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ORIGINAL ARTICLE

Comparison of the nutritional, lipidic and glycemic profile of children and adolescents of different hemispheres of the rural area of Santa Cruz do Sul - RS

Comparação do perfil nutricional, lipídico e glicêmico de crianças e adolescentes de diferentes hemisférios da zona rural de Santa Cruz do Sul - RS

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ABSTRACT

Risk factors for cardiovascular diseases are present in childhood and juvenile obesity, such as dyslipidemia and hyperinsulinemia. ***Objective:*** *to verify the nutritional, glycemic and lipid profile in schoolchildren, comparing the northern, southern, eastern and western hemispheres of the rural area of Santa Cruz do Sul - RS.* ***Method:*** *cross-sectional study, with 729 rural schoolchildren, aged between 7 and 15 years. Two schools had rural characteristics and three urban schools. Blood samples were collected for total cholesterol, HDL-cholesterol, LDL-cholesterol, triglycerides (TG), and glucose. Weight and height were measured to calculate the body mass index. Statistical analysis, was performed using the SPSS 20.0 program, and the comparison of the categorical variables by school was performed using the chi-square test, with p <0.05 considered significant.* ***Results:*** *27% of the students were overweight and obese, 59.7%, 52.4%, 21.8% and 30.5% presented altered LDL-c, CT, TG and glucose, respectively, and 21% HDL-c Decreased. Regarding the comparison between schools, there was a significant difference between schools in all biochemical variables for both sexes.* ***Closing remarks:*** *schoolchildren presented significant biochemical changes, especially in schools with urban characteristics, a result that may contribute to future cardiovascular problems.*

Keywords: *Lipids; Glycemia; Child; Adolescent; School Health.*

RESUMO

Fatores de risco para doenças cardiovasculares estão presentes na obesidade infanto-juvenil, como a dislipidemia e a hiperinsulinemia. **Objetivo:** verificar o perfil nutricional, glicêmico e lipídico em escolares, comparando os hemisférios norte, sul, leste e oeste da zona rural de Santa Cruz do Sul - RS. **Método:** estudo de caráter transversal, com 729 escolares da zona rural, com idades entre sete e 15 anos. Duas escolas apresentaram características rurais e três escolas características urbanas. Foi realizada coleta sanguínea para verificação do colesterol total (CT), colesterol HDL (HDL-c), colesterol LDL (LDL-c), triglicerídeos (TG) e glicose. Foi realizada a mensuração do peso e estatura para cálculo do índice de massa corporal. Para a análise estatística, foi utilizado o programa SPSS 20.0 e a comparação das variáveis categóricas por escola foi realizada por meio do teste qui-quadrado, sendo o valor de p<0,05 considerado significante. **Resultados:** 27% dos escolares apresentaram sobrepeso e obesidade, 59,7%, 52,4%, 21,8% e 30,5% apresentaram LDL-c, CT, TG e glicose alterados, respectivamente, e 21% HDL-c diminuídos. Quanto ao comparativo entre escolas, houve diferença significativa entre as escolas em todas as variáveis bioquímicas para ambos os sexos. **Considerações finais:** os escolares apresentaram expressivas alterações bioquímicas, principalmente nas escolas com características urbanas, resultado este que pode vir a colaborar para futuros problemas cardiovasculares.

Descritores: *Lipídeos; Glicemia; Criança; Adolescente; Saúde Escolar.*

INTRODUCTION

Is evident today the proportion that obesity reach all over the world, being perceived in different ages, breeds and in both genders.[1] Obesity is defined as a chronic condition characterized by fat accumulation and can be supporting on developing of several diseases resulting in health risks.[2]

The increasing prevalence of childhood and juvenile obesity highlight risk factors linked to this metabolic disturb,[3] such as diabetes mellitus,[4] glucose intolerance, dyslipidemia and others comorbidities.[5] These changes favor the development of metabolic syndrome, as well as facilitate the increasing of triglycerides (TG) and decreasing HDL-cholesterol (HDL-c) values.[6]

