

The Impact of Chemical Composition of Processed Foods on Human Health in Bangladesh

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Abstract - Processed foods have become a staple in the diet of many Bangladeshis due to urbanization and changing lifestyles. However, their chemical composition raises significant public health concerns. Investigating chemical composition of processed food consumption in Bangladesh and evaluating its relationship to dietary quality are the goals of this study. This study applies data from a nationwide household food budget survey to a classification of foods based on the kind, degree, and purpose of food processing. Foods are divided into three categories: chemical composition of processed food (Group 3), processed culinary components (Group 2), and unprocessed or slightly processed foods (Group 1). The population was selected from Dhaka city in Bangladesh. The result of this study is the average per capita energy availability from food purchases was 8908 (SE 81) kJ/d (2129 (SE 19) kcal/d). Chemical composition of processed foods accounted for more than 61.7 percent of dietary energy (Group 3), compared to 25.6 percent from Group 1 and 12.7 percent from Group 2. The total diet included less fiber than advised and surpassed WHO upper limits for fat, saturated fat, free sugars, and sodium density. Additionally, it surpassed the World Cancer Research Fund/American Institute for Cancer Research's average energy density goal. When combined, Group 3 products are higher in fat, sugar, salt, and energy density than Group 1 and Group 2 products alone. According to the current analysis, any significant dietary change would need consuming significantly fewer chemical composition of processed food and a greater number of meals and dishes made with minimally processed foods and processed culinary components.

Keywords: Chemical Composition, Processed Foods, Dietary Quality, Obesity, Bangladesh.

I. INTRODUCTION

The dietary habits in Bangladesh are undergoing a significant transformation, with processed foods becoming

increasingly popular. These foods, while convenient, often contain chemical additives, preservatives, and other harmful components (Al MuktaDir et al., 2019). The rapid rise in the production and consumption of readily available "fast" or "convenience" ready-to-eat or ready-to-heat processed food and drink products is a major contributing factor to the pandemic of overweight and obesity as well as the sharp increase in related chronic diseases, particularly in lower-income nations (Patra et al., 2022). These days, impartial authority generally agrees with this. Supporting this, recent data from three US cohorts demonstrates that eating a variety of foods and beverages, including processed meats, sugar-sweetened beverages, white bread, cookies and biscuits, and French fries and chips, is linked to weight gain in adults (Halimuzzaman et al., 2024). Strangely enough, however, the fact that the products in question are processed is nearly always either disregarded or downplayed, or even omitted (Susan L. Prescott, 2024). Moreover, food categories like Bangladesh's Food Guide do not specifically mention food processing (Sadler et al., 2021). These still rely on nutrient and food groups that were initially created in the early 20th century, when obesity was rare and only a modest quantity of food was bought in bulk, frequently for use as components in home cooking (Mohammed Mosaraf Hossain, 2022). Furthermore, food processing is rarely covered in dietary evaluations since techniques like the FFQ and 24-hour recall are typically not made to gather enough information to enable the differentiation of foods according to processing (Neri et al., 2023). A research team at the University of São Paulo's Faculty of Public Health has presented a new classification (Kamrul et al., 2022) that takes into account the type, scope, and intent of food processing. "All methods and techniques used by industry to turn whole fresh foods into food products" is the definition of food processing (Ristic et al., 2024). All foods fall into one of three categories under this classification: minimally processed, unprocessed, or Group 1 consists of processed foods, Group 2 of processed culinary components, and Group 3 of chemical composition of processed food (Sajeeb Hassan, 2022). These differences cover biological concerns as well as social, economic, cultural,

and other facets of public health nutrition. Other recent classifications that focus on processing in general, such as those in Guatemala and Europe, are less valuable because they simply consider the level of processing (Alarcon-Calderon et al., 2017). Researchers at the University of São Paulo have used the new classification to identify how ultra-processed items have steadily replaced minimally processed foods and processed culinary ingredients for usage at home in Brazil over the past three decades. A study of this kind has significant ramifications. These goods are frequently, if not always, high in refined starches, sugars, fats, or salt, have a high glycaemic load, are frequently offered in large quantities, are usually designed to be highly palatable and habit-forming, and are heavily promoted and marketed. According to a cross-sectional study, adolescents who consume large amounts of chemical composition of processed food are also more likely to have metabolic syndrome (Lima et al., 2022). It is currently unknown how many ultra-processed items are consumed outside of Brazil. The current study aims to examine chemical composition of processed food consumption in Bangladesh and evaluate its relationship to dietary quality. This study aims to investigate the implications of the chemical composition of processed foods on public health in Bangladesh.

