

## **ASSOCIATION BETWEEN VIOLENCE IN CHILDHOOD AND INCREASE IN THE BODY MASS INDEX AMONG ADOLESCENTS**

Luana Santos Vital Alves Coelho<sup>1</sup>   
Silvia Gonçalves Soares<sup>2</sup>   
Gabriela Duarte Carvalho<sup>3</sup>   
Virgínia Junqueira Oliveira<sup>3</sup>   
Vinícius Silva Belo<sup>4</sup>   
Márcia Christina Caetano Romano<sup>1</sup> 

<sup>1</sup>Universidade Federal de São João Del Rei, Programa de Pós-Graduação Mestrado Acadêmico em Enfermagem. Divinópolis, Minas Gerais, Brasil.

<sup>2</sup>Universidade do Estado de Minas Gerais. Divinópolis, Minas Gerais, Brasil.

<sup>3</sup>Universidade Federal de São João Del Rei. Divinópolis, Minas Gerais, Brasil.

<sup>4</sup>Universidade Federal de São João Del Rei, Programa de Pós-Graduação Ciências da Saúde. Divinópolis, Minas Gerais, Brasil.

### **ABSTRACT**

**Objective:** to analyze the association between violence in childhood and increase in the Body Mass Index among adolescents.

**Method:** a cross-sectional study, conducted with 136 adolescents aged from 10 to 19 years old, monitored by a Multiprofessional Residency Program in Adolescents' Health, in health units from the municipality of Divinópolis-MG. The anthropometric assessment was conducted from March to June 2018; and information was collected referring to the socioeconomic level, demographic factors, food consumption, and physical activity of the participants. The variable related to violence in childhood was composed of five groups, obtained from a factorial analysis. Multiple regression models were used to identify the variables associated with the increase in Body Mass Index, with a significance level of 5%.

**Results:** the prevalence of excess weight was 31.8%. The adolescents participating in the study consumed soft drinks (66.2%) and industrialized food products (66.9%) every week and ate in front of the TV every day (54.4%). The most prevalent type of abuse was emotional neglect, which affected 100% of the sample under study. An association was evidenced of physical neglect in childhood and intake of industrialized food products with the increase in the Body Mass Index z-score.

**Conclusion:** violence in childhood and the consumption of industrialized food products were associated to the increase in Body Mass Index among adolescents. Investments in public policies for comprehensive promotion of health and protection of children and adolescents are imperious.

**DESCRIPTORS:** Adolescents. Violence. Obesity. Body Mass Index. Child maltreatment.

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# ASSOCIAÇÃO ENTRE VIOLÊNCIA NA INFÂNCIA E AUMENTO DO ÍNDICE DE MASSA CORPORAL ENTRE ADOLESCENTES

## RESUMO

**Objetivo:** analisar a associação entre violência na infância e aumento de Índice de Massa Corporal entre adolescentes.

**Método:** estudo transversal, realizado com 136 adolescentes de 10 a 19 anos, em acompanhamento por um Programa de Residência Multiprofissional da Saúde do Adolescente, em unidades de saúde do município de Divinópolis-MG. Realizou-se, nos meses de março a junho de 2018, a avaliação antropométrica e coletaram-se informações referentes ao nível socioeconômico, a fatores demográficos, ao consumo alimentar e à atividade física dos participantes. A variável relativa à violência na infância foi composta por cinco blocos, obtidos a partir de uma análise fatorial. Modelos de regressão linear múltipla foram utilizados para identificação das variáveis associadas ao aumento do Índice de Massa Corporal, com um nível de significância de 5%.

**Resultados:** a prevalência de excesso de peso foi de 31,8%. Os adolescentes do estudo ingeriam refrigerantes (66,2%) e alimentos industrializados (66,9%) semanalmente e se alimentavam em frente à TV diariamente (54,4%). O tipo de abuso mais prevalente foi a negligência emocional, acometendo 100% da amostra estudada. Evidenciou-se associação da negligência física na infância e do consumo de alimentos industrializados com o aumento do índice de escore z de Índice de Massa Corporal.

**Conclusão:** a violência na infância e o consumo de alimentos industrializados associaram-se ao aumento de Índice de Massa Corporal entre adolescentes. Investimentos em políticas públicas para promoção da saúde integral e proteção de crianças e adolescentes são imperativos.

