

Consumption of ultra-processed foods and metabolic syndrome in adolescents: a systematic review protocol

Consumo de alimentos ultraprocessados e síndrome metabólica em adolescentes: um protocolo de revisão sistemática

Consumo de alimentos ultraprocesados y síndrome metabólico en adolescentes: un protocolo de revisión sistemática

Received: 04/10/2022 | Revised: 05/17/2022 | Accepted: 11/25/2022 | Published: 12/03/2022

Luiz Eduardo Rodrigues Lima

ORCID: <https://orcid.org/0000-0002-1356-6957>
Universidade Federal do Amazonas, Brazil
E-mail: eduardorlima@ufam.edu.br

Camila Ferreira Leonel

ORCID: <https://orcid.org/0000-0002-0535-4743>
Universidade Federal do Amazonas, Brazil
E-mail: camilanutri.cf@gmail.com

Bruno Mori

ORCID: <https://orcid.org/0000-0003-0903-2132>
Universidade Federal do Amazonas, Brazil
E-mail: bruno.mori@hotmail.com

Regismeire Viana Lima

ORCID: <https://orcid.org/0000-0001-7931-7876>
Universidade Federal do Amazonas, Brazil
E-mail: meirevi@hotmail.com

Celsa Moura Souza

ORCID: <https://orcid.org/0000-0002-1669-1462>
Universidade Federal do Amazonas, Brazil
E-mail: celsa22@hotmail.com

Erika Barbosa Camargo

ORCID: <https://orcid.org/0000-0003-1482-8282>
Fundação Oswaldo Cruz, Brazil
E-mail: erikabarbosacamargoo@gmail.com

Mateus Rossato

ORCID: <https://orcid.org/0000-0002-4132-9860>
Universidade Federal do Amazonas, Brazil
E-mail: rossato.mateus@gmail.com

Abstract

Objective: This protocol will describe the methods of a systematic review that examined studies on the relationship between consumption of ultra-processed foods and metabolic syndrome in adolescents. *Methods:* The searches will be carried out in the *MEDLINE* (via *PubMed*), *EMBASE* (via *ScienceDirect*), *LILACS* (via *VHL*), and *Cochrane databases* until March 2022. Observational (cohort, case-control and cross-sectional) and experimental (clinical trials) studies will be included, two researchers' independents will use the *Rayyan QCRI software* for retrieval of the articles, in addition, the *Mendeley software Reference Manager* will be used for reference management. After reading them in full, the articles will be selected according to the eligibility criteria. *Results:* The synthesis of evidence data will be approached from the relationship of consumption of ultra-processed foods and metabolic syndrome in adolescents. *Conclusion:* Therefore, the importance of this review protocol is highlighted to compose the current evidence on the relationship between consumption of ultra-processed foods and the metabolic syndrome.

Keywords: Adolescent; Processed foods; Metabolic syndrome.

Resumo

Objetivo: Este protocolo descreverá os métodos de uma revisão sistemática que examinaram estudos sobre a relação entre o consumo de alimentos ultraprocessados e síndrome metabólica em adolescentes. *Métodos:* As buscas serão realizadas nas bases de dados *MEDLINE* (via *PubMed*), *EMBASE* (via *ScienceDirect*), *LILACS* (via *BVS*), e *Cochrane* até março de 2022. Serão incluídos estudos observacionais (coorte, caso-controle e transversais) e experimentais (ensaios clínicos), dois pesquisadores independentes usarão o *software Rayyan QCRI* para recuperação

dos artigos, além disso, o *software Mendeley Reference Manager* será usado para o gerenciamento de referência. Após a leitura na íntegra, os artigos serão selecionados de acordo com os critérios de elegibilidade. *Resultados*: A síntese dos dados das evidências será abordada a partir da relação do consumo de alimentos ultraprocessados e síndrome metabólica em adolescentes. *Conclusão*: Por conseguinte, realça-se a importância deste protocolo de revisão para compor as evidências atuais sobre a relação entre consumo de alimentos ultraprocessados e a síndrome metabólica.

Palavras-chave: Adolescentes; Alimentos industrializados; Síndrome metabólica.