Another concern is the fact that subjects with childhood obesity became predisposed to develop in adulthood obesity and other health problems such as cardiovascular disease and metabolic syndrome.[7] Concomitantly Sobrero et al.[8] quote that metabolic syndrome and cardio metabolic risk are determined by obesity, particular central fat. Likewise, abdominal obesity favors the emergence of metabolic and cardiovascular risk factors.[9] Bergmann et al.[10] report that overweight is linked to variables that predispose to cardiovascular diseases, being this a great mortality cause in the world. Risk factors for cardiovascular diseases are also present in childhood and juvenile obesity such as dyslipidemia and hyperinsulinemia.[11]

Altered levels in lipid profile such as total cholesterol (TC), LDL-cholesterol (LDL-c), HDL-c and TG are related with arterial hypertension and arteriosclerotic diseases,[12] as well as dyslipidemia is positively associated to overweight and eating habits.[13] Due to the increasing of risk cases for cardiovascular diseases its necessary a survey of lipid profile changes in children and adolescents since overweight have an affect on the variable levels that composes this profile.[14]

In this context the aim of this study is verify the nutritional, glycemic and lipid profile of schoolchildren aged 7 to 15 years and compare the northern, southern, western and eastern hemispheres of the rural area of Santa Cruz do Sul, Brazil.

METHOD

It was performed a cross-sectional study with 729 schoolchildren aged 7 to 15 years being 352 male and 377 female from 5 schools or the rural area of Santa Cruz do Sul in Southern Brazil (Square 1). The present study is part of a research developed at the Universidade de Santa Cruz do Sul (Unisc) entitled "Evaluation of health biochemical markers of schoolchildren using infrared spectroscopy, polymorphisms, oral health and lifestyle related factors: a study in Santa Cruz do Sul – phase II" approved by the ethical research committee of Unisc under protocol number 3044/11.

Data collection begins with a reunion with each school board where we explain the importance of the survey on risk factors associated to obesity. Then a questionnaire was sent to each school with questions related to life style, health and well-being as well as the consent form to the parents or guardians of each children or adolescent. The students were invited to appear at the university in pre-determined day in the morning with 12 hours fasting for blood collection and laboratory tests (TC, HDL-c, LDL-c and TG). Afterwards we performed the determination of weight and high using a calibrated anthropometric scale.

Lipid profile was evaluated according to values from National Heart, Lung and Blood Institute (NHLBI).[15] Results were considered altered of kind borderline and increased when TC was ≥ 170 mg/dL, LDL-c ≥ 110 mg/dL and TG ≥ 75 mg/dL for children and 90 mg/dL for adolescents and borderline and low when HDL-c was ≤ 45 mg/dL. For glucose was used the values of American Diabetes Association,[16] considering altered the students with 100-126 mg/dL (prediabetes) and ≥ 126 mg/dL (diabetes). Body mass index (BMI) classification was performed in accordance to gender and age considering low weight (<p5), normal (≥p5 and <p85), overweight (≥p85 and <p95) and obesity (≥p95), according to the curves and percentiles of Centers for Disease Control and Prevention/National Center for Health Statistics.[17]

Statistical analyses were performed on software SPSS version 20.0 through descriptive analysis (frequency and percentage). The comparison of categorical variables by school was performed using qui-square test, considering significant when $p \leq 0.05$.

RESULTS

Of the 729 children and adolescents participants in this study 51.7% were female. The subject distribution according to school was: 113 (15.5%) on School 1 (south), 193 (26.5%) on School 2 (north[1]), 82 (11.3%) on School 3 (east), 216 (29.7%) on School 4 (west) and 125 (17.1%) on School 5 (north[2]). The cardiovascular risk profile (nutritional, lipid and glycemic) of students can be observed on table 1, in which it was verified high level of alterations in

Chart 1 - Localization and characteristics of each school.

School	Hemisphere	Distance from downtown	Characteristics	Subjects	
				M	F
1	South	About 15 km	School located in region with several farming families who preserve healthy habits and children help parents on the farm	50	50
2	North[1]	About 30 km	School located in a village with urban characteristics	89	89
3	East	About 10 km	School next to a federal highway large flow near to downtown and with several bus lines	41	41
4	West	About 20 km	School in paved area, with commerce and bus lines nearby	108	108
5	North[2]	About 50 km	School distant from urban area and children help their parents on the farm	64	64

evaluated risk factors, especially LDL-c (59.7%), TC (52.4%) and glucose (30.5%). Regarding the nutritional profile 27.0% of subjects presented overweight and obesity. When stratified by gender it was observed that regarding lipid profile variables, as well as BMI, there are higher alterations percentages in girls, especially in relation to TG, TC and LDL-c values. In boys there was higher alteration percentage in glucose (36.1% in boys versus 25.2% in girls).

