Station, USA). Frequencies were calculated for categorical variables and percentile or mean and standard deviation (SD) for continuous variables. The Student's t-test for Independent Samples and Analysis of Variance (ANOVA) were used to explore the differences between means and proportions were compared using the Chi-square test. Correlations between WC, WCTH and BMI-for-age values were evaluated using Pearson's correlation coefficient. A significance level of $p < 0.05$ was adopted for all tests.

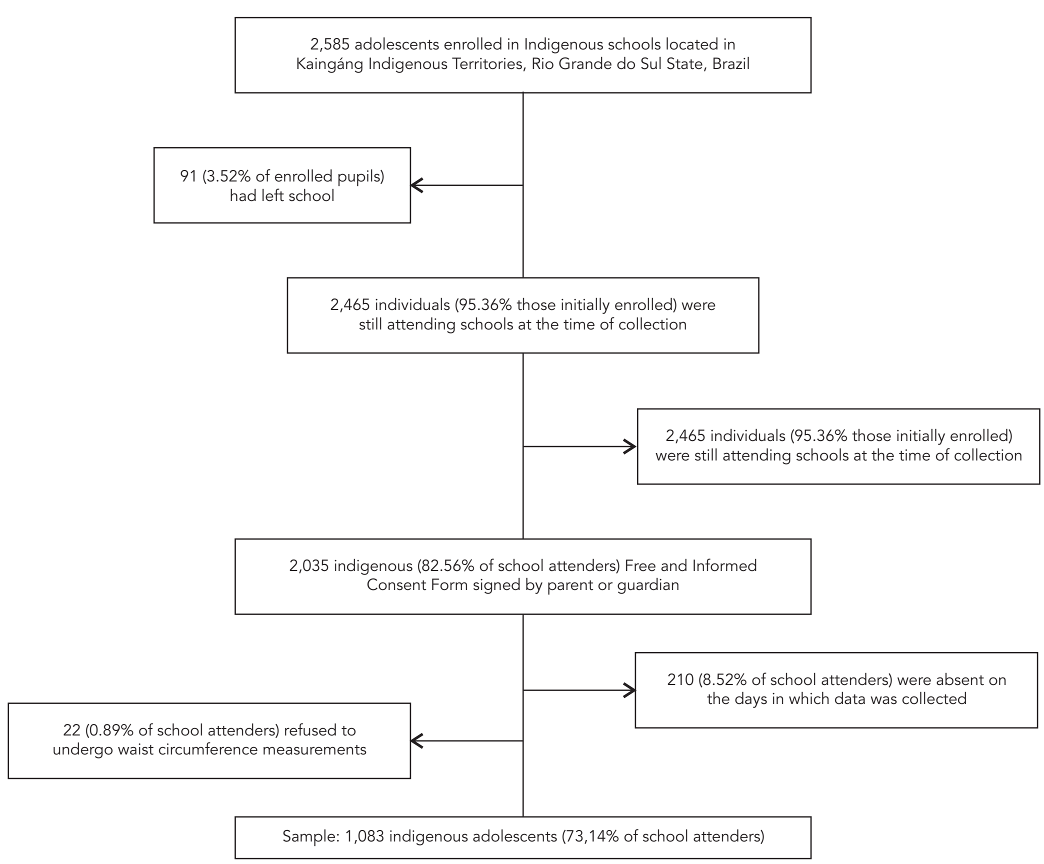
This study was approved by the following organisations at all required levels for research with indigenous individuals [34]: the Ethics Committee of the Federal University of Rio Grande do Sul (Universidade Federal do Rio Grande do Sul; case nº. 2007726), the National Research Ethics Committee (case nº. 14,449), the Brazilian National Research Council (Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq) and the FUNAI (case nº. CGEP/08 1141/08). Only individuals presenting a written or digital Informed and Free Consent Form signed by a parent or guardian were evaluated by this study.

Results

Figure 1 shows the total number of adolescents enrolled in schools at the time of the study, the

Figure 1

Description of the study sample.



total number of assessed adolescents and also the number of losses, refusals and absences. A total of 1,803 indigenous adolescents were evaluated (73.14% of the students enrolled at the time of data collection), of which 931 (51.64%) were boys. The mean age of the adolescents studied was 12.45 years (±2.10) and the mean age of boys and girls was 12.58 years (±2.21) and 12.32 years (±1.97), respectively. A comparison between evaluated indigenous adolescents and those enrolled in a school but not evaluated yielded no statistically significant difference for sex ratio (χ^2 = 0.060, p = 0.807); however, the average age was lower (t = -9.148, p < 0.0001) for evaluated individuals (data not shown).

