



Review Article

Systemic Arterial Hypertension in Children- Systematic Review

Youssef Elias Ammar¹, Cristianne Confessor Castilho Lopes^{2*}, Rodayne Khouri Nascimento³, Edvaldo Santana Pereira Junior⁴, José Francisco Dalcin⁵, Letícia Fernandes Cabral⁶, Melina Anantha Furtado de Sousa⁷, Paulo Sergio Silva⁸, Carolina Alves Quintanilha⁹, Pedro Otavio Piva Esposito¹⁰, Jessica Layra Garcia Ferreira¹¹, Renata Mansur Caldeira¹², Bruna Marra Silva¹³, Alan Marcelo Oliveira São Leão²⁴, Paulo Vítor Ferreira dos Passos¹⁴, Eduardo Barbosa Lopes¹⁵, Guilherme Corrijo Olanda¹⁶, Lucas Castilho Lopes¹⁷, Maria Eduarda Castilho Lopes¹⁸, Marilda Moraes da Costa¹⁹, Tulio Gamio Dias²⁰, Heliude de Quadros e Silva²¹, Fabio Herget Pitanga²², Marivane Lemos²³

¹University of Southern Santa Catarina - Tubarão – SC – Brazil

²University of Joinville Region - Joinville – SC – Brazil

³Federal University of Santa Maria – Santa Maria – RS – Brazil

⁴University Brazil – Fernandópolis – SP – Brazil

⁵Federal University of Santa Maria – Santa Maria – RS – Brazil

⁶Faculty of Medicine of Campos - Campos dos Goytacazes – RJ – Brazil

⁷Faculty of Medicine of Campos - Campos dos Goytacazes – RJ – Brazil

⁸UniSociesc - Joinville – SC - Brazil

⁹Presidente Antônio Carlos University Center - Juiz de Fora – MG – Brazil

¹⁰University of Mogi das Cruzes – Mogi das Cruzes – SP - Brazil

¹¹Peruvian Union University – Lima - Peru

¹²Alfredo Nasser University Center - Aparecida de Goiânia – Goiás - Brazil

¹³University of Uberaba – Uberaba – MG - Brazil

¹⁴Anhanguera-Underp University – Campo Grande – MS - Brazil

¹⁵Alto Vale do Rio do Peixe University - Caçador – SC – Brazil

¹⁶Federal University of Rio de Janeiro – Rio de Janeiro – RJ - Brazil

¹⁷Federal University of Santa Catarina - Florianópolis – SC - Brazil

¹⁸Alto Vale do Rio do Peixe University - Caçador – SC - Brazil

¹⁹Lutheran Educational Association - IELUSC College - Joinville – SC - Brazil

²⁰USP School of Arts, Sciences and Humanities – São Paulo – SP - Brazil

²¹Alto Vale do Rio do Peixe University - Caçador – SC - Brazil

²²Alto Vale do Rio do Peixe University - Caçador – SC - Brazil

²³Contestado University – Concordia – SC – Brazil

²⁴Severo Sombra University Faculty of Medicine - Vassouras – RJ - Brazil

***Corresponding author:** Cristianne Confessor Castilho Lopes, University of Joinville Region-Joinville-SC-Brazil

Citation: Ammar YE, Lopes CCC, Nascimento RK, Pereira Junior ES, Dalcin JF, et al. (2023) Systemic Arterial Hypertension in Children-Systematic Review. *J Community Med Public Health* 7: 308. DOI: <https://doi.org/10.29011/2577-2228.100308>

Received Date: 11 April, 2023; **Accepted Date:** 17 April, 2023; **Published Date:** 21 April, 2023

Abstract

Introduction: Systemic Arterial Hypertension (SAH) in children is a pathology that is often not adequately screened in routine pediatric consultations, and it precedes SAH in adults. **Objective:** The aim of the present study was to systematically review the public health literature on systemic arterial hypertension in children. **Methods:** Systematized literature review performed through Web of Science (Clarivate), Science Direct (Scopus), Wiley Online Library (John Wiley and Sons), Taylor and Francis (Taylor & Francis Group) and PubMed (NIH) databases, using the descriptor: systemic arterial hypertension in children, including complete studies and articles published in the last 5 years. **Results:** 343 articles were found that mention the term, of which only 09 were selected for the construction of the review by six evaluators independently. **Conclusion:** Hypertension in young children is usually related to other health conditions, being primarily associated with overweight, and secondarily with heart defects, kidney diseases, genetic conditions or hormonal disorders.

