Residência RP Pediátrica
Publicação Oficial da Sociedade Brasileira de Pediatria
ISSN-Online: 2236-6814

Submitted on: 06/14/2020
Approved on: 06/19/2020

ORIGINAL ARTICLE

Child obesity and quarantine: obese children have greater risk for COVID-19?

Luciano Rodrigues Costa[1], Maria Eduarda de Oliveira Mueller[1], Júlia Porto Frauches[1], Nicole Braz Campos[1], Lívia Schmeisser de Oliveira[1], Karla Faria Gentilin[1], Ana Luísa Freitas e Pena Mello[1]

Keywords:
Childhood Obesity, SARS-CoV-2, Quarantine, Respiratory Viral Infections.

Abstract

Objective: To discuss the correlation between SARS-CoV-2 infection and obesity in the pediatric group, its possible consequences and severity factors. Thus, enabling greater coverage in relation to the theme and construction of new proposals. **Methods:** A qualitative descriptive study, with a revisional approach by means of a bibliographic survey using data bases such as PubMed, SciELO, MEDLINE, LILACS and websites containing government information. As inclusion criteria, the articles published from 2010 to 2020, in English and Portuguese were included. Among the 12.999 articles published with the specified descriptors, only 26 were used. **Results:** Obesity is defined by the increase of fat tissue in the body in a chronic way, having multifactorial causes involved. In infection caused by SARS-CoV-2, the pediatric range is being associated with a better prognosis and a low mortality rate. The presence of comorbidities, such as childhood obesity, may be related to a severe evolution of cases and/or aggravations due to weight excess and by the widespread pronounced chronic inflammatory character caused by adiposity. **Conclusion:** Although the literature is limited, it is possible to determine the existence of a link between the relationship of SARS-CoV-2 infection and obesity, which can be established by the increased risk of developing the severe form of the disease, since obesity makes it an aggravating factor of the systemic infectious condition. Thus, it is up to the health professional to provide guidance on preventing obesity in view of the increased risk of complications in children and adolescents in the face of viral infections.

[1] University Centre of Volta Redonda, Medicine Program, Pediatrics - Volta Redonda - Rio de Janeiro - Brazil.

Correspondence to:
Maria Eduarda de Oliveira Mueller.
Centro Universitário de Volta Redonda - Medicina. Avenida Paulo Erlei Alves Abrantes, nº 1325, Três Poços.
Volta Redonda - RJ. Brazil. CEP: 27240-560. E-mail: muellerduda@hotmail.com

INTRODUCTION

Infection by the novel coronavirus, also known as SARS-CoV-2, was recognized and reported initially on December 2019 in Wuhan, China.[1,2] The global rise in the number of cases of the disease (COVID-19) prompted the World Health Organization (WHO) to elevate it to the status of a pandemic in March 2020.[1,3]

The clinical signs of disease observed in children globally include fever and coughing, in milder forms than the symptoms seen in adults. Children also have better prognoses and present lower death rates than adults.[2,4] Children are predominantly asymptomatic and may contribute to the transmission and dissemination of the disease.[2]

Although morbidity and mortality rates are low among pediatric individuals, some children may present with severe forms of the disease.[4] In these cases, preexisting comorbidities appear to be an important factor and obesity has emerged as a possible risk factor for severe cases of COVID-19, particularly in older children.[4,5] Children aged two years or older meeting obesity criteria with a body mass index (BMI) above the 97th percentile warrant particular attention by health care workers.[4,6]

Child obesity is a global public health concern. Therefore, the potential correlations between child obesity and infection by SARS-CoV-2 deserves attention and further analysis, particularly in light of the current scenario.[4,7] This paper presents a collection of the information available to date, recognizing that data is still preliminary, along with comments on included study findings. The idea is to enable the construction of a body of knowledge that supports the development of strategies to minimize risk to the pediatric population, since social isolation adversely affects healthy dieting and often prevents children from performing physical exercises, thereby producing BMI increases.

METHOD

This descriptive qualitative literature review included papers indexed on PubMed, SciELO, Medline, Lilacs, and government websites. The papers included in this review were searched based on the following mesh terms in Portuguese: "Obesidade Infantil" and "SARS-CoV-2", with the following subtopics: "Fatores de Risco", "Quarentena" , "Infecções Virais em crianças", ''Comorbidades''; and in English: "Child Obesity" and "SARS-CoV-2", with the following subtopics: "Risk Factor", "Quarantine", "Viral Infections in children", Comorbidities''. The review included full papers published between 2010 and 2020 in English and Portuguese. Papers outside the target time period, written in other languages, and with different subject matters were excluded. Classic book chapters and papers from renowned authors, regardless of year of publication, were also included. The search yielded 12,999 papers, 26 of which were included in the review and used as input for the comments made herein.

