

Review

Ultra-processed products are becoming dominant in the global food system

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Summary

The relationship between the global food system and the worldwide rapid increase of obesity and related diseases is not yet well understood. A reason is that the full impact of industrialized food processing on dietary patterns, including the environments of eating and drinking, remains overlooked and underestimated. Many forms of food processing are beneficial. But what is identified and defined here as ultra-processing, a type of process that has become increasingly dominant, at first in high-income countries, and now in middle-income countries, creates attractive, hyper-palatable, cheap, ready-to-consume food products that are characteristically energy-dense, fatty, sugary or salty and generally obesogenic. In this study, the scale of change in purchase and sales of ultra-processed products is examined and the context and implications are discussed. Data come from 79 high- and middle-income countries, with special attention to Canada and Brazil. Results show that ultra-processed products dominate the food supplies of high-income countries, and that their consumption is now rapidly increasing in middle-income countries. It is proposed here that the main driving force now shaping the global food system is transnational food manufacturing, retailing and fast food service corporations whose businesses are based on very profitable, heavily promoted ultra-processed products, many in snack form.

Keywords: Big Food, global food system, ultra-processed products.

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Introduction

This paper examines trends in the purchase and sales of a specific type of processed food product in high- and middle-income countries, with special attention to Canada and Brazil. The determinants of these trends and their impact on the quality of diets and on health are discussed, along with policy implications.

Background

Food processing in any general sense is not a public health issue. Ever since the use of fire, air and salt to prepare and cook food, and the development of methods of preserva-

tion such as smoking and fermentation, food has been processed in various ways. The processing of food has enabled the evolution, adaptation and increase of human-kind and of settled populations (1–3). However, the nature, extent and purpose of food processing has been revolutionized as an intrinsic part of industrialization (4,5). Mechanization as from the mid-19th century enabled increasingly effective and efficient formulation and mass manufacture, distribution and sale of – as examples – bread, biscuits, cakes, pies, sauces and meat products. This was accompanied by steady declines in food insecurity and nutrient deficiencies, which then were the main food-related public health problems globally, including within industrialized countries, even up to the early 20th century (6). Later in the

century, ample supplies notably of increasingly cheap fatty or sugary foods and animal food products were followed by rapid increases in cardiovascular disease, at first in high-income countries, and then globally (7,8).

A more recent revolutionary development in the use of food processing can be dated as from the 1980s. Acceleration in food science techniques has enabled invention of a vast range of palatable products made from cheap ingredients and additives. Transnational food and drink manufacturing, distribution, retailing, fast food and allied enterprises whose profits derive from uniformly branded ready-to-consume products, have become colossal global corporations. These shifts have been accompanied by dramatic increases of obesity and related chronic noncommunicable diseases, most notably diabetes, at first in high- and middle-income countries (9), and now also in lower-income countries (10). Food supplies are now becoming part of a global food system increasingly dominated by ready-to-consume processed products (11–14).

Ultra-processing defined

Here and elsewhere (13–16), these products are identified as ‘ultra-processed’. They are ready-to-consume, are entirely or mostly made not from foods, but from industrial ingredients and additives, and are extremely profitable. They are defined and characterized as follows (14):

Ultra-processed products are made from processed substances extracted or refined from whole foods – e.g. oils, hydrogenated oils and fats, flours and starches, variants of sugar, and cheap parts or remnants of animal foods – with little or no whole foods. Products include burgers, frozen pasta, pizza and pasta dishes, nuggets and sticks, crisps, biscuits, confectionery, cereal bars, carbonated and other sugared drinks, and various snack products. Most are made, advertised, and sold by large or transnational corporations and are very durable, palatable, and ready to consume, which is an enormous commercial advantage over fresh and perishable whole or minimally processed foods . . . [They] are typically energy dense; have a high glycaemic load; are low in dietary fibre, micronutrients, and phytochemicals; and are high in unhealthy types of dietary fat, free sugars, and sodium.