Keywords: Systemic arterial hypertension; Hypertensive children; Obesity

Introduction

Systemic arterial hypertension in adults is characterized by an irreversible increase in blood pressure levels, with pressure indicators equal to or greater than 140 mm Hg for systolic pressure or 90 mm Hg for diastolic pressure, after having repeatedly measured blood pressure and sustained [1,2].

In childhood, arterial hypertension conditions are rarely studied. In general, systolic or diastolic pressure values equal to or below 90 are established for children under 13 years of age, but several factors must be considered for this classification [3-5]. Among these factors, gender, biotype, lifestyle, diet, age and especially obesity are correlated. It is extremely important to identify and treat arterial hypertension in children due to its sequelae in adulthood. Hypertensive patients since childhood have worsened clinical conditions of arterial hypertension in adulthood [6,7].

Currently, pediatric care protocols do not establish Blood Pressure (BP) measurement as a routine test in children, and many cases end up being underreported or diagnosed late [8,9].

When the child fits at least one risk criterion, it is recommended that the BP be checked at least once a year, from the age of 3 during routine consultations. Three consecutive measurements with identical values or above 90 are predisposing factors for systemic arterial hypertension in adulthood, and should be monitored. The younger the child, the greater the likelihood that the hypertensive condition is related to a specific and identifiable medical condition [8,10].

Thus, this research systematically investigated the public health literature available from the last 5 years regarding arterial hypertension in children under 13 years of age, with emphasis on its primary causes.

Methods

This study constitutes a systematic review, classified as exploratory and descriptive. The elaboration of the research was bibliographical research in electronic databases on methods associated with a Systematic Literature Review (SLR) and SMARTER applications (Simple Multi-Attribute Rating Technique using Exploiting Rankings). The work carried out is qualitative and quantitative. The qualitative analysis of the data is carried out intuitively and inductively during the survey of the theoretical framework. It is also quantitative by using the multicriteria method. In addition, there is also a numerical experimental study in order to simulate an article selection situation based on the observed criteria. From bibliographical research, located in the databases: Systematized literature review carried out by searching the database Web of Science (Clarivate), Science Direct (Scopus), Wiley Online Library (John Wiley and Sons), Taylor and Francis (Taylor & Francis Group), and PubMed (NIH).

The search in the databases was carried out using the terminologies registered in the Health Sciences Descriptors created by the Virtual Health Library developed from the Medical Subject Headings of the US National Library of Medicine, which allows the use of common terminology in Portuguese, English and Spanish. The keywords used in the English language for the search in the databases were: systemic arterial hypertension in children. As a tool to support the decision in the selection and prioritization

of articles, a set of criteria were considered essential to represent the state of the art of the subject object of the research. This method has the following characteristics: (i) rigorous logic allows acceptance of the method as a decision support tool; (ii) simple to understand and apply with easily interpreted results. After all, the result obtained totaled 09 articles that contemplated the desired characteristics for the study.

Results

A systematic review of the literature was carried out with searches carried out in the databases Web of Science (Clarivate), Science Direct (Scopus), Wiley Online Library (John Wiley and

Sons), Taylor and Francis (Taylor & Francis Group) and PubMed (NIH) and manual searches through a search platform, performed in the references of selected studies according to the defined criteria. The searches were carried out from January to March 2023, with temporal delimitation of publications from 2019.

The database search found a total combination of 343 articles, of which 22 were selected for full text reading. Of these, 07 were selected through the SMARTER method (Simple Multi-Attribute Rating Technique using Exploiting Rankings), which were included for descriptive data analysis (Table 1). In Figure 1, the stages and indicators used in the selection are described.

