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Commentary. The big issue is ultra-processing
**Processing. The good,
the bad, and the toxic**



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Introduction



(g) Promote the development and initiate the implementation, as appropriate, of cost-effective interventions to reduce salt, sugar and saturated fats, and eliminate industrially produced trans-fats in foods, including through discouraging the production and marketing of foods that contribute to unhealthy diet, while taking into account existing legislation and policies.

UN High-Level Meeting on NCDs. Political Declaration, Clause 43g

For me, reading the finally agreed Political Declaration agreed by the United Nations at its High-Level Meeting in New York last month (1) has been a strange experience. As the editorial in this issue of **World Nutrition** points out (2), the Declaration never mentions dietary patterns, and makes no reference to cooking (except when this generates toxic fumes). It never mentions meals, or fresh food, or energy density, or soft drinks. Nor does it mention transnational industry. When reference is made to ‘the private sector’ (which seems to be some sort of code for the transnational and other giant manufacturers of ultra-processed products whose executives were present in force in New York) it is as partners in the prevention and control of obesity, diabetes, heart disease and cancer. Specifically, the only reference to food processing (though the word ‘processing’ is not used) is in clause 43(g) as shown above.

The Declaration, in common with most (though not all) authoritative or influential documents on the topic of food and nutrition policy, implicitly assumes (with here the exception of *trans*-fats generated by the process of hydrogenation, a word not mentioned) that the nature, extent and purpose of processing is not relevant to the quality of food and drink products, or to the shape of food supplies, or to relative chances of health and well-being – or to the risk of debilitating, disabling or deadly diseases. This bizarre implication is indefensible.

But as indicated above by the list above of some of the words and phrases that never appear in the Declaration, it is even worse than that. It seems that United Nations member states assume that food *is* industrially processed products. Not only is there no mention of dietary patterns or meals; grains (cereals), vegetables, fruits, legumes (pulses) and other groups of fresh or minimally processed foods, are also never

mentioned. The UN secretariat responsible for the document might argue that it does refer to other UN documents in which the constituents of healthy diets are outlined, in the equivalent of the ‘small print’ – although these are usually more focused on the chemical constituents of foods. We should not accept any such excuse. The official ignorance, at the highest level, of the impact of food processing on human health, is fatuous.

Worse yet, it reveals the hand of the manufacturers of ultra-processed food, guiding the drafters of the Declaration to overlook and thus conceal the significance of food processing, and of different types of food process, the topic of this commentary. Why is food processing ignored? Obviously because the food processors want UN agencies, member states, and all other agents responsible for global and national food and nutrition policies and actions, to believe or assume that food processing (with one exception, which generates *trans*-fats) is irrelevant to human health. I consider that the proof of my point is contained in another clause of the Declaration, shown below. ‘The private sector’ is timidly called on to ‘consider’ the reformulation of some of their products. But this indicates nothing about the processes themselves.

(b) Consider producing and promoting more food products consistent with a healthy diet, including by reformulating products to provide healthier options that are affordable and accessible and that follow relevant nutrition facts and labelling standards, including information on sugars, salt and fats and, where appropriate, trans-fat content;

UN High-Level Meeting on NCDs. Political Declaration, Clause 44b

Discussion

Box 1

Processing: My view

In my first commentary in this series (3), and in associated papers (4,5), I and my colleagues state that food processing as such, is not a public health issue. To suppose so would be like supposing that food technology, or technology in general, is intrinsically problematic. Discussion of food, nutrition and health that makes any judgement on food processing as such, including to attack or defend it, is practically meaningless. Unprocessed foods are parts of plants or animals (and some other living things) after being separated from the living organism. As such, most of them have short duration and require intense preparation and cooking to be edible, palatable, and safe for consumption. Different techniques of food processing have been developed by human societies exactly to enlarge the duration of unprocessed foods and shorten the efforts needed to prepare and cook them.

Again as I said in my first commentary, points like these are often and rightly made by the food and drink manufacturing industry.

