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ULTRA PROCESSED FOODS CONSUMPTION BY ADOLESCENTS: A LITERATURE REVIEW

Consumo de alimentos ultraprocessados por adolescentes: uma revisão de literatura

Consumo de alimentos ultraprocesados en adolescentes: una revisión de la literatura

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RESUMO

Objetivo: identificar na literatura os fatores associados ao consumo de alimentos ultraprocessados na adolescência. **Método:** trata-se de revisão integrativa da literatura. A busca foi realizada nas bases de dados da *National Library of Medicine, Scientific Electronic Library Online* e *a Biblioteca* Virtual em Saúde. Para realização da busca dos artigos e formulação da questão norteadora do estudo, utilizou-se a estratégia PICO. Os critérios de exclusão utilizados foram artigos que não compreendiam a população de adolescentes, artigos que não contemplavam o consumo de alimentos ultraprocessados, artigos indisponíveis na íntegra, artigos não compatíveis com a pergunta norteadora e artigos duplicados. O período de busca utilizada foi de 2018 a 2023. **Resultados:** na busca inicial identificou-se 1.873, após as etapas de identificação e seleção permaneceram 58 artigos, sintetizados por meio de quadro sinóptico. **Considerações finais:** o consumo elevado de alimentos ultraprocessados pode estar associado a diversos aspectos sociais, emocionais e demográficos.

DESCRITORES: Adolescente; Alimento processado; Saúde escolar.

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ABSTRACT

Objective: to identify in the literature the factors associated with the consumption of ultra-processed foods in adolescence. **Method:** this is an integrative literature review. The search was carried out in the databases of the National Library of Medicine, Scientific Electronic Library Online and the Virtual Health Library. To search for articles and formulate the guiding question of the study, the PICO strategy was used. The exclusion criteria used were articles that did not include the adolescent population, articles that did not include the consumption of ultra-processed foods, articles unavailable in full, articles not compatible with the guiding question and duplicate articles. The search period used was from 2018 to 2023. **Results:** in the initial search, 1,873 were identified, after the identification and selection stages, 58 articles remained, synthesized through a synoptic table. **Final considerations:** High consumption of ultra-processed foods may be associated with various social, emotional and demographic aspects.

DESCRIPTORS: Adolescent; Processed food; School health.

RESUMEN

Objetivo: identificar em la literatura los factores asociados al consumo de alimentos ultraprocesados em la adolescencia. **Método:** se trata de una revisión integradora de la literatura. La búsqueda se realizo em las bases de datos de la Biblioteca Nacional de Medicina, Biblioteca Electrónica Científica en Línea y Biblioteca Virtual en Salud. Para la búsqueda de artículos y formulación de la pregunta orientadora del estudio se utilizó la estrategia PICO. Los criterios de exclusión utilizados fueron artículos que no incluyeron población adolescente, artículos que no incluyeron el consumo de alimentos ultraprocesados, artículos no disponibles em su totalidad, artículos no compatibles com la pregunta orientadora y artículos duplicados. El período de búsqueda utilizado fue el 2018 al 2023. **Resultados:** em la búsqueda inicial se identificaron 1.873, luego de las etapas de identificación y selección quedaron 58 artículos, sintetizados a través de um cuadro sinóptico. **Consideraciones finales:** el elevado consumo de alimentos ultraprocesados puede estar asociado a diversos aspectos sociales, emocionales y demográficos.

DESCRIPTORES: Adolescente; Alimentos procesados; Salud escolar.

INTRODUCTION

Adolescence is a phase of human life characterized by the transition from childhood to adulthood, the period between the ages of 10 and 19.[1] It is estimated that in Brazil, the population of Brazilians between the ages of 10 and 19 is 28,050,903 million inhabitants.[2]

This is a stage in life of important developmental and behavioral changes, making it a particularly vulnerable period and susceptible to various situations that will have a direct impact on adult life.[3] Inadequate eating habits in adolescence can lead to nutritional deficiencies and affect the growth process inherent in puberty. In addition, they favor the development of health problems and worsen quality of life over the years.[4-5]

Ultra-processed foods (UPF) are defined by the Nova food classification system as industrial formulations made entirely or mostly from substances extracted from other foods or synthesized in laboratories based on organic materials, with the addition of additives to improve taste, texture, appearance and increase shelf life. These are products ready for immediate consumption, such as packaged snacks, soft drinks, instant noodles and ready meals.[6-7]