Study	Country	Design	No	Study population	Outcome
QUARESMA et al., 2019 [11]	Brazil	Cross-sectional study	67	Children aged 10 to 17 years	The rate of adolescents with BP disorders was 19.4% - prehypertension 14.9% and hypertension 4.5%.
KAMIŃSKA et al., 2021 [12]	Saudi Arabia	Case study	1	7 year old child	The reported case shows that dealing with a child with acute, severe and sustained arterial hypertension, with nonspecific symptoms, requires a careful approach. Acute autonomic neuropathy may be the potential cause of hypertension.
LUCENA FILHO et al., 2022 [13]	Brazil	Cross-sectional study	577	Children aged 5 to 7 years	Association between physical activity and blood pressure as responsible for the role of mediation and moderation of adiposity components in early childhood.
BARBOSA et al., 2021 [14]	Brazil	Case report	1	8 year old child	Early and appropriate clinical management in pediatric patients diagnosed with arterial hypertension reduces morbidity and mortality and maximizes the chances of recovery.
HASELER; SINHA, 2022 [15]	London	NA*	NA*	NA*	Future research should address the future risk of adverse cardiovascular outcomes, establish normative datasets for home BP monitoring, and elucidate the hemodynamic processes that distinguish hypertension in young people.
NGUYEN et al., 2021 [16]	Vietnam	Descriptive Cross-sectional Study	1080	Children aged 6 to 15 years	The results provided useful information in the early diagnosis and timely treatment of systemic hypertension in children.
VILLASÍS-KEEVER et al., 2021 [17]	Mexico	Cross-sectional study	619	Children aged 6 to 17 years	It is of paramount importance that cardiometabolic disorders be monitored in young patients to provide them with early interventions, such as lifestyle changes, and to avoid cardiovascular complications in adult life.

*ND: Not Described

Table 1: Characteristics and results of the included studies.

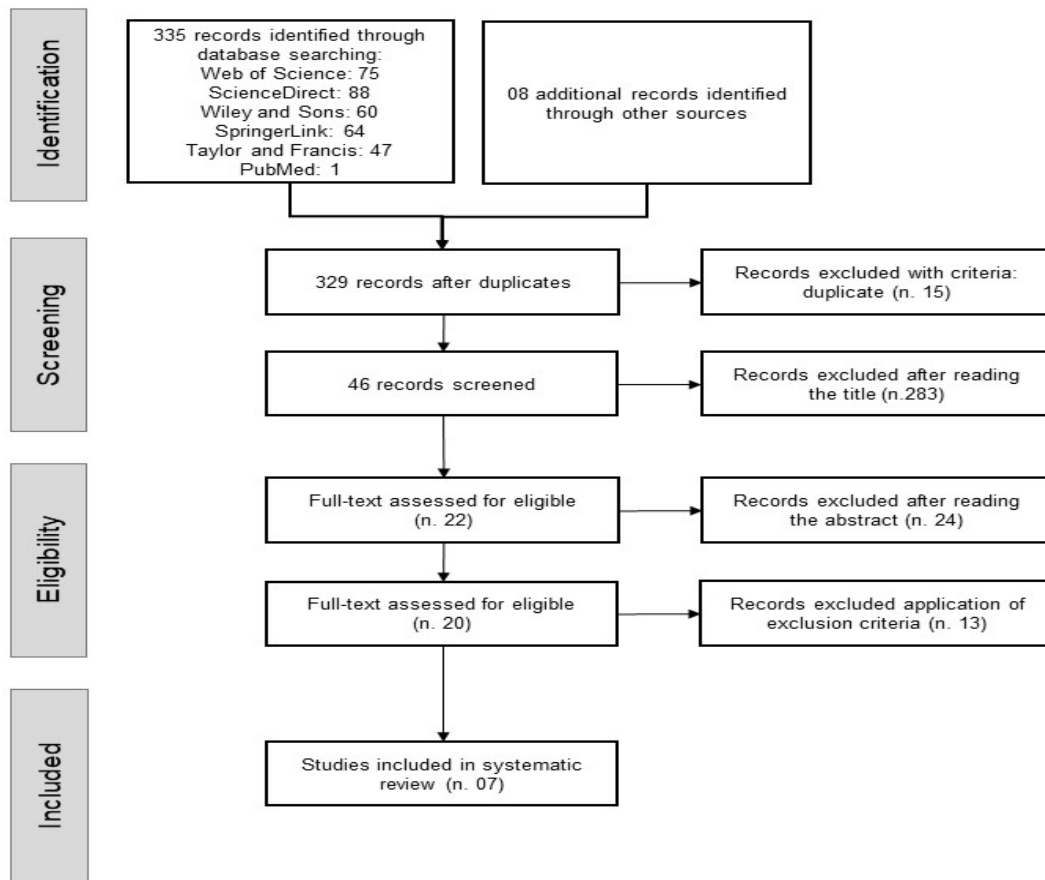


Figure 1: Number of articles selected for the study.

Discussion

For the World Health Organization (WHO), cardiovascular diseases are the main cause of death worldwide, and annually it is the disease with the highest morbidity and mortality, representing three out of every 4 deaths in low- and middle-income countries. It is strongly associated with lifestyle conditions, mainly dietary factors. It is not widely studied in children, being difficult to diagnose and correlate, making SAH frequent and worrying, since the monitoring of health conditions in children and adolescents is different from that of adults, mainly in terms of symptomatology [11].