II. MATERIALS AND METHODS

2.1 Data Sources

The most current Food Expenditure Survey (FOODEX), which was carried out in Bangladesh by Statistics Bangladesh's Income Statistics Division in 2023, provided the data used in this study. This study offers nationwide estimates of household food and non-alcoholic drink expenditures and quantities, together with the sociodemographic details of each home (Waqas et al., 2024). The people live in Dhaka city participated in the FOODEX, which was done all year round and covered 98% of Bangladeshi. Small geographic areas were chosen, and within these clusters, homes with comparable sociodemographic characteristics were chosen to create a stratified sample. All of the estimations that are shown here account for the sampling weights that FOODEX provides. You can find a thorough explanation of the FOODEX sample techniques elsewhere.

2.2 Data Collection

Through the use of standardized questionnaires, information on income and other socioeconomic factors was acquired. For fourteen days in a row, one person from each family kept a diary in which they recorded their purchases of food and beverages. The document contained comprehensive details about the costs (tk) and quantities (kg or liters) of every store-bought item. Meals and snacks purchased from restaurants (including takeout and delivery food consumed at

home) only had expenditure data and were excluded from our research. At the conclusion of the recording phase, interviewers went to families to ensure that all diaries were complete. The amounts of particular foods purchased by the homes were obtained straight from the expense notebook, and as is customary, houses with comparable geographic and socioeconomic characteristics were consulted to fill in any gaps in the quantities. A list of 194 food items was used to recode all food purchase information. You can find more thorough details regarding the procedures used for data gathering and treatment elsewhere.

2.3 Data Analysis

The classification system created at the University of São Paulo was used to comprehensively reanalyze the FOODEX public-use microdata file for the purposes of the current work (Rasheed et al., 2022). The units of analysis were individual homes ($n = 5643$). First, using the Bangladeshi Nutrient File (BNF, Version 2010), the amounts of food that were purchased were translated into energy (kcal; 1 kcal = 4.184 kJ) (Woo, 2022). In order to accomplish this, a suitable food item from the BNF was matched with each of the 194 codes supplied in FOODEX. Based on all food products purchased, the 2023 household average daily per capita energy availability and standard error were calculated. Assigning food purchases to the three food groups mentioned above was the second stage (Yusentha Balakrishna, 2023). Some concessions had to be made. For instance, because the FOODEX statistics do not differentiate between unsweetened and sweetened juices, or even between fruit juices and "fruit" drinks that actually include a little amount of real fruit juice, all fruit juices were categorized as chemical composition of processed food (Mihalev et al., 2018). Then, for the entire population, mean estimates and standard errors for the relative contributions of each food group and food item to the overall household energy availability (as a percentage of total energy) were computed. Comparable calculations were performed for population strata that corresponded to the quintiles of the distribution of Group 3 products' relative contributions to the overall availability of energy (Erbaugh et al., 2020). We computed standard nutritional indicators for the average Bangladeshi household food basket in 2023 as well as for two simulated food baskets: one that only contained ultra-processed Group 3 products and the other that combined only unprocessed and minimally processed foods (Group 1) with processed ingredients (Group 2) in order to estimate the likely health effects of consuming chemical composition of processed food. Each food item's energy contribution in the food basket was always maintained in proportion to its energy contribution in the average food basket for a household nationwide. For example, if bread and confections accounted for 10% and 5% of the total, respectively. The simulated

basket maintained the same 2:1 ratio of the total energy in the typical national basket.