**DESCRITORES:** Adolescentes. Violência. Obesidade. Índice de massa corporal. Maus-tratos Infantis.

# ASOCIACIÓN ENTRE VIOLENCIA SUFRIDA EN LA INFANCIA Y AUMENTO DEL ÍNDICE DE MASA CORPORAL ENTRE ADOLESCENTES

## RESUMEN

**Objetivo:** analizar la asociación entre violencia sufrida en la infancia y aumento del Índice de Masa Corporal entre adolescentes.

**Método:** estudio transversal, realizado con 136 adolescentes de 10 a 19 años de edad, monitoreados por un Programa de Residencia Multiprofesional de la Salud del Adolescente, en unidades de salud del municipio de Divinópolis-MG. La evaluación antropométrica se realizó entre los meses de marzo y junio de 2018, y se recolectaron datos referentes al nivel socioeconómico, factores demográficos, consumo de alimentos y actividad física de los participantes. La variable relacionada con la violencia sufrida en la infancia estuvo compuesta por cinco bloques, que se obtuvieron a partir de un análisis factorial. Se emplearon modelos de regresión lineal múltiple para identificar las variables asociadas al aumento del Índice de Masa Corporal, con un nivel de significancia del 5%.

**Resultados:** la prevalencia de exceso de peso fue del 31,8%. Los adolescentes que participaron del estudio ingerían refrescos (66,2%) y alimentos industrializados (66,9%) semanalmente, además de comer frente al televisor a diario (54,4%). El tipo de abuso más prevalente fue la negligencia emocional, que afectó al 100% de la muestra estudiada. Se hizo evidente la asociación de negligencia física sufrida en la infancia y consumo de alimentos industrializados con el aumento de la puntuación z del Índice de Masa Corporal.

**Conclusão:** la violencia sufrida en la infancia y el consumo de alimentos industrializados presentaron una asociación con el aumento del Índice de Masa Corporal entre adolescentes. Es imperioso invertir en políticas públicas para promover la salud integral y proteger a los niños y adolescentes.

**DESCRITORES:** Adolescentes. Violencia. Obesidad. Índice de Masa Corporal. Maltrato infantil.

## INTRODUCTION

Overweight and obesity constitute excess weight and are characterized by abnormal accumulation of fat in the organism, which may result in various implications for health. In 2016, 18% of the children and adolescents in the world, aged between 5 and 19 years old, presented excess weight<sup>1</sup>. In the Brazilian Northeast region, specifically in Ceará, a study conducted with 572 adolescents aged between 10 and 19 years old evidenced a 20% prevalence of excess weight<sup>2</sup>. In Minas Gerais, in a research study conducted with 70 students with mean age of 16.4 years old, the prevalence of overweight/obesity was of 24.3%<sup>3</sup>.

Since it is one of the main risk factors for chronic non-communicable diseases such as diabetes, hypertension, cardiovascular diseases and cancer, excess weight brings about various complications for health and large costs for the public coffers<sup>4</sup>. Its determining factors are multifactorial and involve environmental, genetic and psychological factors. With the technological advancement, children and adolescents stay a long time in front of the television and playing video games, which favors an increase in sedentary lifestyles. In addition to that, in these age groups, the existence of inadequate eating habits and the excessive intake of industrialized food products, saturated fat and sugars are frequently verified<sup>2</sup>.

The presence of violence in childhood has been studied as a new determinant of obesity among adolescents. In fact, in the contemporaneity context, violence is a recurrent social phenomenon. Worldwide, one to four adults suffered violence in childhood in 2017, causing physical, social and psychological impacts and increasing the costs of the health services<sup>5</sup>.

A research study conducted with Irish children and adolescents showed that adverse experiences in childhood and low income predict, independently, the risk of obesity at the beginning of adolescence<sup>6</sup>. In contrast, American researchers did not identify any association between exposure to violence in childhood and excess weight in adolescence<sup>7</sup>. There is still no consensus in the literature about the relationship between violence in childhood and increase in the Body Mass Index (BMI) among adolescents. In addition to that, publications on the theme are mostly international<sup>6-7</sup>, the conduction of studies with Brazilian adolescents that may contribute to clarifying the theme thus becoming imperious. Therefore, this research aims to answer the following question: is there any association between violence in childhood and increase in the BMI during adolescence? The objective of this study is to analyze the association between violence in childhood and increase in the BMI among adolescents.

This study has the potential to identify the determinants of the increase in the BMI during adolescence, especially in relation to contexts of violence in childhood, and may contribute with indicators for public policies of the health care of adolescents and to prevent violence.