Health indicators of boys are presented on table 2. There was significant difference ($p < 0.001$) in all variables evaluated of lipid profile and in glucose when comparing the 5 schools participants. Schools 4 and 2 presented, respectively, higher percentage of students with TC altered (61.1 and 52.8%), LDL-c altered (67.6 and 60.7%), glucose increased (53.7 and 49.4%) and TG increased (20.4 and 25.8%); schools 1 and 4 presented higher percentage of overweight and obesity (26.0 and 35.2%, respectively). HDL-c borderline predominated in schools 3 (39.0%) and 5 (25.0%).

DISCUSSION

In the present study 59.7% of students presented altered values of LDL-c, 52.4% of TC, and 30.5% of glucose. A cross-sectional study from Vitória, state of Espírito Santo (Brazil) with 511 children aged 6 to 9 years reported lower rates of TC (32.7%) and LDL-c (27.0%) increased.[18] Another study performed in Amargosa, state of Bahia (Brazil) with 1,139 students aged 6 to 18 years reported the prevalence of increased TC, TG and LDL-c in 23.1, 12.4 and 4.5% of subjects, respectively, being these results lower than the reported in our study. The same study also reported higher percentage of low HDL-c: 41.5% of subjects.[19]

Lower values than our study also was reported for TC (44.3%), LDL-c (23.0%) and TG (21.8%) in a nationwide study which evaluated 38,069 adolescents aged 12 to 17 years; low HDL-c was observed 46.8% of adolescents, higher than we found in our study[20].

Table 1 - Health indicators of subjects.

	Total n (%)	Girls n (%)	Boys n (%)
BMI			
Low weight/normal	532 (73,0)	273 (72,4)	259 (73,6)
Overweight/obesity	197 (27,0)	104 (27,6)	93 (26,4)
Triglycerides			
Aceptable	570 (78,2)	276(73,2)	294 (83,5)
Borderline + increased	159 (21,8)	101(26,8)	58 (16,6)
Total cholesterol			
Aceptable	347 (47,6)	165 (43,8)	182 (51,7)
Borderline + increased	382 (52,4)	212(56,2)	170 (48,3)
HDL-cholesterol			
Aceptable	576 (79,0)	296 (78,5)	280 (79,5)
Borderline + low	153 (21,0)	81 (21,5)	72 (20,5)
LDL-cholesterol			
Aceptable	294 (40,3)	136 (36,1)	158 (44,9)
Borderline + increased	435 (59,7)	241 (63,9)	194 (55,1)
Glucose			
Normal	507 (69,5)	282 (74,8)	225 (63,9)
Altered	222 (30,5)	95 (25,2)	127 (36,1)
Total	729 (100)	377 (51,7)	352 (48,3)

Table 2 - Health indicators of boys.

	School1 South n (%)	School 2 North[1] n (%)	School 3 East n (%)	School 4 West n (%)	School 5 North[2] n (%)	*p*
BMI						
Low weight/normal	37 (74,0)	69 (77,5)	32 (78,0)	70 (64,8)	51 (79,7)	0,156
Overweight/obesity	13 (26,0)	20 (22,5)	9 (22,0)	38 (35,2)	13 (20,3)	
Triglycerides						
Aceiptable	41 (82,0)	66 (74,2)	40 (97,6)	86 (79,6)	61 (95,3)	<0,001
Borderline + increased	9 (18,0)	23 (25,8)	1 (2,4)	22 (20,4)	3 (4,7)	
Total cholesterol						
Aceptable	29 (58,0)	42 (47,2)	30 (73,2)	42 (38,9)	39 (60,9)	<0,001
Borderline + increased	21 (42,0)	47 (52,8)	11 (26,8)	66 (61,1)	25 (39,1)	
HDL-cholesterol						
Aceptable	48 (96,0)	69 (77,5)	25 (61,0)	90 (83,3)	48 (75,0)	<0,001
Borderline + low	2 (4,0)	20 (22,5)	16 (39,0)	18 (16,7)	16 (25,0)	
LDL-cholesterol						
Aceptable	25(50,0)	35 (39,3)	32 (78,0)	35 (32,4)	31 (48,4)	<0,001
Borderline + increased	25 (50,0)	54 (60,7)	9 (22,0)	73 (67,6)	33 (51,6)	
Glucose						
Normal	29 (58,0)	45 (50,6)	41 (100,0)	50 (46,3)	60 (93,8)	<0,001
Altered	21 (42,0)	44 (49,4)	0 (0,0)	58 (53,7)	4 (6,2)	