It follows that meaningful discussion of the impact of food processing on human health and well-being needs to make distinctions between different types of processing. Here, as a first attempt, I suggest that all specific forms of processing can be classified into three groups. First are processes that can be called good. With reference to Table 1, below, most of these modify whole foods in minimal ways and do not alter its basic nature. They may directly or indirectly enhance nutritional quality, or else be practically neutral in their effects. Second are processes that can be identified as bad. These substantially degrade foods, or produce substantially degraded ingredients, or else – singly or in combination – are used as further degradation in the manufacture of ultra-processed products. This is most significant when such foods, ingredients or products are staples or commonly consumed.

The third class of process is those identified here as toxic. No food process is in itself poisonous, as is strychnine, say, or as is food contaminated with powerfully pathogenic micro-organisms; and if it was, and identified as such, it would be prohibited. Toxic processes defined as such here, are either carcinogenic, or harmful and addictive, or else identified as intensely pathogenic. In my view all toxic processes should be subjected to statutory regulation, and in one case in particular – hydrogenation – should be prohibited.

I now turn to the classification of food processes in terms of their impact on human health. This includes the issue of relative risk of disease and disability, but what I mean here is broader and more positive. I include positive good health, usually identified as well-being, and in addition enjoyment, in the sense that delicious meals consumed best in good company are part of the good life well led.

Good processes

Now please refer to Table 1. This is an extract from a larger table published in my first commentary (3) and elsewhere (4,5) which also includes a column not shown here giving examples of group 1 foods, group 2 ingredients, and group 3 products. The main column here, lists types of food process. Those used to produce group 1 foods can all generally be identified as good. As stated, they are mostly physical processes that can be carried out by hand, or by artisanal or industrial methods. Their purpose usually is to make single whole foods more durable, accessible, convenient, palatable, or safe. They also can improve the value of whole foods as is the case of fermentation..

The processing of rice is an interesting case in point. The cleaning, drying and removal of foreign objects used in the production of wholegrain rice are certainly good processes. So also in my view is parboiling, which retains a substantial amount of the nourishment in the whole grain. Of course, industrial milling used to process

Table 1

Food classification based on the extent and purpose of processing

Food group	Extent, purpose of processing
<p>Group 1 foods</p> <p>Unprocessed or minimally processed foods</p>	<p>No processing (as defined here), or mostly physical processes used to make single whole foods more durable, accessible, convenient, palatable, or safe.</p> <p>Specific processes include cleaning, removal of inedible fractions, grating, squeezing, draining, flaking, drying, parboiling, bottling (without additions other than water), chilling, freezing, fermentation (when the result is not alcoholic), pasteurisation, vacuum and gas packing, and simple wrapping.</p>
<p>Group 2 ingredients</p> <p>Processed culinary or food industry ingredients</p>	<p>Extraction and purification of components of single whole foods aiming the production of ingredients used in the preparation and cooking of dishes and meals made up from Group 1 foods in homes or on the spot in catering outlets, or else in the formulation by manufacturers of Group 3 foods.</p> <p>Specific processes include pressing, crushing, milling, refining, ‘purifying’, hydrogenation, hydrolysatation, extrusion, and use of enzymes and additives.</p>
<p>Group 3 products</p> <p>Ultra-processed food products</p>	<p>Combination of already processed group 2 ingredients usually with some unprocessed or minimally processed group 1 foods in order to create durable, accessible, convenient, and palatable drinks or ready-to-eat or to-heat products liable to be consumed as snacks or desserts or to replace home- or restaurant-prepared dishes and meals..</p> <p>Specific processes include baking, battering, frying, deep frying, curing, smoking, pickling, canning, use of preservatives and cosmetic additives, the addition of synthetic vitamins and minerals, and sophisticated packaging.</p>

Extracted from (3-5). These listings do not include alcoholic drinks. The examples given are not meant to be complete. Many others can be added.

what are now the most common types of white rice is less good than the previous processes. However, wholegrain, parboiled or white rice are all good food options when consumed together with a variety of vegetables as in some Asian food cultures or with legumes, as they are in my country of Brazil, in the form of *arroz e feijão* (rice and beans).