REVIEW RESULTS

Child obesity

Obesity is a chronic condition characterized by excessive body fat tissue.[7] In pediatric individuals, obesity may be diagnosed based on anthropometric data (weight [W], height [H], circumference, and fold thickness measurements) and age (A) of the subject, often represented via ratios such as W/A and H/A.[8] The body mass index (BMI) is a value derived from the mass in kilograms divided by the squared height of a person.[7] The resulting amount can be plotted against percentiles described by the Brazilian Society of Pediatrics (SBP), the WHO, and the Ministry of Health. Children with a BMI in the 97th percentile meet the criteria for obesity, while children with a BMI in the 85th percentile are in the overweight range.[6,9] According to a survey published by the Brazilian Institute of Statistics and Geography (IBGE), one in three Brazilian children are overweight and about 9.5% of the children aged 5-10 years are obese.[10]

Obesity is a condition with a multifactorial etiology stemmed from imbalances between calorie intake and energy expenditure.[7] Genetic, environmental, metabolic, nutritional, cultural, and psychosocial factors are involved in the genesis of the largest global public health epidemic according to the WHO.[8] A study published by the Federal University of Pelotas (UFPel) found that breastfeeding is associated with higher lean mass and lower visceral fat levels, in addition to decreasing by 13% the risk of children becoming obese.[11]

Obesity has been associated with diseases that may produce complications during childhood and adolescence with effects extending into adult age.[7] The more commonly associated comorbidities are high blood pressure, dyslipidemia, and insulin resistance, jointly referred to as metabolic syndrome.[6] Evidence indicates that obesity and dyslipidemia lead to a prethrombotic state and generalized chronic inflammation, yielding increased proinflammatory cytokine levels such as tumor necrosis factor alpha (TNFα), interleukin-6 (IL-6), and decreased levels of anti-inflammatory peptides such as adiponectin.[6] In other words, protective factors are decreased and inflammatory factors increased, producing a state of endothelial dysfunction and atherosclerosis, which further complicates the patient's condition. Obese children may develop early cardiovascular disease when they reach adult age and suffer from a roster of other conditions, including viral infections commonly seen in individuals in the pediatric age range.[6,8]

COVID in pediatrics

In late 2019, patients with severe pneumonia for unknown causes were diagnosed with an RNA virus of the Coronavirinae subfamily in Wuhan, China.[12] The new virus named SARS-CoV-2 (Severe acute respiratory syndrome coronavirus 2) produced a disease called COVID-19 (Coronavirus disease 19), which caused a global pandemic

as declared by the WHO.[12] A local meat and seafood market was identified as the potential source of contamination, with primarily human beings becoming infected, some presenting symptoms and others not.[13]

Transmission occurs via droplets projected during speech, coughing, and sneezing by an infected person. Touching objects, toys, and surfaces contaminated with droplets and then touching the nose, mouth, or eyes with the contaminated hand is another way of contracting the disease.[14] The risk of fecal and oral contamination appears to be low, but the virus has been identified in stool.[15] Tests performed in breast milk, amniotic fluid, umbilical cord blood, and oropharyngeal swabs of neonates born from mothers with the disease came back negative. There is no documented case of vertical transmission or transmission of the disease by breastmilk.[16]

Transmission of the disease by individuals infected with SARS-CoV-2 occurs on average seven days after the onset of symptoms. However, reports indicated that transmission may occur even without the appearance of signs and symptoms. Mean incubation time of infection is five days, although it may take up to 14 days.[17] One of the most relevant findings related to pediatric cases is the clear evidence around the fact that children are susceptible to infection by SARS-CoV-2, although they often do not suffer from severe disease, a factor that possibly characterizes them as facilitators of virus transmission. With this in mind, social and public health policies (avoiding interactions with elderly individuals, for example) may be devised to decrease transmission and protect vulnerable populations.[17]

Infection by this strain of the coronavirus has been related to a broad range of clinical manifestations, including signs and symptoms similar to common influenza, such as coughing, sore throat, nasal congestion, coryza, fever, headache, diarrhea, vomiting, and myalgia, possibly progressing, in some cases, to pneumonia, severe acute respiratory syndrome, sepsis, and multiple organ failure.[1] Children and adolescents develop mild disease, while adults and individuals aged 60+ years with comorbidities in particular account for most of the severe cases and deaths by the disease.[14] Some children are at higher risk of developing severe acute respiratory syndrome (SARS) and/or worsening of clinical signs, including subjects aged less than two years, subjects with chronic pulmonary disease (uncontrolled asthma and cystic fibrosis), heart conditions, diabetes mellitus, kidney failure, and patients on immunosuppressants.[18]