Resumen

Objetivo: Este protocolo describirá los métodos de una revisión sistemática que examinó estudios sobre la relación entre el consumo de alimentos ultraprocesados y el síndrome metabólico en adolescentes. *Métodos*: Se realizarán búsquedas en MEDLINE (vía PubMed), EMBASE (vía ScienceDirect), LILACS (vía BVS) y bases de datos Cochrane hasta marzo de 2022. Se incluirán estudios observacionales (cohorte, caso-control y transversales) y experimentales (ensayos clínicos), dos investigadores independientes utilizarán el software Rayyan QCRI para la recuperación de artículos, además, se utilizará el software Mendeley Reference Manager para la gestión de referencias. Después de leerlos en su totalidad, los artículos serán seleccionados de acuerdo con los criterios de elegibilidad. *Resultados*: Se abordará la síntesis de datos de evidencia a partir de la relación del consumo de alimentos ultraprocesados y el síndrome metabólico en adolescentes. *Conclusión*: Por lo tanto, se destaca la importancia de este protocolo de revisión para componer la evidencia actual sobre la relación entre el consumo de alimentos ultraprocesados y el síndrome metabólico.

Palabras clave: Adolescente; Alimentos industrializados; Síndrome metabólico.

1. Introduction

Metabolic syndrome (MS) is characterized by a set of metabolic disorders that include high levels of blood pressure, blood glucose, dyslipidemia and abdominal obesity and has been associated with increased risks of morbidity and mortality (O'Neill & O'Driscoll, 2015). It is estimated that around 20 to 25% of the global population has developed the metabolic syndrome (MS), and its prevalence continues to grow, especially in developing countries (O'Neill & O'Driscoll, 2015). In Brazil, data from 2013 (De Carvalho Vidigal et al., 2013) indicate a prevalence of MS in adults of approximately 29%, but we believe that these values are currently higher. Among adolescents aged between 15 and 17 years, according to data from the Study of Cardiovascular Risks in Adolescents (ERICA) in 2014 (Kuschnir et al., 2016), they indicated that the prevalence of MS was 2.6%. This prevalence showed a significant association between MS conditions and behavioral risk factors, physical inactivity and abdominal obesity.

Monteiro et al., (2018) (Monteiro, Moubarac, et al., 2018) reported that the dietary intake of ultra-processed foods (UPF) was classified from 10.2% to 50.7% of the total energy value and their consumption was positively correlated with the prevalence of obesity in adults. In Brazilian adolescents, UPF consumption was associated with MS and was a predictor factor related to an increase in total cholesterol and LDL cholesterol from preschool to school age (Rauber et al., 2015; Tavares et al., 2012).

This type of food has essentially industrial ingredients in its formulation, normally containing little or no complete food (Monteiro, Cannon, et al., 2018). UPAs are also characterized by the presence of fast-absorbing carbohydrates, with high lipid content and low in fiber (Damiani et al., 2011). These eating and nutritional behaviors have been identified as a fundamental factor both in the development and in the subsequent course of MS (Damiani et al., 2011; Grundy et al., 2005).

UPF consumption has grown significantly in recent decades and currently 75% of all world food sales are UPF (Alexander et al., 2011). These foods already account for more than half of the total dietary energy consumed in high-income countries such as the US, Canada and the UK and between 20-30% of total dietary energy in middle-income countries such as Brazil, Mexico, and Chile (Baraldi et al., 2018; Louzada et al., 2018; Marrón-Ponce et al., 2018; Monteiro et al., 2019; J. C.

Moubarac et al., 2017; Rauber et al., 2018). Despite this increase in consumption occurring at all social levels, the greatest trends occur especially in the lower social classes (Martins et al., 2013).

The health effects caused by UPAs still remain uncertain, especially in adolescents, since not enough epidemiological and intervention studies were carried out for this purpose (Juul; Hemmingsson, 2015). However, some evidence shows that UPF like sugary drinks are one of the main contributors to lipid alterations, weight gain, obesity and type 2 diabetes (Shin et al., 2018). In addition, trans fats present in UPF can negatively affect cardiovascular health; processed meats may be associated with an increased risk of mortality from cardiovascular diseases and cancer (Ambrosini et al., 2013).

In recent years, changes in the dietary profile have occurred in all age groups, especially among children and adolescents. However, despite some studies indicating a relationship between excess weight and metabolic alterations with high UPA intake (Moubarac et al., 2013) to the best of our knowledge, we did not find in the literature studies that had synthesized evidence on the relationship between alcohol consumption, AUP and MS in adolescents. In this sense, the objective of the study will be to describe the protocol methods that we will use for the development of a systematic review involving UPF consumption and MS in adolescents.