Table 1 presents the mean, SD, minimum and maximum values, and percentiles 5 (p5) and 90 (p90) for WC and WCTH by sex and age. Mean WC and WCTH values were higher for girls than for boys in all age categories (p < 0.05). Mean WCTH

Table 1

Mean values, standard deviation (SD), minimum and maximum values and percentiles 5 (p5) and 90 (p90) of waist circumference and waist circumference/height by sex and age among adolescents from the Kaingáng Indigenous Territories, Rio Grande do Sul State, Brazil, 2008.

	n	Mean	SD	Minimum	Maximum	p5	p90	p-value *
Waist circumference (cm)								
Boys (years)								< 0.001
Total	931	68.12	7.59	51.00	115.00	58.41	77.15	
10-11	360	64.45	6.72	51.00	101.25	56.75	72.10	
12-13	289	67.77	5.89	56.80	92.60	60.35	75.25	
14-15	173	71.57	6.96	61.25	102.45	63.47	77.99	
16-19	109	75.64	7.38	60.80	115.00	67.65	81.90	
Girls (years)								< 0.001
Total	872	71.66	9.22	54.40	121.90	58.93	83.95	
10-11	361	66.45	7.03	54.40	97.00	57.25	76.17	
12-13	282	72.58	7.80	54.65	105.25	61.81	83.13	
14-15	163	77.77	8.29	56.90	103.00	65.02	88.25	
16-19	66	81.10	9.65	65.35	121.90	67.72	93.08	
Boys and girls (years)								< 0.001
Total	1,803	69.83	8.60	51.00	121.90	58.56	80.88	
10-11	721	65.45	6.95	51.00	101.25	57.20	74.69	
12-13	571	70.15	7.30	54.65	105.25	60.53	80.08	
14-15	336	74.58	8.23	56.90	103.00	64.00	86.23	
16-19	175	77.70	8.70	60.80	121.90	67.74	87.48	
Waist circumference/height								
Boys (years)								< 0.001
Total	931	0.47	0.04	0.39	0.70	0.42	0.51	
10-11	360	0.47	0.04	0.41	0.68	0.42	0.52	
12-13	289	0.46	0.04	0.39	0.62	0.42	0.52	
14-15	173	0.46	0.04	0.40	0.66	0.41	0.49	
16-19	109	0.46	0.04	0.40	0.70	0.41	0.50	
Girls (years)								< 0.001
Total	872	0.49	0.05	0.40	0.77	0.43	0.56	
10-11	361	0.48	0.04	0.40	0.65	0.43	0.54	
12-13	282	0.49	0.05	0.40	0.69	0.43	0.55	
14-15	163	0.51	0.05	0.41	0.68	0.43	0.58	
16-19	66	0.53	0.06	0.43	0.77	0.45	0.60	
Boys and girls (years)								0.001
Total	1,803	0.48	0.05	0.39	0.77	0.42	0.55	
10-11	721	0.48	0.04	0.40	0.68	0.43	0.53	
12-13	571	0.48	0.04	0.39	0.69	0.42	0.54	
14-15	336	0.48	0.06	0.40	0.68	0.42	0.57	
16-19	175	0.49	0.06	0.40	0.77	0.42	0.57	

Note: All mean differences were statistically significant (p < 0.05) between sexes for all age categories (Student's t-test for unequal variances between groups).
* p-value for comparing means among the different age categories (ANOVA).

increased with age for girls ($p < 0.001$), with values above 0.5 in the age categories 14-15 and 16-19 years. Conversely, WCTH tended to decrease with age among boys.

As expected, mean WC and WCTH values were significantly higher among adolescentes presenting BMI-for-age > 2 z-scores when compared to normal-weight ones. Normal-weight girls showed higher WC and WCTH mean values than normal-weight boys throughout all age categories. Furthermore, in normal-weight girls aged 16-19 years the WCTH ratio was greater than 0.5, in contrast to normal-weight boys where the WCTH ratio was less than 0.5 in all age categories. Finally, in boys and girls with BMI-for-age > 2 z-scores, WCTH values were greater than 0.5 throughout all age categories, reaching 0.62 in boys and 0.68 in girls in the 16-19 years age category (Table 2).

