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FOOD PROCESSING: OPPORTUNITIES AND CHALLENGES

With a projected global population of almost 10 billion people by 2050 and limited natural resources available, sustainable production of adequate high-quality food is a major challenge facing our society. Food processing and preservation are among the most powerful tools available to achieve the goal of feeding the constantly increasing population because they are useful in addressing both post-harvest and consumer food losses. Food processing and full utilization of resources help to achieve food safety, increase shelf life, and improve the nutritional value of foods. Typical food processing includes operations such as mixing and formulating raw materials, pasteurization, heating, freezing, chilling, filtration, drying, fortification, packaging and the addition of preservatives, colorants, and flavors. In this sense, cooking is a form of food processing. Nowadays, the majority of foods sold in grocery stores have been subjected to some degree of processing; however, people and organizations often give different definitions of “processed food”.

Food processing eliminates pathogenic microorganisms, may increase the availability or preservation of nutrients, and even reduce or deactivate innate harmful components. However, it is also evident that certain processes may result in the reduction of nutrients or potential bioactives. Some formulations increase ingredients that can contribute to poor health when consumed in high amount. Others may employ additives to extend shelf life and maintain flavor, texture and safety. Concerns have been raised among consumers and some health professionals about the potential negative effects of processed foods on human health and their relation to the obesity epidemic and chronic diseases such as type-2 diabetes and cardiovascular disease, in a scenario of increased sedentarism, reduced time for food preparation at home and overeating. These concerns are mainly associated with food products that have been subjected to heavy processing or contain components that dietary guidance recommends ‘to limit’, such as sugar and salt.

The impacts of processed foods on human health status have been studied using various systems to characterize the foods. Systems classifying foods according to levels of processing[1] include, EPIC,[2] LangaL,[3] NOVA,[4,5] and IFIC[6]. However, there is lack of agreement among the various systems as to placement of foods into a category. Some focused less attention on the degree and complexity of processing and more on a food’s formulation such as the presence of detractor ingredients or food additives including added nutrients and packaging. EPIC and LangaL provide detailed information about the composition of foods, but LangaL looks at the impact of various processes and their impact on nutrition. IFIC classification relies more on degree of processing than on the presence or absence of various ingredients. Studies analyzing the health impacts of this classification show that diets constructed according to recommended patterns, such as USDA’s MyPlate with a balance of foods from

all levels of processing, produced diets that would meet current dietary and nutrient recommendations.[6,7]

The NOVA classification of foods was first proposed by Monteiro and his colleagues from the Department of Nutrition, School of Public Health, University of São Paulo, Brazil[5]. NOVA groups foods into four categories: group 1, unprocessed foods; group 2, processed culinary ingredients; group 3, processed foods; and group 4, ultra-processed foods (UPF) and drink products. UPF were defined as industrial formulations rich in salt, sugar, oils, and fats, while poor in fiber, micronutrients and bioactives.[4,5] They may contain ingredients not used in kitchens or may have been subjected to a series of processing steps. Typical examples of UPF are cakes, chips, carbonated soft drinks, reconstituted meat/fish products, and ready-to-eat meals,[8] but they also include any foods enriched or fortified with added nutrients including infant formulas; frozen or canned vegetables and fruits with added sugar or salt and bread, even whole-grain breads and cereals with more than five ingredients.

NOVA has been used in scientific research as a classification system, despite criticism about its rigorousness and reliability.[1,9] Studies assessing the health impacts of NOVA classification show that high intakes of some UPFs are associated with greater likelihood of weight gain and other adverse effects.[10-15] Because of their composition and limited nutritional contribution, many are also named in current dietary guidance as foods 'to limit' because overconsumption may have some negative health effects due to their low nutrient density and because they may displace recommended dietary choices.[16] However, infrequent and moderate consumption of such food may still be safe and it is unlikely to have negative impacts on weight or health, while more scientific evidence is required before making final conclusions.

