artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

Prevalence of cardiovascular risk factors in children: an integrative review

Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa
Prevalencia de factores de riesgo cardiovascular en niños: una revisión integradora

RESUMO

OBJETIVOS: Analisar na literatura científica a prevalência dos principais fatores de risco cardiovascular em crianças. MÉTODOS: Revisão integrativa da literatura, realizada entre agosto a dezembro de 2020 utilizando o PubMed e a Biblioteca Virtual de Saúde. O estudo contempla 36 pesquisas transversais compreendendo os anos de 2005-2020. RESULTADOS: Verificou-se uma alta prevalência de excesso de peso entre as crianças e uma relação significativa entre excesso de peso e a dislipidemia, aumento da pressão arterial, hiperinsulinemia e síndrome metabólica. Na maioria dos estudos visualizou-se uma maior prevalência de excesso de peso entre os meninos (8,6% a 30,6%), em relação às meninas (3,8% a 23,5%). CONCLUSÃO: A prevalência dos fatores de risco mostrou-se presente, realçando a necessidade do planejamento de ações para a diminuição desses agravos no público infantil. Outros métodos de investigação dos fatores de risco devem ser incluídos, visualizando a maior sensibilidade na identificação das alterações.
DESCRITORES: Desordens Metabólicas; Prevalência; Fatores de Risco; Crianças.

ABSTRACT

OBJECTIVES: To analyze the prevalence of the main cardiovascular risk factors in children in the scientific literature. METHODS: Integrative literature review, carried out between August and December 2020 using PubMed and the Virtual Health Library. The study includes 36 cross-sectional studies covering the years 2005-2020. RESULTS: There was a high prevalence of overweight among children and a significant relationship between overweight and dyslipidemia, increased blood pressure, hyperinsulinemia and metabolic syndrome. In most studies, a higher prevalence of overweight was observed among boys (8.6% to 30.6%), compared to girls (3.8% to 23.5%). CONCLUSION: The prevalence of risk factors was present, highlighting the need to plan actions to reduce these problems in children. Other methods of investigation of risk factors should be included, showing greater sensitivity in identifying changes.
DESCRIPTORS: Metabolic Disorders; Prevalence; Risk factors; Kids.

RESUMEN

OBJETIVOS: Analizar la prevalencia de los principales factores de riesgo cardiovascular en niños en la literatura científica. MÉTODOS: Revisión integrativa de la literatura, realizada entre agosto y diciembre de 2020 utilizando PubMed y la Biblioteca Virtual en Salud. El estudio incluye 36 estudios transversales que abarcan los años 2005-2020. RESULTADOS: Hubo una alta prevalencia de sobrepeso entre los niños y una relación significativa entre sobrepeso y dislipidemia, aumento de la presión arterial, hiperinsulinemia y síndrome metabólico. En la mayoría de los estudios, se observó una mayor prevalencia de sobrepeso entre los niños (8,6% a 30,6%), en comparación con las niñas (3,8% a 23,5%). CONCLUSIÓN: La prevalencia de factores de riesgo estuvo presente, destacando la necesidad de planificar acciones para reducir estos problemas en los niños. Deben incluirse otros métodos de investigación de los factores de riesgo, que muestren una mayor sensibilidad en la identificación de cambios.
DESCRIPTORES: Trastornos Metabólicos; Predominio; Factores de Riesgo; Niños.

SINTIA ANDREA BARBOSA GOMES
Nutritionist. Master's student in the Science and Health Course at the Federal University of Piauí/UFPI. Specialist in Clinical Nutrition – State University of Piauí/UESPI. Specialist in Health Management – UFPI. Specialist in School Health – Federal Institute of Piauí/IFPI. Nutritionist at UFPI. Picos (PI), Brazil
ORCID: 0000-0002-5816-066X.

IRAÍLDO FRANCISCO SOARES
Nutritionist. PhD student in Food and Nutrition at the Federal University of Piauí/UFPI. Master in Food and Nutrition - UFPI. Specialist in Food Science - UFPEL. Professor at the Federal University of Tocantins/UFT. Palmas (TO), Brazil
ORCID: 0000-0002-6995-0894.

ELIAKIM AURELIANO DA SILVA
Nutrition Academic. Federal University of Piauí/UFPI. Marcolândia (PI), Brazi
ORCID: 0000-0002-3866-4406

ANDRESSA SUELLY SATURNINO DE OLIVEIRA
Nurse. PhD in Nursing. Professor at the Institute of Health Sciences of the University of International Integration of Afro-Brazilian Lusophony (UNILAB).
ORCID: 0000-00022675-5159.

ANA LARISSA GOMES MACHADO
Nurse. PhD in Nursing. Associate Professor at the Federal University of Piauí/Campus Senator Helvídio Nunes de Barros (UFPI/CSHNB).
ORCID: 0000-0002-7937-6996.

LUÍSA HELENA DE OLIVEIRA LIMA
Nurse. PhD in Nursing. Associate Professor at the Federal University of Piauí/Campus Senator Helvídio Nunes de Barros (UFPI/CSHNB) and at the Graduate Program in Science and Health. Picos (PI), Brazil.
ORCID: 0000-0002-1890-859X.