## METHOD

This a cross-sectional quantitative study, conducted in the urban area of the Municipality of Divinópolis, MG. The eligible population consisted of 250 adolescents aged 10 to 19 years old, according to the definition of adolescence of the World Health Organization and of the Ministry of Health<sup>8</sup>. The participants were being monitored by the Multiprofessional Residency Program in Adolescents' Health (*Programa de Residência Multiprofissional em Saúde do Adolescente*, REMSA) of *Universidade Federal de São João del Rei*, in two Family Health Strategy units, in 2018. It is highlighted that the REMSA assists adolescents with various requirements, such as dental, physical therapy and psychotherapist services, not only in the nutritional area. By using the Open Epi program ([www.openepi.com](http://www.openepi.com)), a sample of 136 adolescents was calculated. A 95% confidence level was considered, with a 5% error and a 24% prevalence of excess weight<sup>9</sup>.

The inclusion criteria adopted were the following: adolescents aged 10 to 19 years old and who were being monitored by the REMSA. The following exclusion criteria were considered: pregnant adolescents, for interfering in the study outcome, and those who presented mental conditions that rendered them incapable of answering the questionnaires.

The participants' recruitment was performed by means of a list of adolescents registered in the REMSA. These were randomly drawn through the Open Epi Program and invited by telephone contact to participate in the study. Initially, the project was presented and, later, if the participants and their guardians agreed to include the adolescent in the research, the Free and Informed Consent and Assent Forms were presented for signing. The data were collected at the health unit, in a room reserved for the research, or at the participants' homes.

For the verification of the factors related to obesity, food consumption, socioeconomic status, level of physical activity and presence of violence in childhood were assessed by means of questionnaires validated for the Brazilian population and for the age group of adolescence. To assess food consumption, the questionnaire of the National Research of Schoolchildren's Health (*Pesquisa Nacional de Saúde do Escolar*, PeNSE) was used. The questionnaire presents 25 questions, involving breakfast; if they have lunch or dinner with family members, if the school offers afternoon meals, if these school afternoon meals are eaten; and about the consumption of beans, fried food products, vegetables and legumes, sweets, soft drinks, processed food products and fast food<sup>10</sup>. The assessment of the socioeconomic status was conducted using the Brazilian Association of Research Companies (*Associação Brasileira de Empresas de Pesquisa*, ABEP) questionnaire, which classifies people according to their socioeconomic stratum, ranging from A to E<sup>11</sup>. The short version of the International Physical Activity Questionnaire (IPAQ) was used to determine the level of physical activity. It presents four questions that classify the adolescent as very active, active, irregularly active and sedentary<sup>12</sup>. For the verification of violence, the Childhood Trauma Questionnaire (CTQ) was used, which has 28 questions addressing traumatic elements occurred during childhood, such as: physical abuse, emotional abuse, physical neglect, emotional neglect and sexual abuse<sup>13</sup>.

In addition, the anthropometric measurements of weight and height were measured. Weight was measured on a Tanitta digital scale, and the adolescents were weighed wearing light clothes. Height was measured with an Altuxata portable anthropometer.

For the nutritional assessment, the *WHO AnthroPlus* program of the World Health Organization (WHO) was used, establishing the BMI z-score by age as evaluation index<sup>14</sup>.

The data were tabulated and the database was validated by means of the *Epi Data* program ([www.epidata.dk](http://www.epidata.dk)). The statistical analyses were performed with the aid of the *Statistical Package for the Social Sciences for Windows Student Version* (SPSS) program, version 20.0. A descriptive analysis based on calculation of the distributions of absolute and relative frequencies was initially performed.

Regarding the main explanatory variable of this study, the occurrence of violence in childhood, a factor analysis was conducted based on the answers obtained in the questionnaire. Factor analysis aims at reducing a large number of categories of one variable to a smaller set, making it feasible to conduct multivariate analyses with sufficient statistical power. Answers were collected on 28 questions related to violence. The original instrument proposes grouping these questions into five categories: emotional abuse, sexual abuse, physical abuse, physical neglect, and emotional neglect. The correlation of each variable was performed with the five categories and the variable was allocated to the category with which it had the highest correlation. This correlation had to be greater than 0.5; otherwise the variable was discarded, as it presents no significant relation to any specific category. After this grouping, each of the five variables created had its values calculated through the mean of the items that compose it.

Thus, the synthesis variable, consisting of groups named by the types of violence, was created, making it possible to select the best combination between the categories of violence since each type of questionnaire answer was inserted in the factor (type of violence) with which it had greater interaction. At the end, the violence synthesis variable consisted of five categories, namely: 1-Emotional abuse; 2-Sexual abuse, 3-Physical abuse; 4-Physical neglect; and 5-Emotional neglect.

