Rapid Review of Ultra-Processed Food and Obesity

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1 Introduction

This report aims to examine the link between the consumption of ultra-processed foods and obesity. It gives an overview of the literature in this area and key studies. It reviews Welsh data on the consumption of foods which fit the definition according to the NOVA classification of ultra-processed foods from existing survey data.

At the 2011 UN high-level meeting on non-communicable diseases (NCDs), the political declaration presented the case for prevention of NCDs in low-income and middle income countries (UN, 2011). Participants agreed that no one factor could fully address the burden of NCDs and called for collaboration with "non-health actors and key stakeholders, where appropriate, including the private sector and civil society, in collaborative partnerships to promote health and to reduce non-communicable disease risk factors". To achieve the agreed goal to reduce premature mortality due to NCDs of 25% by 2052 will need a massive scale-up of concerted action to reduce consumption of unhealthy commodities, mainly tobacco, alcohol, and *ultra-processed food* and drink products (Moodie et al, 2013).

There has been a change in the consumption of foods in both developed and less developed countries. Food surveys show an increase in consumption of ready meals and more processed foods. This has coincided with the rise in obesity levels across the globe. It is now generally acknowledged that the current pandemic of obesity and related chronic diseases has as one of its important causes increased consumption of convenience including pre-prepared foods (Popkin et al, 2012). However, further longitudinal studies are needed, particularly those using longitudinal designs and with sufficient control for confounding, to potentially confirm these findings in different populations and to determine whether ultra-processed food consumption is associated with obesity independent of nutrient content of food processing (Poti et al, 2017).

2 Ultra-Processed Food

Studying potential effects on health of ultra-processed foods is a very recent field of research, facilitated by the development of the NOVA classification of products according to their degree of processing. Currently, epidemiological evidence linking intake of ultra-processed food to risk of disease is still very scarce and mostly based on cross sectional and ecological studies (Canella et al 2014; Juul et al, 2015; Louzada et al 2015).

In 2010 the NOVA (a name not an acronym) classification was launched (Monteiro et al, 2010). This is a food classification system which categorises foods according to the extent and purpose of food processing, rather than in terms of nutrients (Monteiro et al, 2010).

Examples of typical ultra-processed foods are soft drinks; sweet or savoury packaged snacks; confectionery, mass-produced packaged breads, buns, biscuits and cakes; hot dogs, poultry and fish 'nuggets' and other reconstituted meat products; 'instant' soups and noodles; industrialized desserts; and industrially pre-prepared pizzas, pies and other dishes and meals (Monteiro et al, 2010).

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 pizza and pasta dishes, nuggets and sticks, crisps, biscuits, confectionery, cereal bars, carbonated and other sugared drinks, and various snack products (Moodie et al, 2013).

Ultra-processed products 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 (Monterio et al, 2011; Ludwig et al, 2011). When consumed in small amounts and with other healthy sources of calories, ultra-processed products are harmless; however, intense palatability (achieved by high content 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 endogenous satiety mechanisms and so promote energy overconsumption and thus obesity (Moodie et al, 2013)

3 Changes in Eating Patterns

An important factor which has contributed to the rise in obesity rates is the transition which has occurred in eating patterns and the increased consumption of convenience and pre-prepared foods (WHO, 2003; World Cancer Research Fund 2009). The substantial growth of ultra-processed products has paralleled and contributed to the increase in obesity, diabetes, and other diet-related chronic diseases (WHO, 2010). During the past decades, diets in many countries have shifted towards a dramatic increase in consumption of ultra-processed foods (Monteiro et al, 2013; Moodie et al, 2013; Moubarac, 2014; Venn et al, 2017). The growth in obesity in industrialised countries has coincided with a shift towards higher levels of dietary energy alongside diminished intakes of beneficial micronutrients typically gained through plant-based foods (Fiolet et al, 2018). Fiolet et al highlight that studies in a range of industrialised countries have shown contributory factors are:

- a greater prevalence of eating out
- less time spent cooking and eating
- a growing reliance on processed foods
- a decline in traditional meal patterns
- an increase in the prevalence and importance of snacking or grazing
- mixed evidence of a decline in commensal eating and changes in time spent eating

Fiolet et al highlight, that this change in practice has nutritional significance. Commercially prepared foods from takeaway outlets and restaurants typically (with similar portion sizes) contain higher levels of sugar, fat and energy than foods prepared at home. Ultra-processed foods, including pre-prepared meals and snack foods, provide more energy and fewer nutritional benefits than minimally processed foods (Mendonca et al, 2017; Hercberg et al, 2010). Snack-dominated meal patterns have been associated with significantly higher consumption of energy and lower consumption of nutrient-rich foods than meal-dominated patterns while a higher frequency of eating occasions is associated with higher energy consumption.

