

ESTABLISHMENT OF FOOD COMPOSITION DATABASE FOR LOCAL PROCESSED FOODS IN THE STATE OF KUWAIT

Alfeeli B* and Al-Mutairi A

*Food Technology Program, Environment, and Life Sciences Research Center, Kuwait Institute for
Scientific Research, Kuwait.*

Abstract: In Kuwait, there has been an increase in the consumption of fast and processed foods, resulting in a rise in non-communicable diseases. To make informed policy decisions, it is crucial to establish a comprehensive local food database. The purpose of this study was to create a local food composition database. The database includes nutrient values for locally processed foods from major Kuwaiti food processing lines. We collected nutrition information from 518 food products' labels of 16 food companies representing Kuwait's primary food processing lines. Following the USDA Food and Nutrient Database for Dietary Studies, we created a Microsoft Excel spreadsheet to establish a food composition database for locally processed food. The products' label information was grouped into six food groups. Each food group's products were classified into four classes based on their level of processing: Minimally processed food, processed food, Culinary processed food, and Ultra-processed food, according to the NOVA classification system. About 74.7% of the collected products were Ultra-processed food, which is high in saturated fats, sodium, and calories, and has negative impacts on global health and nutrition. This is the first study to use the NOVA in Kuwait, and the results will be recommended to policymakers for product classification in the market, visible to consumers as stickers or codes to raise awareness of highly processed food. Moreover, Results are ready to be incorporated into the ESHA food processing system in future research to be accessible to researchers in the nutrition field. This generated database will be a valuable tool for researchers and policymakers to establish preventive actions to reduce the prevalence of NCDs in the population and increase consumers' awareness of processed food.

Keywords: Food supply, Dietary patterns, non-communicable diseases, Food composition database

Introduction

In Kuwait, urbanization, globalization, and food industrialization have drastically changed food consumption patterns and caused numerous foods to evolve. As a result, the ultra-processed foods (UPF) share has increased in the population's diet. Food processing is defined by the U.S. Department of Agriculture (USDA) as any procedure that alters food from its natural state. Hence, any food apart from raw, agricultural commodities is processed food ((Poti et al., 2015)). Typical examples of UPFs are sweetened beverages, ice cream, chocolates, savory snacks, burgers, processed

*Corresponding Authors' Email: bfeili@kisir.edu.kw

meat, and frozen dishes. They are characterized by being high in fat, sugar, salt, and high-energy-dense foods. On the other hand, they are low in protein, fiber, and micronutrients ((Louzada et al., 2015)). Moreover, scientific evidence showed that unprocessed, minimally processed, and freshly prepared meals are gradually displaced with UPF worldwide ((Chen et al., 2020)). According to the global burden of Disease report published in the Lancet, the displacement caused a driving rise in the prevalence of obesity and other diet-related non-communicable diseases (NCDs) ((Dai et al., 2020a)). Therefore, the need to develop a nutritional values database of UPFs has become a scientific public demand globally. This approach will lead to the study of the relationship between diet-related diseases and the consumption of UPFs. Many countries began to develop food composition databases for their national and local processed foods to assess the population's dietary consumption and study the relationship between diet and healthy lifestyle in the population.

Food composition tables and databases traditionally include values of various nutrients and other components of foods related to health. In Kuwait, food composition databases were focused on only traditional and highly consumed dishes. One of the Kuwaiti food composition database's limitations is the lack of the nutritional values of highly consumed processed foods. According to the global nutritional recommendation, the nutritive values of locally processed foods should be included in the food composition database of the country to fill the gap of missing nutritive values for epidemiological and dietary assessment research.

Food composition databases are highly requested to include a range of food items that cover as completely as possible the foods eaten by the population. In Kuwait, the government subsidizes most basic food items such as rice, powdered full-fat milk, long-life liquid full-fat or skimmed milk, meat, chicken, fish, date, instant cereal, and other culinary ingredients like oil and tomato paste, etc. Major local food processing lines cover a large part of the Kuwaiti diet, including subsidies. Therefore, these products are widely consumed, and most of them are processed.