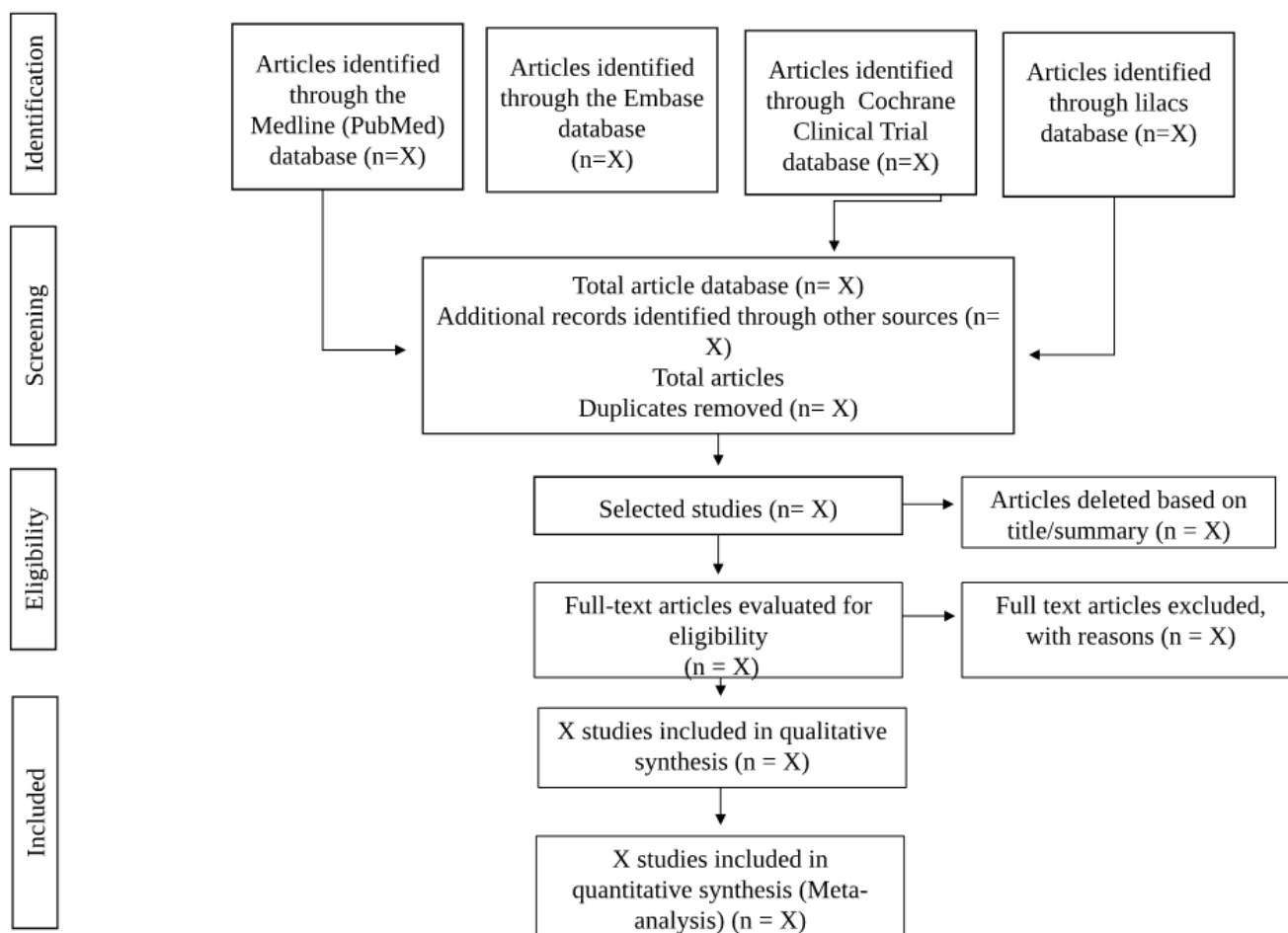
2. Methodology

This study is a protocol systematic review. The protocol was submitted to the International Prospective Register of Systematic Reviews (PROSPERO) registered under number CRD42021227770 (<http://www.crd.york.ac.uk/PROSPERO>). This systematic review protocol followed the guidelines indicated in Preferred Reported Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) (Moher et al., 2016). The systematic review will include studies that meet the following eligibility criteria based on the Population, Exposure, Control, Outcome (PECO acronym) design framework. The acronym PECO (Ministério da Saúde, 2014) was used to describe all components related to the problem identified and to structure the research question: “Adolescents with high consumption of UPF are more likely to develop MS than adolescents with low UPF consumption?”.