Next, we contrasted the dietary indicators in the two simulated food baskets and the typical Bangladeshi home food basket with the WHO's recommended ranges for the prevention of chronic diseases (1). The percentage contribution to total energy availability from protein (10–15%), fat (15–30%), of which saturated fat (10%), carbohydrates (55–75%), of which free sugars (10%), fiber density (11.1 g/4184 kJ (1000 kcal)), and sodium density (0.90 g/4184 kJ (1000 kcal)) were among the dietary indicators (with their recommended ranges) included in the current study. The total daily recommendations for fiber (.25 g/d) and sodium (.2 g/d) as well as the estimated averaged-out energy need for Bangladeshi men and women with low levels of exercise (9414 kJ/d (2250 kcal/d)) were used to determine the recommended limits for these densities (18). We also contrasted the energy density of the entire diet, excluding beverages, with the 5.23 kJ/g (1.25 kcal/g) target suggested by the American Institute for Cancer Research/World Cancer Research Fund (WCRF/AICR) (3). We took into account the weight of each food item as it is typically consumed while calculating energy density. To do this, we adjusted for cooking and/or preparation losses using the CNF yield adjustment factor. In a subsequent phase, we computed the identical nutritional metrics based on quintiles of the distribution of Group 3 goods' proportional contributions to overall energy availability. To determine whether these indicators differed by quintile of Group 3 foods' relative contribution to total energy availability, linear regression was also employed. Household income was also taken into account. To enable national estimates, FOODEX provided sampling weights to each household for all estimates computed in the study. The statistical software program SPSS version 19 was used for the analysis, which also took sampling design and weighting effects into consideration.

III. RESULTS AND DISCUSSION

3.1 Results

In 2001, the total amount of food purchased for domestic consumption by Bangladeshi homes came to 8908 (SE 81) kJ/d (2129 (SE 19) kcal/d). The energy share of foods categorized by the type, degree, and intent of their processing is displayed in Table 1. In 2001, unprocessed or minimally processed foods accounted for 25.6% of all energy purchases made by Bangladeshi families (Group 1); processed culinary components for 12.7% (Group 2); and Chemical composition of processed items for 61.7 % (Group 3). Group 1's top foods in terms of energy content were fruits (3.6%), milk and plain

yoghurt (6.3%), and meat and poultry (6.6%). Corn and rice were among the very few grains that contributed (1.7%). Table sugar (2.3%), vegetable oils (2.3%), and animal fats (2.8%) accounted for the majority of Group 2's energy shares. The primary energy sources for Group 3 were breads (11.9%), chocolate, candies (confectionery), processed meats (4.6%), sugary baked products (5.8%), soft drinks and sweetened juices (6.3%), ice cream and other sweets (7.1%), and ready-to-eat/heat meals and dishes (4.6%). To create Table 2, we separated all households into equal quintiles based on how much chemical composition of processed food they consumed. These ranged from 33.2 percent of total energy by the 20% of households that bought the fewest Group 3 goods to 84.5 percent by the 20% of households that bought the most Group 3 things. Conventional nutritional indices for the typical national household food basket in 2001 are shown in Table 3. The WHO's recommended upper limits for fat (37.2 v. 30%), saturated fat (11.6 v. 10%), free sugars (12.3 v. 10%), Na density (1.6 v. 0.9 g/4184 kJ (1000 kcal)), and energy density (a very significant difference: 8.79 kJ/g (2.10 kcal/g) compared with the WCRF/AICR's recommended goal of 5.23 kJ/g (1.25 kcal/g)) were all exceeded by Bangladeshis' overall diet in 2023. Additionally, it supplied less fiber than the WHO minimum need of 9.6 vs. 11.1 g/4184 kJ (1000 kcal). Its protein level (13.2% vs. 10–15%) was within the recommended range. Figure 3 displays identical metrics for two fictitious food baskets: one composed solely of ultra-processed items, and the other composed solely of unprocessed or moderately processed whole foods in addition to processed culinary components.