When consumed in small amounts and with other healthy sources of calories, ultra-processed products are harmless; however, intense palatability (achieved by high content of fat, sugar, salt, and cosmetic and other additives), omnipresence, and sophisticated and aggressive marketing strategies (such as reduced price for super-size servings), all make modest consumption of ultra-processed products unlikely and displacement of fresh or minimally processed foods very likely. These factors also make ultra-processed products liable to harm endog-

enous satiety mechanisms and so promote energy overconsumption and thus obesity.

The aim of this study was to examine the scale of change in the household share of ultra-processed products for two countries (Canada between 1938 and 2001, and Brazil between 1987 and 2003) and to investigate changes in the annual per capita sales of selected ultra-processed products for 79 countries between 1998 and 2012, grouped according to income level.

Methods

Time trends in the household share of ultra-processed products in Canada and in Brazil are estimated from household food expenditure surveys. In Canada, surveys were conducted by Statistics Canada in 1938–1939 ($n = 1,569$), 1953 ($n = 4,437$), 1969 ($n = 10,022$), 1984 ($n = 5,542$) and 2001 ($n = 5,643$). In Brazil, surveys were conducted by the Brazilian Institute of Geography and Statistics in 1987–1988 ($n = 13,611$), 1995–1996 ($n = 16,014$) and 2002–2003 ($n = 13,848$). Detailed information on the methodology of these surveys is available elsewhere (17,18).

All food purchases were converted into their dietary energy content (kcal day^{-1}) using Canadian (19) or Brazilian (20) food composition tables. The share of ultra-processed products was expressed as a percentage of total household energy availability.

Worldwide recent changes in sales of ultra-processed products in countries classified according to level of income, were estimated using the Euromonitor Passport Global Market Information Database (21) and the World Bank income classification (22).

The Euromonitor database covers 33 high-income countries (97.8% of the total population in this income class in 2012), 29 upper-middle-income countries (90.5%), 17 lower-middle-income countries (93.9%) and 1 low-income country (data not included here). For the list of countries, see Table 1.

Some food groups in the Euromonitor database used in this study aggregate ultra-processed with non-ultra-processed products, so analyses are restricted to three groups of ultra-processed products. These are frozen products, snacks (which include sweet and savoury snacks, confectionery, and ice cream) and soft drinks. Table 2 lists the items included in each of these three groups.

Annual sales between 1998 and 2012 of each of the groups were plotted for high-income, upper-middle-income and lower-middle-income countries. The total populations of the countries were used to weight estimates of income aggregates of countries. The absolute and relative mean annual rates of growth of each group were calculated for each income class, and for high-income Canada and

Table 1 Income classes and countries included in this study*

Income classes	Annual GNI per head (\$US)	Countries
Lower-middle	1,036–4,085	Belarus, Bolivia, Bosnia-Herzegovina, Cameroon, China, Egypt, Georgia, Guatemala, India, Indonesia, Morocco, Nigeria, Pakistan, Philippines, Ukraine, Uzbekistan, Vietnam
Upper-middle	4,086–12,615	Algeria, Argentina, Azerbaijan, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Hungary, Iran, Kazakhstan, Latvia, Lithuania, Macedonia, Malaysia, Mexico, Peru, Poland, Romania, Russia, Serbia, South Africa, Thailand, Tunisia, Turkey, Uruguay, Venezuela.
High	12,616 or more	Australia, Austria, Belgium, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Saudi Arabia, Singapore, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, United Arab Emirates, UK, USA

*Economies are divided according to 2012 gross national income (GNI) per capita, calculated using the World Bank Atlas method (<http://data.worldbank.org/about/country-classifications>). Countries that shifted income class between 1998 and 2012 are classified where they spend the most time during the period.

Table 2 The three types of ultra-processed product analysed in this study*

Frozen products	Snacks	Soft drinks
Includes: Frozen processed products (Bakery products; potatoes; desserts; meat, poultry, fish, seafood, meat substitutes, red meat, processed poultry, processed fish/sea food, meat substitutes; dishes such as pizza, ready meals, others).	Includes: Sweet and savoury snacks (Chips/crisps, corn chips, pretzels, sweet snacks, salted nuts. Confectionery (Chocolates, sweets, gums, pastilles, jellies) Ice creams (Also frozen yoghurt)	Includes: Carbonates (Carbonated drinks) Fruit and vegetable juices (Sweetened juices, nectars, fruit drinks, fruit-flavoured drinks) Ready-to-drink tea or coffee Sports and energy drinks Asian speciality drinks

*Products as stated in Euromonitor Passport Global Market Information Database (21).

upper-middle-income Brazil. Finally, regression analyses using data from all the countries were run between the average growth of each of the three groups of ultra-processed products between 1998 and 2012, and gross national income (GNI) per capita in 2005.