Studies have attempted to explain the peculiar situation faced by children. Infection by SARS-CoV-2 triggers innate and adaptive immune response in the host, with increased levels of proinflammatory cytokines contributing to the onset of septic shock and multiple organ failure. A possible explanation is that cell and humoral immunity are less developed and present decreased inflammatory response capabilities in children. In addition, ACE2 receptor immaturity may also hamper cell invasion by the virus.[17] Some have postulated theories around the protective effect the Bacillus Calmette-Guérin (BCG) vaccine may have against COVID-19 via heterologous immunity with other pathogens, potentially driven by a phenomenon involving innate cells including macrophages, monocytes, and epithelia.[19] However, further studies are required to elucidate the reasons why children are less susceptible to COVID-19.[20]

Obesity and covid

Recent findings indicate that fat tissue, in addition to working as an energy storage system, play an endocrine role and produce cells capable of promoting hormonal modulation.[21] Excess adipose tissue may induce metabolic dysfunction and a state of inflammation that alters immune system and T-cell function.[6,8] Besides, overweight and its ensuing inflammatory trait have been associated with increased incidence of chronic respiratory diseases such as asthma in school-age children.[22]

Although the BMI has been widely used to define whether an individual is overweight or obese, the index has its limitations at estimating actual adiposity, especially in cases of severe obesity of individuals aged 2-19 years.[23] A cohort study was unable to find a direct relationship between the BMI and severe cases of viral infection by the influenza (A or B) or common non-influenza respiratory viruses in a pediatric population. The authors further indicated that the relevance of actual adiposity might be neglected as a result of the inability of the BMI to demonstrate actual body composition.[24]

Data collected during the pandemic showed that the association between COVID-19 and preexisting comorbidities such as cardiovascular disease, diabetes, chronic respiratory conditions, and cancer yielded higher death rates.[25] Other reviews, however, revealed that obesity is a risk factor to be accounted for. A study found that individuals aged less than 60 years with a BMI ranging between 30 and 34 (class I obesity) infected with COVID-19 were 1.8-2 times more likely to need hospitalization than their counterparts with a BMI lower than 30.[26]

Although most cases of children with COVID-19 are of lower complexity, patients requiring intensive care often have higher levels of inflammation markers (C-reactive protein, procalcitonin, and pro-BNP) than subjects not admitted to an intensive care unit (ICU).[27] Other authors have also reported that a remarkable number of the children admitted to pediatric ICUs were also obese.[5,27] A retrospective study investigating a potential link between the two factors analyzed the cases of 265 patients hospitalized for COVID-19 in the United States and found an inverse correlation between age and the BMI, indicating that younger patients needing hospitalization had higher BMIs.[28] Therefore, one might expect that younger individuals in populations in which obesity is a more prevalent condition may be more affected than their counterparts in areas in which obesity rates are lower, as in the case of China and Italy.[28]

Obesity vs. quarantining

Although priority has been assigned to limiting the direct impacts of disease by SARS-CoV-2 (COVID-19), the long-term effects of the pandemic should also be considered, particularly on how it may affect the health of children. With schools closed and social distancing measures - including home confinement - in place, authors have discussed the potential increases in the number of obese children along with the risks inherent to obesity after the end of the pandemic.[29,30]

Social distancing measures and home confinement have decreased the rate at which children are involved in physical activities, which means they have been exercising less.[29] In addition, the intake of processed foods has increased during the pandemic by a rate similar to the one seen during school holidays.[29,30]

This is a concerning situation, since studies have shown that weight gain does not occur during the school year, but rather during school holidays, and that the weight gained in these months is kept during the next school year and accumulates holiday after holiday.[30] If this finding is reproduced in conditions of home confinement, the risk of child obesity rates increasing becomes very real.

FINAL CONSIDERATIONS

To sum up with, there is a lack of comprehensive, conclusive information on the impact of obesity in children with COVID-19, although it makes sense to think that obese children may be at higher risk of developing severe disease, since obesity is a risk factor for severe systemic infection. Most of the literature reviewed described adult populations, whose findings do not always transfer well to pediatric groups. The findings discussed in this review may therefore be used as input in the development of future studies looking into children with COVID-19.

