Public Health Nutrition: 21(1), 247–252 doi:10.1017/S1368980017001392

Commentary

Ultra-processed foods and the limits of product reformulation

Gyorgy Scrinis[1,*] and Carlos Augusto Monteiro[2]
[1]Faculty of Veterinary and Agricultural Sciences, University of Melbourne, Building 142, Parkville, Melbourne, VIC 3010, Australia: [2]Department of Nutrition, School of Public Health, University of São Paulo, São Paulo, Brazil

Submitted 31 October 2016: Final revision received 2 May 2017: Accepted 25 May 2017: First published online 13 July 2017

Abstract
The nutritional reformulation of processed food and beverage products has been promoted as an important means of addressing the nutritional imbalances in contemporary dietary patterns. The focus of most reformulation policies is the reduction in quantities of nutrients-to-limit – Na, free sugars, SFA, *trans*-fatty acids and total energy. The present commentary examines the limitations of what we refer to as 'nutrients-to-limit reformulation' policies and practices, particularly when applied to ultra-processed foods and drink products. Beyond these nutrients-to-limit, there are a range of other potentially harmful processed and industrially produced ingredients used in the production of ultra-processed products that are not usually removed during reformulation. The sources of nutrients-to-limit in these products may be replaced with other highly processed ingredients and additives, rather than with whole or minimally processed foods. Reformulation policies may also legitimise current levels of consumption of ultra-processed products in high-income countries and increased levels of consumption in emerging markets in the global South.

Keywords
Food processing
Ultra-processed foods
Product reformulation
Nutrition policy

Product reformulation commonly refers to policies and practices aimed at reducing the quantities of a set of 'negative nutrients' – or so-called 'nutrients-to-limit' – in packaged or fast-food products: Na, free sugars, SFA, *trans*-fatty acids and total energy.

Reformulation has been promoted by many nutrition experts, governments, international agencies and food corporations as an important means of addressing the nutritional imbalances in contemporary dietary patterns[1–4]. In many countries, there are now a range of industry- and government-led initiatives to systematically reformulate packaged and fast foods, as well as to inform new product development[2,5]. While still in its early phases, this systematic and often 'quiet' (i.e. without labelling) reformulation across entire product categories and company portfolios can be contrasted with the more selective reformulation of products that food companies have introduced since the 1970s, such as prominently marketed 'low-fat' and 'low-calorie' foods and beverages that function as optional choices for consumers[6].

Some governments are beginning to develop their own mandatory standards and limits for some nutrients, such as *trans*-fatty acids and Na[7]. However, most government policies to date have taken the form of voluntary and indirect measures to encourage food corporations to reformulate their products through the use of labelling, taxes, advertising restrictions and voluntary public–private partnerships[8]. Most transnational food manufacturing and service corporations have also developed their own company-specific policies and set their own nutrient standards that they are progressively applying to their product portfolios[9,10].

The success or otherwise of these public and private reformulation policies is usually evaluated in terms of reductions in the quantities of these nutrients-to-limit within particular food products. Common criticisms of these policies from public health experts relate to the voluntary and inadequate targets and timelines for reformulation that have been set, the slow and uneven progress, and the lack of accountability of food corporations[11–13]. Some of these criticisms are based on the assumption that nutrients-to-limit reformulation is a worthwhile and important goal, but that there are limitations in its implementation[3,12,14,15]. Common proposals are for higher and mandatory independent standards to be adopted by industry or to be legislated by governments[16].

*Corresponding author: Email gyorgys@unimelb.edu.au

Beyond some of these commonly identified inadequacies of existing industry and government reformulation policies and practices, the present commentary examines some of the inherent limitations – and potential risks – of nutrients-to-limit reformulation policies, particularly when applied to the reformulation of *ultra-processed products*. These products are the main driver of the excessive intake of nutrients-to-limit in many people's diets around the world[17]. First, we define ultra-processed products and consider the function and potential health impacts of the range of processed ingredients used in their production. Second, we consider the limitations of focusing only on a narrow range of nutrients-to-limit and the potential for the 'mal-substitution' of ingredients to achieve this reformulation. Third, we argue that reformulation policies may be used to provide scientific and political legitimacy for the continued and growing consumption of ultra-processed foods. Finally, we explore alternatives approaches to reformulation, including those involving the reduction in consumption of ultra-processed foods and the more substantial and comprehensive reformulation of these products.