INTRODUCTION

Diseases that affect the circulatory system constitute, in recent decades, the highest mortality rate in Brazil and represent a serious public health problem. Although some of its risk factors are known, the reduction of cardiovascular morbidity and mortality has been one of the obstacles to be faced, in view of the need to start early changes in the population's lifestyle. [1;2]

Among the risk factors identified in children, overweight and increased blood pressure are the most prevalent. Although the percentage of children who have already undergone blood pressure measurement is low, an increase in this factor has also been observed in some studies. [1;3]

Studies indicate that individuals with excess body fat are at greater risk of developing chronic diseases such as heart disease, stroke, hypertension, dyslipidemia, diabetes mellitus, atherosclerosis, among others. [3] Obesity, in turn, is a growing problem in childhood, reaching 25–30% of the child population. It has been mainly attributed to environmental and sociocultural factors and a sedentary attitude. The WHO estimates that, in 2015, 700 million individuals with health problems were due to obesity and, of these, 43 million were overweight children, thus contributing to the emergence of risk factors. [54]

Another very common factor is metabolic syndrome (MS), which is defined as the association of at least three of the following risk factors: abdominal obesity, hypertension, hypertriglyceridemia, high levels of fasting blood glucose (FBG) and low levels of high density lipoprotein (HDL-C) and its prevalence has increased in the last decade, making it an important global health problem. [4;5]

Physical inactivity is a growing condition in Brazil and in the world as a result of modern times, resulting in an increase in the rates of the emergence of chronic non-communicable diseases (NCDs). [6]

There is consensus among researchers that lifestyle modifications are the most effective way to improve or prevent risk factors. Changes in diet and regular physical exercise change the metabolic and inflammatory profile, leading to a state of metabolic balance. [7]

It is important to emphasize that in Brazil and in the world the classification of children and adolescents according to age is quite divergent. In this research, the age group used to reference the searches is defined by art. 2 of the Statute of the Child and Adolescent (ECA), Law No. 8.069, of July 13th, 1990, where "a child is considered, for the purposes of this Law, to be a person up to twelve years old, and adolescents between twelve and eighteen years old". [53]

Given the fact that numerous descriptive and analytical researches have been published over the years investigating this object, it is necessary to gather results from all over the world through a review, seeking to synthesize the findings and discuss the importance of the main results found.

In this context, it is important to investigate the main cardiovascular risk factors: overweight, abdominal obesity, increased blood pressure, MS, dyslipidemia, hyperglycemia, physical inactivity and sedentary lifestyle, in order to establish prevention strategies for the child population, aiming thus, with this work, to analyze in the scientific literature the prevalence of the main cardiovascular risk factors in children.

METHODS

The work carried out is an integrative literature review, elaborated with a careful selection of scientific articles and followed

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

Table 1: Description of studies. Picos-PI, Brazil, 2021.					
DATA SOURCE	**COUNTRY**	**TYPE OF STUDY**	**AUTHORS/DATE**	**SEQUENCE**	**JOURNAL**
PUBMED	Japan	Cross-sectional	Yoshinaga et al. (2005)	I (11)	International Journal of Obesity
PUBMED	Australia	Cross-sectional	Golley et al. (2006)	II (12)	International Journal of Obesity
VHL	USA	Cross-sectional	Hirschler et al. (2006)	III (13)	Archives of Pediatrics & Adolescent Medicine
PUBMED	Brazil	Cross-sectional	Borges; Peres; Horta (2007)	IV (14)	Revista de Saúde Pública
PUBMED	Brazil	Cross-sectional	Nogueira et al. (2007)	V (15)	Revista da Associação Médica Brasileira
VHL	Mexico	Cross-sectional	Aregullin-Eligio; Alcorta-Garza (2008)	VI (16)	Salud Pública del México
VHL	Turkey	Cross-sectional	Sağlam; Tarım (2008)	VII (17)	Journal of Clinical Research in Pediatric Endocrinology
PUBMED	Canada	Cross-sectional	Salvadori et al.(2008)	VIII (18)	Pediatrics
VHL	Brazil	Cross-sectional	Silva; Lopes (2008)	IX (19)	Arquivos Brasileiros de Cardiologia
VHL	Brazil	Cross-sectional	Cândido et al. (2009)	X (20)	Europen Journal Pediatric
PUBMED	Mexico	Cross-sectional	Guerrero-Romeroa; Violanted; Morána (2009)	XI (21)	Pediatric and Perinatal Epidemiology
VHL	Venezuela	Cross-sectional	Paoli et al. (2009)	XII (22)	Endocrinology Nutrition
PUBMED	Brazil	Cross-sectional	Silva et al. (2009)	XIII (23)	International Journal of Obesity
VHL	Italy	Cross-sectional	D'Adamo et al. (2010)	XIV (24)	Metabolism
VHL	Brazil	Cross-sectional	Ferreira; Aydos (2010)	XV (25)	Revista Ciência & Saúde Coletiva
VHL	Italy	Cross-sectional	Genovesi et al. (2010)	XVI (26)	American Journal of Hypertension
VHL	USA	Cross-sectional	Meininger et al. (2010)	XVII (27)	Journal of Pediatric Nursing