4 Food Surveys - Consumption of Processed Foods

There is a wide variation in the dietary contribution of ultra-processed foods in different countries. The usual way to assess this is through national food purchase surveys and through national dietary surveys. Monterio (2018) showed that these estimations ranged from 21·5% of total dietary energy in Brazil in 2008–2009 (Louzada et al, 2015) to 57·9% in the USA in 2009–2010 (Martinez Steele et al, 2016). From 2000 to 2013, in the eighty countries taken together, the sales of these ultra-processed foods –carbonated soft drinks, sweetened breakfast cereals, sweet and savoury snacks, confectionery, ice cream, fruit juices, sports and energy drinks, spreads, sauces, and ready meals – increased by 43·7% (PAHO, 2015).

Studies of national diets undertaken in the USA, Canada, Brazil and Chile have consistently shown that, as a group, ultra-processed foods have an obesogenic nutrient profile (Monterio et al, 2018). These studies showed a wide variation of the contribution of ultra-processed foods to the diet from 10·2% of total purchased dietary energy in Portugal and 13·4% in Italy to 46·2% in Germany and 50·7% in the UK. (Monterio et al, 2018).

A study in the US showed that Ultra-processed foods comprised 57.9% of energy intake, and contributed 89.7% of the energy intake from added sugars. The content of added sugars in ultra-processed foods (21.1% of calories) was eightfold higher than in processed foods (2.4%) and fivefold higher than in unprocessed or minimally processed foods and processed culinary ingredients grouped together (3.7%). Consumption of added sugars increased linearly across quintiles of ultra-processed food consumption: from 7.5% of total energy in the lowest quintile to 19.5% in the highest. A total of 82.1% of Americans in the highest quintile exceeded the recommended limit of 10% energy from added sugars, compared with 26.4% in the lowest (Steele et al, 2016).

A study examining dietary intake of sugars in European countries found that total and added sugars are high in the European countries, especially in children, and point to sweet products and beverages as the major contributors to added sugar intakes. These types of drinks are considered ultra- processed. Four of five studies found that higher purchases or consumption of ultra-processed food was associated with overweight/obesity. Additional studies reported relationships between ultra-processed food intake and higher fasting glucose, metabolic syndrome, increases in total and LDL cholesterol, and risk of hypertension (Azaïs-Braesco et al, 2017).

Monterio et al, 2017 has recently published a study which looked at the link between obesity and the consumption of ultra –processed foods at a population level. The graph below shows a regression analysis which showed a significant positive relationship between the prevalence of obesity among male adults versus household availability of ultra-processed food (as a percentage of energy) in nineteen European countries (1991 to 2008). The UK had the highest prevalence of obesity and consumption of ultra-processed foods.