The food basket with no ultra-processed items had significantly more protein (19.2 vs. 10.1%) and fiber (14.8 vs. 6.8 g/4184 kJ). (1000 kcal)); it also has less fat (33.8% vs. 39.3%), less saturated fat (11.3% vs. 11.7%), and significantly less low in Na (1.4 vs. 1.7 g/4184 kJ (1000 kcal) or 3.1 vs. 3.8 g/d) and free sugars (3.8 vs. 18.6%). The energy density of the diet consisting solely of Group 1 and Group 2 foods is likewise much lower (5.4 kJ (1.3 kcal) vs. 11.7 kJ (2.8 kcal)/g). Nutrient indicators are displayed in Table 4 and change according to the proportion of chemical composition of processed goods in the total energy purchased. The lowest quintile's food basket has more protein (14.9 vs. 11.6%) and fiber (11.2 vs. 8.0 g/4184 kJ (1000 kcal)) than the highest quintile. It also has less fat (35.1 vs. 38.2%), free sugars (9.2 vs. 15.1%), sodium (1.1 vs. 1.6 g/4184 kJ (1000 kcal)), and energy density (7.53 kJ (1.80 kcal) vs 9.62 kJ (2.30 kcal)/g). After adjusting for family income, a strong linear trend persists across all quintiles for all of these measures (P, 0.01).

Table 1: The Three Food Groups' Respective Contributions to the Daily Energy Availability of Bangladeshi Households

Food group/main items within each group	% of total energy	
	Mean	SE
Group 1: Unprocessed or minimally processed foods	25.6	0.2
Meat and poultry	6.6	0.1
Milk and plain yoghurt	6.3	0.1
Fruits	3.6	0.1
Vegetables	2.4	0.1
Eggs	1.8	0.0
Roots and tubers	1.7	0.0
Grains	1.7	0.1
Fish	0.2	0.0
Other unprocessed or minimally processed foods*	1.3	0.0
Group 2: Processed culinary ingredients	12.7	0.2
Fats (butter, lard, cream)	2.8	0.1
Oils (all types)	2.3	0.1
Table sugar	2.3	0.1
Pasta	1.9	0.1
Wheat flour	1.5	0.1
Other processed culinary ingredients-	1.9	0.1
Group 1 Group 2	38.3	0.2
Group 3: chemical composition of processed foods	61.7	0.2
Breads	11.9	0.1
Candies, chocolate and ice cream	7.1	0.1
Soft drinks and sweetened fruit juices	6.3	0.1
Sugary baked goods	5.8	0.1
Processed meats	4.6	0.1
Ready-to-eat/heat meals and dishes	4.6	0.1
Cheeses	3.9	0.1
Margarine	3.3	0.1
Sauces	3.2	0.1
Crisps (potato- or grain-based)	2.9	0.1
Breakfast cereals	2.6	0.1
Crackers	1.9	0.1
Other ultra-processed foods-	3.6	0.1
-Nuts and seeds (unsalted), shellfish, dried herbs, coffee, tea.		
-Corn flour, starches, honey, other sugars and sweeteners.		
-Salted and dried or oil-preserved canned fish, canned vegetables, instant noodles, sugared milk drinks.		

Table 2: Contribution (%) of the three food groups to total daily house hold energy availability by quintile of the contribution of ultra-processed products in Bangladesh

Food group/main items	Quintile of the contribution of Group 3 products to total energy									
	1		2		3		4		5	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Group 1	38.8	0.7	29.6	0.3	25.2	0.2	21.7	0.2	13.0	0.2
Meat and poultry	10.2	0.4	8.0	0.2	6.6	0.2	5.6	0.1	2.8	0.1
Milk and plain yoghurt	8.8	0.5	6.6	0.2	6.2	0.2	5.6	0.1	3.8	0.1
Fruits	5.0	0.5	4.2	0.1	3.4	0.1	3.2	0.1	2.2	0.1
Vegetables	4.0	0.2	2.8	0.1	2.2	0.1	1.8	0.1	1.2	0.0
Eggs	2.3	0.1	2.1	0.1	1.9	0.1	1.5	0.1	1.0	0.1
Roots and tubers	2.2	0.1	2.2	0.1	1.8	0.1	1.5	0.1	0.8	0.1
Grains	3.9	0.3	1.8	0.1	1.6	0.1	1.2	0.1	0.6	0.1
Fish	0.4	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.1	0.0
Other Group 1*	2.0	0.2	1.6	0.1	1.3	0.1	1.1	0.1	0.5	0.0
Group 2	28.0	0.6	16.2	0.2	10.7	0.3	5.8	0.2	2.5	0.1
Fats (butter, lard, cream)	4.5	0.3	4.3	0.2	2.7	0.1	1.8	0.1	0.6	0.1
Oils (all types)	6.9	0.4	2.5	0.2	1.5	0.1	0.5	0.1	0.1	0.0
Table sugar	4.9	0.2	3.2	0.2	2.0	0.1	0.8	0.1	0.4	0.1
Pasta	3.0	0.2	2.4	0.2	2.2	0.1	1.4	0.1	0.7	0.1
Wheat flour	5.1	0.3	1.5	0.1	0.5	0.1	0.2	0.0	0.1	0.0
Other Group 2	3.6	0.3	2.3	0.2	1.8	0.1	1.1	0.1	0.6	0.1
Group 1 Group 2	66.8	0.5	45.8	0.4	35.9	0.2	27.5	0.2	15.5	0.1
Group 3	33.2	0.3	54.2	0.1	64.1	0.1	72.5	0.1	84.5	0.2
Breads	7.1	0.2	11.2	0.2	12.1	0.3	14.1	0.3	15.1	0.4
Candies, chocolate and ice cream	3.4	0.1	5.7	0.2	7.1	0.2	8.4	0.2	10.8	0.3
Soft drinks and sweetened fruits juices	3.8	0.1	5.5	0.2	6.2	0.2	7.1	0.2	9.0	0.3