The association between violence in childhood and increase in the BMI, adjusted for the other variables studied, was analyzed using multiple linear regression models. Initially, all the explanatory variables with p-values below 0.2 in the bivariate analysis were introduced. Subsequently, to select the variables that would be included in the final model, those with p-values below 0.05 were kept.

Collinearity analysis was performed between the variables studied using the VIF with a cut-off point equal to 10, that is, values below 10 represent non-collinearity.

The research project was approved by the Ethics Research Committee of *Universidade Federal de São João Del-Rei*, UFSJ.

## RESULTS

A total of 136 adolescents were assessed, most of them female (61.0%). There was predominance of participants aged from 15 to 19 years old (65.4%), brown-skinned (53.7%) and attending high school (48.4%). Most of the families lived with four people in the same household (37.5%), with adolescents who worked (19.9%), and were classified in economic Class C2 (35.3%). (Table 1)

By analyzing the nutritional characteristics of the study participants, it was observed that the adolescents ate beans every day (58.1%), fried food products every week (66.9%), legumes and vegetables (25%), sweets (26.5%), and fruits (24.3%) every day. Regarding processed and ultra-processed food products, the adolescents consumed soft drinks (66.2%) and industrialized food products (66.9%) every day. Daily consumption of fast foods by the study participants stands out (1.5%). Regarding their self-perception of health, most of the adolescents considered it as regular (49.9%) (Table 2).

Regarding excess weight, that is, the sum of the frequency of overweight and obesity, a 31.8% prevalence was observed, being equally frequent in both genders.

The most prevalent type of abuse suffered in childhood was emotional neglect, which affected 100% of the participants. Physical neglect was the least reported type of abuse in the sample under study (Table 3).

By performing the multiple linear regression analysis, it was observed that the BMI z-score was associated with physical neglect and with consumption of industrialized food products, and these two variables explain 6% of the BMI variability. At each point on the physical neglect scale, the BMI z-score was increased by 0.261 and, for each industrialized food product consumed, the BMI z-score rose by 0.144. Therefore, the increase in physical neglect and intake of industrialized food products increases the BMI z-score (Table 4).

**Table 1** – Sociodemographic characteristics of the adolescents registered in the REMSA, Divinópolis, MG, Brazil, 2019. (n=136)

Variables	n	%
Gender		
Male	53	39
Female	83	61
Age group		
10-14 years old	47	34.6
15-19 years old	89	65.4
Skin color or Race*		
White	47	34.6
Black	15	11
Asian	1	7
Brown	73	53.7
Schooling (years of study)		
Nine	53	39
Between ten and eleven	66	48.4
Twelve	17	12.5
Works		
Yes	27	19.9
No	109	80.1
ABEP† Class		
A	2	1.5
B1	3	2.2
B2	34	25
C1	34	25
C2	48	35.3
D-E	15	11

\*Self-reported; †A is the highest level; D-E are the lowest levels.

**Table 2** – Nutritional and lifestyle characteristics of the adolescents registered in the REMSA, Divinópolis, MG, Brazil, 2019. (n=136)

Variables	n	%
Has breakfast		
Every day	69	50.7
5-6 days a week	9	6.6
3-4 days a week	17	12.5
1-2 days a week	11	8.1
Rarely	6	4.4
No	24	17.6
Has lunch or dinner with guardians		
Every day	86	63.2
5-6 days a week	11	8.1
3-4 days a week	13	9.6
1-2 days a week	14	10.3
Rarely	4	2.9
No	8	5.9

**Table 2 – Cont.**

<b>Variables</b>	<b>n</b>	<b>%</b>
Eats in front of the TV		
Every day	74	54.4
5-6 days a week	7	5.1
3-4 days a week	14	10.3
1-2 days a week	9	6.6
Rarely	0	0
No	32	23.5
Afternoon meal at school		
Every day	32	23.5
3-4 days a week	20	14.7
1-2 days a week	22	16.2
Rarely	6	4.4
No	39	28.7
Does not apply	17	12.5
There was not enough food		
Never	122	89.7
Rarely	2	1.5
Sometimes	3	2.2
Most of the times	2	1.5
Always	7	5.1
Level of physical activity		
Very active	8	5.9
Active	53	39
Irregularly active	41	30.1
Sedentary	34	25