The proportion of WCTH values > 0.5 was significantly different between all age categories. In girls, the prevalence of WCTH > 0.5 almost tripled between the 10-11 and 16-19 years age categories, increasing from 24.93% to 72.73%, respectively. Overall, the prevalence of high WCTH values was lower among boys, regardless of age category (Table 3).

With respect to WC and BMI-for-age values, a moderate positive correlation ($r = 0.75$, $p < 0.001$) was observed for the entire study population. A similar correlation was observed for WCTH and BMI-for-age values ($r = 0.79$, $p < 0.001$). When the data was stratified by sex, a stronger positive correlation was observed between WC and BMI-for-age, and WCTH and BMI-for-age in girls ($r = 0.79$ and 0.80, respectively; $p < 0.001$ for both). Among boys, this correlation was weaker, but was also statistically significant ($r = 0.68$ for WC and BMI-for-age, and $r = 0.76$ for WCTH and BMI-for-age; $p < 0.001$ for both) (data not shown).

Discussion

For indigenous adolescents enrolled in schools in Kaingáng ITs in the State of Rio Grande do Sul, mean WC and WCTH values were greater among female adolescents than in their male counterparts. The prevalence of WCTH values > 0.5 was also high. For all age categories, the prevalence of WCTH values > 0.5 was higher in female adolescents. As expected, mean WC and WCTH values were significantly higher for adolescents with BMI-for-age > 2 z-scores when compared to adolescents with normal weight. Moreover, a positive correlation between WC and BMI-for-age and WCTH and BMI-for-age was observed among both sexes.

Few studies have evaluated the nutritional status of indigenous adolescents and even fewer have evaluated WC, limiting comparative analyses with studies conducted with non-indigenous populations. This lack of health and nutrition information for indigenous peoples in Brazil affects broader planning, implementation and evaluation of health interventions targeted at this segment of the population [35]. A clear example of this neglect is the fact that Brazilian indigenous individuals have not been included in national surveys on health and nutrition, while the rest of the population has been evaluated in such surveys since the 1970s [2]. In fact, it was only in 2008 that a specific study of the health and nutrition status of the Brazilian indigenous population was conducted through the *First National Survey on Nutrition and Health of Indigenous Peoples* [36].

Nevertheless, specific national studies with different ethnic groups provide evidence that overweight and obesity are emerging problems among indigenous population and show that dietary and nutritional patterns are in transition and that these changes may be happening even more rapidly than among the non-indigenous population [4,37,38,39,40]. Data from the *First National Survey on Health and Nutrition of Indigenous Peoples* show that when the prevalence of child malnutrition and anaemia becomes alarming, chronic non-communicable diseases are already a reality [36]. The survey also revealed a worrying scenario in which obesity, hypertension and changes in glucose levels have occurred with high frequencies amongst women of reproductive age. However, the national survey assessed indigenous children aged zero to five years and women aged 14 to 49 years [36], as opposed to the current study that evaluated adolescents of both sexes aged 10 through 19 years. Comparisons of the results of the present study with the national survey are therefore very limited.

Studies indicate that the Kaingáng people face serious health care problems. Research also highlights a complex epidemiological profile for this population, in which health problems as diverse as respiratory and parasitic infections coexist at relevant magnitudes [41,42] with chronic non-communicable diseases, such as type 2 diabetes, hypertension [43] and even alcoholism [44]. A critical factor that may partially explain the results obtained in the present study are dietary changes in the Kaingáng population over time. The traditional dietary patterns of the Kaingáng, based on hunting and gathering, fishing and agriculture [45] have changed markedly; today, this population relies on the acquisition of commercial foods at markets in nearby towns and donated "food bas-

Table 2

Mean values and standard deviation (SD) of waist circumference and waist circumference/height according to sex, age and nutritional status among adolescents from the Kaingáng Indigenous Territories, Rio Grande do Sul State, Brazil, 2008.

