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Lipid profile of a population of children and adolescents with excess of weight

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ABSTRACT
Background: Excess weight in the childhood and adolescence is a morbidity that has been increasingly prevalent in recent decades, whether due to the sedentary condition of this population or the increased caloric intake in their diet.
Objective: To analyze the lipid profile of a pediatric population with excess weight, relating it to age, sex, and anthropometric measurements.
Methods: children and teenagers aged 5 to 17 years with excess weight, attended in a pediatric outpatient clinic at a university hospital, were included. The variables analyzed were age, sex, body mass index (BMI), blood pressure, waist circumference, fasting glucose, and total cholesterol (CT) and fractions.
Results: There was a relationship between sex and waist circumference ($p<0.001$). According to BMI classification, a higher prevalence of obesity/severe obesity was observed in boys (90.5% vs. 74.1%, $p<0.001$), and there was an increase in glucose levels with age (12.07 vs 9.17, $p=0.003$).Arelationship was also found between sex and total cholesterol level (55.6% vs. 38.1%, $p=0.027$).
Conclusion: Sex correlated with increased waist circumference and total cholesterol level, with significance between boys and excess weight, and glucose levels increased with age.
Key-words: Children, HDL Cholesterol, LDL Cholesterol, Blood Glucose; Overweight; Obesity.

I.INTRODUCTION

Overweight and obesity are conditions associated with excess adipose tissue and the total body mass percentage, which can result in reversible and irreversible organic and pathological changes. Both conditions have a growing prevalence worldwide, as highlighted by the World Health Organization (WHO) in 2021[1]. These changes are globally screened through the Body Mass Index (BMI). In the age group between 5 and 19 years, the WHO (2006)[2]defines overweight as an individual with a BMI standard deviation (SD) for the age group above 1, while obesity is above 2. In children under 5 years, the WHO (2006) defines overweight and obesity as having a BMI SD for the age group above 2 and 3, respectively.

The prevalence of excess weight in the pediatric population has been increasing since the 1980s in both developed and developing countries[3]. It is estimated that in the developed group, the prevalence was 23.8% and 22.6% for males and females, respectively, while in developing countries, the estimates were 12.9% and 13.4% for the same groups. These figures are reinforced by the WHO in 2021[1], which estimates an increase from 4% of overweight and obesity in children and adolescents in 1975 to 18% in 2016, with similar growth rates in both sexes.

In all age groups, the WHO[1] indicates the main etiologies of overweight and obesity as increased consumption of high-calorie foods and reduced physical activities, as well as increased sedentary behavior. According to the literature, overweight and obesity are risk factors for the development of cardiovascular diseases such as hypertension, diabetes, and dyslipidemia, as well as other health issues (obstructive sleep apnea, asthma, non-alcoholic fatty liver disease, among others) in both pediatric and adult age groups[3,4].

This research aimed to analyze the lipid

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profile of a pediatric population with excess weight and correlate it with age, sex, abdominal circumference, and blood pressure.

II.METHODS

This is a descriptive, cross-sectional, and observational study of children and adolescents with weight excess who were attended at a pediatric outpatient clinic of a university hospital from September 2021 to September 2023. Before starting the research, parents or legal guardians of the participants signed an informed consent form for children and adolescents. Additionally, the adolescent group also signed an assent form when over 12 years old.

The variables assessed during the study were age, sex, weight, height, BMI, abdominal circumference, blood pressure, lipid profile, triglycerides, and fasting glucose. Overweight (85th to 97th percentile), obesity (97th to 99.9th percentile), and severe obesity (above the 99.9th percentile) were classified according to BMI, as defined by the WHO in 2006[2]. BMI was calculated using the formula BMI = weight/height². Weight measurement was conducted with the subject wearing light clothing on a Líder scale (model P-300C, serial number 31403, manufactured in Brazil, 2014), and height was measured with a wall stadiometer with the participant barefoot.