Among adolescents, the consumption of UPF is prevalent, especially cookies, bread and soft drinks.[8-9] On the other hand, the consumption of vegetables, legumes and fruit has been shown to be insufficient compared to the intake of UPF. This diet, characterized by the high presence of saturated fat, trans fat, sugars and sodium, has exceeded the recommended limits, which can result in excessive weight gain and increase the risk of developing chronic non-communicable diseases (NCDs).[10] Recent scientific evidence suggests direct associations between greater exposure to UPF and higher risks of all-cause mortality, cardiovascular disease-related mortality, occurrence of common mental disorders, overweight, obesity and type 2 diabetes.[11]

The estimated prevalence of excessive UPF consumption in Brazil was 75.4% (95%CI 73.3-77.3) with variations between the five Brazilian macro-regions. The highest and lowest consumption was estimated in the Southeast and North regions of Brazil, respectively. The factors for excessive UPF consumption were biological: age; behavioral factors: daily sitting hours, habit of eating meals in front of the TV or studying, daily TV hours and frequency of breakfast; socioeconomic and demographic factors: maternal schooling, school location, having a cell phone and school administrative dependence.[9]

Given the importance for public health and the impacts of PSA consumption in adolescence, this article aims to identify factors associated with PSA consumption in adolescence in the literature.

METHOD

This is an integrative literature review, based on the methods and concepts suggested by Soares et al. (2014).[12]

The PICO strategy was used to search for articles and formulate the study's guiding question. PICO is an acronym in which the letter P (population) indicates the population that will be part of the study, the letter I (intervention) refers to the intervention, C (comparison) refers to the comparison and the letter O (outcome) refers to the expected outcomes.[13] That said, for this review the acronym determined was: P - adolescent, I - ultra-processed foods, C - not applicable, O - identification of factors associated with the consumption of ultra-processed foods. In this context, the guiding question was: what factors are associated with the consumption of ultra-processed foods by adolescents?

The National Library of Medicine (Medline via PubMed), Scientific Electronic Library Online (Scielo) and the Virtual Health Library (BVS) databases were used to survey published articles. These databases were chosen by the authors because they include good quality health journals.

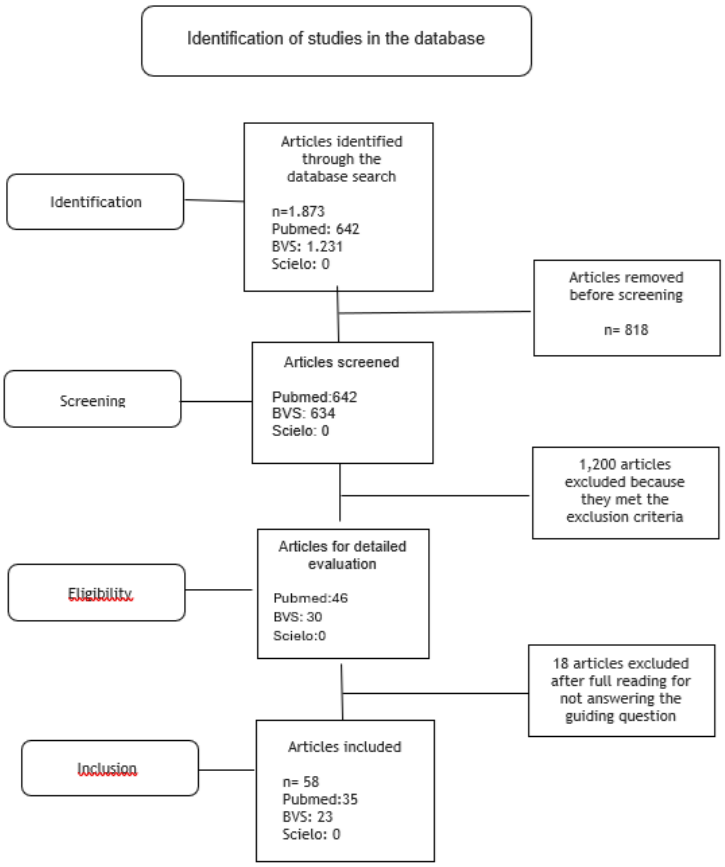
The search was carried out using an advanced search, using the Boolean and. The search was carried out using the descriptors (adolescent) and (food, processed). The filters used were articles in Portuguese and English, published between January 2018 and December 2023.