Figure 1: Regression of prevalence of obesity among adults v. household availability of ultra-processed foods (percentage of total energy) in nineteen European countries (1991–2008)
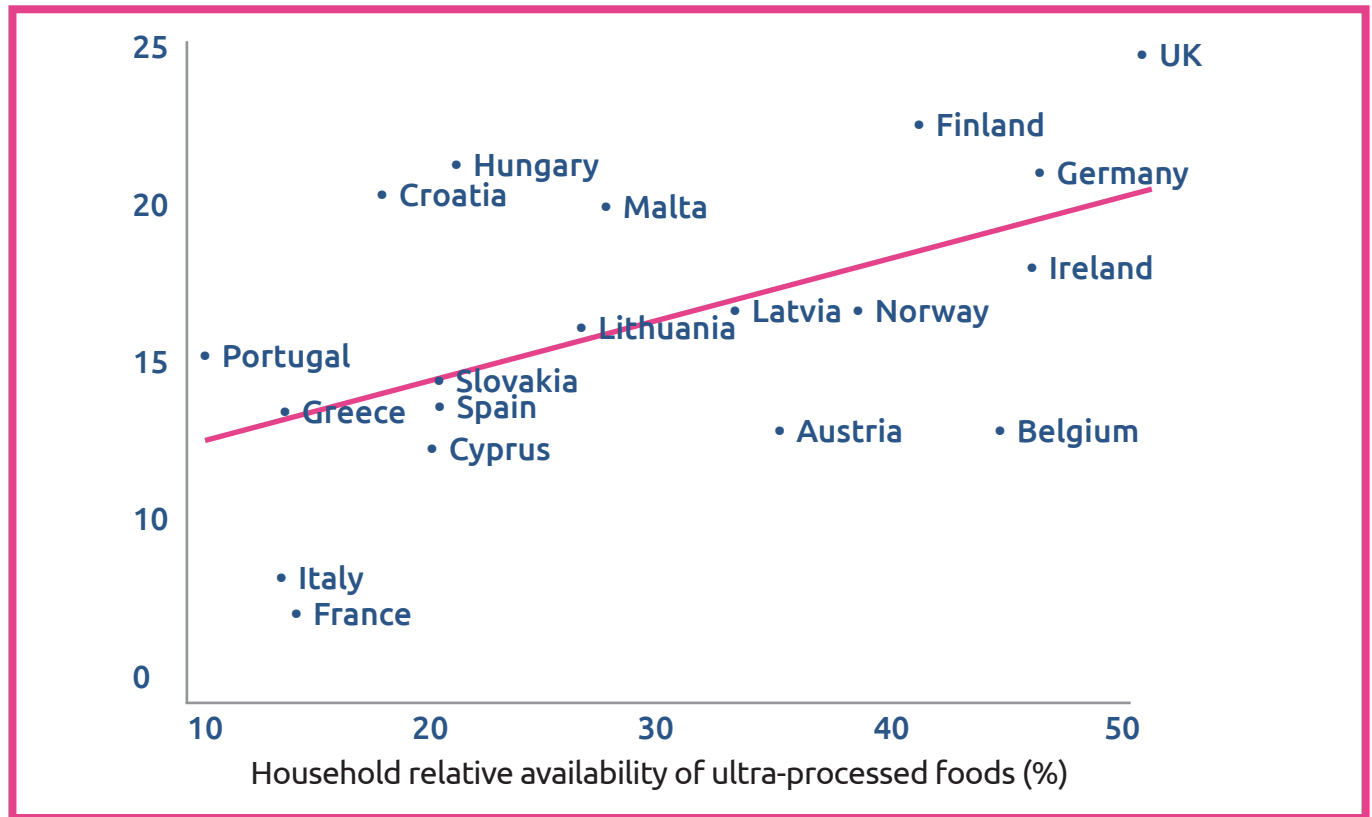
Source: Monterio et al, 2017

It shows that Italy and France, who traditionally consume a more Mediterranean diet consume less ultra-processed foods than other countries and have a lower prevalence of obesity. Portugal had the lowest percentage of energy from ultra-processed foods (10.2%), followed by Italy (13.4%) and France (14.2%). Obesity prevalence was 15.2%, (Portugal) 8.2% (Italy) and 7.1% (France).

The regression model predicted that each percentage point increase in the energy share of ultra-processed foods would result in an increase of 0·25 percentage points in obesity prevalence. This means that a difference of 40 percentage points in the average contribution of ultra-processed foods to total household dietary energy, such as that existing between Portugal in 2005 and the UK in 2008, would determine a difference of 10 percentage points in obesity prevalence. This is not far from the difference between the actual prevalence of obesity in Portugal and the UK (15·2 and 24·5%, respectively) (Monterio et al, 2017).