Observational (cohort, case-control and cross-sectional) and experimental (clinical trial) studies carried out in adolescents aged 10 to 18 years will be included, with no limits on ethnicity, gender and nationality and that address the consumption of AUP, without language or date restriction. of publication. For attribution of consumption of ultra-processed foods, studies will be selected with registered food items with a high degree of industrial processing, or that have more than 5 ingredients added to their formulation or articles that used a food classification system that considers industrial processing and different techniques of processing as a definition for ultra-processed foods.

The comparator group will include adolescents who have a low AUP consumption and who did not participate in any type of intervention or guidance during the period in which the study was developed. The primary outcome will include metabolic syndrome. Secondaries will include at least one of the components of the metabolic syndrome (abdominal obesity, dyslipidemia, hypertension, hyperglycemia, insulin resistance). The research development process will be carried out according to the PRISMA flowchart as presented in Figure 1.

Figure 1 - PRISM flow diagram.



Source: Authors.

The searches will be carried out in the MEDLINE (via PubMed), EMBASE (via ScienceDirect), LILACS (via VHL), and Cochrane databases. For searches, publications up to march 2022 will be considered. The descriptors will be combined with the medical subject headings (MeSH), (Emtree) and (DeCS): “The chosen descriptors will be identified by “quotes” and properly separated by the Boolean terms AND and OR. Combinations of free words and subject terms will be used for the search, which will not be limited by language. Likewise, cross-searching will be carried out across all databases to ensure that all relevant articles are identified.

A software (*Mendeley Reference Manager*) will be used for reference management and duplicate removal. Subsequently, the data will be imported into the *Rayyan software* (Ouzzani et al., 2016), so that the screening process can be carried out. The selection process will be presented as follows: After searching the databases, all references will be transferred to a single *Mendeley library* for subsequent removal of duplicates. A manual check of all references will be performed to ensure that all duplicates have been removed. Subsequently, all references will be transferred to *Rayyan Software QCRI 27* with the intention of allowing independent selection by two experienced reviewers (LL and CL), meeting all eligibility criteria to be included in the present study, reasons for excluding materials not selected will be logged. In case of doubts or disagreements between reviewers, the inclusion or exclusion of the study will be decided by discussion and a third researcher (RL) will help in the evaluation in cases of disagreement.

Data in these articles will be independently extracted by LL and CL and reviewed by RL. If data extraction from a selected study cannot be performed due to lack of information or information inadequately described in the full-text article, LL will contact the corresponding author of the publication via email to request the data.

The extracted data will include descriptive information about the study (authors, year of publication, study collection period, study design, country in which the study was carried out, number of participants, sex, age group), intervention/exposure (food consumed), instruments used to collect food consumption, Food Frequency Questionnaire (FFQ) and 24-hour recall (R24h), result information, information on secondary results.

The quality assessment of the articles included will be carried out by two reviewers (LL and CL), using the *Joana Briggs Institute tools* JBI Critical appraisal for clinical trials and for cohort, case-control and cross-sectional studies, in order to assess the risk of bias. The level of certainty of evidence for the relationship between AUP consumption and outcome will be conducted using the *Grading system of Recommendations Assessment, Development and Evaluation (GRADE)*. In case of divergence, the third reviewer (RL) will make the final decision.

RevMan software (v.5.3) will be used to calculate the relative risk (RR) in dichotomous data and the mean difference (MD) for variables with continuous data. The estimated value and 95% CI of each effect will be calculated. The magnitude of heterogeneity will be evaluated by the *Q test* and I^2 statistics with *RevMan 5.4*, which ranges from 0 to 100%. I^2 index percentages of approximately 25% ($I^2 \leq 25$), 50% ($25 < I^2 < 75$) and 75% ($I^2 \geq 75$) will be considered, respectively, low, medium and high heterogeneity. Random effects models can be used, depending on the number of studies selected and if the studies are significantly different ($I^2 > 50\%$). The *forest-plot type plot* will be used to summarize the estimates. Results that presented a significance level ≤ 0.05 will be considered statistically significant associations.