	BMI/age -2/2 z-scores				BMI/age > 2 z-scores				p-value *
	n	Mean	SD	p-value **	n	Mean	SD	p-value **	
Waist circumference (cm)									
Boys (years)				< 0.001				< 0.001	
Total	873	67.06	5.99		46	86.07	9.55		< 0.001 ***
10-11	332	63.07	4.44		27	81.49	6.86		< 0.001 #
12-13	280	67.19	4.92		9	85.72	5.63		< 0.001 #
14-15	165	70.55	4.67		7	96.61	4.96		< 0.001 ***
16-19	96	74.41	4.57		3	103.78	9.89		0.017 ***
Girls (years)				< 0.001				< 0.001	
Total	792	70.26 *	7.87		75	86.23	9.16		< 0.001 ***
10-11	329	65.13 *	5.57		31	80.53	5.55		< 0.001 #
12-13	257	71.20 *	6.41		25	86.76	6.66		< 0.001 #
14-15	146	76.33 *	6.67		15	92.30	6.64		< 0.001 #
16-19	60	79.52 *	6.47		4	104.40	15.48		0.024 ***
Boys and girls (years)				< 0.001				< 0.001	
Total	1,665	68.58	7.13		121	86.17	9.27		< 0.001 ***
10-11	661	64.10	5.13		58	80.97	6.16		< 0.001 ***
12-13	537	69.11	6.02		34	86.48	6.34		< 0.001 #
14-15	311	73.26	6.38		22	93.67	6.37		< 0.001 #
16-19	156	76.38	5.91		7	104.14	12.35		< 0.001 ***
Waist circumference/height									
Boys (years)				< 0.001				0.048	
Total	873	0.46	0.03		46	0.58	0.05		< 0.001 ***
10-11	332	0.46	0.03		27	0.57	0.05		< 0.001 #
12-13	280	0.46	0.03		9	0.57	0.04		< 0.001 #
14-15	165	0.45	0.03		7	0.62	0.03		< 0.001 ***
16-19	96	0.46	0.03		3	0.62	0.07		0.032 ***
Girls (years)				< 0.001				< 0.001	
Total	792	0.49 ##	0.04		75	0.59	0.05		< 0.001 ***
10-11	329	0.47 ##	0.03		31	0.57	0.03		< 0.001 #
12-13	257	0.48 ##	0.04		25	0.58	0.04		< 0.001 #
14-15	146	0.50 ##	0.04		15	0.61	0.04		< 0.001 #
16-19	60	0.52 ##	0.04		4	0.68	0.10		0.024 ***
Boys and girls (years)				< 0.001				< 0.001	
Total	1,665	0.47	0.04		121	0.59	0.05		< 0.001 ***
10-11	661	0.47	0.03		58	0.57	0.04		< 0.001 ***
12-13	537	0.47	0.04		34	0.58	0.04		< 0.001 #
14-15	311	0.48	0.05		22	0.61	0.04		< 0.001 #
16-19	156	0.48	0.05		7	0.65	0.09		0.001 ***

BMI: body mass index.

* p-value for comparison of means between BMI/age categories (Student's t-test);

** p-value for comparison of means among different age categories (ANOVA);

*** Student's t-test for unequal variances between sexes;

Student's t-test for equal variances between sexes;

Mean statistically significant values higher for girls when compared to boys from the same age category.

kets". Furthermore, available data points to a fat and carbohydrate-rich diet [37,40].

The mean WC values for both sexes described in this study were lower than those found in a study conducted between 1999 and 2004 among non-indigenous adolescents aged 12 to 17 years in the United States (78.9cm for girls and 79.8cm for boys) [33]. However, when data from our study is compared with data from studies of non-indigenous Brazilian adolescents, mean WC values are similar or higher. Mean WC values similar to those found in our study were observed in a

Table 3

Prevalence of elevated values of waist circumference/height by sex and age among adolescents in the Kaingáng Indigenous Territories, Rio Grande do Sul State, Brazil, 2008.

	N	Waist circumference/height (> 0,5)		
		n	%	p-value *
Boys (years)				0.009
Total	931	133	14.29	
10-11	360	68	18.89	
12-13	289	38	13.15	
14-15	173	16	9.25	
16-19	109	11	10.09	
Girls (years)				< 0.001
Total	872	330	37.84	
10-11	361	90	24.93	
12-13	282	101	35.82	
14-15	163	91	55.83	
16-19	66	48	72.73	
Boys and girls (years)				< 0.001
Total	1,803	463	25.68	
10-11	721	158	21.91	
12-13	571	139	24.34	
14-15	336	107	31.85	
16-19	175	59	33.71	

Note: All differences in prevalence were statistically significant ($p < 0.05$) between sexes for all age categories (two-sample test of proportion).

* p-value from chi-square test for comparison of proportions between the different age categories.

study in the State of Pernambuco [46] of adolescents aged 14 to 19 years and in a study which investigated adolescents from three Brazilian cities [47]. In a study of adolescents aged between 10 and 17 years in the city of Londrina in the State of Paraná, mean WC values for male adolescents were higher (72.4cm) than the present study, while among female adolescents they were lower (67.5cm) [48].