Processes that may be good or bad

The processes used to generate group 2 ingredients and also group 3 products are not so easily classified. For example, everybody who uses olive oil as an ingredient and who pays attention to information on the label and elsewhere, is aware that ‘first pressing’ or cold-pressed oil is benign in its effects, whereas oil produced by much more intensive methods of pressing, with the use of heat and chemicals, is

inferior – how inferior is debated. Thus, genuine ‘extra-virgin’ olive oil is produced by a good process, whereas the processes used to produce inferior olive oil are not so good, or actually bad.

Stone-grinding and forms of milling that generally preserve the whole grain of wheat and other cereals are good processes, whereas much more intensive industrial type of milling that strip off and discard the germ and bran, leaving only the starchy part of the grain, are bad.

One problem with the classification of processing in the way first attempted here, is that often the same word is normally used to identify different degrees and intensities of processing that are very different in their effects on health and well-being. Refining is an example. Generally, the less ‘refined’ any ingredient is, the better it is, and in practice informed choice involves trade-offs that include consideration of for example price and availability. Palatability is of course also a factor. For example, brown pasta is less refined and therefore is nutritionally better than white pasta, but many people prefer the taste and texture of white pasta, depending on the sauce mixed with the pasta, the differences in taste and texture between them are more important.

Toxic processes

A number of processes, including some that are commonly used in the manufacture of ultra-processed products, are or may be toxic. These include the age-old processes of salt-pickling, curing and smoking, and also fermenting when used to produce alcoholic drinks. In these cases, ‘toxic’ is used in the sense of carcinogenic (6).

The same point applies to many types of ultra-processing formulations that depend on the use of cosmetic additives to give the impression that the product is wholesome. Toxicological evidence is that the great bulk of chemical additives are in themselves innocuous. However, there are no toxicological data on the vast majority of synthetic flavourings used singly or in combination in the manufacture of ultra-processed products. Also, the evidence that some chemicals used to colour products are toxic, in the sense of being a direct cause of various diseases and disorders especially in vulnerable children, while disputed by manufacturers and often also by regulatory agencies, is commonly agreed by reputable public interest organisations to be strong enough to justify a judgement of ‘probable’ or even ‘convincing’ (7).

The case to prohibit the use of some cosmetic additives on the grounds that they are toxic contaminants is strong. The case to prohibit them on the grounds that they are adulterants which, even if innocuous in themselves, enable the manufacture of grossly degraded ultra-processed products, is in my view conclusive.

It is sometimes proposed that refining as used to produce sugar is toxic in its effects (8). Here the term 'toxic' is used in a broader sense, to summarise evidence of relatively acute pathogenicity, together with addictive qualities. Such a claim is naturally resisted by the sugar industry.

The processes used to manufacture baby formula are bad, in that all formulations are inferior, and sometimes grossly inferior, to breastmilk. As produced it is of course normally safe in the sense of not being contaminated with pathogenic micro-organisms. In use, however, it is liable to be toxic unless water used to prepare it is safe, and in tropical countries where water supplies are commonly contaminated it is very hazardous. It therefore needs stricter restriction and regulation (9).

In my view it is right to identify the process of hydrogenation as toxic. It is implicated in addictive-type properties, in that it is very extensively used in the manufacture of intensely palatable ultra-processed products, formulated so as to be extremely habit-forming. It generates vast quantities of saturated fats in industrial food systems and thus diets, now throughout the world. It certainly is a very bad process. More specifically, partial hydrogenation directly generates *trans*-fatty acids, which probably are more acutely pathogenic in their effect on cardiovascular function than saturated fats (10). This is discussed at greater length in *a previous* commentary and also in a WN editorial column (11,12). For this reason alone, it is appropriate to identify the hydrogenation process as toxic (13).

Box 1

What is toxic?

A standard definition of 'toxic' is 'carcinogenic, poisonous, or otherwise directly harmful to life in any form'. It goes on to say: 'Practically every substance is toxic. The only difference is in the quantity (dose) that produces a toxic effect' (14,15).

This makes clear that there are degrees of toxicity, that identification of any food, drink or product as toxic is a matter of judgement, and also that the term should be used carefully. For instance, cases of water intoxication caused by people consuming vast amounts of water are known, but nobody would for this reason identify water as toxic. Again, there are recent reports of men dying after winning dumpling and pancake eating contests, but nobody would say this means that dumplings and pancakes are in themselves toxic.