Results

Purchases in Canada and Brazil

Time changes in dietary contribution of ultra-processed products, as estimated from repeated nationwide household food expenditure surveys conducted in Canada and Brazil, are presented in Fig. 1.

Ultra-processed products, expressed as a percentage of total purchased calories, have increased continuously. In Canada, the increase was from 24.4% in 1938 to 54.9% in 2001. In Brazil it was from 18.7% in 1987 to 26.1% in 2003. In the most recent surveys, the share of ultra-processed products is almost twice as high in Canada than in Brazil, but relative growth has been higher in Brazil (2.1% per year) than in Canada (1.3% per year).

Sales in high- and middle-income countries

Figures 2 and 3 show the rates of annual retail sales for three groups of ultra-processed products – as said earlier, frozen products, snacks and soft drinks – between 1998

and 2012. Sales rates are average quantities (kilograms or litres) sold per year per capita in high-income countries (Fig. 2) and in upper- and lower-middle-income countries (Fig. 3).

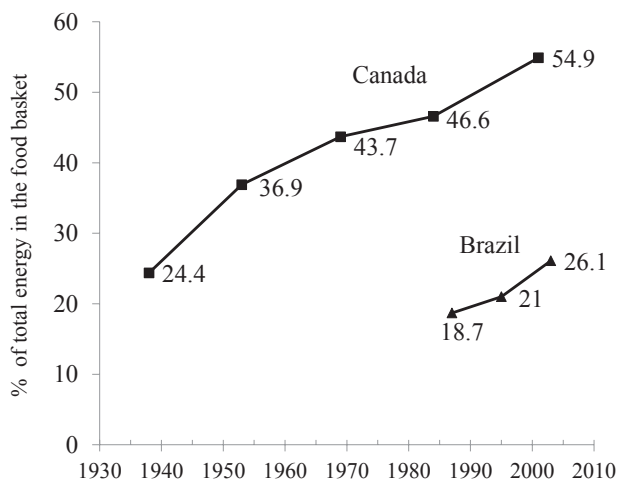


Figure 1 Time changes in the dietary share of ultra-processed products in the average household food basket in Canada and Brazil.

Sales of frozen products continuously increased in high-income and upper- and lower-middle-income countries. Sales of both snacks and soft drinks continuously increased only in the two groups of middle-income countries. In high-income countries, sales of snacks were static, whereas sales of soft drinks increased in the first half of the period and decreased in the second.

Table 3 shows average annual sales growth of the three groups of ultra-processed products between 1998 and 2012. Absolute growth rate (kilograms or litres per person) and relative growth rate (% of growth between two consecutive years) are both shown. Rates are presented for high-income and lower- and upper-middle-income countries, and also specifically for Canada and Brazil.

In absolute terms, the groups of snacks and soft drinks increased most in upper-middle-income countries, and increased little if at all in high-income countries. Frozen products increased most in high-income countries. In relative terms, the increase of the three groups was lowest in high-income countries, intermediate in upper-middle-income countries and highest in lower-middle-income countries.

Sales growth of frozen products, snacks and soft drinks in Canada follow the pattern of high-income countries, except