In this literature review, in several databases and complementing the research on a search platform, only seven studies were identified that used original research exclusively on arterial hypertension in children. Of the studies carried out, six contemplate the reality of low- and middle-income countries, which does not represent data from epidemiological studies carried out in countries with a high human development index.

The prevalence of SAH in children in developed countries ranges from 3 to 6%, being affected by diagnostic conditions, when applying the American Academic guidelines of Pediatrics [18]. The application of these guidelines can increase this index to approximately 11%.

Regular pediatric visits also increase the chance of early diagnosis. Points to note should be the investigation of the primary causes, such as changes in lifestyle. Adiposity and excess weight are relevant factors, as approximately 13 to 17% of hypertensive children are overweight or obese, which are related to the primary causes [13]. The weight management strategy combined with physical activity and reduced sodium intake are important in the management of primary hypertension [15].

A sedentary lifestyle and inadequate nutrition, with the high consumption of processed foods and fast foods, are the main causes of increased cholesterol levels in the pediatric age group. In fact, the prevalence of hypertension is progressive with increasing

age, with an increasing incidence of development at younger and younger ages [16]. And there is also familial hypercholesterolemia (increased genetic cholesterol), which can start manifesting in childhood [19].

Primary hypertension is the most common diagnosis of hypertension in children. As a result, the new American Academy guidelines of Pediatric recommend a limited diagnostic evaluation for children and adolescents aged 6 years and older with history or physical examination findings of secondary hypertension, particularly children with a positive family history of hypertension and body mass index (BMI) above the 90th percentile [18].

Screening tests should include blood and urine biochemical tests (blood urea nitrogen test and creatinine) and electrolyte panel. In patients with a BMI above the 90th percentile, glucose and glycated hemoglobin, transaminases and a fasting lipid profile should be obtained. Renal ultrasonography is recommended in all patients younger than 6 years or in those aged 6 years or older with urinary profile findings. Additional studies should be obtained based on history, physical examination and abnormalities in screening laboratory tests, according to individual factors [20].

Among the secondary factors may be related to renovascular changes, such as renal artery stenosis [14] and cardiac changes, such as left ventricular hypertrophy, heart failure, left atrial enlargement, arrhythmias and aortic diseases that may be related to congenital factors or subsequent hypercholesterolemia [12,21,22].

Education and counseling on lifestyle modifications, such as promoting physical activity, promoting a healthy diet and regular consultations, can help identify and prevent hypertension in children [15]. In addition, the monitoring of associated genetic factors, metabolic risks and reduced obesity and sedentary lifestyle may be a combination of factors that result in education about lifestyles with hypertension control, with screening for economic risk factors, medical needs, risk factors and referral can help reduce the risk of developing high blood pressure [17].

Final Considerations

Systemic arterial hypertension in children is a growing clinical condition, and silent because it is not adequately screened in routine consultations. In addition, many health facilities in low- and middle-income countries lack the resources to effectively measure children's blood pressure and establish adequate guidelines.

Furthermore, arterial hypertension is poorly detected and recognized, especially in obese children. It needs specific equipment for children, which restricts its use only to offices, making screening difficult in non-ambulatory settings. The main cause of hypertension, called primary, is overweight, and it is

essential to establish an adequate diet, weight control and increased physical activity, requiring multidisciplinary care, which is also not very well established.

Lifestyle modification interventions are notoriously difficult, as the group of child patients present with specific vulnerabilities and needs. Secondly, systemic arterial hypertension in children is usually related to other health conditions such as heart defects, kidney diseases, genetic conditions or hormonal disorders.

Therefore, the literature currently lacks consistent information that correlates in-depth studies on systemic arterial hypertension in children, mainly establishing valid guidelines that can be established in order to effectively track the impacts both in childhood and in adulthood.