For this analysis, we introduce a classification of types of reformulation practices. As the primary aim of these reformulation policies is to limit the set of negative nutrients or nutrients-to-limit, we refer to this form of reformulation as *nutrients-to-limit reformulation*. We could equally refer to this form of reformulation as *negative-nutrient reformulation,* or as *harm-reduction reformulation,* since the aim is largely to reduce the harmfulness of food products containing these negative nutrients, rather than to make them more nutritious or healthful. Nutrients-to-limit reformulation can be contrasted with two forms of more positive reformulation that are mentioned below. The first is *positive-nutrient reformulation*, which involves the addition of 'positive' nutrients – or so-called 'nutrients-to-encourage' – that are considered by many nutrition experts to be beneficial. The second is *wholefood reformulation,* which is focused on foods and ingredients rather than nutrients, and that involves the replacement of highly processed with minimally and unprocessed foods and ingredients.

The nutritional qualities and characteristics of ultra-processed foods

The focus on Na, free sugars, SFA, *trans*-fatty acids and energy within product reformulation initiatives is commonly justified on the basis that these are key nutrients of concern identified within national dietary guidelines and supported by broad scientific consensus[18]. There is a reasonable body of scientific evidence and expert consensus linking diets with excessive content of Na, free sugars (particularly in the form of sugar-sweetened beverages) or with *trans*-fatty acids and excess energy intake to particular detrimental health outcomes[19–22]. The focus on SFA is, arguably, somewhat more problematic because the scientific evidence supporting reduced intake of SFA *per se* is increasingly being challenged by some nutrition experts[23–25].

The target of most reformulation policies is ultra-processed products. However, it is important to acknowledge the exclusive nutrient focus of these reformulation policies and scientific discourses[26]. Free sugars, Na, SFA and *trans*-fatty acids are added to many packaged and fast-food products mostly as parts of ingredients, such as sugarcane, sugarbeet, high-fructose corn syrup, fruit concentrates, table salt and other types of salt, and refined or hydrogenated plant oils. These ingredients are themselves the products of particular food processing techniques, including the processes of extraction, concentration, enzyme treatment, chemical synthesis, refinement and hydrogenation. Yet the sources of the nutrients-to-limit in packaged and fast-food products and the level of processing used in their production are typically not considered within these product reformulation policies.

The focus on nutrients-to-limit within reformulation policies is an extension of the way nutrients and nutrient profiling remain the primary lens of analysis within nutrition science. This nutri-centric approach has been a feature of the dominant paradigm of 'nutritionism' within nutrition science – a paradigm characterised by a reductive focus on, and reductive interpretation of, nutrients[27]. Yet this nutrient focus has tended to obscure and hinder research into the health impacts of food processing and processed food products. It is only in recent years that there have been attempts to bring food processing to the centre of the understanding of food quality and as the basis for conducting nutrition science research[28,29]. This involves consideration of the levels and types of processing that foods and their constituent ingredients have been subjected to[27,28,30,31].

The NOVA system for classifying levels of processing developed by Monteiro and colleagues has become increasingly studied and adopted in public health nutrition research and policy analysis[17]. The NOVA classification distinguishes four groups of foods according to the nature, extent and purpose of the industrial processing they undergo: *minimally processed foods*, *processed culinary ingredients*, *processed foods* and *ultra-processed foods*[32]. The most highly processed products in the NOVA system are ultra-processed foods[17]. NOVA defines ultra-processed foods as industrial food and drink formulations mostly or entirely made from processed culinary ingredients, such as sugar, oils and salt, and other substances derived from foods but not normally used in kitchens, such as protein isolates, modified starches and hydrogenated fats. Also common in ultra-processed foods are additives used to imitate the sensory qualities of natural foods or to disguise undesirable qualities of the final product, such as colorants, flavourings, artificial sweeteners and emulsifiers. The nature of the ingredients, the various processing techniques and

the sequences of stages used by the industry to manufacture ultra-processed foods (hence 'ultra-processed') are designed to create durable, accessible, convenient, hyper-palatable, highly profitable ready-to-eat, ready-to-drink or ready-to-heat products liable to displace all other NOVA food groups and the dishes and meals made with them[17]. Longitudinal and cross-sectional studies in several countries have found a positive association between ultra-processed food consumption and obesity, hypertension, metabolic syndrome and dyslipidaemia[33–39]. These types of highly processed foods have also been referred to by Scrinis as 'processed-reconstituted foods', which are similarly defined as products that contain little whole or minimally processed ingredients, and instead are largely constructed – from the ground up – out of refined, extracted, concentrated, deconstituted and chemically transformed components of whole foods[27].