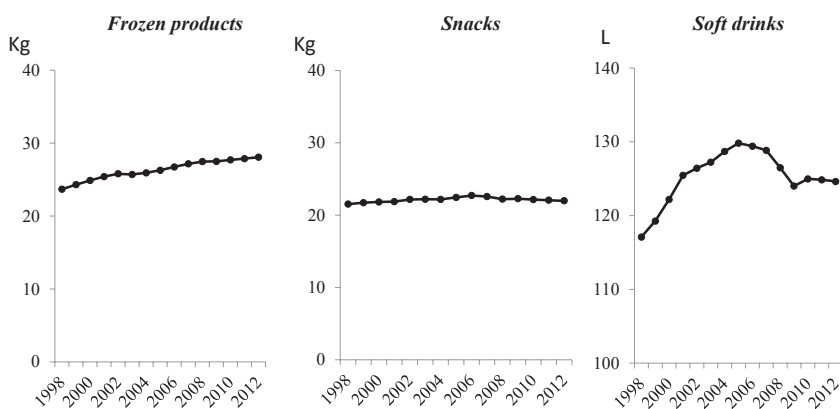
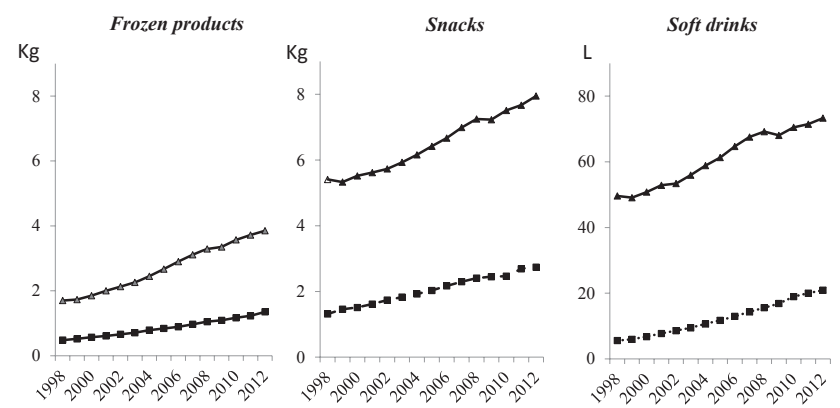


Figure 2 Per capita retail sales of selected ultra-processed products in high-income countries (1998–2012).



▲ Upper-middle-income countries; ■ Lower-middle-income countries.

Figure 3 Per capita retail sales of selected ultra-processed products in lower- and upper-middle-income countries (1998–2012).

Table 3 Statistics on per capita retail sales of selected ultra-processed products in the period 1998–2012*

Products/Statistics	High-income countries (a)	Upper-middle-income countries (b)	Lower-middle-income countries (c)	a + b + c	Canada	Brazil
Frozen products						
Sales in 1998 (kg)	23.7	1.7	0.5	5.2	37.2	1.5
Sales in 2012 (kg)	28.1	3.9	1.4	6.7	42.9	4.6
Absolute annual growth (kg)	0.31	0.15	0.06	0.11	0.41	0.22
Relative annual growth (%)	1.22	6.01	7.67	1.83	1.02	8.33
Snacks						
Sales in 1998 (kg)	21.5	5.4	1.3	6.0	20.5	5.6
Sales in 2012 (kg)	22.0	7.9	2.8	7.3	22.3	7.0
Absolute annual growth (kg)	0.03	0.18	0.10	0.09	0.13	0.10
Relative annual growth (%)	0.15	2.79	5.45	1.34	0.60	1.61
Soft drinks						
Sales in 1998 (l)	117.1	49.6	5.6	35.9	152.0	56.3
Sales 2012 (l)	124.6	73.3	20.9	50.0	143.7	75.4
Absolute annual growth (l)	0.54	1.69	1.10	1.01	-0.59	1.36
Relative annual growth (%)	0.45	2.83	9.90	2.40	-0.40	2.11

*Data are from the Euromonitor Passport Global Market Information Database (21).