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

VHL	Brazil	Cross-sectional	Molina et al. (2010);	XVIII (28)	Cadernos de Saúde Pública
PUBMED	Mexico	Cross-sectional	Montemayor et al. (2010)	IX (29)	Jounal Clinical of Hypertension
PUBMED	Argentina	Cross-sectional	Szer; Kovalskysa; Gregorio (2010)	XX (30)	Archives Argentine of Pediatric
PUBMED	China	Cross-sectional	Xu et al. (2012)	XXI (31)	BMC Public Health
PUBMED	Brazil	Cross-sectional	Andaki et al. (2014)	XXII (32)	BMC Public Health
VHL	Thailand	Cross-sectional	Sukhonthachit et al. (2014)	XXIII (33)	BMC Public Health
PUBMED	Italy	Cross-sectional	Lazzeri et al. (2015)	XXIV (34)	Public Health Nutrition
PUBMED	Angola	Cross-sectional	Silva et al. (2016)	XXV (35)	Cardiovascular Journal of África
VHL	Brazil	Cross-sectional	Heleno et al. (2017)	XXVI (36)	Revista da Associação Médica Brasileira
VHL	Castile - La Mancha	Cross-sectional	Martín-Espinosa et al. (2017)	XXVII (37)	PloS ONE
PUBMED	South Africa	Cross-sectional	Moselakgomo; Staden (2017)	XXVIII (38)	South African Journal of Clinical Nutrition
VHL	Brasil	Cross-sectional	Pazin et al. (2017)	XXIX (39)	Arquivos Brasileiros de Cardiologia
VHL	Mexico	Cross-sectional	Ávila et al. (2018)	XXX (40)	Salud Pública de México
VHL	Serbia	Cross-sectional	Halasi et al. (2018)	XXXI (41)	Health and Quality of Life Outcomes
PUBMED	Portugal	Cross-sectional	Iturzaeta et al. (2018)	XXXII (42)	Archives Argentine of Pediatric
VHL	Brasil	Cross-sectional	Andrade et al. (2019)	XXXIII (43)	Revista Latino-Americana de Enfermagem
PUBMED	Rome	Cross-sectional	Lorenzo et al. (2019)	XXXIV (44)	Nutrition
VHL	Ghana	Cross-sectional	Adom et al. (2020)	XXXV (45)	International Journal Environmental Research of Public Health
VHL	Vietnam	Cross-sectional	Pham et al. (2020)	XXXVI (46)	BMC Public Health

Source: Survey data (2021).

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

the method proposed by Cunha et al. (2014), (8) followed by 6 steps: I - identification of the theme and construction of the guiding question; II - study search and selection strategy; III - eligibility assessment; IV - data extraction; V - analysis and interpretation of results; VI - presentation of knowledge construction.

The study aimed to locate researches that addressed children aged between 03 and 12 years and assessed the prevalence of cardiovascular risk factors. The POT acromion was used to define the following guiding question: "what is the prevalence of cardiovascular risk factors in children aged 3 to 12 years?". The survey was conducted from August to December 2020.

The search patterns were defined taking into account the proximity of cardiovascular risk factors with other variables, including: overweight, insulin resistance, type 2 diabetes mellitus, hyperinsulinemia, high blood pressure patterns, dyslipidemias, central obesity (circumferences of the waist), excess body fat, impaired glucose tolerance,

metabolic syndrome, level of physical activity and sedentary lifestyle, as conditions for the analysis.

Articles published between 2000 and 2020 were included in this review, located between the months of August and December 2020, in the electronic data sources PubMed and Virtual Health Library (VHL). The descriptors used to form the search key applied to the data sources were: hypertension; hypotension; prehypertension; diabetes mellitus; metabolic syndrome; obesity; abdominal obesity; morbid obesity; pediatric obesity; hypolipoproteinemias; hyperlipidemias; sedentary behavior; kids; and prevalence, words extracted from the Medical Subject Headings (MeSH) and with results applied in the languages: English, Portuguese and Spanish. The Boolean operators "OR" and "AND" were used to establish the crossing of the relationship between the descriptors in the search key.

The inclusion criteria defined were: study population consisting of preschoolers:

3-5 years, child: 6-12 years; original studies; research with participants who had some of the defined risk factors; works with full texts and free access; original articles; languages: English, Portuguese and Spanish; female and male sex. Articles that had incomplete text, other languages, duplicate studies, works with animals, research involving children with type 01 diabetes, adolescents, cancer, kidney disease, congenital diseases, mental illnesses, revisions, age under 02 years and 11 months and over 12 years and 11 months, surgeries, eating behavior, gestational diabetes and trauma or trials that used some type of medication were excluded from the selection.

The search, reading of the titles and abstracts of each reference was carried out by two researchers independently, with agreement for inclusion and/or exclusion of works. After initial screening, the full articles were read for evaluation. With a detailed reading of the texts, it is possible to identify the relevance of the studies, hypotheses or objectives according to the criteria

SEQUENCE	SAMPLE	AGE	CARDIOVASCULAR RISK FACTORS	
I	471	6 to 11	OW, MS, DL, HBP, AO	The prevalence of wc was 91,5%, and it was higher in boys (92,6%). Hyperinsulinemia was higher in obese girls (60,8%), the prevalence of MS in girls was higher than in boys (16,0% and 13,6%)
II	99	6 to 9	OW and MS	Prevalence of MS ranged from 39-60% when using child-specific definitions. 90% of individuals identified as overweight by BMI were classified as centrally obese by waist percentile (WC). There were no differences between the sexes.
III	167	3 to 9	OW,MS, DL, HBP, AO	The prevalence of MS was 11,3% in the entire group and 21,9% among obese children. Risk factors: AO: 20,2% and low HDL: 36,9%. Obese: 43,7%; High TG: 42,8% and high BG: 40%.
IV	601	7 to 10	HBP	The prevalences found were 0,3% of stage 2 hypertensive children, 2,0% of stage 1 hypertensive children, 3,8% of pre-hypertensive children.
V	7440	7 to 10	OW, HBP	High BP: 15%; obese children had more frequent HBP. In the second phase, (2,7%) had HBP and again the presence of obesity conferred a greater risk for increased blood pressure. In addition, an increase in systolic BP was observed according to body mass in all the studied BMI intervals and not only after the onset of obesity. 29,1% of children were obese girls, 42% and boys 58%.

Table 2. Characterization of the studies included in this review. Picos-PI, Brazil, 2021.