Identification of foods, ingredients or products as toxic can be taken to generate the need for restriction or prohibition, or at least warning labels. It may therefore be best, in identifying any substance that is not poisonous as toxic, to say why the term is appropriate.

Some forms of processing make food or drink products toxic, directly or indirectly. Any reasonable account should also state that a substantial number of fresh foods are toxic unless carefully treated. In nature many plants are defended against predation by containing toxins which may be seriously poisonous for humans. Some mushrooms are relatively exotic examples. Cassava (manioc) root, a staple in parts of Asia, Africa and Latin America, of which around 250 million tonnes are now produced a year, is an important example: bitter varieties contain substantial amounts of cyanide compounds, and have to be drained, fermented or cooked to be safe to eat. More generally, one of the main reasons for processes that preserve food and its products is to protect not just against rotting, but also against poisonous microbial contamination, a reason why some processes mentioned in this commentary are identified as 'good'.

In this commentary the term 'toxic' is mostly used to identify processes used to make ingredients and products that are not poisonous in the sense that arsenic or food contaminated with dangerous pathogens is toxic. Rather, it is mostly used for processes used to make ingredients or foods that directly or indirectly are carcinogenic, or addictive, or else acutely pathogenic, because of the process itself. Here, to identify an edible substance as acutely pathogenic, means that as commonly consumed, it will or is liable seriously to derange metabolic processes, or rapidly increase the risk of serious disorders or diseases. What is 'serious' is a matter for judgement that needs to become the subject of further discussion and definition.

Seven observations on food processes

These observations are preliminary work in progress. They will be developed and published in revised form at a later date.

1 Many processes are good

Most food is processed, in some sense. Any rational account of processing, especially when used as a basis for public policies and actions, needs to stress that many types of food process are harmless, and that many of these are positively beneficial, directly or indirectly.

2 Many bad processes are nevertheless consistent with healthy dietary patterns

This and the other commentaries in this series are not recommending that food systems and thus dietary patterns 'go back to nature'. Foods and ingredients produced by processes that degrade the original whole food need not be excluded from diets, especially when consumed in combination with fresh or minimally processed foods. This said, public advice should invariably state that these are inferior to less processed items, when these exist and are available.

3 *Some toxic products if consumed sparingly can be reasonably safe*

All ingredients and products that use toxic processes must be identified as such in all relevant literature, and the items themselves must carry prominent warning labels. This will be resisted by manufacturers and therefore needs to be a statutory requirement agreed at global level as well as by national governments. In most cases there is no need to prohibit the products. Usually the required information should state that while using toxic processes, the ingredient or product is not likely to be harmful if consumed only occasionally, say on feast days or at weekends. Examples include smoked, cured and salt-pickled products of animal origin, and grilled and barbecued meat.

4 *Most ultra-processed products are not toxic*

Toxic or not, ultra-processed products tend to harm health (and the planet, food cultures, and local economies). I have said why in previous commentaries. Other things being equal, the less ultra-processed products consumed the healthier. Preliminary research, to be published in a later commentary, suggests a prudent top limit amounting to around 10-20 per cent of total energy depending on the mix between fresh or minimally processed foods and processed culinary ingredients, in contrast with the 50-60 per cent now common in the US, UK and some other high-income countries. All this said, in my view it would be going too far to say that most ultra-processed products are for these reasons toxic. Other commentators may disagree, and point to the facts that many ultra-processed products derange metabolic processes, most when consumed regularly are a cause of obesity and of chronic diseases, and many are formulated to be habit-forming to the point of being addictive.

5 *Some toxic products need stricter regulation*

Alcoholic drinks should be regulated by law, in ways similar to tobacco products. Methods include higher levels of taxation, stricter laws on availability, prosecution of traders selling alcohol to children, prominent warning labels, and lower 'safe limits' levels. These, and warning labels, should state that ethanol is carcinogenic as well as addictive, that in the case of cancer there is no safe limit (6), and also that women who are liable to become pregnant or who are pregnant should abstain. Baby formula as prepared is liable to be toxic unless water used to prepare it is safe, and in less resourced countries is very hazardous. It therefore needs much stricter regulation (9).