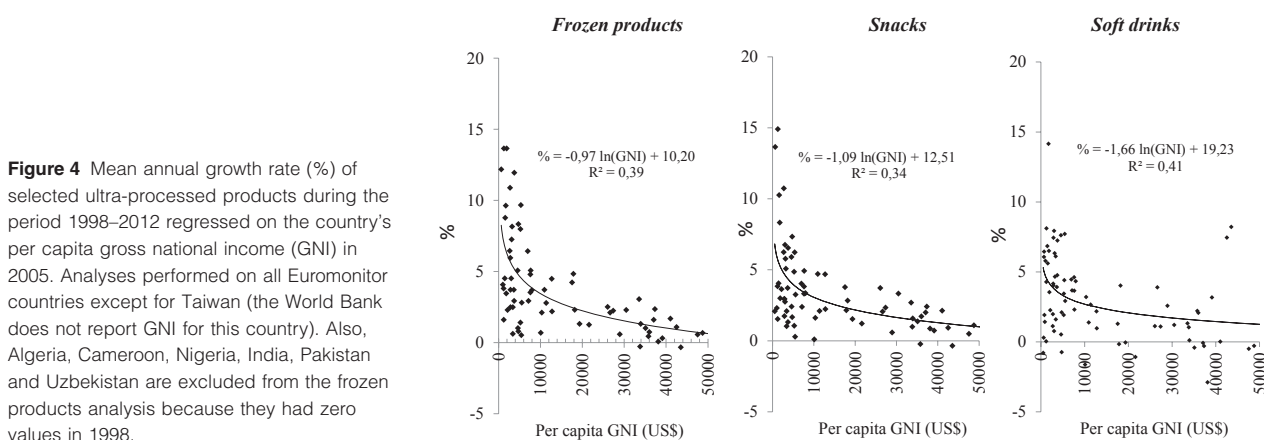


Figure 4 Mean annual growth rate (%) of selected ultra-processed products during the period 1998–2012 regressed on the country's per capita gross national income (GNI) in 2005. Analyses performed on all Euromonitor countries except for Taiwan (the World Bank does not report GNI for this country). Also, Algeria, Cameroon, Nigeria, India, Pakistan and Uzbekistan are excluded from the frozen products analysis because they had zero values in 1998.

that sales of soft drinks decreased. Sales growth in Brazil followed the pattern of upper-middle-income countries.

Figure 4 shows that the relative growth of sales of frozen products, snacks and soft drinks is inversely related to the country's GNI per capita. Annual growth rates higher than 5% and up to and even higher than 10% are seen in several lower- and upper-middle-income countries, but in no high-income countries. Predicted growth of all ultra-processed products in very high per capita countries (GNI \geq \$US 50,000) is close to zero.

Discussion

The study of time trends in household availability of all ultra-processed products in high-income Canada and upper-middle-income Brazil shows increases in both countries, at a faster rate in Brazil. It also shows that by the early 2000s, ultra-processed products had risen to over

half of all calories consumed in Canada, and to over one-quarter in Brazil, from much lower levels. These findings are consistent with more recent changes in sales of selected ultra-processed products in 79 countries, also examined here. These show greatest consumption in high-income countries, but greater relative and sometimes absolute increases in lower-income countries. The data suggest that in high-income countries consumption of ready-to-consume snacks may remain static and that consumption of soft drinks may be past peak levels.

Limitations

This study has limitations. Not all types of ultra-processed products listed in Euromonitor were included because of aggregation of products that prevented precise identification. However, previous analyses of the Brazilian food expenditure surveys indicate that all groups of

ultra-processed products follow a similar pattern of increase (17). These analyses in Canada indicate common pattern of increase for all ultra-processed products, except bread (18). Another limitation is that this study does not include data on low-income countries, available only for one country in the Euromonitor database. In this country (Kenya), consumption of the selected ultra-processed products was very low, no doubt as a consequence of low available income.

Context

The findings of this study support previous analyses using Euromonitor data. These show fast-growing sales of 'packaged foods' (a reasonable proxy for ultra-processed products) in lower-income countries, and identify and forecast static sales in high-income countries (12,23,24). Results from more recent food expenditure surveys conducted in Canada (2011) and Brazil (2008–2009) show no change in the share of ultra-processed products in Canada (18) and further increases in Brazil (25).

Previous and more detailed analyses of all foods purchased by households in Canada and Brazil show that ultra-processed products have displaced and are displacing staple foods, such as potatoes in Canada, and rice and beans in Brazil; and also other foods, such as legumes, milk, and fruits in Canada, and milk, cassava (manioc), vegetables and fruits in Brazil; and culinary ingredients in both countries (17,18).