VI	329	6 to 12	OW, HBP	The prevalence of overweight was 39,2% in the sample. The probability of hypertension was seven times greater in overweight children. A total of 4,9% of school-age children had hypertension, with an increased prevalence occurring between overweight and the older group..
VII	5368	6 to 12	OW	The prevalence of overweight, obesity and severe obesity according to BMI was 12,4%, 7,8% and 2,2%, respectively. 80% of obese children had one or both obese parents. Age, gender, presence of obesity in parents, higher parental education, consumption of soft drinks and juices, low level of physical activity and higher family income were identified as contributing factors to obesity.
VII	675	4 to 12	HBP	Prehypertension and hypertension were detected in 4,5% and 7,8% respectively. In this population of children living in a rural community in Canada, overweight and obesity were strongly associated with increased BP.
IX	1570	7 to 12	PI and SB	Active commuting was associated with a decrease in the prevalence of excess weight and fat compared to passive commuting. The prevalence ratio (PR) for overweight was associated with fat (male: PR = 6,45, 95% CI = 4,55 - 9,14; female: PR = 4,10, 95% CI = 3,09 - 5,45), to high BP (male: PR = 1,99, 95% CI = 1,30 -3,06; female: PR = 2,09, 95%CI = 1,45-3,01) and to high HB in girls (PR = 1,96, 95%CI = 1,41-2,75). Both excess fat and high BP were only associated with excess weight.
X	293	6 to 9	OW, PI, SB, DL, HBP, AO	Girls: 17,2% and 30,8% were overweight and obese, respectively, while boys were 9,4% overweight and 13,5% obese. WC values above the 75th percentile were more frequent in girls (14,5%) than in boys (6,5%). The prevalence of dyslipidemia (characterized by high TC - 24,6% girls, 14,1% boys and LDL-c 29,9% girls, 15,6% boys and low levels of HDL-c - 22,4% and 12,6% of girls and boys, respectively) was remarkably high, with female prevalence. The risk of high blood pressure was 30 times greater for children who suffered from obesity and also had low birth weight compared to normal children.
XI	297	6 to 9	DL	High prevalence of pre-diabetes in Mexican children and adolescents, with a prevalence of blood glucose of 16,5%. Obese children had higher glucose levels than overweight and normal weight children. Regarding obesity, there were no differences by age strata.
XII	370	6 to 9	OW, MS, DL, HBP, AO	9,7% of the sample were obese and 13,8% were overweight. There were no differences regarding sex or educational establishment. Abdominal obesity was observed in 69,4%, normal-high BP in 27,8%, dyslipidemia in 66,7% and MS in 38,9% of obese children. The probability of presenting high-normal BP in obese individuals was 6,3 times greater than in non-obese individuals; dyslipidemia was 2,2 times higher; abdominal obesity, 60,9 times higher, and MS, 70,2 times higher. There was a positive and significant correlation between waist circumference and BMI with BP and with the atherogenic indices of triglycerides, HDL, TC and HDL.

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

XIII	1570	7 to 12	HBP, high % BG	The prevalence of hypertension was 16,2% for the entire sample. There was a significant correlation between BP and anthropometric variables. The risk of increased BP was higher among overweight boys as well as for the other criteria compared to normal weight children. In the present study, among boys, BMI was the best variable to explain the increase in BP (12%).
XIV	89	6 to 10	OW MS, DL, HBP	MS was diagnosed in 13,5% of children according to the first definition and in 20,2% when hepatic steatosis was included. The prevalence of MS throughout the assessment. The prevalence of the unique components of MS was: obesity, 100%; hypertriglyceridemia, 27%; low HDL, 2,2%; hypertension, 34,8%; impaired glucose tolerance, 4,5%; and non-alcoholic fatty liver disease, 21,3%.
XV	237	7 to 12	OW, HBP	Prevalence of arterial hypertension in both sexes did not differ statistically from each other. In different age groups, the disease also manifested itself. Hypertension was markedly present in the population investigated, indicating that obesity can interfere with the elevation of blood pressure in children and adolescents.
XVI	5131	5 a 11	OW, HBP	A proportion of 3,4% had hypertension, 2,7% pre-hypertension and 10,4% transient high BP, 20% overweight and 6% obesity. Weight class and WC were significantly associated with an increased risk of falling into any of the hypertensive categories.
XVII	1070	8 to 9	OW, HBP, AO	The percentage of overweight was 28,7%, 17,9% were at risk of overweight, 28,8% had WC ≥ 90th percentile, and 9,4% had high systolic and/or diastolic BP (≥90th percentile). WC explained the variance in high BP not explained by BMI (p<0,001). Hispanic Americans had a higher prevalence of waist-to-height ratio ≥ 0,5 (49,5%) compared to African Americans (31,2%).
XVIII	1282	7 to 10	OW, PI, SB, HBP	Higher percentage of overweight children, with a subsequent increased risk of premature cardiovascular disease and type 2 diabetes. The observed prevalence of MS was similar in the 6 to 9 year and 10 to 12 year age groups in these obese Mexican children.
IXX	259	6 to 12	OW, SM, DL, HBP, high % of BG, AO	Higher percentage of overweight children, with a subsequent increased risk of premature cardiovascular disease and type 2 diabetes. The observed prevalence of MS was similar in the 6 to 9 year and 10 to 12 year age groups in these obese Mexican children.
XX	816	6 to 9	OW, HBP, AO	The overall prevalence of overweight and obesity was 17,9% and 16,7%, respectively. Boys were significantly more overweight than girls. 9,4% of the population had hypertension, with no significant sex differences. The prevalence of hypertension in overweight and obese children was 10,9% and 25%, respectively. WC was higher at the 80th percentile it was 16.6% in overweight children and 26,5% in obese children..

