Ultra-Processed Food Availability

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1. Introduction

Over time, changes in the food environment lead to modifications in the population's health [1]. Broad changes in dietary and physical activity patterns, obesity trends and diet-related non-communicable diseases (NCDs) are part of the concept of nutritional transition, of which the fourth stage emphasizes the change from the consumption of processed to ultra-processed food (UPF) [2][3][4].

UPF are described as "processed ingredients typically combined with the sophisticated use of additives to make them edible, palatable and habit forming" [5][6][7]. Although this definition dates from 2010, before this, these foods were already referred to in the literature, either as an independent food group or as particular foods. Food processing often leads to increased nutrient bioavailability, either for beneficial (lycopene from tomato) or deleterious effect, such as the increase in the proportion of sugars [8][9]. Processed and UPF are generally less satiating than fresh foods [10][11].

Reference reports have stated that consumption of processed foods and drinks such as "fast food", "convenience foods", soft drinks, sugary drinks, processed meat and others is associated with obesity and several chronic non-communicable diseases [1][12]. The latest updates to dietary guidelines recommend a decrease in the frequency of UPF consumption. The updated Mediterranean Dietary Pyramid (MDP), which represents environmental sustainability, has processed meat and sweets on the top, suggesting that they should only be consumed occasionally [13][14][15].

The guidelines for the collection of information on food processing through food consumption surveys indicate that such information can be used for different purposes, including assessment of the relationship between food processing and obesity and NCDs and monitoring time trends in the consumption of processed foods [16]. The information sources for studying such relationships need to be based on dietary data, which may be evaluated either by using estimates based on direct or indirect assessment methods. Direct methods include 24-h recall, food frequency questionnaires and other individual-based dietary assessment. Individual-level assessments measure

food intake, while indirect methods refer to food supply or availability, usually estimated at national or household level [17]. For example, expenditures or acquisition lists, such as data derived from household budget surveys, can be an extremely important instruments to assist in long-time assessment of UPF availability [18][19]. The lack or scarcity of individual dietary surveys in many countries makes these indirect data the only tool available to assess food consumption and study time trends. Such a fact exposes the relevance of identifying whether the associations observed when using individual data are maintained when an ecological approach is used. Although there are several recent systematic reviews on UPF consumption and health outcomes [20][21][22][23][24][25][26], there are none that focus on the availability of UPF with health outcomes.

2. Discussion

Of the 11 articles, six evaluated availability through purchase and five through sales of UPF. These five studies used the Euromonitor Passport Global Market Information Database, which collects sales volume data, from many countries worldwide, from various sources including trade associations, industry bodies, company financial reports, and official government statistics [27][28][29][30][31]. The others six studies in this systematic review used purchase data from HBS [32][33][34][35][36][37]. To classify food according to the purpose and extent of processing, six studies [32][33][28][34][35][36] used NOVA [7], a system that was launched in 2010, and one used a classification developed at the International Food Policy Research Institute [37]. The other four specified the type of UPF studied, namely, soft drinks [27][29][31] and fast food [30].

Almost all studies in this systematic review showed a positive association or correlation between UPF availability and increase of BMI, overweight or obesity, only one showed no significant association between UPF availability and overweight. However, the only study that did not find a positive association used a biased sample [32]. Although the study defined the population as representative of a municipality, in fact, the population was from primary health care services that had access to health intervention programs [32].

Of the 11 selected studies, five studies explored the association of UPF availability with only BMI increase [28][30], overweight [32][33] or obesity [34]. The other six studies evaluated the association of UFP availability using both prevalence of overweight or obesity as separate outcomes in the same sample [27][29][35][36][31][37]. Three of them studied soft drink sales [27][29][31]. Basu et al. [31] showed that the soft drink consumption was strongly associated with overweight and obesity. Both Ferretti and Mariani [27] and Goryakin et al. [29] showed that the increased availability of UPF was similarly associated with the increased prevalence of overweight and obesity. Juul and Hemmingsson [35] evaluated overweight and obesity time trends separately, and concluded that the increasing trends followed the increase in UPF availability. However, due to the study methods used, the association between the outcome and exposure was not calculated. Canella et al. [36] and Asfaw [37] followed the findings of the other studies. Canella et al. [36] evaluated mean BMI, overweight and obesity, and found a positive association with increase in UPF availability. Asfaw [37] found that an increase in the share of highly processed foods (in the total food expenditure) significantly increases the likelihood of overweight and obesity.

Only two articles related the availability of UPF with other health outcomes, in this case diabetes, and did not find a significant association [29][31]. These two articles have only SSB as an exposure variable. These findings may reflect residual confounding. Basu et al. [31] described a limitation of their study as the fact that the soft drink consumption data did not include fruit drinks (fruits and vegetable juices), which have been independently related to the risk of diabetes, likely because of their high sugar content. Goryakin et al. [29] reported that their soft drink price models might suffer from potentially important unobserved confounding, because they assumed that soft drink sales/prices affect BMI and diabetes with only a one-year lag.

Four studies that used UPF availability data were excluded, as they did not evaluate health outcomes. Three studies used UPF availability data for forecast estimation [38][39][40], two studies analyzed dietary patterns [41][42] and one was a qualitative study [43]. Qualitative studies do not measure the relationship between UPF and health outcomes, but are useful to explore topics and suggest interventions [43].

All eligible studies were ecological. No specific quality assessment was found in the literature for this type of study. However, the Newcastle–Ottawa quality assessment scale adapted for cross-sectional studies was used. However, the lack a specific scale may lead to under or overestimation of final scores. Based on the Newcastle–Ottawa adapted scale, most studies showed positive results: all of them presented a representative sample, with a justified and satisfactory size. Nine studies reached the maximum score in regard to comparability, such as the control of confounding factors [32][27][28][34][29][36][30][31][37]. Only one study did not score on the statistical test [35]. Only two studies obtained a score in the description assessment of outcome [32][36]. Only one study obtained a maximum score for the ascertainment of exposure [32]. None of the studies presented a description of the non-respondents' characteristics.

Limitations and Strengths

The first limitation of this review was the variability of methods used to investigate food availability, either acquisitions/purchases or sales. This factor hindered evaluation of the data by means of meta-analysis. A second limitation was related to the fact that the selected articles were not uniform with each other regarding the exposure measure, for example, using different UPF classifications or only a specific UPF. Another limitation was that most of the studies analyzed only BMI and the prevalence of overweight and obesity. In addition, a possible publication bias might be expected, since only one of the studies showed no significant association with health outcomes.

The main strength of this review is its broad approach, including reference lists as well as grey literature, and not restricting language or publication date. In addition, the clear identification of inclusion and exclusion criteria and the presence of three reviewers reduced possible bias. Despite the fact that all the eligible studies were ecological, many of them used HBS food availability as the base of the exposure variable. Although national studies based on individual consumption show results with greater consistency, they are scarce and not comparable in many countries. On the other hand, HBS have a periodicity of data collection with similar methodology among countries and have been recognized as a highly cost-effective tool for monitoring food patterns [44][45]. Therefore, these data are an important source for studying associations between food consumption and health outcomes [20][38]. Results

from longitudinal studies produce more robust evidence [46][47], however, such studies are more long-lasting and expensive than ecological studies. In this systematic review, six authors performed temporal series studies either with HBS or sales data [28][34][29][35][30][31]. This study design allows assessment of the changes that occur over several periods unlike a single cross-sectional study. This research shows that the results for the availability of UPF associated with overweight and obesity follow the same trend as cross-sectional and longitudinal studies that use individual dietary data [48][49].

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