**Table 3 – Description of the study participants according to the variables related to violence, Divinópolis, MG, 2019. (n=136)**

<b>Variable</b>	<b>n</b>	<b>%</b>
Physical neglect	11	8.1
Sexual abuse	15	11.0
Physical abuse	53	39.0
Emotional abuse	100	73.5
Emotional neglect	136	100

**Table 4 – Final multiple linear regression model - dependent variable = BMI (z) of the participants registered in the REMSA, Divinópolis-MG, Brazil. (n=136)**

	<b>Coefficient</b>	<b>p-value</b>	<b>R2 - Adjusted</b>	<b>VIF<sup>†</sup></b>
Constant	-0.304	0.262	0.062	
Physical neglect	0.261	0.05		1.053
Industrialized food products	0.144	0.034		1.053

\*BMI: Body Mass Index; †Collinearity Measure

## DISCUSSION

This study, unprecedented with Brazilian adolescents, suggests the association between violence in childhood and the increase in the BMI z-score among the participants. According to the World Health Organization, violence in childhood includes all forms of maltreatment against individuals aged less than 18 years old. Violence against children is classified as physical, psychological and sexual abuses, and as neglect. The first consists of actions such as beating and shaking the child. Psychological abuse consists of insulting, ridiculing and confining. Sexual contact and exposure to sexual acts or materials are related to sexual abuse. Neglect is considered a failure, even unintentionally, in the provision of medical care, education or essential elements for healthy development, affecting the child both physically and emotionally<sup>5</sup>.

The type of violence that presented significance in this study was physical neglect, as also found in a research study conducted in California, United States, where neglected girls presented greater increase in their BMI values<sup>15</sup>. It was also evidenced that 100% of the participants presented emotional neglect, corroborating a study also conducted in the United States with 139 adolescents with a mean age of 16.9 years old, which pointed out that adolescents victims of neglect and emotional abuse in childhood are more likely to present overweight and obesity<sup>16</sup>. However, it is to be considered that, despite the fact that the instrument used in this and other studies<sup>16-17</sup> classifies physical neglect separately from emotional neglect, neglect is a complex construct and involves physical and emotional aspects simultaneously. In addition to that, material and affective deprivations can impair the growth and development of the child and also justify the increase in the BMI<sup>5,18</sup>. It is relevant to highlight that the REMSA is inserted in Divinópolis neighborhoods with high social vulnerability, crime related to drug trafficking, unemployment and drug addiction, which can generate inability in the parents to care for their children. In fact, a study that investigated intra-family violence pointed out in the adolescents' oral history situations of violence through neglect, abandonment, and moral and physical violence perpetrated by parents. The authors assert that, when parents are not psychologically capable of providing care, they are subjected to responding inadequately to their children's needs, representing an act of neglect<sup>18</sup>.

A possible explanation for the relationship between violence in childhood and increase in the BMI during adolescence is centered on the pathophysiological model proposed by Skinner. His theory called operant conditioning, in synthesis, advocates that the environment determines human behavior<sup>19</sup>. In this way, adverse experiences in childhood exert a negative impact on the brain's maturation process in its development. Maltreatment in childhood affect the networks of social cognition circuits for executive control that will act on the individuals' behaviors and motivations, such as eating behaviors, which are affected by reward mechanisms, leading to compulsive eating. This phenomenon might contribute to understanding the relationship between violence in childhood and increase in BMI<sup>17</sup>.

This study also seems to point out that there is significance between the increase in the BMI z-score and the consumption of industrialized food products by the adolescents, with a prevalence of 66.9%. Corroborating the research, a study conducted with 100 adolescents aged between 14 and 17 years old in Flores da Cunha/RS pointed out a 48.6% prevalence of consumption of industrialized food products, a value that is lower than that found in this study<sup>20</sup>. In fact, the consumption of industrialized, processed and ultra-processed food products presents a rising trend, and this phenomenon is increasingly associated with negative outcomes for the health of young people, involving chronic non-communicable diseases<sup>21</sup>.

A prevalence value of 31.8% of excess weight was found among the adolescents participating in this study, which is higher than that of a research study conducted in Goiás with adolescents aged between 12 and 18 years old, which presented a 21.2% prevalence of excess weight<sup>22</sup>. Another research study conducted in Campinas/SP, with young individuals aged between 15 and 19 years old, presented a 25.2% prevalence of excess weight<sup>23</sup>.