XXI	8764	7 to 11	OW, SM, DL,AO	The overall prevalence of MS in children over 10 years of age was 0,8%. Obese children had significantly MS prevalence compared to their overweight counterparts (6,6% vs. 0,9%, p < 0,01) and normal weight (6,6% vs. 0,05%, p < 0,01). The prevalence of abdominal obesity, high triglycerides, low high density lipoprotein cholesterol, hypertension and high glucose in obese children was 93.4%, 16.5%, 14,3%, 7,3% and 4,0% , respectively, which was significantly higher than in overweight children (37,0%, 6,1%, 10,0%, 4,2% and 3,3%, respectively) and among normal weight children (1,2%, 3,3%, 4,0%, 1,7% and 2,5%, respectively).
XXII	187	3 to 9	OW, PI, SB, SM, DL, alto %GC, AO	MS was found in 8,5% of children. Regarding the five components of MS (TAG, HDL, BG, WC and HBP), 53.2% of the children had normal values in all measurements. The prevalence of overweight and obesity was 15,0% and 5,9%, respectively, with boys showing a higher prevalence of obesity (8,6%) than girls (3,8%). For girls, hypertriacylglycerolemia and high % BG were significantly associated with MS. P>0,05 for screen time.
XXIII	693	8 to 12	OW, AO	The prevalence of obese children was of 30,6% for boys and 12,8% for girls. Prehypertension was 5,7% and 2,7% for boys and girls and hypertension was 4,7% for boys and 3,2% for girls, respectively. Children with prehypertension and hypertension had significantly levels of body weight, height, WC, BMI, BP, TG and TC / HDL-C, but lower levels of HDL-C than those with normotension.
XXIV	7183	7 to 9	OW	Absolute prevalence of overweight in children was observed to be a discrepancy between the two criteria. Boys with overweight and obesity.
XXV	198	7 to 11	OW, DL	The prevalence of overweight/obesity was 17,7% (12,4–23,0%), high blood pressure was 14,6% (9,7–19,5%), high glucose level was 16,7% (11,5–21,9%) and total cholesterol level <170 mg/dl (4,4 mmol/l) was 69,2% (62,8-75,6%). Significant associations were found between BMI and systolic and diastolic BP. No association between BMI and high levels of glucose or cholesterol was found.
XXVI	284	6 to 10	HBP high % BG	The prevalence of arterial hypertension was 15,2%. The percentage of body fat showed significant differences between genders, with 24,2 and 26,2%, respectively for boys and girls. Significant associations were made between BP levels, body weight, BMI, WC, body fat percentage.
XXVII	1604	4 to 6	OW, HBP, high % BG	Pre-hypertension and hypertension prevalence estimates were 12,3% and 18,2%, respectively. In both sexes, adiposity indicators were positively and significantly associated with all BP components (p<0,001), therefore, students in the highest adiposity categories had significantly higher blood pressure levels (p<0,001). Our results show a high prevalence of hypertension in Spanish children. In addition, high levels of adiposity are associated with high blood pressure in early childhood, which argues that it may be related to cardiovascular risk later in life.

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

XXVIII	1361	9 to 13	OW	Higher prevalence of overweight and obesity in boys and girls when the categories of BMI and SF were used. In contrast, international BMI classifications indicated a strong prevalence of underweight among children.
XXIV	3.417	6 to 11	OW, HBP, AO	The prevalence of high BP was 10,7%. In children with WC in the lowest quartile, the prevalence of high BP was 8,1%. There was expansion in the upper quartiles: 10,6% in the second, 12,4% in the third and 12,1% in the highest quartile. Thus, in this group, being in the highest WC quartile was associated with a 57% higher probability of having high BP compared to the lowest quartiles.
XXX	1017	6 to 12	OW,SM, DL, AO	The prevalence of MS was higher in obese children. Regarding insulin resistance, it was observed in both groups, although the prevalence occurred in children with obesity. Regarding blood pressure ≥ 90th percentile, statistically significant differences in prevalence were found in the two age groups among children with obesity vs. children with normal nutrition. Prevalence of MS of 77,3% in children aged 10 to 12 years.
XXXI	182	7 to 8	OW, alto %GC	Among boys, 17,2% were overweight and 4,3% were obese according to BMI, while in relation to the percentage of body fat (% BF), the corresponding percentages were 12,9 and 9,7%, respectively. Among girls, the prevalence of overweight and obesity was 11,2 and 9,0% for BMI and 10,1 and 7,9% for % BF, respectively.
XXXII	110	5 to 11	OW, HBP,	23 of the patients had a neonatal history and obesity; 101 had at least one factor corresponding to family history; 7 had isolated nocturnal hypertension (6,4%; 95% CI: 3,1-23,5) and 28 had prehypertension (25,4%; 95% CI: 18,2-34,3)
XXXIII	335	6 to 10	OW, HBP, AO	BMI and WC were important anthropometric indicators for high blood pressure, as well as age in children living in rural areas. The assessment of BMI and WC represents the important action for screening for high blood pressure in children from different territorial contexts. The prevalence of high blood pressure was obtained among children in rural areas.
XXXIV	134	8 to 11	OW	prevalence of adiposity in boys and 43,2% (95% CI 37,3-49,2) in girls. BMI indicated adiposity in children.
XXXV	183	8 to 11	OW	The prevalence of obesity by WHO, CDC, IOTF and percentage of body fat derived from deuterium oxide was 11,5%, 10,4%, 8,2% and 17,5%, respectively, with significant positive correlations between the z scores of BMI and percentage of body fat.
XXXVI	1806	7 to 9	OW	The prevalence of obesity among boys was twice the rate for girls (24,7 vs 12,3%). The prevalence of overweight and obesity was also higher among students from schools located in urban districts than in semi-rural districts. Father's body weight and child's BMI were more strongly associated with boys from poorer families than with boys from wealthier families, while the differences were not significant for girls..