The concept of ultra-processed foods does not just focus attention on the high levels of sugar, fat and salt in packaged and fast foods, but also on the lack of intact foods and the range of processed ingredients and food processing techniques used in their production. Some forms of processing strip wholefoods of some of their nutritious components[40]. In some cases, there is evidence of potentially detrimental health effects related to these ingredients, beyond that of salt, sugar, saturated and *trans* fats. For example, there is evidence linking highly refined flours and starches to increased glycaemic load and detrimental impacts on blood cholesterol levels[23,41]; and experimental evidence indicates that dietary emulsifiers, a common additive of ultra-processed foods, may impact the gut microbiota promoting colitis and metabolic syndrome[42]. Aside from any intrinsic harmful effects, these ingredients may also play a role in creating products that are hyper-palatable, rapidly consumable, cheap, durable and possibly addictive[43,44]. For example, salt, sugars and other processed sweeteners and flavourings are used in large quantities by packaged and fast-food producers to give flavour to foods that have had their intrinsic flavours processed out of them and to mask any unpleasant flavours in the final product.

Reformulation and the mal-substitution of ingredients

In considering the effectiveness of nutrients-to-limit reformulation policies, it is important to identify and to distinguish between the types of foods that are the target of these initiatives. In the case of the NOVA category of processed foods – whose ingredients are restricted to minimally processed foods, salt, sugar, and non-modified oils and fats extracted from minimally processed foods – reducing the quantity of the nutrients-to-limit could substantially improve their nutritional quality. However, in the case of ultra-processed foods that are primarily constructed out of sources of nutrients-to-limit and other highly processed ingredients, the substantial reduction of nutrients-to-limit poses great technological and economic challenges for manufacturers and will not necessarily result in the production of nutritious products.

While the focus of reformulation strategies has been on reducing nutrients-to-limit, there has been relatively little attention given to the quality of the ingredients being substituted during reformulation. Nutrition and public health experts have certainly emphasised the need to avoid replacing one nutrient-to-limit with another nutrient-to-limit as when fats are replaced with sugar or sources of *trans*-fatty acids are replaced by sources of saturated fats[45]. There have been a number of studies that document the reductions of nutrients-to-limit achieved through reformulation programmes and also the overall nutrient profile of the reformulated products[10,46–48]. Yet there have not been systematic examinations of the changes in ingredients before and after nutrients-to-limit reformulation.

Manufacturers of ultra-processed products can be expected to replace the sources of nutrients-to-limit with ingredients that replicate their taste, texture, bulk and processing functionality, and without significantly adding to costs[49]. This often means substituting with other refined and reconstituted processed ingredients. These substitute ingredients may themselves be of minimal nutritional value and may even be harmful in large quantities. These substituted ingredients are also intended to perform a similar role to salt/sugar/fat in maintaining the hyper-palatability and cheap cost of food products, and to thereby maintain the high levels of consumption of the reformulated products. The overall health benefits resulting from this *mal-substitution* of ingredients – as we refer to it – are therefore questionable.

There are two well-documented historical examples of this mal-substitution of ingredients. The first is the increase in the intake of *trans*-fatty acids when partially hydrogenated vegetable oils were promoted as a substitute ingredient for saturated fats derived from animal fats, such as in the promotion of margarine over butter beginning in the 1960s[27]. The second is the replacement of fat with sugar in the manufacture of low-fat processed foods during the 1980s and 1990s when the low-fat dietary advice was dominant in the USA and other countries[50,51]. Other questionable substitutions currently being practised include: the substitution of sugar and reduction of energy using highly processed non-caloric sweeteners, most recently stevia-derived sweeteners; the reduction of fats and energy through the use of refined and chemically modified starches; and the replacement of *trans*-fat-rich, partially hydrogenated vegetable oils with vegetable oils that have been fully hydrogenated, fractionated and interesterified[27,52,53].

The legitimation of ultra-processed foods and dietary patterns

Another concern with current reformulation policies is that they may serve to legitimate, endorse and even promote – rather than significantly challenge – the consumption of ultra-processed foods[54]. One of the policy rationales for nutrients-to-limit reformulation is that it is a means of reducing the consumption of these nutrients without consumers having to change their food choices or dietary patterns. For example, in an article promoting reformulation in a food science and technology journal, reformulation is referred to as 'the unobtrusive strategy': 'It creates the prospect of nutritional improvement without dietary change'[55].

Reformulation policies effectively provide positive endorsement for the consumption of (reformulated) ultra-processed products, as long as these reformulated products have met the required single-nutrient goals. If nutrients-to-limit reformulation is promoted as a primary goal of nutrition policy, then it potentially undermines policies that aim to more substantially improve the quality of the food supply and that promote the increased consumption of minimally processed foods. Reformulated products that have met the minimum standards for salt or fat or sugar may even be promoted as positively health-enhancing if they have also been fortified with supposedly beneficial or 'positive' nutrients and food components, such as vitamins, fibre or *n*-3 fatty acids – that is, if nutrients-to-limit reformulation is accompanied by positive-nutrient reformulation[54].