The exclusion criteria used were articles that did not include the population of adolescents aged between 10 and 19, articles that did not include UPF consumption, articles that were not available in full, articles that were not compatible with the guiding question and duplicate articles.

The search and reading of scientific articles took place between May 2023 and January 2024 and was carried out by three authors in order to achieve the review's objective. The studies were selected independently by three researchers, initially analyzing the title and abstract and then reading the articles in full.

The articles listed to make up the scope of the literature review were organized in a synoptic table containing the following items: article number, author, year of publication and place of study, sample and associated factors. The flowchart elucidates the structuring of the corpus of this integrative literature review (Figure 1), adapted according to the Prisma review protocol (2020).

Figure 1 - Flowchart of the stages for identifying and selecting studies for the integrative literature review



RESULTS

The articles were selected by searching the BVS, Pubmed and Scielo databases, reaching a total of 1,873 articles. After carrying out the stages of the review, 58 articles were used, using as exclusion criteria those that did not meet the study filters and those that were excluded after reading the titles and abstracts for not answering the PICO question. Other reasons for exclusion were duplicates, being ineligible or not available to read in full.

Of the 58 articles included in the integrative review, due to the filter, all were published in the last 5 years, eight (13.97%) in 2018, 15 (25.8%) in 2019, five (8.6%) in 2020, four (9%) in 2021, 17 (29.3%) in 2022 and nine (15.5%) in the last year (Chart 1). Of this total, the articles selected used data from adolescents from different countries and continents, 63.9% from Latin America, 13.8% from Asia, 8.6% from Europe, 5% from North America and 1.7% from Africa. The other 4 articles used global data. As for the type of study, the majority of authors carried out cross-sectional studies (77.6%), the others used systematic reviews (8.6%), randomized clinical trials (5.1%), cohort studies (3.4%), longitudinal studies (3.4%) and observational studies (1.7%).

Chart 01 - Summary of the studies included in the final sample of this review (n = 58). Montes Claros, MG, Brazil, 2024.

Authors, year of publication and place of study	Sample	Associated factors
1) Carmo *et al.* (2018), Brazil.	n = 79.589	- Private schools
2) Zhen*et al.* (2018), China.	n = 489	- Subsequent obesity - Higher socioeconomic status - Higher parental schooling
3) Corrêa *et al.* (2018), Brazil.	n = 2.195	- Use of snack bars and fast-food outlets - Use of butcher shops decreases UPF consumption
4) Ribeiro-Silva *et al.* (2018), Brazil.	n = 1496	- Body dissatisfaction
5) Bueno *et al.* (2018), Brazil.	n = 377	- Female gender - Higher parental schooling
6) Costa *et al.* (2018), Brazil.	n = 101 755	- Female - Southeast and Center-West regions - Private schools - Higher socioeconomic status - Higher maternal schooling - Sedentary behavior
7) Nicolau *et al.* (2018), Brazil.	n = 111	- Lower water consumption - Skipping meals - Low consumption of fruit and vegetables
8) Cunha *et al.* (2018), Brazil.	n = 1035	- Lower consumption of fruit and vegetables - Higher level of physical activity - Higher percentage of body fat
9) Gonçalves *et al.* (2019), Brazil.	n = 73.399	- Private schools
10) Leme *et al.* (2019), Brazil.	Revisão Sistemática	- Female gender - Most studies showed no associated factors
11) Leandro *et al.* (2019), Global.	Revisão Sistemática	- Overweight/obesity - Low level of physical activity - Lower vegetable consumption - Skipping meals
12) Fonseca *et al.* (2019), Brazil.	n = 461	- Lack of knowledge about food ingredients and labels
13) Bodega *et al.* (2019), Spain.	n = 1324	- Female gender - Lower educational level of parents