Source: Survey data (2021). Caption: BMI: body mass index; OW: overweight; HBP: high blood pressure; AO: abdominal obesity; PI: physical inactivity; SB: sedentary behavior; DL: dyslipidemia; WC: waist circumference; BG: blood glucose; LP: lipid profile; SF: skinfolds; PA: physical activity; HDL: high density lipoprotein; LDL: low density lipoprotein; TC: total cholesterol; MS: metabolic syndrome;

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

established for the research.

Linked to the steps of searching and reading the titles, a critical appraisal of the studies and the definition of potentially eligible articles were carried out. Important information was collected from the articles used for this review, including authors' names, year of publication, research site, sample size, variable and observed cardiovascular risk factors, sex and age of the studied population, main research instruments and methods, main results and relevance of the study. Such information was recorded in the cataloging form of the articles based on the methods established by the Preferred Reporting Items in Systematic Reviews and Meta-Analyses (PRISMA). (9)

The eligibility of the works included in the review also took into account the level of research evidence according to Pereira and Bachion (2006), (10) classifying at level III, as they are all cross-sectional studies. The search, reading of the titles and abstracts of each reference was carried out by two researchers independently, with agreement for inclusion and/or exclusion of works, with a critical appraisal of the studies and the definition of potentially eligible articles.

In the bibliographical survey, 2.595 results were found covering the years 2000 to 2020, with 2,145 studies in the BVS database and 450 in PubMed. Observing the necessary criteria for the eligibility of the studies, 2.559 articles were excluded for not meeting the baseline parameters for this selection, remaining 36 articles in this research, covering the years 2005-2020.

RESULTS

The results found in the bibliographical research included studies that addressed the main cardiovascular risk factors presented in children. This mapping can be seen in Table 1, bringing information such as data source, country, type of study, authorship, year of publication, presentation sequence and journal.

All selected articles are cross-sectional studies, works published between the years 2005 to 2020 were found. Among the 36 articles that make up this review, Brazil has the largest number of selected studies, with 11 articles, followed by Mexico (4 studies), from Italy (3 studies) and the United States (2 articles). The size of the sample public, age, cardiovascular risk factors and the main results of the studies are described in Table 2. The surveys covered children of both sexes.

It is observed that overweight (overweight and/or obesity) is the main risk factor for CVD among the studies, and that this factor is present in 83,3% of the articles, followed by high BP, present in 69,4% of the studies. In relation to excess body fat, assessed through waist circumference, skinfolds and bioimpedance, a prevalence of 52,7% can be seen. 30,5% of the articles evaluated dyslipidemia as a risk factor for cardiovascular disease, 25% investigated MS and 11,1% studied physical inactivity and sedentary lifestyle in childhood, in a single article it is possible to find 3 or more factors of major risk for the development of CVD.

When comparing studies XX and XXXVI, it is observed that the two have in common the prevalence of overweight in boys higher than in girls, this fact also appears in other articles such as XXIII, XXII, XXIV and XXXI .

There was a high prevalence of pre-hypertensive and hypertensive individuals in the studied children, ranging from 2,7% to 40,7% and from 3,4% to 40%, respectively. High rates of dyslipidemia were also observed among children. Regarding MS, it was possible to verify a high prevalence in children under 12 years of age, regardless of the studied continent, with prevalence values of up to 77,3%.

DISCUSSION

It appears that studies are always relating excess weight as a key point for the development of other health problems, such as high BP, MS, hyperinsulinemia, diabetes mellitus and altered lipid profile, corroborating the literature. According to the WHO, obesity is one of the main risk factors for the growth of dyslipidemia, insulin resistance, hypertension and diabetes mellitus, being considered the fifth factor of death worldwide, as it is a risk factor for development of various diseases. (47)

A British cohort study showed that being overweight during childhood increases by twice the risk of death from ischemic heart disease in adulthood, requiring interventions in childhood and adolescence, visualizing educational actions and measures, in a multidisciplinary context, at a biopsychosocial level, aiming at promoting and impacting health throughout life, mitigating aspects that comprise the context of overweight and obesity. (48)

According to the Brazilian Society of Hypertension, the prevalence of AH in children and adolescents is 12% to 17% and the higher the body mass index, the higher the prevalence of hypertensive individuals. (49) This characteristic was also confirmed by the studies surveyed, which highlight that BMI and WC are important anthropometric indicators for high blood pressure, being described in studies before and after 2010.

The prevalence of MS in Brazilian children and adolescents ranged from 0% to 4,4%, data from a systematic review. In view of the results, it appears that both in Brazil and in other countries there were percentages varying between this MS prevalence range, it is necessary to change the current diagnostic criteria, differentiating the cutoff points for children and adults. (50;51)

According to the WHO, the regular practice of physical activity reduces the risk of premature death, heart disease, DM 2, acts in the prevention or reduction of high blood pressure, insulin resistance, dyslipidemia and prevents weight gain. (52,55) Therefore, it is necessary to prevent excess weight, encourage children to practice physical activity, even when traveling to school, trying to avoid the accumulation of fat and the increase in BP.

CONCLUSION

It was possible to observe that overweight children (overweight and/or obesity) are much more likely to develop other

artigo

Gomes, S. A. B., Soares, I. F., Silva, E. A., Oliveira, A. S. S., Machado, A. L. G., Lima, L. H. O.
Prevalência de fatores de risco cardiovascular em crianças: uma revisão integrativa

cardiovascular risk factors, such as dyslipidemia, increased BP, hyperinsulinemia and MS, which are preponderant factors for the onset of CVD in adulthood .