In a scenario in which two global relevant conditions are present, despite the weak scientific evidence suggesting a correlation between the two, approaches developed to address the situation must be based on proper evidence. The information currently available is still preliminary, but managing child obesity, a condition with proven associations with increased risk of childhood diseases further complicated by social isolation, is of the essence.

Obesity may be prevented and risks to children decreased if body weight and BMI percentiles are monitored in routine appointments with a pediatrician and parents/guardians are adequately advised on the matter. Health care workers should advise and encourage their patients to develop healthy eating habits and perform physical exercises whenever possible. Individuals with comorbidities and other associated conditions must be properly diagnosed and treated to make sure they are able to enjoy a healthier childhood.

REFERENCES

1. Sociedade Brasileira de Pediatria (SBP). Departamento Científico de Infectologia. Orientações a Respeito da Infecção pelo SARS-CoV-2 (conhecida como COVID-19) em crianças. Rio de Janeiro (RJ): SBP; 2020 Mar; [acesso em 2020 Jun 03]. Disponível em https://www.sbp.com.br/fileadmin/user_upload/Covid-19-Pais-DC-Infecto-DS__Rosely_Alves_Sobral_-convertido.pdf
2. Balasubramanian S, Rao NM, Goenka A, Roderick M, Ramanan AV. Coronavirus disease (COVID-19) in children - what we know so far and what we do not?. Indian Pediatr [Internet]. 2020 Mai; [citado 2020 Jun 04]; 57(5):435-42. Disponível em: http://www.ncbi.nlm.nih.gov/pubmed/32273490
3. Soriano JM, González A, Soler C, Catalá-Gregori AI, Merino-Torres JF. Body Mass Index (BMI) and coronavirus disease 2019 (COVID-19): a living systematic review. Preprints. 2020;2020050166.
4. Sinha IP, Harwood R, Semple MG, Hawcutt DB, Thursfield R, Narayan O, et al. COVID-19 infection in children. Lancet Respir Med [Internet]. 2020 Mai; [citado 2020 Jun 04]; 8(5):446-7. Disponível em: https://linkinghub.elsevier.com/retrieve/pii/S2213260020301521
5. Shekerdemian LS, Mahmood NR, Wolfe KK, Riggs BJ, Ross CE, McKiernan CA, et al. Characteristics and Outcomes of Children With Coronavirus Disease 2019 (COVID-19) Infection Admitted to US and Canadian Pediatric Intensive Care Units. JAMA Pediatr [Internet]. 2020 Mai 11; [citado 2020 Jun 06]; [Epub ahead of print]. Disponível em: https://jamanetwork.com/journals/jamapediatrics/fullarticle/2766037
6. Sociedade Brasileira de Pediatria (SBP). Tratado de Pediatria. 4a ed. Barueri (SP): Manole; 2017.
7. Kliegman R, Stanton B, Geme BMD, Schor JS, Nina F. Nelson: Tratado de Pediatria. 20ª ed. Rio de Janeiro (RJ): Elsevier; 2017.
8. Sociedade Brasileira de Pediatria (SBP). Departamento de Nutrologia. Obesidade na infância e adolescência: manual de orientação. São Paulo (SP): Sociedade Brasileira de Pediatria – Departamento de Nutrologia; 2019.
9. qMinistério da Saúde (BR). Estratégias para o cuidado da pessoa com doença crônica obesidade – Cadernos de Atenção Básica [Internet]. Brasília (DF): Ministério da Saúde; 2014; [acesso em 2020 Jun 05]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/estrategias_cuidado_doenca_cronica_obesidade_cab38.pdf
10. Silva MJ, Nogueira S. Obesidade infantil desafia pais e gestores [Internet]. Goiânia (GO): Secretaria de Estado da Saúde – Governo do Estado de Goiás; 2019 Out 19; [acesso em 2020 Jun 04]; 1(38):1-214. Disponível em: https://www.saude.go.gov.br/noticias/81-obesidade-infantil-desafia-pais-e-gestores
11. Horta BL, Victora CG, França GVA, Hartwig FP, Ong KK, Rolfe EL, et al. Breastfeeding moderates FTO related adiposity: a birth cohort study with 30 years of follow-up. Sci Rep. 2018 Fev;8(1):2530.
12. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): the epidemic and the challenges. Int J Antimicrob Agents. 2020 Mar;55(3):105924.
13. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020 Fev;382(8):727-33.
14. Phan LT, Nguyen TV, Luong QC, Nguyen TV, Nguyen HT, Le HQ, et al. Importation and human-to-human transmission of a novel coronavirus in Vietnam. N Engl J Med. 2020 Fev;382(9):872-4.
15. Lu X, Zhang L, Du H, Zhang J, Li YY, Qu J, et al. SARS-CoV-2 infection in children. N Engl J Med. 2020 Abr;382:1663-5. DOI: https://doi.org/10.1056/NEJMc2005073
16. Chen Z, Fu J, Shu Q, Chen YH, Hua CZ, Li FB, et al. Diagnosis and treatment recommendations for pediatric respiratory infection caused by the 2019 novel coronavirus. World J Pediatr. 2020 Feb;16:240-6. DOI: https://doi.org/10.1007/s12519-020-00345-5