The authors highlight the strength of their study was the reliance on standardised data, the use of population-based, actual (non-modelled) estimates of the prevalence of obesity, and the consideration of multiple confounding factors. They also point out that close to half of the national estimates of obesity relied on self-reported data which are liable to underestimate the true prevalence of obesity. To reduce this potential bias, the method used to assess obesity (self-reported or directly measured) was included as a confounder in the adjusted linear regression model. Second, food purchase surveys do not include food consumed outside the home and do not allow for food wastage in the home. This limitation was

reduced but not eliminated by use of a relative measure of food consumption: the proportion of ultra-processed foods in total dietary energy. Another limitation is that the times when the household budget survey and the obesity survey were conducted, although close, were not the same for all countries. The fact that national estimates for household food availability and obesity cover a large period of time (1991– 2008) and that some estimates are relatively old, should not be considered a limitation of the study; its objective was not to assess the association between the two variables at one particular moment in time (Monterio et al, 2017).

5 Ultra-processed Foods and Cancer Risk

The World Cancer Research Fund and the American Institute for Cancer Research has stated that a third of the most common neoplasms could be avoided by changing lifestyle and dietary habits in developed countries. The World Cancer Research Fund has estimated that 27–39% of the main cancers can be prevented by improving diet, physical activity and body composition (WCRF, 2009). A varied and natural diet has been recommended as one of the most important modifiable risk factors in the primary prevention of cancer.

The WHO (2009) have highlighted in their report on Global health risks that approximately 16 million (1.0%) DALYs and 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption (WHO, 2003, 2009). Adequate consumption of fruit and vegetables reduces the risk for cardiovascular diseases, stomach cancer and colorectal cancer (Bazzano et al 2003, Ribioli 2003). There is convincing evidence that the consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables (WHO, 2003).

Fiolet et al have recently reported in the *British Medical Journal* on the NutriNet-Santé prospective cohort, which showed that a 10% increase in the proportion of ultra-processed foods in the diet was associated with a significant increase risk of 12% in the risk of overall cancer and 11% in the risk of breast cancer. A few studies have previously suggested that ultra-processed foods contribute to increasing the risk of cardiometabolic disorders such as obesity, hypertension and dyslipidaemia but no previous prospective epidemiological study has evaluated the association between food processing and risk cancer. The authors recommended that the results should be confirmed by other large scale, population based observational studies in different populations and settings. They also highlight that policy actions targeting product reformulation, taxation, and marketing restrictions on ultra-processed products and promotion of fresh or minimally processed foods may contribute to primary cancer prevention. Several countries have already introduced this aspect in their official nutritional recommendations in the name of the precautionary principle (Ministry of Health, Brazil 2014; Haut Conseil de la Sante Publique, 2017).

6 Dietary Intake of Ultra-Processed Foods in Wales

There are a number of sources of data which highlight the food patterns and intake in the Welsh population. The National Diet and Nutrition Survey (NDNS) has a rolling programme with the most recent report for Wales was using 2009/10-2012/13 data. There have been more recent NDNS Surveys for the United Kingdom but data has not been stratified by country. Other key data sources are the FSA Food and You survey and the National Survey for Wales. However these surveys do not categorise food according to the NOVA classification for ultra-processed foods.

The NDNS Survey Years 2-5 showed that using the definition of 'ultra-processed foods' (not defined in the survey) in Wales, 'white bread' and 'pasta, rice, pizza and other miscellaneous cereals' were the most commonly consumed 'cereals and cereal products', both eaten by more than 70% of participants over the four-day diary period, except for those aged 65 years and over who were less likely to consume 'pasta, rice, pizza and other miscellaneous cereals'. Children aged 1.5 to 3 years consumed similar quantities of bread (all types combined) and 'pasta, rice, pizza and other miscellaneous cereals', as did adults aged 19 to 64 years. Children aged 4 to 10 years and adults aged 65 years and over consumed more bread; children aged 11 to 18 years consumed more 'pasta, rice, pizza and other miscellaneous cereals'. Mean consumption of white bread exceeded that for other types of bread combined, accounting for 60% of total bread consumption in adults, higher in children.

'Biscuits' were consumed by more than three-quarters of children aged 1.5 to 3 years and 4 to 10 years and by over half of the other age groups. 'Buns, cakes, pastries and fruit pies' were also consumed by 73% of adults aged 65 years and over.