Nevertheless, research studies that used NOVA as a classification system are an indication of the system's usefulness. However, NOVA system can be confusing in terms of understanding which foods should be in each category since it neither delineates nor describes the processing operations used. Further, there is no assessment of their complexity and impact on the nutritional and food safety qualities of the food. Thus, the NOVA definition of UPF fails to clearly differentiate the degree of processing or amounts of detractor ingredients. For example, tomatoes canned without salt are considered to be 'processed'. Vacuum-packed tomatoes in a pouch would be considered minimally processed (despite the fact this is a form of canning); those canned with salt are categorized as 'processed'; and those canned with salt and four other ingredients would be UPF even though the processing in the three examples is roughly the same. Further they are labeled UPF irrespective of whether the other five ingredients are oregano, garlic, basil, and onions, or fat, sugar, additives and celery extract.

Foods designated as 'processed' or 'UPF' may actually be recommended by dietary guidance because they are important foods in MyPlate food groups due to their nutrient-dense and contain health-promoting bioactives and ingredients. Examples include foods fortified with folate and other vitamins, minerals, and other important compounds such as omega-3 fatty acids or with additives that prevent microbial growth. These have been shown to be used in a diet that meets dietary

recommendations.[6] Foods such as bran-rich, fortified breakfast cereals have been shown to improve the nutritional status of folate, B vitamins and iron and dietary fiber. [17-22] Further, despite their sugar and salt content, these foods have been associated with greater likelihood of normal body mass index (BMI).[7,16,17] Nonetheless, attention should also be paid to the consumers' demand for clean label products and to avoid using unfamiliar chemical names.

Concerns about the use of the NOVA classification include the following:[1,7,9] There are no published studies showing that consumers both understand and can utilize NOVA in order to make healthy food choices, and no studies compare the use of the NOVA with the use of vetted dietary advice (e.g. the Mediterranean diet) for consumer understanding and use. No studies show that its use as a tool for informing and influencing consumer choice is equal to or better than conventional advice or various national dietary guidance such as MyPlate. Such non-precise categorizations can lead consumers to erroneously deduce that all food processing is bad and that processed foods and/or foods that contain additives and ingredients not used in the home kitchen are unhealthy. This subtle bias is worrying since food processing is one of the most efficient tools to provide safe, adequate and high-quality food to the growing global population. Thus, such generalizations should be avoided. Different views about ultra-processed foods have been expressed and published by various researchers and organizations. For further information, interested readers may refer to the various references in the bibliography.

It is important to note that there are three key criteria for selection of a specific food to be in a diet plan. First is the food's nutritional composition and an assessment of how the food contributes to the total diet. Even homemade foods or foods with minimal processing can have low nutritional value and negative health consequences if they are improperly cooked or contain few nutritious components and high amounts of culinary ingredients that should be used sparingly such as added sugars, salt, or saturated or trans fats. Second, diets constructed without all the food groups or the right mix of foods may not be healthy, despite all the food being minimally processed or homemade. Third, dietary advice should be affordable and practical, in order to be used by the population. For that reason, education of consumers about food composition, nutrition labeling, and basic food processing is crucial.

The food industry is continuously trying to develop and improve processing methods that produce safe and tasty foods while preserving and enhancing their nutritional value. They also are trying to minimize inputs, improve sustainability, and address ways to stabilize the food supply and prepare for the needs of 2050. Continuing investigations to identify relationships between food processing, food composition, and health status are also required. The application of the latest research tools, such as metabolomics, can be ideal to assess the impact of various processing techniques not only on food quality and composition, but also their effects on human health and disease.

Processed food is not part of the problem, and it must be part of the solution. Dietary advice must be clear, unambiguous and give real help with dietary choices for consumers from all ethnic, ages and economic groups. It should help consumers integrate processed foods in a varied and equilibrated

diet. Denigrating UPFs and not giving clear advice about dietary choices may not address nutrition and health problems.

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