Table 3 - Health indicators of girls.

	School 1 South n (%)	School 2 North[1] n (%)	School 3 East n (%)	School 4 West n (%)	School 5 North[2] n (%)	*p*
BMI						
Low weight/normal	49 (77,8)	74 (71,2)	31 (75,6)	78 (72,2)	41 (67,2)	0,731
Overweight/obesity	14 (22,2)	30 (28,8)	10 (24,4)	30 (27,8)	20 (32,8)	
Triglycerides						
Aceiptable	47 (74,6)	69 (66,3)	39 (95,1)	83 (76,9)	38 (62,3)	0,002
Borderline + increased	16 (25,4)	35 (33,7)	2 (4,9)	25 (23,1)	23 (37,7)	
Total cholesterol						
Aceptable	24 (38,1)	33 (31,7)	33 (80,5)	45 (41,7)	30 (49,2)	<0,001
Borderline + increased	39 (61,9)	71 (68,3)	8 (19,5)	63 (58,3)	31 (50,8)	
HDL-cholesterol						
Aceptable	58 (92,1)	86 (82,7)	24 (58,5)	90 (83,3)	38 (62,3)	<0,001
Borderline + low	5 (7,9)	18 (17,3)	17 (41,5)	18 (16,7)	23 (37,7)	
LDL-cholesterol						
Aceptable	24 (38,1)	23 (22,1)	33 (80,5)	39 (36,1)	17 (27,9)	<0,001
Borderline + increased	39 (61,9)	81 (77,9)	8 (19,5)	69 (63,9)	44 (72,1)	
Glucose						
Normal	45 (71,4)	72 (69,2)	41(100,0)	67 (62,0)	57 (93,4)	<0,001
Altered	18 (28,6)	32 (30,8)	0 (0,0)	41 (38,0)	4 (6,6)	

However, another study performed with children and adolescents aged 10 to 18 years from Korea observed altered levels of HDL-c in 7.1%, LDL-c in 4.7% and TG in 10.1% of subjects.[21]

Beck et al.[22] in a cross-sectional study with 660 students from Três de Maio, state of Rio Grande do Sul (Brazil) reported alterations of TC and HDL-c in 20.3 and 25.9% of subjects, respectively. They also observed that 0.9% of subjects presented hyperglycemia, very different from our study which found altered glucose in 30.5% of subjects. A cross-sectional study performed in United States of America with 1,235 adolescents aged 12 to 19 years showed among boys altered rates of 4.3, 2.0 and 18.1% for TG, LDL-c and HDL-c respectively; among girls they observed alterations in 5.4% for TG, 3.8% for LDL-c and and 12.2% for HDL-c.[23] Another study performed in Recife, state of Pernambuco (Brazil) observed, among 470 adolescents aged 10 to 14 years, borderline and altered levels of TC, LDL-c and TG in 36.2, 14.5 and 35.3%, respectively, and altered levels of HDL-c in 56% of students. Both studies presented lower alteration rates than our study.[14]

Regarding nutritional profile our study showed that 27% of subjects presented overweight and obesity. However, another Brazilian studies presented most worrying results. Almeida *et al*.[18] in a study in the city of Vitória, state of Espírito Santo (Brazil) observed weight above normal in 38.5% of children evaluated, 13.9% with overweight and 24.6 with obesity. Concomitantly, Lima, Romaldini and Romaldini[24] in a study with children and adolescents aged 5 to 17 years from Santa Rita do Sapucaí, state of Minas Gerais (Brazil) observed that 37.2% of students presented weight above normal.