Food processing plays a significant role in providing the population with edible, safe, and nutritious foods as well as in food preservation. Processed food has several classification systems which classify processed food depending on different factors such as the extent of change (from the natural state), the nature of change (properties/ ingredients addition), and the purpose of processing (essential/cosmetic) ((Sadler et al., 2021)). Because of heterogeneity in industrially processed food, researchers suggested frameworks to aid the classification of processed food according to the degree of processing, from minimally to highly processed ((Eicher-Miller et al., 2012; Monteiro et al., 2010; Poti et al., 2015)). There are several systems for dietary data collection classifying processed food globally. One system is called the NOVA system, founded in Brazil and used in research internationally classifies food into four categories ((Monteiro et al., 2010)); another system is developed by the International Food Information Council (IFIC), which is used to examine the

nutrient quality of food consumed by Americans by five processing categories ((Eicher-Miller et al., 2012, 2015)), and one system by researchers at the University of North Carolina at Chapel Hill (UNC) that classifies all barcoded foods items sold in U.S. supermarkets into seven categories ((Poti et al., 2015)). According to the number of categories, NOVA and UNC describe the lowest processing categories as “unprocessed and minimally processed”; however, IFIC defines it as “minimally processed.” Defining the highest processing category also differs; NOVA uses the term “ultra-processed,” IFIC specifies a class called “prepared foods/meals,” and UNC identifies a group called “highly processed stand-alone”. Ultra-processed food (UPF) contains additives and preservatives; additionally, the NOVA system considers energy-dense products and those high in added sugars, fats, or sodium as UPF, which may be related to their observed detrimental effects on human health ((Fardet, 2018)). This GRA aimed to establish a computerized food composition database of locally processed foods from Kuwait's primary food processing lines. The products were classified according to the NOVA food processing classification system, which has been recognized as a tool in nutrition research with potential for broader application in food policy ((Kelly & Jacoby, 2018a)). The developed database provides scientific evidence for policymakers to set prevention measures to decrease the prevalence of NCDs in the population.

Samples and Methodology:

Sample: Major food processing lines in Kuwait were contacted to obtain a list of their products, including food labels. An official letter was sent to each company to provide a detailed soft copy of their products' food label information, and most companies cooperatively and gratefully responded. Other food companies' label information was collected from supermarkets as product images; hence A total of 518 food products' nutrition fact label information were collected.

Development of food database. A database for the nutrient content of locally processed foods was created using a Microsoft Excel spreadsheet. The database was created following the USDA Food and Nutrient Database for Dietary Studies (U.S. Department of Agriculture, 2020).

Data entry. Data were collected either from food nutrition fact labels on the products available in local supermarkets and Co-ops. or were provided by food companies as digital documents. Data were entered as 100ml or 100g, with all nutrition fact label information included in an Excel Spreadsheet. In the Excel spreadsheet, any values that were not mentioned per 100 g/ml in the food label were calculated to be per 100 g or ml, as well as converting the percent daily values. Nutrient values that were not mentioned in the label were assigned a value of zero.

Results and Discussion

Food processing classification systems, in particular NOVA, offer benefits in nutrition research for evaluating diets, dietary patterns, and food environments. NOVA has already contributed to public policy specifications for promoting healthy diets, including healthy eating guidelines and the identification of foods that require regulatory control. This system appears to adapt across countries and cultures, leading to broader application in food policy (Kelly & Jacoby, 2018b).

In this research, a total of 518 food products' nutrition fact-label information were collected from 16 food companies representing Kuwait's main food processing lines. Data were entered in an Excel spreadsheet and grouped into several categories as follows: Dairy products and Ice creams, Bread and Bread Products, Meat and Meat Products, Beverages, Snacks, and culinary products. Products quantity in each category were (201, 69, 39, 138, & 19) respectively. Products were classified according to the NOVA food processing classification system (Monteiro et al., 2019). As shown in Table. 1, the most abundant processing category is Ultra-processed, with 74.7% of all products, followed by Minimally processed, then processed, with Culinary processed as the least category since culinary products are limited.