Authors, year of publication and place of study	**Sample**	**Associated factors**
14) Nurwanti *et al,* (2019), Indonesia.	n = 155 645	- Living in urban areas - Sedentary lifestyle and obesity/overweight
15) Chen*et al.* (2019), USA.	n = 743	Non-white skin color - Lower maternal schooling - Paternal and maternal occupation (work outside the home) - Living with only one parent - Higher percentage of body fat, waist circumference, BP, insulin, C-reactive protein and triglycerides
16) Massarani *et al.* (2019), Brazil.	n = 83	- Presence of PSA at school
17) Nascimento *et al.* (2019), Brazil.	n = 617	- Female - Overweight - Private schools - Higher socioeconomic status - Lower fiber and protein intake
18) Martins *et al.* (2019), Brazil.	n = 102.072	- No meals with parents
19) Noll *et al.* (2019), Brazil.	n = 102.072	- Schools without PNAE meals - Presence of a canteen in schools
20) Enes *et al.* (2019), Brazil.	n = 200	- Higher socio-economic level
21) Andrade *et al.* (2019), Brazil.	n = 50	- Adolescents who organized their own money
22) Falcão *et al.* (2019), Brazil.	n = 444	- Micronutrient intake (Selenium, Vitamin B1 and Zinc)
23) Sviscoe*t al.* (2019), USA.	n = 97	- Ultra-processed foods are hyper-palatable, adding to adolescents' preference
24) Lima *et al.* (2020), Brazil.	n = 327	- Females - Students from public schools - Adolescents with a family income of less than 2 salaries
25) Jain A *et al.* (2020), India.	n = 1.030	- Adolescents with higher socioeconomic status
26) Chao Qiu *et al.* (2020), China.	n = 2.578	- Lower maternal schooling - Breastfed for more than 6 months - Activity level f< 0.04) - Age - Female gender
27) Santos *et al.* (2020), Brazil.	n = 1.384	- Sleep duration - Level of physical activity
28) Rocha *et al.* (2020), Brazil.	n = 71.553	-Adolescents from private schools - Adolescents who do not eat school meals - Teenagers who do not eat breakfast regularly - Teenagers who eat in front of screens almost every day or every day - Teenagers who spend more time in front of screens
29) Moraes *et al.* (2021), Portugal.	n = 1.153	- Higher parental education
30) Bui *et al.* (2021), Taiwan.	n = 18.461	- Young people with emotional eating - Reading labels reduces consumption of less healthy foods - Sedentary participants - Male adolescents had higher consumption of fast foods and fried snacks
31) Silva *et al.* (2021), Brazil.	n = 16.324	- Higher consumption in the Southeast - Lower consumption in the North

Authors, year of publication and place of study	**Sample**	**Associated factors**
32) Silva *et al.* (2021), Brazil.	n = 52.038	- Dissatisfaction with body image due to underestimation of weight
33) Martins *et al.* (2022), Brazil.	n = 391	- Higher consumption of simple carbohydrates, lipids, saturated fat and sodium - Lower consumption of proteins
34) Amicis *et al.* (2022), Global.	Revisão Sistemática	- Obesity - Increased lipid parameters - Unbalanced body composition in the future
35) Parnhamet *et al.* (2022), UK.	n = 3.321	- Food provided by the school - Consumption of packed lunches - Lower family socioeconomic status
36) Souza *et al.* (2022), Global.	n = 576	- Overweight - Abdominal obesity
37) Islam *et al.* (2022), Bangladesh.	n = 2.463	- Higher socio-economic standard - Higher educational level - Male gender
38) Akin *et al.*(2022), Istambul.	n = 611	- Presence of ADHD - Exacerbation of ADHD symptoms
39) Lane *et al.* (2022), Iran.	n = 733	- Lower quality of life - Insomnia
40) Chiong *et al.* (2022), USA.	n = 1.703	- Parental occupation - Higher risk of food insecurity
41) Costa *et al.* (2022), Brazil.	n = 101.689	- Higher socioeconomic status
42) Faisal-Cury *et al.* (2022), Brazil.	n = 2.680	- Presence of internalizing symptoms (mental health) - Female gender - Private schools - No meals with parents
Leite *et al.* (2022), Brazil.	n = 2.680	- Presence of canteen in schools - Easy access to PSA at school
44) Chen *et al.* (2022), China.	n = 60	- Higher BMI - Higher percentage of body fat - Higher fasting glucose, insulin and cholesterol levels
45) Mesas *et al.* (2022), Brazil.	n = 94.767	- Symptoms of poor mental health
46) Alves *et al.* (2022), Brazil.	n = 23.509	- Obesity - Living in municipalities with a higher per capita income - Not eating 3 full meals a day
47) Gomes *et al.* (2022), Brazil.	n = 9.470	- Female gender - Food insecurity
Trübswasse *et al.* (2022), Africa.	n = 217	- High number of advertisements for ultra-processed foods - Lower socioeconomic status
49) Silva *et al.* (2022), Brazil.	n = 74.589	- More time in front of screens - Not eating breakfast - Female and black - Fewer meals with parents - Sleeping only a few hours - Living in economically favored regions
50) Calcaterra *et al.* (2023), Global.	Revisão Sistemática	- Obesity