Mean consumption of 'sugar confectionery' and 'chocolate confectionery' combined was highest in those aged 4 to 10 years (14g per day) and 11 to 18 years (17g per day). 'Chocolate confectionery' was more commonly consumed than 'sugar confectionery' consumed by 53% compared with 23% of children aged 1.5 to 3 years, 50% compared with 36% of children aged 4 to 10 years and 55% compared with 30% of children aged 11 to 18 years over the four day recording period. Mean consumption of 'sugar confectionery' and 'chocolate confectionery' combined was lowest in those aged 65 years and over (5g per day). Mean consumption of 'sugar, preserves and sweet spreads' (including table sugar) was highest in adults aged 19 years and over (13g per day).

Highest mean consumption of 'soft drinks, not low calorie' was seen in children aged 11 to 18 years (258g per day) while highest mean consumption of 'soft drinks, low calorie' was seen in children aged 1.5 to 3 years (249g per day). Children aged 10 years and under consumed more 'soft drinks, low calorie' than 'soft drinks, not low calorie'. Seventy-nine per cent of children aged 11 to 18 years consumed 'soft drinks, not low calorie' over the four-day recording period compared to 59% who consumed 'soft drinks, low calorie'.

The Food and you survey[1] looks at dietary eating habits and the table below shows the consumption of ready meals and pre-packed sandwiches consumed. The survey shows 16% of the Welsh population consumed pre-packed sandwiches once a week and 23% consumed ready meals at least once a week.

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[1]https://www.food.gov.uk/sites/default/files/media/document/food-and-you-w4-dev-report.pdf

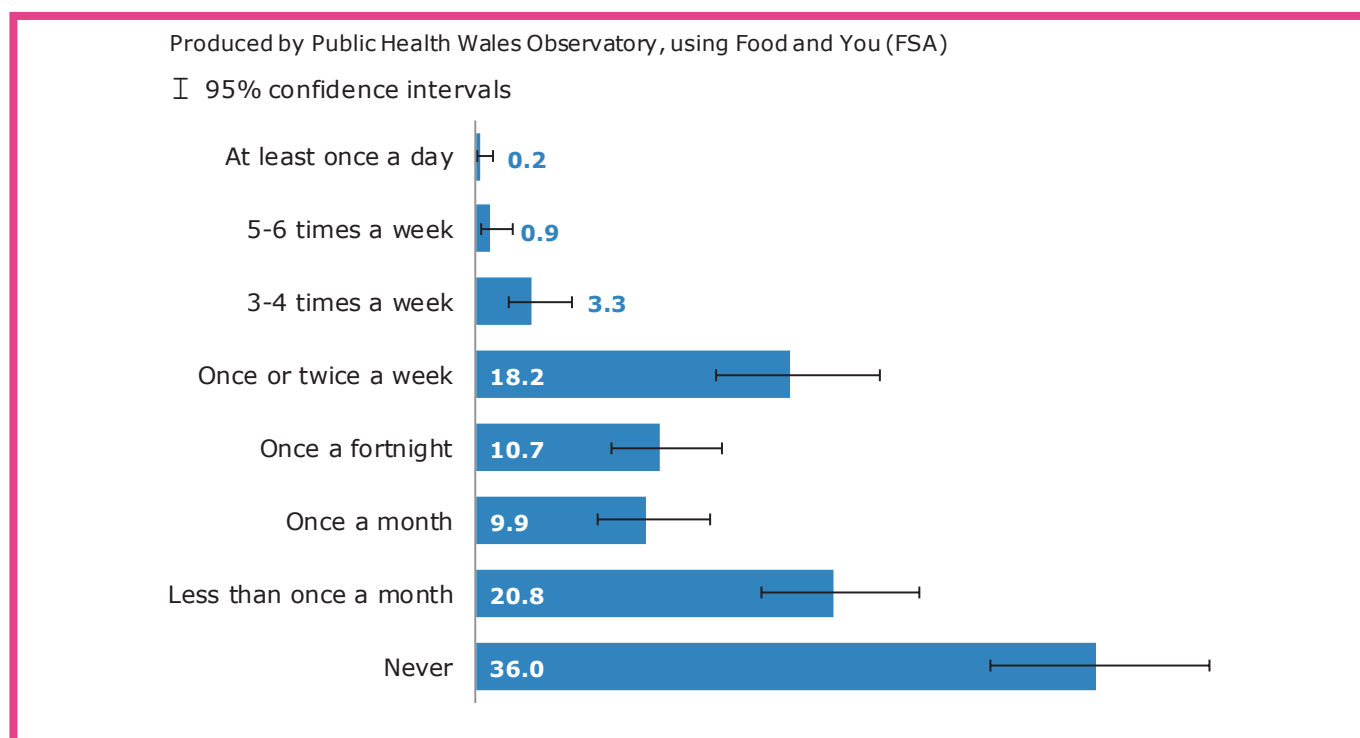**Table 1: Frequency of eating pre-packed sandwiches and ready meals, by country (Wave 4) Food and You Survey**