Risk factors for CVD proved to be quite prevalent in children, highlighting the need to plan measures aimed at reducing the appearance of these diseases in children. Prevention measures should be taken as an aid to public health prevention policies.

As a contribution to other works to be developed addressing methods of investigation of risk factors, other parameters should be included, showing greater sensitivity in identifying changes, such as the measurement of neck circumference in children.

REFERENCES

1.Fraporti MI, Adami FS, Rosolen MD. Cardiovascular risk factors in children. Port J Cardiol. 2017;36(10):699-795.

2. Secretaria de Vigilância em Saúde. Principais causas de morte no Brasil. [acesso em 09 ago 2020]. Disponível em: <http://svs.aids.gov.br/dantps/centrais-de-conteudos/paineis-de-monitoramento/mortalidade/gbd-brasil/principais-causas.

Williamson W et al. Association of Cardiovascular Risk Factors With MRI Indices of Cerebrovascular Structure and Function and White Matter Hyperintensities in Young Adults. JAMA. 2018; 320(7):665-673.

3. Williamson W et al. Association of Cardiovascular Risk Factors With MRI Indices of Cerebrovascular Structure and Function and White Matter Hyperintensities in Young Adults. JAMA. 2018;320(7):665-673.

4. Guilherme FR et al. Comparison of different criteria in the prevalence of metabolic syndrome in students from Paranavaí, Paraná. Rev Paul Pediatria. 2019; 37(3):332-337.

5. Zimmet A et al. IDF Consensus Group. The metabolic syndrome in children and adolescents--an IDF consensus report. Pediatr Diabetes. 2007; 8(2):299-306.

6. Alberga AS, Sigal RJ, Goldfield G. Overweight and obese teenagers: why is adolescence a critical period? Pediatric Obesity. 2021; 4(7):261-273.

7. Azambuja CR et al. O diagnóstico da síndrome metabólica analisado sob diferentes critérios de definição. Rev Baiana de Saúde Pública. 2015; 39(3):482-496.

8. Cole T et al. Establishing a standard definition for childo ver weight and obesity worldwide: international survey. BMJ. 2000; 6(320):1240-1243.

9. Liberati A et al. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. PLoS Medicine. 2009; 6(7).

10. Pereira AM, Bachion MM. Atualidades em revisão sistemática de literatura, critérios de força e grau de recomendação de evidência. Rev Gaúcha de Enf. 2006; 27(4):491-499.

11. Yoshinaga M et al. Metabolic syndrome in overweight and obese Japanese children. International J Obesity. 2005; 13(7):1035-1040.

12. Golley R et al. Comparison of the prevalence of metabolic syndrome using six different definitions in overweight prepubertal children enrolled in a weight control study. Inter J Obesity. 2006; 30(5):853-860.

13. Hirshler V et al. Can waist circumference identify children with the metabolic syndrome? Archives of Pediatrics & Adolescent Medicine. 2005; 159(8):740–744.

14. Borges L, Peres M, Horta B. Prevalence of high blood pressure among schoolchildren in Cuiabá, Midwestern Brazil. Rev de Saúde Pública. 2007; 41(4):530-538.

15. Nogueira PC et al. Pressão arterial elevada em escolares de Santos. Revista da Associação Médica Brasileira. 2007; 53(5):426-432.

16. Aregullin-Eligio EO, Alcorta-Garza MC. Prevalence and risk factors for arterial hypertension in Mexican schoolchildren: Sabinas Hidalgo case. Salud Pública del México. 2008; 51(1):14-18.

17. Saglam H, Tarim O. Prevalence and correlates of obesity in students from the city of Bursa, Turkey. Journal of Clinical Research in Pediatric Endocrinology. 2008; 1(2):80-88.

18. Salvori M et al. High blood pressure in relation to overweight and obesity among children in a rural Canadian community setting. Pediatrics. 2008; 122(4):821-827.

19. Silva K, Lopes A. Excess Weight, Blood Pressure and Physical Activity on the Way to School. Arquivos Brasileiros de Cardiologia. 2008;91(2):133-142.

20. Cândido AP et al. Cardiovascular risk factors in children and adolescents to live in an urban area of southeastern Brazil: Ouro Preto Study. Europen Journal Pediatric. 2009; 168(5):1373-1382.

21. Guerrero-Romeroa F, Violanted R, Morána M. Distribution of fasting plasma glucose and prevalence of decreased fasting glucose, impaired glucose tolerance and type 2 diabetes in the Mexican pediatric population. Pediatric and Perinatal Epidemiology. 2009; 23(4):1-7.

22. Paoli M et al. Obesity in schoolchildren in Mérida, Venezuela: association with cardiovascular risk factors. Endocrinology Nutrition. 2009; 56(5):218-226.

23. Silva K et al. Udernutrition and obesity associated with hypertension in children and adolescents in João Pessoa, Paraíba, Brazil. International Journal of Obesity. 2009; 30(3):248-255.

24. D'Adamo E et al. The possible role of hepatic steatosis in the definition of the metabolic syndrome in prepubertal children. Metabolism. 2010; 59(5):671-676.

25. Ferreira JS, Aydos RD. Prevalence of hypertension among obese children and adolescent. Revista Ciência & Saúde Coletiva. 2010; 15(1):97-104.

26. Genovesi S et al. Hypertension, pre-hypertension and high blood pressure in children: association with overweight and wave circumference. American Journal of Hypertension. 2010; 23(7):756-761.