Authors, year of publication and place of study	Sample	Associated factors
51) Mescoloto *et al.* (2023), Global.	Revisão Sistemática	- Overweight/obese - Sedentary lifestyle - Cardiovascular diseases - Periodontal diseases
52) Gonçalves *et al.* (2023), Brazil.	n = 159.245	- Private schools - Female gender - Residence in non-capital cities
53) Gomes *et al.* (2023), Brazil.	n = 2.285	- Brown/black skin color - Eating in front of screens - Private schools
54) Oliveira *et al.* (2023), Brazil.	n = 432	- Longer screen time - Inadequate sleep duration - High percentage of body fat
55) Esteves *et al.* (2023), Brazil.	n = 242	- Reduced quality of life - Group of adolescents with immunosuppressive diseases consumed less UPF
56) Paz *et al.* (2023), Colombia.	n = 79.640	- Low consumption of fruit, vegetables and dairy products - High salt intake - Low level of physical activity
57) Marques *et al.* (2023), Brazil.	n = 43	- Interventions covering various areas of the adolescent's life were successful in reducing UPF consumption
58) Gketsio *et al.* (2023), Greece.	n = 1.615	- Obesogenic family environment - Aggression - Loneliness

DISCUSSION

The most prevalent dietary profile among adolescents is what some studies characterize as "Western", identifying a diet consisting of sweets, pasta, fast foods, snacks, sugary drinks and cheese.[14-15] In emerging countries such as Brazil, this prevalence of the "Western" diet is not yet the majority, but the country has been undergoing this dietary change due to the influence of globalization and the ease with which UPF can be acquired. Studies have shown a higher prevalence of a diet rich in UPF among students from private schools ($p < 0.001$), due to the lack of school meals offered by the school and the occurrence of UPF trade in these schools.[16-17]

The school environment plays a central role in shaping the eating habits and preferences of future consumers, as it is where adolescents spend at least ⅓ of their day. This factor exemplifies the importance of measures such as the PNAE (National School Feeding Plan), which is present in some public schools to ensure the provision of more fruit and vegetables, as well as foods that are a source of heme iron, at least four times a week.[18 -19] In addition, the PNAE prohibits UPF, which is essential if students are to be less likely to consume UPF excessively.[20]

Among other factors that influence adolescent food consumption, in addition to the school environment, are sociodemographic characteristics. Two of the selected studies investigated this association and observed, based on the Food Frequency Questionnaire and data from PeNSE (National Student Health Survey), that UPF consumption is more frequent in girls than in boys when considering the same age group (43% vs 36%). In addition, these studies analyzed that all adolescents, regardless of gender or age, reported consuming UPF the day before the survey and that between 30-40% of them consumed at least one serving of UPF a day.[21,8]

A systematic review aimed to understand the lifestyle habits of overweight or obese adolescents that keep them in this classification and what factors help them to reverse this situation.[22] According to this study, the barriers to healthy eating were the ease with which fast foods and snacks were purchased, lower consumption of fruit and vegetables, skipping meals and sedentary behavior. This context can be reversed with school policies aimed at increasing the supply of fruit and preventing

the sale of UPF in schools, as well as encouraging physical activity through recreational programs.[18]