In examining the implications of these reformulation policies, it is important to distinguish between countries and classes of people whose diets may already be high in ultra-processed foods, on the one hand, and those still in the transition towards highly processed diets, on the other. In the largely saturated processed food markets in the global North, if these reformulation policies are systematically applied then we could expect to see modest population-wide reductions in some of these nutrients-to-limit. In the UK, for example, where voluntary salt reduction strategies have been in place since 2003, studies suggest that these policies have coincided with a modest reduction of salt intake[56]. However, it is a different story in emerging markets in the global South, where the distribution and consumption of ultra-processed foods continue to grow rapidly, resulting in the displacement of traditional, freshly prepared and minimally processed meals[57–59]. In many low- and middle-income countries currently recording double-digit annual growth in packaged food consumption, any reductions in nutrients-to-limit within individual products are likely to be cancelled out by an overall increase in the consumption of ultra-processed food and drink products.

Reformulation policies can not only create political legitimation for ultra-processed products, but also for the food manufacturing and service corporations that produce them. By actively promoting their own reformulation policies, or complying with government standards for reformulation, food corporations will be able to demonstrate their corporate responsibility commitments and present themselves as part of the solution to obesity and diet-related non-communicable diseases[26,60]. Food corporations may thereby maintain their access to emerging markets in the South and their social licence to operate and expand within them. Their compliance with any government-endorsed nutritional standards may also protect corporations from the threat of future litigation. Beyond the defensive strategy of reformulating their products to reduce nutrients-to-limit, food corporations are also fortifying and 'functionalizing' these same products, and marketing them as addressing micronutrient deficiencies and providing targeted health benefits[26].

Beyond nutrients-to-limit reformulation

An alternative to the substitution of nutrients-to-limit with other processed-refined-reconstituted ingredients is to replace the source of these nutrients with intact or minimally processed ingredients, a practice we refer to as *wholefoods reformulation*. Such more comprehensive reformulation is already being selectively carried out by some food companies, and is evident in the increased availability of premium packaged foods and fast-food/restaurant meals. These may take the form of new product innovations, rather than the reformulation of old products. It is also evident in the trend towards 'clean labelling', whereby manufacturers seek to avoid adding some artificial flavours or preservatives to their products, as well as adding some whole grains to their products[61]. These trends towards minimally processed ingredients point to the maturing of the packaged and fast-food industries in some markets and the growing consumer demand for better-quality foods. However, convenience premium products often cost more and therefore may not be as affordable to those on low incomes who already consume the poorest-quality diets[62].

The aim of the present commentary has not been to deny the importance of reducing levels of some of the nutrients-to-limit in the food supply, but to identify some of the limitations of a narrow focus on nutrients-to-limit. Even within the terms of nutrients-to-limit reformulation, setting higher nutrient standards can serve to weed out many ultra-processed products. This is the case with the new Chilean food labelling and advertising standards, which have resulted in many ultra-processed products receiving black symbols (up to four) that warn consumers of the high content in sugar, salt, saturated fat and energy[63,64]. Importantly, any products carrying at least one black symbol cannot be advertised to children nor sold in schools in Chile.

If there is a genuine concern with reducing the consumption of nutrients-to-limit, then strategies that aim to restrict and reduce the production and consumption of ultra-processed products ultimately need to be considered. There are consumption trends and political movements heading in this direction, and that are in some cases supported by government policies. For example, the national dietary guidelines in Brazil and Uruguay now explicitly refer to the category of ultra-processed foods and advise the population not to replace minimally processed foods and their culinary preparations with ultra-processed food and drink products[65,66]. Policies restricting or banning the sale of ultra-processed products – such as sugar-sweetened beverages and confectionery – in schools and other institutional or commercial settings have been implemented in several countries, and are a more direct way of reducing their consumption[67].

As governments begin to demonstrate a greater determination and resolve to address the problem of poor-quality foods and diets, there may be more scope and political will to push beyond the narrow focus of nutrients-to-limit reformulation.

Acknowledgements

Financial support: This work was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP; grant number 2015/14900-9). FAPESP had no role in the design, analysis or writing of this article. *Conflict of interest:* The authors declare that there are no conflicts of interest. *Authorship:* Both authors participated in the conception and drafting of the commentary. *Ethics of human subject participation:* Not applicable.

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