Table 1. Locally Processed Food Categories Classified According to NOVA Food Classification System

Processing Category /Food Category	Minimally processed	Processed Culinary	Processed	Ultra- processed	Total
Dairy products and Ice- creams	43	0	43	115	201
Bread and Bread products	0	0	0	69	69
Meat and Meat products	0	0	12	40	52
Snacks	0	0	1	137	138
Beverages	14	0	0	25	39
Culinary products	12	3	3	1	19
Total products	69	3	59	387	518

Ultra-processed foods are usually characterized by high saturated fats, sodium, and calories. Gupta et al. reported that UPFs are likely to be energy-dense, low-cost, and nutrient-poor with low energy cost that might explain the link between UPFs and adverse health effects (Gupta et al., 2019). As shown in Table 2. we found that among all processed food surveyed in this research in Kuwait, the highest average of saturated fats and calories are in Processed culinary ingredients; this is attributed mainly to oils and butter. The second-highest average of saturated fats and calories is in the Ultra-processed category. The average sodium was highest in the Ultra-processed, followed by processed food category, consistent with Gupta et al.'s research.

Table 2. Average of Saturated fat, Sodium, and Calories per 100g within each Processing Category

Processing Category	Average of Saturated fats	Average of Sodium	Average of calories per 100g
Minimally processed	1.08	67.40	104.83
Processed	6.25	229.82	216.78
processed culinary ingredients	44.00	3.33	817.33
Ultra-Processed	5.79	1589.96	309.56