References

1. January CT, Wann LS, Calkins H, Chen LY, Cigarroa JE, et al. (2019) 2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol* 74: 104-132.
2. De Carvalho JJF, Alves MB, Viana GAA, Machado CB, Dos Santos BFC, et al. (2011) Stroke epidemiology, patterns of management, and outcomes in Fortaleza, Brazil: A hospital-based multicenter prospective study. *Stroke* 42: 3341-3346.
3. Song P, Zhang Y, Yu J, Zha M, Zhu Y, et al. (2019) Global Prevalence of Hypertension in Children. *JAMA Pediatr* 173: 1154-1163.
4. Martinez F, Redon J, Aguilar F, Calderon JM, Lurbe (2023) Persistence and determinants of blood pressure phenotypes according to office and ambulatory blood pressure measurements in youth. *Hypertens Res* 46: 1257-1266.
5. Falkner B (2023) Development of Blood Pressure Norms and Definition of Hypertension in Children. *Pediatric Hypertension* 1: 297-309.
6. Li Y, Haseler E, Chowienzyk P, Sinha MD (2020) Haemodynamics of Hypertension in Children. *Curr Hypertens Rep* 22: 60.
7. Genovesi S, Parati G, Giussani M, Bona G, Fava C, et al. (2020) How to Apply European and American Guidelines on High Blood Pressure in Children and Adolescents. A Position Paper Endorsed by the Italian Society of Hypertension and the Italian Society of Pediatrics. *High Blood Press Cardiovasc Prev* 27: 183-193.
8. Butler JE, Vincent C, South AM, Chanchlani R (2022) Updates to Pediatric Ambulatory Blood Pressure Monitoring in Clinical Practice: a Review and Strategies for Expanding Access. *Curr Pediatr Rep* 10: 172-181.
9. Conceição R dos S da, Souza ILL de (2021) Hipertensão arterial na infância: uma revisão de literatura. *Res Soc Dev* 10: e484101119935.
10. Rabi DM, McBrien KA, Sapir-Pichhadze R, Nakhla M, Ahmed SB, et al. (2020) Hypertension Canada's 2020 Comprehensive Guidelines for the Prevention, Diagnosis, Risk Assessment, and Treatment of Hypertension in Adults and Children. *Can J Cardiol* 36: 596-624.

11. Quaresma FRP, da Silva Maciel E, dos Santos Figueiredo FW, Adami F (2019) Factors associated with blood pressure disorders in Afro-descendant children and adolescents. *BMC Pediatr* 19: 244.
12. Kamińska H, Kostera-Pruszczyk A, Potulska-Chromik A, Werner B (2021) Acute Autonomic Neuropathy as a Rare Cause of Severe Arterial Hypertension in a Child. *Int J Pediatr Adolesc Med* 8: 121-124.
13. Lucena Filho A, Lima RA, Soares FC, Bezerra J, de Barros MVG (2022) The Role of Adiposity in the Association between Physical Activity and Blood Pressure in Children. *Res Q Exerc Sport* 93: 578-584.
14. Barbosa ILA, do Vale Cabral T, Carraro M, Borges e Curi CLM (2021) Arterial Hypertension Secondary to Renal Artery Stenosis in a Child: Diagnosis and Management, a Case Report. *Cardiol Cardiovasc Med* 5: 385-390.
15. Haseler E, Sinha MD (2022) Hypertension in Children and Young Adults. *Pediatr Clin North Am* 69: 1165-1180.
16. Nguyen LV, Truong PN, Tran LTN, Bui NQ, Lieu KT, et al. (2021) Blood pressure percentiles and systemic hypertension-associated factors among children aged between 6 and 15 years in Southern Vietnam. *Arter Hypertens* 25: 77-81.
17. Villasís-Keever MA, Zurita-Cruz JN, Serret-Montoya J, de Leon-Herrera AP, Galván-Heredia P, et al. (2021) Cardiometabolic Factors in Pediatric Patients with Chronic Diseases. *Arch Med Res* 52: 535-543.
18. Flynn JT, Kaelber DC, Baker-Smith CM, Blowey D, Carroll AE, et al. (2017) Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics* 140: e20171904.
19. Calastri MCJ, Hattori G, Rodrigues NLTO, Gregorio ML, Brancati CIFO, et al. (2019) Genetic variants related to cell cycle and stability of telomere in patients with glioma. *Asian Pac J Cancer Prev* 20: 2345-2351.
20. Weaver DJ (2019) Pediatric Hypertension: Review of Updated Guidelines. *Pediatr Rev* 40: 354-358.
21. Bigras JL (2020) Cardiovascular Risk Factors in Patients With Congenital Heart Disease. *Can J Cardiol* 36: 1458-1466.
22. Vitarelli A (2021) Myocardial strain impairment, heterozygous familial hypercholesterolemia and systemic arterial hypertension: Is there a link? *Int J Cardiol Hypertens* 9: 100086.