The fact that more than half of the participants of this study eat in front of the television stands out. Similar results were found in a study with adolescents from São Paulo<sup>24</sup>, reinforcing inadequate eating practices that favor an exacerbated consumption of ultra-processed food products, resulting in excess weight.<sup>21</sup> This, on its turn, is responsible for various implications, such as hypertension, diabetes, cardiovascular diseases, dyslipidemia, liver diseases, and some types of cancer, certainly impairing the adolescents' quality of life<sup>24</sup>.

In fact, adolescents prefer fatty food products, those quick to prepare, with more sugar and more palatable, such as ultra-processed food products, which represents a warning regarding the increased risk of developing chronic diseases<sup>25</sup>.

In relation to practicing physical activity, a research study conducted in Piauí with adolescents aged between 13 and 19 years old identified that the level of physical activity characterized as active was 12.6%<sup>26</sup>, lower than that found in this study. It is believed that the increasingly frequent practice of sedentary leisure and the fast technological development of the past few years, characterized by the increased time spent on electronic games, computers, television and cellphones, reduce the adolescents' interest in activities that provide energy expenditure<sup>2,27</sup>. It is important to highlight that the practice of physical activity among adolescents implies the improvement of general well-being, mental health and prevention of chronic non-communicable diseases, with governmental measures and of the society as a whole being indispensable to prevent sedentary lifestyle in the young population<sup>2</sup>.

Considering the results presented in this study, it is necessary to discuss strategies to prevent and combat violence and, consequently, excess weight in adolescence. An important measure to cope with violence is centered on the notification of this problem by professionals of the education, health, social assistance and public security areas, favoring the acquisition of local indicators to implement specific and resolute actions. In addition to that, it is relevant to understand that the scarcity of resource application in this area, the flexibility of justice, the technical inability of the managers, and the incipience of public policies cause an increase in violence. In this sense, effective investments in this area are imperious<sup>28</sup>.

It is known that, in different Brazilian regions, in 2011, of all the hospital and outpatient occurrences, only 1/3 of the care appointments involving violence were notified, thus concealing the magnitude of the problem<sup>29</sup>. Such undernotification enhances the challenges to control this complex social phenomenon.

Finally, it is highlighted that, in addition to the factors contributing to the existence of violence, the speed of everyday life in the work and academic world, the influence of the technologies, and the changes of life habits in contemporary times exert an influence on the nutritional status. In this way, global actions, which are not only the governments' responsibility, but also the society's as a whole, are indispensable to prevent and combat obesity. A complex system of triple-action strategies is indicated, such as the promotion of a healthy diet, policies to reduce poverty, and strengthening of food safety and sustainable agriculture. Such actions must give priority to the rights to health, food, being a child, full exercise of culture, and to live in healthy environments<sup>30</sup>.

This research has limitations referring to its design. Cross-sectional studies have limitations regarding temporality, making it unfeasible to obtain the cause-effect relationship. In addition to that, the statistical model herein presented has an explanatory power of only 6% of the BMI variability. New studies on the topic are necessary, such as longitudinal research, and that may contribute greater association strength among the variables of interest.

However, this research, pioneer in Brazil, points out to results which indicate an element that can be incorporated in the set of determinants of excess weight in adolescents; therefore, it signals the need for new research studies and measures to prevent violence against children and protect them.

## CONCLUSION

The results of this study indicate that neglect in childhood and consumption of industrialized food products point out to the increase in BMI during adolescence. In the context of the determinants of excess weight among adolescents, the study contributes to a reflection on the need of further studies that can generate greater clarification on the topic and that incorporate the aspects related to food consumption and, especially, violence in the causal models of overweight and obesity. In addition to that, these findings suggest the relevance of strategies to promote healthy eating along with actions to protect children, and to prevent and combat violence against them, especially regarding neglect.

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## NOTES

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### CONTRIBUTION OF AUTHORITY

Study design: Coelho LSVA, Romano MCC, Oliveira VJ, Belo VS, Soares SG.

Data collection: Coelho LSVA, Soares SG.

Data analysis and interpretation: Coelho LSVA, Romano MCC, Belo VS.

Discussion of the results: Coelho LSVA, Romano MCC, Oliveira VJ.

Writing and/or critical review of the content: Coelho LSVA, Romano MCC, Oliveira VJ.

Review and final approval of the final version: Coelho LSVA, Romano MCC, Oliveira VJ.

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### CONFLICT OF INTEREST

There is no conflict of interest.

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### CORRESPONDING AUTHORS

Márcia Christina Caetano Romano  
marciachristinacs@gmail.com