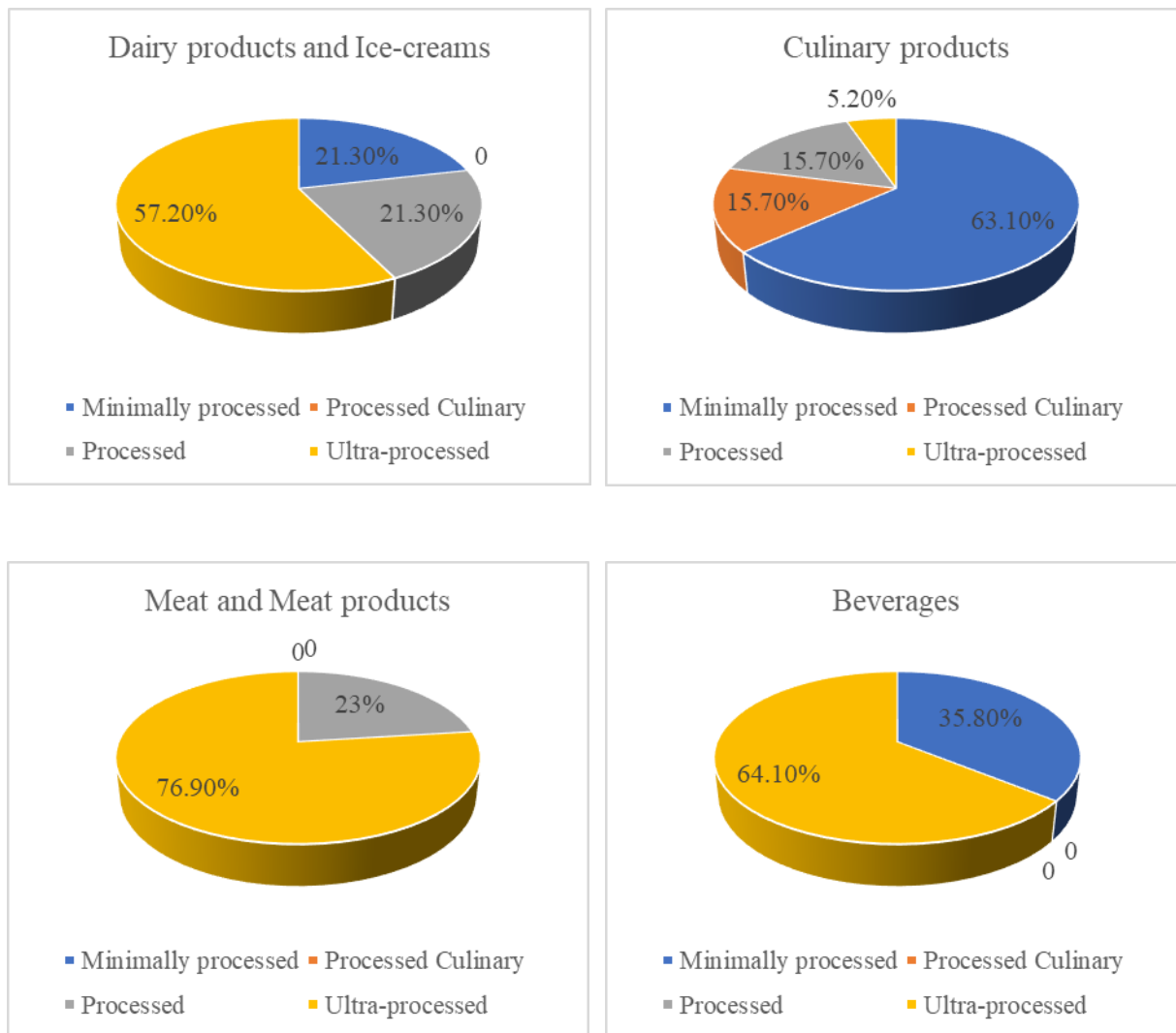


Figure 1. Food processing categories within each food category.

Fig. 1 shows food processing categories across all food groups. In Dairy products and Ice-creams, more than half of the products are Ultra-processed, while minimally processed and processed products each accounted for 21% of the products. In Meat and meat products, slightly more than Three-quarters of all products are Ultra-processed, while less than a quarter are Processed with no other categories. In Beverages, more than half of the products are Ultra-processed, with the rest Minimally processed. In Culinary products, around 60% are Minimally processed while processed culinary and Processed products each accounted for 15.7% of the products, this food category has the least amount of Ultra-processed product 5.2% only. Bread and Bread products are not shown in the figure because all of the products are Ultra-processed. Also, almost all Snacks products are Ultra-processed with only one processed product. According to our data, most of the local products in Kuwait are Ultra-processed classified by the NOVA food processing classification system.

Conclusions and Recommendations

Ultra-processed food products have negative impacts on global nutrition and health. The evidence so far suggests that the displacement of unprocessed or minimally processed foods and freshly prepared dishes and meals by ultra-processed food and drinks is causing the global burden of obesity and other diet-related chronic non-communicable diseases (Dai et al., 2020b). Having a specified, well-recognized system such as NOVA is crucial for identifying UPFs. Food composition data generated from this research activity serves as a valuable tool for dietary assessment to meet the nutrition research needs of the Kuwaiti population to find a dietary pattern and eating lifestyle. Since the database is based on an Excel sheet, it also represents the best proper database, which can be exported to any data utilizing an app or food processor program such as ESHA. We have encountered some food labeling issues in some local products, such as presenting the values as Daily Percent values only, the order of macronutrients and micronutrients not uniform across different food companies as well as within the same food company, some labels not per 100 g/ml for the consumer to compare easily and using different units for nutrients shown in the label. We strongly recommend policymakers have legislation regarding a unified nutrition fact label for local products produced and processed in Kuwait. Moreover, most of the processed foods in Kuwait, as per our data, are Ultra-processed, and many research studies linked UPFs to NCDs. Therefore, such awareness can be raised by enforcing a policy for food companies to label food products with colored tags by NOVA classification that assists the consumer in choosing healthier choices. To the best of our knowledge, this is the first study to classify Kuwait's local food products according to the NOVA food classification system. In conclusion, our data will be an essential tool to aid researchers and policymakers in establishing preventive actions to reduce the prevalence of NCDs in the population.

Funding: The research was funded by the Kuwait Institute for Scientific Research (KISR)

Declaration of Interest Statement: The authors declare that they have no conflict of interest.

Acknowledgments: The authors express their gratitude to the management of the Kuwait Institute for Scientific Research (KISR) for their continuous support during the execution of this project.