	Wales	England	Northern Ireland
Pre-packed sandwiches			
At least once a week	16	19	10
Less than once a week	40	36	35
Never	44	45	55
Ready meals			
At least once a week	23	24	15
Less than once a week	41	38	34
Never	36	38	51
Bases (unweighted)	**492**	**2105**	**521**

Source: (Wave 4) Food and You Survey

Almost all respondents (97%) ate out, with over a third (39%) doing so at least once or twice a week. Forty-two per cent of men ate out at least once or twice a week compared with 37% of women.

Younger respondents were more likely to have eaten at a fast food restaurant in the past month (37% of those aged 16 to 24 and 46% of those aged 25 to 34, compared with 4%–22% of older respondents). Over a fifth of Welsh respondents reported that they eat ready meals at least once a week.[2]

Figure 2: Frequency of eating ready meals, percentage, Wales, Wave 4 of the Food and You Survey (2016)

Produced by Public Health Wales Observatory, using Food and You (FSA)

⊣⊢ 95% confidence intervals

At least once a day	0.2
5-6 times a week	0.9
3-4 times a week	3.3
Once or twice a week	18.2
Once a fortnight	10.7
Once a month	9.9
Less than once a month	20.8
Never	36.0

Source: Wave 4 of the Food and You Survey (2016)

[2]Obesity in Wales Survey Data, March 2018.

6.1 Unprocessed Foods

The number of portions of fruit and vegetables consumed per day has been calculated from the disaggregated data in line with the "5-a-day" criteria, including up to one portion each of fruit juice and baked beans or pulses per day. For children aged 11 to 18 years, mean consumption was 2.9 portions per day. Adults in both age groups consumed 3.8 portions per day. The proportion of participants meeting the "5-a-day" guideline was 7% of children aged 11 to 18 years, 24% of adults aged 19 to 64 years and 27% of adults aged 65 years and over.

Mean consumption of oily fish was well below the recommendation of at least one portion (140g) per week in all age groups: for adults aged 19 to 64 years, mean consumption was equivalent to 46g per week and equivalent to 70g per week for adults aged 65 years and over.

The National Survey for Wales (2017/18)[3] highlighted the percentage of adults reporting eating five or more portions of fruit or vegetables the previous day by age. The age group 35-44 had the highest number of people achieving "5-a-day" (27%), with the lowest number being in the 75+ age group.

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[3]https://gov.wales/statistics-and-research/national-survey/?tab=el_home&topic=population_health&lang=en

7 Conclusion

There are several ecological population level studies which provide evidence of the link between the association of high consumption of ultra-processed foods and high prevalence of obesity and diet related non-communicable disease. However, the current evidence is limited with only a few studies examining this area in Europe, Canada, US and Brazil.   There are no intervention studies which look at reducing consumption of ultra-processed foods and the impact this will have on obesity.

There is strong evidence on changing dietary patterns (also reflected in the Welsh population), with more people eating outside of the home and a higher reliance on convenience food and this has been cited as a cause for rising obesity levels. The majority of ultra-processed food has a poor nutritional profile; energy dense and high in sugar or saturated fats. There is evidence from nutritional surveys that this type of food is increasing in the percentage of energy intake in the diet. It is recommended that population measures to reduce obesity should focus on advising limiting this particular food group in order to achieve a healthy energy balance and to increase the consumption of fruit and vegetables.

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