3. Results and Discussion

The synthesis of evidence data will be approached from the relationship of consumption of ultra-processed foods and metabolic syndrome in adolescents. Data will be presented in a narrative format using tables. This process will be carried out through consensus between two reviewers. Any discrepancies will be resolved using a third reviewer.

We understand that this systematic review protocol is the first that proposes to synthesize evidence on the relationship between UPF consumption and MS in adolescents. Diets with the highest UPA intake, therefore, with lower nutritional quality, are strongly associated with increased prevalence of cardiovascular diseases, dyslipidemia, obesity and metabolic syndrome in adults (Batal et al., 2018).

However, when the same situation is observed in adolescents, the same association has not been evidenced. According to research involving adolescents, there was no significant association between AUP (*fast foods* and snacks) with obesity and hypertension (Payab et al., 2015).

Previous studies have shown that higher UPA consumption is related to lower consumption of vitamins, proteins and fiber, as well as higher consumption of saturated fats, free sugars, carbohydrates, sodium and overall energy intake. The results of studies corroborate the literature indicating that UPF contribute negatively to the nutritional quality of the diet (Cornwell et al., 2018).

It is possible to affirm that the significant increase in the prevalence of obesity in adolescents has become irrefutable, pointing to the need for preventive measures, since this group is directly exposed to favorable environments and habits (Nascimento et al., 2020).

UPA intake is a marker of an unhealthy diet, however, experimental studies aimed at displacing energy foods by increasing vegetable and fruit consumption have not been successful and some studies have not confirmed that fruit intake

is an adequate intervention for prevention of obesity. These findings suggest that obesity is much more a problem of quantity than quality of food consumption (Bayer et al., 2014; Kaiser et al., 2014).

4. Partial Final Considerations

Note the importance of a survey on food consumption and metabolic parameters of adolescents and their associations with the increase in UPF intake. Thus, it is essential that more robustness in relation to the amount of evidence on this theme occur, a fact that highlights the importance of this review.

The review is expected to systematically map evidence available in the literature on the consumption of ultra-processed foods and the relationship with the metabolic syndrome in adolescents.

Acknowledgments

The authors thank the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES), POSGRAD/FAPEAM and Universidade Federal do Amazonas/UFAM.