17. Sociedade Brasileira de Pediatria (SBP). Nota de Alerta. COVID-19: Protocolo de Diagnóstico e Tratamento em Unidade de Terapia Intensiva Pediátrica. Rio de Janeiro (RJ): SBP; 2020.
18. World Health Organization (WHO). Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020 [Internet]. Geneva: WHO; 2019; [acesso em 2020 Jun 05]. Disponível em: https://www.who.int/publications-detail/clinical-management-of-severe-acuterespiratory-infection-when-novel--coronavirus-(ncov)-infection-is-suspected
19. Lewnard JA, Lo NC. COVID-19 in children: the link in the transmission chain. Lancet. 2020 Jun;20(6):633-4. DOI: https://doi.org/10.1016/S1473--3099(20)30236-X
20. Yaling S, Mingkai T, Xing C, Yanxia L, Jide H, Jingyi OU, et al. Immunopathological characteristics of coronavirus disease 2019 cases in Guangzhou, China. Med Rxiv. 2020 Mar 16. DOI: https://doi.org/10.1101/2020.03.12.20034736
21. Coelho M, Oliveira T, Fernandes R. Biochemistry of adipose tissue: an endocrine organ. Arch Med Sci. 2013 Abr;9(2):191-200.
22. Gilliland FD, Berhane K, Islam T, McConnell R, Gauderman WJ, Avol E, et al. Obesity and the risk of newly diagnosed asthma in school-age children. Am J Epidemiol. 2003 Set;158(5):406-15.
23. Freedman DS, Butte NF, Taveras EM, Lundeen EA, Blanck HM, Goodman AB, et al. BMI z-Scores are a poor indicator of adiposity among 2- to 19-year-olds with very high BMIs, NHANES 1999-2000 to 2013-2014. Obesity (Silver Spring). 2017 Abr;25(4):739-46.
24. Moser JS, Galindo-Fraga A, Ortiz-Hernández AA, Gu W, Hunsberger S, Galán--Herrera JF, et al. Underweight, overweight, and obesity as independent risk factors for hospitalization in adults and children from influenza and other respiratory viruses. Influenza Other Respir Viruses. 2019 Jan;13(1):3-9.
25. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72,314 cases from the Chinese Center for Disease Control and Prevention. JAMA. 2020 Feb;323(12):1239-42. DOI: https://doi.org/10.1001/jama.2020.2648
26. Lighter J, Phillips M, Hochman S, Sterling S, Johnson D, Francois F, et al. Obesity in patients younger than 60 years is a risk factor for Covid-19 hospital admission. Clin Infect Dis. 2020 Apr;ciaa415. DOI: https://doi.org/10.1093/cid/ciaa415
27. Chao JY, Derespina KR, Herold BC, Goldman DL, Aldrich M, Weingarten J, et al. Clinical characteristics and outcomes of hospitalized and critically Ill children and adolescents with coronavirus disease 2019 (COVID-19) at a tertiary care Medical Center in New York City. J Pediatr. 2020 May 11; [Epub ahead of print]. DOI: https://doi.org/10.1016/j.jpeds.2020.05.006
28. Kass DA, Duggal P, Cingolani O. Obesity could shift severe COVID-19 disease to younger ages. Lancet. 2020 Mai;395(10236):1544-5.
29. Ribeiro KDS, Garcia LRS, Dametto JFS, Assunção DGF, Maciel BLL. COVID-19 and nutrition: the need for initiatives to promote healthy eating and prevent obesity in childhood. Childhood Obes. 2020 Jun;16(4):235-7.
30. Rundle AG, Park Y, Herbstman JB, Kinsey EW, Wang YC. COVID-19-related school closings and risk of weight gain among children. Obesity (Silver Spring). 2020 Jun;28(6):1008-9.