27. Meininger J et al. Overweight and central adiposity in school-age children and connections with hypertension. Journal of Pediatric Nursing. 2010; 25(2):119-125.

28. Molina MCB et al. Fatores de risco cardiovascular em crianças de 7 a 10 anos de área urbana, Vitória, Espírito Santo, Brasil. Cadernos de Saúde Pública. 2010; 26(5):909-917.

29. Montemayor LE et al. Risk factors for metabolic syndrome among a sample of overweight and obese Mexican children. Jounal Clinical of Hypertension. 2010; 12(5):308-387.

30. Szer G, Kovalskysa I, Gregorio A. Prevalence of overweight, obesity and its relationship with arterial hypertension and centralization of adipose tissue in schoolchildren. Archives Argentine of Pediatric. 2010; 108(6):492-498.

31. Xu H et al. Prevalence of metabolic syndrome in children from six cities from China. BMC Public Health. 2012; 12(3):13-22.

REFERENCES

32. Andaki AC et al. Skinfold reference curves and their use in predicting metabolic syndrome risk in children. Jornal de Pediatria, Rio de Janeiro. 2014; 93(5):490-496.

33. Sukhonthachit P et al. The association between obesity and blood pressure in children Thai public schools. BMC Public Health. 2014; 14(7):729-736.

34. Lazzeri G et al. Trends in the prevalence of overweight and obesity in school-aged children in Tuscany (2002 - 2012). Public Health Nutrition. 2015; 18(17):3078-3085.

35. Silva A et al. Cardiovascular risk factors in school-aged children in Angola. Cardiovascular Journal of África. 2016; 27(5):315-321.

36. Heleno P et al. Systemic arterial hypertension, blood pressure levels and associated factors in schoolchildren. Revista da Associação Médica Brasileira.2017; 63(10): 869-875.

37. Martín-Espinosa N et al. Prevalence of hypertension and association with obesity in Spanish schoolchildren from 4 to 6 years old. PloS ONE. 2017; 12(1):170-178.

38. Moselakgomo VK, Staden M. Diagnostic comparison of Centers for Disease Control and Prevention and International Obesity Task Force criteria for obesity classification in South African children. South African Journal of Clinical Nutrition. 2017; 33(4):2020-2034.

39. Pazin DC et al. Circunferência da Cintura está Associada à Pressão Arterial em Crianças com Índice de Massa Corpórea Normal: Avaliação Transversal de 3417 Crianças Escolares. Arquivos Brasileiros de Cardiologia. 2017; 109(6):509-515.

40. Ávila-Curiel A et al. Síndrome metabólico en niños de 6 a 12 años con obesidad, en escuelas públicas de siete municipios del Estado de México. Salud Pública de México. 2018; 60(4):395-403.

41. Halasi S et al. Relationship between obesity and health-related quality of life in children aged 7 to 8 years. Health and Quality of Life Outcomes. 2018; 16(3):149-155

42. Itazuera A et al. Prevalence of masked hypertension among children with risk factors for arterial hypertension. Archives Argentine of Pediatric. 2018; 116(5):328-332.

43. Andrade G et al. Indicadores antropométricos associados à hipertensão em crianças que vivem em áreas urbanas e rurais. Revista Latino-Americana de Enfermagem. 2019; 27(3):31-42.

44. Lorenzo A et al. Triponderal mass index rather than body mass index: An indicator of high adiposity in Italian children and adolescents. Nutrition. 2019; 18(6):41-47.

45. Adom T et al. Diagnostic accuracy of the body mass index in the definition of childhood obesity: analysis of cross-sectional data of children Ghanaians. International Journal Environmental Research of Public Health. 2020; 17(1):36-44.

46. Pham N et al. Correlates of body mass index among elementary school children in Ho Chi Minh City, Vietnam. BMC Public Health. 2020; 181(11):65-72.

47. Hu Y Instrumental Variable Treatment of Nonclassical Measurement Error Models. Econometrica. 2008; 164(3): 655-662.

48. Guimarães MSJ et al. Fator de risco cardiovascular: a obesidade entre crianças e adolescentes nas macrorregiões brasileiras. Revista Brasileira de Obesidade, Nutrição e Emagrecimento. 2018; 12(69):132-142.

49. Sociedade Brasileira de Pediatria. Departamento de Nutrologia. Obesidade na infância e adolescência. Manual de Orientação / Sociedade Brasileira de Pediatria. Departamento Científico de Nutrologia. 3ª. Ed. – São Paulo: SBP. 2019.

50. Tavares L et al. Metabolic syndrome in Brazilian children and adolescents: systematic review. Cadernos de Saúde Coletiva. 2010; 18(4):469-476.

51. Andersen LB et al. A new approach to define and diagnose cardiometabolic disorder in children. Journal of Diabetes Research. 2015; 53(9):1-10.

52. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Atenção à Saúde. Instituto Nacional de Câncer. Coordenação de Prevenção e Vigilância. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis: Brasil, 15 capitais e Distrito Federal, 2002-2003. Rio de Janeiro: INCA, 2004.

53. Brasil. Lei no 8.069, de 13 de julho de 1990. Dispõe sobre o Estatuto da Criança e do Adolescente e dá outras providências. Diário Oficial da República Federativa do Brasil, Brasília, DF, 16 jul. 1990.

54. Fraporti MI et al. Fatores de risco cardiovascular em criançasCardiovascular risk factors in children. Revista Portuguesa de Cardiologia. 2017; 36(10):699-715.

55. Alves EL; Campos MMC; Moura TEG. Avaliação da qualidade de vida, do sono e sintomas respiratórios em crianças e adolescentes obesos. Saúde Coletiva (Barueri). 2021;11(65):6138-6151.