6 *All accounts of food and health need to stress processing*

The thesis of this series of commentaries is that with nutrition and health, what most matters is not food, nor nutrients, so much as what is done to food before it is

prepared and consumed – which is to say, processing. This needs to be reflected in all academic, professional, policy, consumer and public interest contexts.

7 *Some toxic processes need to be prohibited*

There is a good case for processes using specified cosmetic chemical additives to be prohibited. The hydrogenation process should be prohibited.

Conclusion

Public health nutritionists, and all other policy-makers, researchers and professionals concerned with the protection of public health inasmuch as this is affected by food and nutrition, need to know, agree and act on the impact of food processing and specific processes, on human health and well-being.

From the point of view of human health and well-being, the issue is not processing, it is the type, nature and extent of processing. The greatest hazard is food systems and supplies, and therefore diets, that are largely or even mostly, made up from ultra-processed products, whose characteristics are described elsewhere (1-3).

This commentary outlines three types of specific food processes. The distinction is made between processes that can be identified as good, in that they extend the duration of unprocessed foods or make their preparation and cooking easier, without changing substantially their nutritional quality; those that are bad, usually because they degrade foods, most importantly those that are commonly consumed; and those that are toxic, defined here as either carcinogenic, or harmful and addictive, or intensely pathogenic.

These three types of processing should be the subject of different types of statutory regulation, at global level, and as modified by governments at regional and national level to allow for traditional and established food systems and supplies and dietary patterns.

By law, foods that are processed in good ways, and which are not problematic in other respects, should be advertised, promoted, labelled and identified as such, in programme convened by governments that involve all actors with conflicted industry involved only in policy implementation, which are given priority at head of government level.

By law, foods and products that are processed in bad ways, should receive no support in any form from public funds, and should be identified in advertising,

promotion, labelling and other relevant ways, as degraded and best consumed occasionally if at all.

By law, toxic processes and products need to be identified and dealt with as such, by analogy with drugs, tobacco, and biocides. All toxic products, and relevant ingredients such as cooking fats, should carry prominent warning labels. The hydrogenation process, as used to make edible products, should as soon as practically possible be made illegal, worldwide.

References and note

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- 11 Monteiro C. The big issue is ultra-processing. The hydrogenation bomb. [Commentary] *World Nutrition*, April 2011, 2, 4: 176-194
- 12 Anon. It's the beginning of a new age. [Editorial] *World Nutrition*, April 2011, 2, 4: 169-175.
- 13 The prohibition of the hydrogenation process, while clearly justified by the evidence, will not of itself prevent cardiovascular disease as a pandemic condition. The evidence that saturated fats are an important cause of cardiovascular disease, is conclusive. Partial hydrogenation generates *trans*-fats

and also saturated fats; and complete hydrogenation generates greater quantities of more intensively saturated fats, which is why it is rational to prohibit hydrogenation rather than single out *trans*-fats. But hydrogenation can be replaced by other processes that naturally saturated fats and oils, notably palm oil. Prohibition of hydrogenation is a vitally important public health measure, but it is not, as some think, a panacea.

14 www.businessdictionary.com

15 The definition goes on to say: ‘Technically, a substance is toxic if its (1) medial lethal dose (Lethal Dose 50 or LD50) is more than 50 milligrams (but not more than 500 milligrams) per kilogram of body weight when administered orally to albino rats weighing between 200 to 300 grams each, (2) LD50 is more than 200 milligrams (but not more than 1000 milligrams or 1 gram) per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 to 3 kilograms each...’And so on. This is useful from a toxicological point of view, in regulation of foods as safe or unsafe, but not otherwise.

Acknowledgement and request

Readers may make use of the material in this commentary, provided acknowledgement is given to the authors and the Association, and WN is cited.

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CAM states: Geoffrey Cannon has worked with me on all these commentaries and I regard him as my co-author. All the commentaries have benefited from discussions I have had in the last two years or so with Inês Castro, Renata Bertazzi-Levy, and Rafael Claro, and also with Geoffrey Cannon and Fabio Gomes, who are co-authors with me of other papers, published (2,3) and in preparation. I have no conflicts of interest.

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