A study performed in private schools from Divinópolis, state of Minas Gerais (Brazil) with children aged 8 to 10 years observed that 33.2% presented overweight/obesity and these was associated to gender and mother's weight.[25] However, in Chapada, state of Rio Grande do Sul (Brazil) a study with children aged 6 to 10 years reported 30.0% of students with overweight, being the higher prevalence in rural area.[26] In the same way, Barros et al.[27] in a study with subjects with 12 years mean age in Carmo, state of Rio de Janeiro (Brazil) reported overweight/obesity of 28.9%.

Lower values to those found in our study are also observed in other studies. Alcântara Neto et al.[13] found 12.4% of overweight and obesity in 937 children and adolescents aged 7 to 14 years in the city of Salvador, state of Bahia (Brazil). Souza e Farias[28] in a cross-sectional study performed in Rio Branco, state of Acre (Brazil) evaluated 706 students aged 8 to 14 years from public schools and found an overweight prevalence of 17.6%.

In other countries we can see more expressive values of overweight and obesity. Sobrero et al.[8] in a study with adolescents aged 10 to 19 years from 7 cities in Argentina reported 40.4% of subjects with overweight or obesity. In the city of Beja (Portugal) children and adolescents aged 9 to 18 years were evaluated and it was found that about 14.4% of students presented obesity and 16.7%, overweight, totalizing 31.0% of students with weight above normal.[29]

Some studies reported lower values than the ones we founded. Cross-sectional study of Boukthir et al.[30] with 1,335 students aged 6 to 12 years from Tunis (Tunisia) showed overweight and obesity prevalence of 19.7 and 5.7%, respectively, totalizing 25.4% of students above normal body weight. In the study of Pangani et al.[31] in Dar es Salaam (Tanzania) with 1,781 children and adolescents aged 8 to 13 years, the prevalence of overweight and obesity was 15.9 and 6.7%, respectively, in a total of 22.6% with weight above normal. The same study also showed that weight above normal was more prevalent in children aged 8 to 10 years when compared to the age group 11 to 13 years.

In our study there was significant difference among schools of all variables evaluated of lipid profile and glucose for both gender. In the same way, regarding boys stands out schools 2 and 4 with major alterations and for girls, schools 2 and 5. As for the location, school 5 is located far from the urban area with several outstanding rural aspects and with children of farmers helping on the farm. Differently, school 2 even

not close from downtown, is located in a place with several urban characteristics. Concomitantly, school 4 is located in a paved area, with commerce and bus lines nearby, presenting also urban characteristics. Such urban characteristics might lead both schools to adopt life habits of urban areas and these might be influenced the unfavorable results of these schools, showing that the school localization might interfere in lipid and glucose profile of students.

A study performed in the same city of our study showed possible differences on health-related physical fitness of children and adolescents from different hemispheres of rural area of Santa Cruz do Sul. As well as in our study there was significant difference among schools: schools geographically far from urban area presented better results on variables abdominal strength/resistance and cardiorespiratory fitness when compared to other schools for both genders.[32] Another study in the same city also found significant differences among the schools from rural area concerning physical fitness related to motor performance. They found significant differences regarding upper limb strength, velocity and agility in girls. However, it was not concluded that typically urban schools had worst results in all test evaluated.[33]

The strength of our study is the large number of children and adolescents, constituting a representative sample of students from our city. We also highlight the comparison among the schools with different localization characteristics since few studies evaluate this kind of difference among schools. On the other hand this study has the limitation of being cross-sectional which does not allow evaluating the cause-and-effect relationship.

CONCLUSION

There were a high percentage of alterations in cardiovascular risk profile (nutritional, lipid and glycemic) of students. About the comparison among schools the study pointed significant difference among schools in all variables evaluated of lipid profile and glucose in both genders, showing that these markers may suffer interference according to school localization.

This study determined the nutritional, lipid and glycemic profile of students from rural area of Santa Cruz do Sul, state of Rio Grande do Sul (Brazil), and despite the data here presented be assigned to just one city this survey is valid for its contribution to the scientific area and by the data obtained from the Southern Brazil. Thus, measures to check the cardiovascular risk profile in childhood and adolescence may have an important impact on the cardiovascular diseases in the future of these students.

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