The family environment also has a major influence on adolescents' dietary characteristics. One study used a 24-hour food recall to analyze the caloric intake of UPF and found that consumption of these foods was higher among adolescents who did not eat breakfast regularly ($p < 0.001$) and among those who ate in front of screens ($p < 0.001$).[16] Another study, using PeNSE data, reinforced these findings by concluding that adolescents who eat meals with their parents are more likely to have a healthy diet ($p < 0.001$), as they are more likely to eat beans and less likely to eat sweets, fried snacks and soft drinks.[23]

According to the NOVA classification, PSA are not nutritionally balanced and therefore affect health in such a way that they do not supply the necessary amount of macro and micronutrients for human beings. Research has shown that a diet rich in UPF promotes inadequate selenium intake ($p < 0.01$) and may be linked to low intake of vitamin D, calcium and phosphorus, with implications for bone health.[24]

In addition to interfering with the nutritional quality of the food, UPF is also associated with CNCDs such as hypertension, diabetes, obesity, cancer and others. We identified an association between UPF consumption and lipid parameters in adolescents. Higher consumption of these foods was negatively associated with HDL-c levels and positively associated with triglyceride levels and dyslipidemia, which creates a risk factor in adolescents for diseases such as obesity, atherosclerosis and even stroke[10],[25].

The high consumption of UPF is also associated with emotional eating, that is, the consumption of food as a result of some psychological factor, especially anxiety, establishing a direct connection with the psychological illness of the generation and the unbridled consumption of UPF.[26] One study investigated the relationship between dissatisfaction with body image and adolescents' eating patterns, concluding that those who were dissatisfied with their images were less likely to eat healthily, following a diet that they characterized as "restrictive".[15] This shows that, concomitantly, the psychological factor has an influence on eating, just as eating can worsen the adolescent's emotional state.

The association between level of education and consumption of UPF foods was identified and it was found that adolescents whose parents had a low level of education tended to consume more of this category of food. On the other hand, adolescents whose parents had a higher level of schooling had a healthy eating pattern. This finding establishes a direct relationship, within the Brazilian context, between UPF consumption and socioeconomic classes, which are strongly influenced by the level of education in the country. This evidence reinforces the statistics presented in studies that establish a direct association between the prevalence of overweight and UPF consumption, especially among less privileged socioeconomic groups, identified as belonging to the lower and lower-middle classes.[27-28]

Increased consumption of UPF among adolescents is associated with a range of health problems, including obesity, cardiovascular disease, type 2 diabetes and metabolic disorders. Understanding the prevalence of this eating pattern in adolescence is essential to inform health policies and targeted interventions aimed at promoting healthier food choices and preventing chronic diseases in the future.[29] These studies can provide valuable insights into the social, economic and cultural determinants that influence adolescent eating patterns, thus contributing to the development of more effective health promotion strategies at this stage of life.

Evidence shows that encouraging physical activity in schools has a positive effect on diet, because the longer the sedentary behavior, the higher the prevalence of UPF consumption.[30] The implementation of simple activities such as lectures and dynamic games has been shown to influence diet. One study showed that after activities on food classification and label reading, adolescents increased their consumption of vegetables ($p=0.0007$) and decreased their consumption of soft drinks (0.012).[29] The implementation of measures and actions aimed at changing the habits of adolescents, encouraging the consumption of minimally processed and in natura foods, as well as regular physical activity, is essential to promote a healthy life in this age group. Operations aimed at increasing the facilitators for lower UPF consumption among adolescents, such as a ban on sales in schools, tax incentives for businesses near schools that sell healthy foods and meals, among others, are also necessary to ensure a healthy future for the adolescent population.[22]

Among the limitations of this review was the impossibility of defining the preponderant factors and longitudinal characteristics of chronic non-communicable diseases, making it difficult to obtain more precise results. It is suggested that further studies be carried out on the subject of UPF consumption among adolescents in Brazil, in order to identify other factors associated with this condition.

FINAL CONSIDERATIONS

High consumption of UPF can be associated with various social, emotional and demographic aspects. Although these characteristics have distinct individual impacts, they tend to interact in a complex and interrelated way.

The quality of food during adolescence is a public health problem that directly influences the growth and physical development of young people.

A school intervention, backed by the support of family members and public authorities, is essential to promote a healthier diet among adolescents, prioritizing fresh and minimally processed foods over UPF. In addition, such interventions have the potential to reduce other risk factors, such as sedentary lifestyles and overweight/obesity in this age group.

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