Mean WCTH values identified in the present study are consistent with those observed in the above mentioned study of North American adolescents (0.47 among boys and 0.49 for girls) [33]. Work conducted by Ribeiro et al. [47] among adolescents in three Brazilian state capitals, showed lower (0.45) mean WCTH values than those observed for Kaingáng adolescents. The prevalence of WCTH values > 0.5 in male adolescents was lower than the percentage indicated by Li et al. [33] from a study of North American adolescents of the same sex (28.8%). However, for female adolescents, the percentages were similar in both studies. In Recife, Brazil, the prevalence of WCTH values > 0.5 among adolescents aged 10 to 14 years was lower (12.6%) than in the present study [49].

Strong positive correlations between the anthropometric indicators measured in this study (BMI-for-age, WC and WCTH) have also been described by other authors [13,49]. The use of more than one indicator gives additional information, especially regarding the risk of co-morbidities related to excessive weight and particularly the association with central adiposity. In line with this idea, a study by Jansen et al. [50] showed that for adolescents diagnosed as overweight using BMI-for-age, those with a concomitant high WC value were twice as likely to have high levels of triglycerides and insulin and metabolic syndrome when compared with the overweight group without abdominal obesity [50]. Given this evidence, the use of WC together with BMI to diagnose obesity in adolescents and to screen patients at risk for co-morbidities, particularly cardiovascular disease, has been recommended [50].

Our study design made it possible to evaluate more than 70% of the adolescents enrolled in schools in the Kaingáng ITs of Rio Grande do Sul. However, care should still be taken when extrapolating these results to all Kaingáng children and adolescents from Rio Grande do Sul, as the study included only individuals enrolled in the IT schools and is therefore representative of only this fraction of the Kaingáng population. Furthermore, the low height values presented by this population may have led to an overestimation of prevalence of high WCTH and should therefore be interpreted with caution. For adolescents, height may not depend exclusively on the nutritional status, living conditions or environment that may differ between populations [2]. It should be noted that the lack of comparative WCTH data on indigenous adolescents hinders further comparisons and conclusions. Another important limitation of this study is the lack of information on the sexual maturation stage of the adolescents studied, which also restricts the interpretation of the results. Furthermore, due the lack of data on specific metabolic diseases, it was not possible to perform correlation analysis between WC and WCTH and metabolic diseases as suggested in previous studies in the area [51,52,53].

The anthropometric nutritional assessment of adolescents can also be a challenging task due to the issues regarding the cut-off points and reference standards used. To the authors' best knowledge, the present study is the largest to assess the distribution of WC and WCTH values among students of a single indigenous ethnic group in Brazil. Considering the importance of WC and WCTH values in a more sensitive diagnosis of obesity, additional studies assessing these indicators in different indigenous populations are sorely needed. The anthropometric profile of WC and WCTH among Kaingáng adolescents in the schools of Rio Grande do Sul presented in this study may be result of dietary and nutritional transitions among these individuals, revealing worrying prospects for the development of chronic non-communicable diseases.

Resumo

Os objetivos do estudo foram descrever a distribuição das medidas de circunferência de cintura (CC) e CC/estatura (CC/E) para adolescentes indígenas Kaingáng; estimar a prevalência de valores elevados para CC/E; e avaliar a correlação entre CC e CC/E com o IMC/idade. Um total de 1.803 adolescentes indígenas foi avaliado no estudo seccional de base escolar. Foram considerados elevados valores de CC/E superiores a 0,5. Observaram-se maiores valores médios de CC e CC/E para meninas, em todas as faixas etárias. Valores de CC/E > 0,5 foram encontrados em 25,6% dos adolescentes. Valores médios de CC e CC/E foram significativamente maiores para os adolescentes com IMC/idade > 2 z-scores, em comparação aos eutróficos. Os coeficientes de correlações entre CC e CC/E com o IMC/idade foram: meninos: r = 0,68 e 0,76, respectivamente, e meninas: r = 0,79 e 0,80, respectivamente. Destaca-se proeminência de valores médios elevados de CC e CC/E e prevalências expressivas de obesidade abdominal.

Antropometria; Obesidade Abdominal; População Indígena; Saúde de Populações Indígenas

Contributors

T. G. Castro participated in drafting the study, data collection, analysis and writing of the manuscript. L. A. Barufaldi contributed to gathering and recording information, analyzing data and writing the manuscript. M. M. Schlüssel, W. L. Conde, M. S. Leite and I. Schuch participated in study design and writing of the manuscript.

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