Displacement of foods and culinary ingredients by ultra-processed ready-to-consume products transforms food supplies and thus food culture and dietary patterns. The nature of ultra-processed products (14) indicates that these changes are harmful to public health. In general, ultra-processed products are more energy-dense and contain more harmful fats, and more sugars and salt, and less fibre, than unprocessed or minimally processed foods, as such, and also when combined with culinary ingredients such as oils, flours, sugars and salt into dishes and meals (17,26). Additionally, there is direct evidence of links between ultra-processed product consumption and overweight, obesity (Canella *et al.*, unpublished data) and metabolic syndrome (27).

The scale of change in dietary patterns especially since the 1980s has been and still is so rapid, that some explanation is needed.

As societies become more urbanized, as available income grows and as the proportion of women employed outside the home increases, ready-to-eat and ready-to-heat food products become convenient and attractive choices. However, this alone does not explain the explosive recent increase in the consumption of ultra-processed products in lower- and upper-middle-income countries. The main reasons are economic as well as social.

Since the 1980s, national food systems have been shaped by dominant international economic policies designed to promote the flow of capital and the rapid expansion of trade. International and global trade agreements, intensified since the 1990s, have enabled transnational food manufacturing, retailing, 'fast food' chains and associated corporations, to become colossal (13,28,29).

The annual turnover of some transnational manufacturing corporations, collectively sometimes known as Big Food and Big Soda, and also Big Snack, is on a level with the gross national products of middle-size countries (13). They spend vast sums on advertising and marketing of their branded ready-to-consume products (13,28,29).

National and multinational supermarket chains, some owned by conglomerate corporations, have also rapidly increased in scale and reach, as have 'fast food' chains, at first in high-income countries and then globally (30–34). Their profits also come largely or mainly from ultra-processed products. In the global South, the shift from small and specialist stores to supermarkets and smaller 'mini-markets' and 'convenience stores' first occurred in higher-income Latin America countries. Similar shifts also occurred in India and in other Asian countries such as Singapore, Hong Kong, South Korea and Taiwan, as available income increased (35). Thailand and China now both have a retail share of what is identified as 'processed/packaged food' of more than 60% (36). In lower-income countries and settings, food manufacturing transnationals also work through small retailers (36), and even by hiring door-to-door sellers of branded 'popularly positioned products' (13).

As the nature of what is consumed has changed, so have the ways of consumption. Food and culinary ingredients are mostly made into and consumed as meals, usually at regular times and normally in specified places. Ultra-processed products are mostly consumed as snacks, almost any time and anywhere. Up to the second half of the 20th century few adults consumed snacks. But now, in countries such as the United States, Canada, Mexico, Brazil and China, products in snack form amount to up to a quarter of all calories consumed (37–42). In China, since 2000 snacking has tripled every 2 years (40). In lower-income countries, many snacks are currently in the form of fresh food such as fruits, but as income increases, more and then most are ultra-processed products, as in the United States (40–42). It is suggested that the global strategy of transnational food manufacturing corporations is to 'teach the world to snack' on their branded products from infancy to old age (43).

The context and significance of what now amounts to a revolution in manufacture, distribution and sale, and thus in dietary patterns and the whole environment of eating and drinking, has been indicated by the director-general of the World Health Organization (44):

It is not just Big Tobacco anymore. Public health must also contend with Big Food, Big Soda, and Big Alcohol. All of these industries fear regulation, and protect themselves by using the same tactics . . . These . . . include front groups, lobbies, promises of self-regulation, lawsuits, and industry-funded research that confuse the evidence and keep the public in doubt. . . . This is formidable opposition. Market power readily translates into political power. Few governments prioritize health over big business. As we learned from experience with the tobacco industry, a powerful corporation can sell the public just about anything.

Implications

This paper shows that ultra-processed products dominate the food supplies of high-income countries, and that consumption of these products is now rapidly increasing in middle-income countries. The general effect is displacement of dietary patterns based on regular freshly prepared meals, by constant snacking on relatively energy-dense, fatty, sugary or salty ready-to-consume products. The scale and power of the corporations whose profits depend on these products is colossal. Realistic policies and actions to check or reduce their consumption will go beyond education and information programmes and will be centred on fiscal and other statutory measures.

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Conflicts of interest

No conflicts of interest were declared.

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