Waist circumference (WC) was measured with the subjects in an orthostatic position using a measuring tape at the mid-point between the last rib and iliac crests, with results in centimeters. Abnormal circumferences were considered above the 90th percentile[5].

Blood Pressure (BP) was measured with a Welch-Allyn sphygmomanometer (Mexico, 2014) with a cuff suitable for the child's or adolescent's brachial circumference after resting for20 minutes, on the right arm at heart level. Classification was determined according to the VII Brazilian Guidelines on Hypertension (2016) [6].

The laboratory tests included in the study were fasting glucose, total cholesterol (TC), Low-Density Lipoprotein (LDL) cholesterol, High-Density Lipoprotein (HDL) cholesterol, and triglycerides (TG). Altered glucose levels were considered above 100 mg/dL. For dyslipidemia evaluation, the following reference values were used: normal when TC<150 mg/dL, LDL<100 mg/dL, HDL≥45 mg/dL, and TG<100 mg/dL; borderline level for TC 150-169 mg/dL, LDL 100-129 mg/dL, and TG 100-129 mg/dL; altered level for TC≥170 mg/dL, LDL≥130 mg/dL, and TG≥130 mg/dL[7].

Statistical analysis considered mean, median, minimum and maximum values, first and third quartiles, and standard-deviation to describe quantitative variables, while qualitative variables were described using frequencies and percentages. The Chi-square test and Fisher's Exact Test were used for qualitative variable relations. For quantitative variables, the T-Student Test for independent samples was used. The Jarque-Bera Test was used to determine normality of results. Results with $p < 0.05$ indicated statistical significance.

This research was approved by the Research Ethics Committee of Western Paraná State University under protocol number 4.899.979/2021.

III.RESULTS

A total of 69 subjects were included in the study, 42 males and 27 females, aged from 5 to 17 years old (average: 9.64 years), all with overweight, obesity, or severe obesity according to WHO curves. Of this group, 19 were adolescents aged between 12 and 17 years (average: 14.5 years), with 13 males and six females.

Table 1 shows the relationship between age and the variables of waist circumference, blood pressure, fasting glucose, triglycerides, total cholesterol and its fractions, and BMI. There was a relationship between waist circumference, fasting glucose, and age. No significance was found inother variables (BP, triglycerides, LDL, HDL, TC, and BMI).

Table 1: correlation between age and variables studied.

Age	n	Mean	Minimum	1stquartile	Median	3rdquartile	Maximum	Standart Deviation	p*
WC									
Within the reference	6	5.38	5.00	5.10	5.21	5.63	6.00	0.40	
Above the reference	63	10.04	5.00	8.21	9.58	12.42	17.00	2.82	<0.001
Blood Pressure									
Within the reference	50	9.68	5.00	7.15	9.58	12.04	17.00	2.88	

Above the reference	19	9.50	5.08	6.54	9.17	12.54	15.50	3.40	0.817
Blood Glucose									
Normal	58	9.17	5.00	6.75	9.04	10.98	15.50	2.74	
Altered	11	12.07	5.08	11.50	13.07	13.50	17.00	3.32	0.003
Triglycerides									
Normal	26	10.13	5.00	8.79	10.00	12.04	15.50	2.53	
Altered	43	9.33	5.00	6.17	8.83	12.29	17.00	3.25	0.290
LDL									
Normal	48	9.58	5.00	6.81	9.29	12.33	15.50	2.99	
Altered	21	9.75	5.50	7.50	9.58	11.92	17.00	3.11	0.826
HDL									
Normal	31	9.54	5.08	7.71	9.42	11.67	15.50	2.68	
Altered	38	9.71	5.00	6.69	9.83	12.44	17.00	3.28	0.815
CT									
Normal	38	9.84	5.00	6.77	9.92	12.50	15.50	3.08	
Altered	31	9.38	5.25	7.33	8.83	10.75	17.00	2.95	0.526
BMI									
Overweight	11	10.58	5.00	8.83	11.08	13.04	13.58	2.94	
Obesity or severe obesity	58	9.45	5.00	6.77	9.17	11.77	17.00	3.01	0.256

*Tstudent test for independent samples;p<0.05 indicate that is significant.