References

- Chen, X., Zhang, Z., Yang, H., Qiu, P., Wang, H., Wang, F., Zhao, Q., Fang, J., & Nie, J. (2020). Consumption of ultra-processed foods and health outcomes: A systematic review of epidemiological studies. In *Nutrition Journal* (Vol. 19, Issue 1). BioMed Central Ltd. <https://doi.org/10.1186/s12937-020-00604-1>
- Dai, H., Alsalhe, T. A., Chalghaf, N., Riccò, M., Bragazzi, N. L., & Wu, J. (2020a). The global burden of disease attributable to high body mass index in 195 countries and territories, 1990–2017: An analysis of the Global Burden of Disease Study. In *PLoS Medicine* (Vol. 17, Issue 7). Public Library of Science. <https://doi.org/10.1371/journal.pmed.1003198>
- Eicher-Miller, H. A., Fulgoni, V. L., & Keast, D. R. (2012). Contributions of processed foods to dietary intake in the us from 2003-2008: A report of the food and nutrition science solutions joint task force of the academy of nutrition and dietetics, American society for nutrition, institute of food technologists, and international food information council. *Journal of Nutrition*, 142(11), 2065–2072. <https://doi.org/10.3945/jn.112.164442>
- Eicher-Miller, H. A., Fulgoni, V. L., & Keast, D. R. (2015). Processed food contributions to energy and nutrient intake differ among US children by race/ethnicity. *Nutrients*, 7(12), 10076–10088. <https://doi.org/10.3390/nu7125503>
- Fardet, A. (2018). *Characterization of the Degree of Food Processing in Relation With Its Health Potential and Effects* (pp. 79–129). <https://doi.org/10.1016/bs.afnr.2018.02.002>
- Gupta, S., Hawk, T., Aggarwal, A., & Drewnowski, A. (2019). Characterizing ultra-processed foods by energy density, nutrient density, and cost. *Frontiers in Nutrition*, 6(May), 1–9. <https://doi.org/10.3389/fnut.2019.00070>
- Kelly, B., & Jacoby, E. (2018a). *Public Health Nutrition* special issue on ultra-processed foods. *Public Health Nutrition*, 21(1), 1–4. <https://doi.org/10.1017/S1368980017002853>
- Louzada, M. L. da C., Martins, A. P. B., Canella, D. S., Baraldi, L. G., Levy, R. B., Claro, R. M., Moubarac, J. C., Cannon, G., & Monteiro, C. A. (2015). Ultra-processed foods and the nutritional dietary profile in Brazil. *Revista de Saude Publica*, 49. <https://doi.org/10.1590/S0034-8910.2015049006132>
- Monteiro, C. A., Cannon, G., Lawrence, M., Costa Louzada, M. L., & Machado, P. P. (2019). The NOVA food classification system and its four food groups. In *Ultra-processed foods, diet quality, and health using the NOVA classification system*.

Monteiro, C. A., Levy, R. B., Claro, R. M., Castro, I. R. R. de, & Cannon, G. (2010). A new classification of foods based on the extent and purpose of their processing. *Cadernos de Saúde Pública*, 26(11), 2039–2049. <https://doi.org/10.1590/S0102-311X2010001100005>

Poti, J. M., Mendez, M. A., Ng, S. W., & Popkin, B. M. (2015). Is the degree of food processing and convenience linked with the nutritional quality of foods purchased by US households? *American Journal of Clinical Nutrition*, 101(6), 1251–1262. <https://doi.org/10.3945/ajcn.114.100925>

Sadler, C. R., Grassby, T., Hart, K., Raats, M., Sokolović, M., & Timotijevic, L. (2021). Processed food classification: Conceptualisation and challenges. In *Trends in Food Science and Technology* (Vol. 112, pp. 149–162). Elsevier Ltd. <https://doi.org/10.1016/j.tifs.2021.02.059>

U.S. Department of Agriculture. (2020). *Food Surveys Research Group Home Page*. USDA Food and Nutrient Database for Dietary Studies 2017-2018. <http://www.ars.usda.gov/nea/bhnrc/fsrg>