References

- Alexander, E., Yach, D., & Mensah, G. A. (2011). Major multinational food and beverage companies and informal sector contributions to global food consumption: implications for nutrition policy. *Globalization and Health* 2011 7:1, 7(1), 1–8. <https://doi.org/10.1186/1744-8603-7-26>
- Ambrosini, G. L., Oddy, W. H., Huang, R. C., Mori, T. A., Beilin, L. J., & Jebb, S. A. (2013). Prospective associations between sugar-sweetened beverage intakes and cardiometabolic risk factors in adolescents. *The American Journal of Clinical Nutrition*, 98(2), 327. <https://doi.org/10.3945/AJCN.112.051383>
- Baraldi, L. G., Steele, E. M., Canella, D. S., & Monteiro, C. A. (2018). Consumption of ultra-processed foods and associated sociodemographic factors in the USA between 2007 and 2012: evidence from a nationally representative cross-sectional study. *BMJ Open*, 8(3), e020574. <https://doi.org/10.1136/BMJOPEN-2017-020574>
- Batal, M., Johnson-Down, L., Moubarac, J., Ing, A., Fediuk, K., Sadik, T., Tikhonov, C., Chan, L., & Willows, N. (2018). Quantifying associations of the dietary share of ultra-processed foods with overall diet quality in First Nations peoples in the Canadian provinces of British Columbia, Alberta, Manitoba and Ontario. *Public Health Nutrition*, 21(1), 103–113. <https://doi.org/10.1017/S1368980017001677>
- Bayer, O., Nehring, I., Bolte, G., & Von Kries, R. (2014). Fruit and vegetable consumption and BMI change in primary school-age children: a cohort study. *European Journal of Clinical Nutrition*, 68(2), 265–270. <https://doi.org/10.1038/EJCN.2013.139>
- Cornwell, B., Villamor, E., Mora-Plazas, M., Marin, C., Monteiro, C., & Baylin, A. (2018). Processed and ultra-processed foods are associated with lower-quality nutrient profiles in children from Colombia. *Public Health Nutrition*, 21(1), 142–147. <https://doi.org/10.1017/S1368980017000891>
- Damiani, D., Kuba, V. M., Cominato, L., Damiani, D., Dichtchekian, V., & Menezes Filho, H. C. de. (2011). Síndrome metabólica em crianças e adolescentes: dúvidas na terminologia, mas não nos riscos cardiometabólicos. *Arquivos Brasileiros de Endocrinologia & Metabologia*, 55(8), 576–582. <https://doi.org/10.1590/S0004-27302011000800011>
- De Carvalho Vidigal, F., Bressan, J., Babio, N., & Salas-Salvadó, J. (2013). Prevalence of metabolic syndrome in Brazilian adults: A systematic review. *BMC Public Health*, 13(1). <https://doi.org/10.1186/1471-2458-13-1198>
- Grundy, S. M., Cleeman, J. I., Daniels, S. R., Donato, K. A., Eckel, R. H., Franklin, B. A., Gordon, D. J., Krauss, R. M., Savage, P. J., Sidney C. Smith, J., Spertus, J. A., & Costa, F. (2005). Diagnosis and Management of the Metabolic Syndrome. *Circulation*, 112(17), 2735–2752. <https://doi.org/10.1161/CIRCULATIONAHA.105.169404>
- Juul, F., & Hemmingsson, E. (2015). Trends in consumption of ultra-processed foods and obesity in Sweden between 1960 and 2010. *Public Health Nutrition*, 18(17), 3096–3107. <https://doi.org/10.1017/S1368980015000506>
- Kaiser, K., Brown, A., Bohan Brown, M., Shikany, J., Mattes, R., & Allison, D. (2014). Increased fruit and vegetable intake has no discernible effect on weight loss: a systematic review and meta-analysis. *The American Journal of Clinical Nutrition*, 100(2), 567–576. <https://doi.org/10.3945/AJCN.114.090548>
- Kuschnir, M. C. C., Bloch, K. V., Szklo, M., Klein, C. H., Barufaldi, L. A., Abreu, G. de A., Schaan, B., Veiga, G. V. da, Silva, T. L. N. da, Vasconcellos, M. T. L. de, Moraes, A. J. P. de, Oliveira, A. M. A. de, Tavares, B. M., Oliveira, C. L. de, Cunha, C. de F., Giannini, D. T., Belfort, D. R., Santos, E. L., Leon, E. B. de, & Goldberg, T. B. L. (2016). ERICA: prevalência de síndrome metabólica em adolescentes brasileiros. *Revista de Saúde Pública*, 50, 1s-13s. <https://doi.org/10.1590/S01518-8787.2016050006701>
- Louzada, M. L. da C., Ricardo, C. Z., Steele, E. M., Levy, R. B., Cannon, G., & Monteiro, C. A. (2018). The share of ultra-processed foods determines the overall nutritional quality of diets in Brazil. *Public Health Nutrition*, 21(1), 94–102. <https://doi.org/10.1017/S1368980017001434>
- Marrón-Ponce, J. A., Sánchez-Pimienta, T. G., Louzada, M. L. da C., & Batis, C. (2018). Energy contribution of NOVA food groups and sociodemographic

determinants of ultra-processed food consumption in the Mexican population. *Public Health Nutrition*, 21(1), 87–93. <https://doi.org/10.1017/S1368980017002129>

Martins, A. P. B., Levy, R. B., Claro, R. M., Moubarac, J. C., & Monteiro, C. A. (2013). Participação crescente de produtos ultraprocessados na dieta brasileira (1987-2009). *Revista de Saúde Pública*, 47(4), 656–665. <https://doi.org/10.1590/S0034-8910.2013047004968>

Ministério da Saúde, B. (2014). *Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos. Departamento de Ciência e Tecnologia*. www.saude.gov.br

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A., Estarli, M., Barrera, E. S. A., Martínez-Rodríguez, R., Baladia, E., Agüero, S. D., Camacho, S., Buhning, K., Herrero-López, A., Gil-González, D. M., Altman, D. G., Booth, A., & Whitlock, E. (2016). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Revista Espanola de Nutricion Humana y Dietetica*, 20(2), 148–160. <https://doi.org/10.1186/2046-4053-4-1/TABLES/4>

Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J.-C., Louzada, M. L., Rauber, F., Khandpur, N., Cédriel, G., Neri, D., Martinez-Steele, E., Baraldi, L. G., & Jaime, P. C. (2019). Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*, 22(5), 936–941. <https://doi.org/10.1017/S1368980018003762>

Monteiro, C. A., Cannon, G., Moubarac, J.-C., Levy, R. B., Louzada, M. L. C., & Jaime, P. C. (2018). The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutrition*, 21(1), 5–17. <https://doi.org/10.1017/S1368980017000234>

Monteiro, C. A., Moubarac, J. C., Levy, R. B., Canella, D. S., Da Costa Louzada, M. L., & Cannon, G. (2018). Household availability of ultra-processed foods and obesity in nineteen European countries. *Public Health Nutrition*, 21(1), 18–26. <https://doi.org/10.1017/S1368980017001379>

Moubarac, J. C., Batal, M., Louzada, M. L., Martinez Steele, E., & Monteiro, C. A. (2017). Consumption of ultra-processed foods predicts diet quality in Canada. *Appetite*, 108, 512–520. <https://doi.org/10.1016/J.APPET.2016.11.006>

Moubarac, J., Martins, A., Claro, R., Levy, R., Cannon, G., & Monteiro, C. A. (2013). Consumption of ultra-processed foods and likely impact on human health. Evidence from Canada. *Public Health Nutrition*, 16(12), 2240–2248. <https://doi.org/10.1017/S1368980012005009>

Nascimento, F. J. do, Silva, D. R. F., Barbosa, H. C. B. C., Santos, V. F. dos, Martins, L. M., & Luz, D. C. R. P. (2020). Sobrepeso e obesidade em adolescentes escolares: uma revisão sistemática. *Saúde Coletiva (Barueri)*, 10(55), 2947–2958. <https://doi.org/10.36489/SAUDECOLETIVA.2020V10I55P2947-2958>

O'Neill, S., & O'Driscoll, L. (2015). Metabolic syndrome: A closer look at the growing epidemic and its associated pathologies. *Obesity Reviews*, 16(1), 1–12. <https://doi.org/10.1111/OBR.12229>

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan-a web and mobile app for systematic reviews. *Systematic Reviews*, 5(1), 1–10. <https://doi.org/10.1186/S13643-016-0384-4/FIGURES/6>

Payab, M., Kelishadi, R., Qorbani, M., Motlagh, M. E., Ranjbar, S. H., Ardalan, G., Zahedi, H., Chinian, M., Asayesh, H., Larijani, B., & Heshmat, R. (2015). Association of junk food consumption with high blood pressure and obesity in Iranian children and adolescents: the CASPIAN-IV Study. *Jornal de Pediatria*, 91(2), 196–205. <https://doi.org/10.1016/J.JPED.2014.07.006>

Rauber, F., Campagnolo, P. D. B., Hoffman, D. J., & Vitolo, M. R. (2015). Consumption of ultra-processed food products and its effects on children's lipid profiles: a longitudinal study. *Nutrition, Metabolism, and Cardiovascular Diseases : NMCD*, 25(1), 116–122. <https://doi.org/10.1016/J.NUMECD.2014.08.001>

Rauber, F., Louzada, M. L. D. C., Steele, E. M., Millett, C., Monteiro, C. A., & Levy, R. B. (2018). Ultra-Processed Food Consumption and Chronic Non-Communicable Diseases-Related Dietary Nutrient Profile in the UK (2008–2014). *Nutrients* 2018, Vol. 10, Page 587, 10(5), 587. <https://doi.org/10.3390/NU10050587>

Shin, S., Kim, S. A., Ha, J., & Lim, K. (2018). Sugar-Sweetened Beverage Consumption in Relation to Obesity and Metabolic Syndrome among Korean Adults: A Cross-Sectional Study from the 2012–2016 Korean National Health and Nutrition Examination Survey (KNHANES). *Nutrients*, 10(10). <https://doi.org/10.3390/NU10101467>

Tavares, L. F., Fonseca, S. C., Garcia Rosa, M. L., & Yokoo, E. M. (2012). Relationship between ultra-processed foods and metabolic syndrome in adolescents from a Brazilian Family Doctor Program. *Public Health Nutrition*, 15(1), 82–87. <https://doi.org/10.1017/S1368980011001571>