Table 2 presents the relationship between WC, BP, fasting glucose, TG, LDL, HDL, TC, BMI, and sex. There was a relationship between WC, TC, BMI, and sex. The variables BP, fasting glucose, TG, LDL, and HDL did not show significant differences in relation to sex.

Table 2: correlation between sex and variables studied.

	Sex				
	Male		**Female**		**p**
	n	**%**	**n**	**%**	
WC					
Within the reference	6	14.3%	0	0.0%	
Above the reference	36	85.7%	27	100.0%	<0.001
Total	42	100.0%	27	100.0%	
Blood Pressure					
Within the reference	30	71.4%	20	74.1%	
Above the reference	12	28.6%	7	25.9%	0.810
Total	42	100.0%	27	100.0%	
Blood Glucose					
Normal	34	81.0%	24	88.9%	
Altered	8	19.0%	3	11.1%	0.508
Total	42	100.0%	27	100.0%	
Triglycerides					
Normal	16	38.1%	10	37.0%	

Altered	26	61.9%	17	63.0%	0.929
Total	42	100.0%	27	100.0%	
LDL					
Normal	30	71.4%	18	66.7%	
Altered	12	28.6%	9	33.3%	0.675
Total	42	100.0%	27	100.0%	
HDL					
Normal	22	52.4%	9	33.3%	
Altered	20	47.6%	18	66.7%	0.121
Total	42	100.0%	27	100.0%	
TC					
Normal	26	61.9%	12	44.4%	
Altered	16	38.1%	15	55.6%	0.027
Total	42	100.0%	27	100.0%	
BMI					
Overweight	4	9.5%	7	25.9%	
Obesity or Severe obesity	38	90.5%	20	74.1%	<0.001
Total	42	100.0%	27	100.0%	

IV.DISCUSSION

In this study, there was a high prevalence of overweight in boys, a result similar to that found in the literature[8,9,10,11]. In other studies, both national and international, researchers found different results, with a higher prevalence of overweight in girls[12,13,14]. This difference may have occurred due to the sample size, the age of the individuals selected, and the fact that this research only considered subjects with excess weight.

In this study, a relationship was found between age and waist circumference, a result similar to a foreign study[15,16,17], although the literature shows the opposite[12]. It is worth noting that a study conducted in Spain did not find a relationship between WC and age but revealed a significant increase in the prevalence of abdominal obesity in both gender as age increased[18,19].

Glucose levels in this study were related to age. This finding may be related to the higher prevalence of insulin resistance/type II diabetes mellitus in overweight and obese individuals, and due to the nature of the disease itself, laboratory alterations are expected to appear in older children[20]. According to a North American study[21], the prevalence of type II diabetes was higher in older and overweight adolescents[21,22].

In this study, excess cholesterol was related to sex, contrary to what was found in many studies in the medical literature[14,23,24,25,26].

This study had some limitations: the number of individuals analyzed, which may partly account for the differences in findings compared to other studies; the short duration of the study; and the lack of stratification of cardiovascular risks by age group or comparison with a non-obese population as conducted in other similar studies. Additionally, there was no evaluation based on ethnicity in the study groups, which may explain the divergence in results when associated with waist circumference.

V.CONCLUSION

Significant relationships were noted between abdominal circumference, glucose, and age, as well as significance between sex, abdominal circumference, and BMI, which are estimators of cardiovascular risk and metabolic syndrome development in adulthood. Early and frequent monitoring and control of weight, glucose, abdominal circumference, and lipid profile in overweight children and adolescents are necessary to avoid cardiovascular risk in adulthood.

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