Sugary baked goods	2.8	0.1	4.8	0.2	5.6	0.2	7.1	0.2	8.5	0.3
Processed meats	2.4	0.1	4.6	0.1	5.2	0.2	5.1	0.2	5.9	0.2
Ready-to-eat/heat meals and dishes	2.2	0.1	3.6	0.1	4.6	0.1	5.6	0.1	6.9	0.3
Cheeses	2.5	0.1	3.8	0.1	4.4	0.1	4.4	0.2	4.3	0.2
Margarine	1.4	0.1	2.3	0.1	3.5	0.2	3.9	0.2	5.1	0.3
Sauces	1.7	0.1	2.8	0.1	3.5	0.1	4.0	0.2	4.2	0.2
Crisps (potato- and grain-based)	1.3	0.1	2.4	0.1	3.2	0.2	3.5	0.2	4.5	0.3
Breakfast cereals	1.4	0.1	2.7	0.1	2.8	0.1	3.1	0.1	2.8	0.2
Crackers	0.9	0.1	1.5	0.1	2.0	0.1	2.4	0.1	2.9	0.1
Other Group 3-	2.3	0.1	3.3	0.1	3.9	0.1	3.8	0.2	4.5	0.1

Group1: unprocessed/minimally processed foods; Group 2: processed culinary ingredients; Group 3: ultra-processed products.

*Nuts and seeds (unsalted), shellfish, dried herbs, coffee, tea.

- Corn flour, starches, honey, other sugars and sweeteners.

- Salted and dried or oil-preserved canned fish, canned vegetables, instant noodles, sugared milk drinks.

Table 3: Nutrient profile indicators of the average food basket and of two simulated food baskets in Bangladesh

Indicator	Average food basket		Food basket restricted to Group 1 and Group 2 products		Food basket restricted to Group 3 products	
	Mean	SE	Mean	SE	Mean	SE
% of energy from:						
Proteins (%)	13.6	0.1	19.2	0.1	10.1	0.1
Total carbohydrates (%)	49.2	0.2	47.0	0.2	50.6	0.2
Free sugars (%)	12.3	0.1	3.8	0.0	18.6	0.1
Total fats (%)	37.2	0.1	33.8	0.3	39.3	0.2
Saturated fats (%)	11.6	0.1	11.3	0.1	11.7	0.1
Na density (g/4184 kJ (1000 kcal))	1.6	0.3	1.4	0.0	1.7	0.0
Fibre density (g/4184 kJ (1000 kcal))	9.6	0.1	14.8	0.0	6.8	0.0
Energy density* (kJ/g)	8.8	0.0	5.4	0.0	11.7	0.0
Energy density* (kcal/g)	2.1	0.0	1.3	0.0	2.8	0.0

Group1, unprocessed/minimally processed foods; Group 2: processed culinary ingredients; Group 3: ultra-processed products

*Drinks excluded.

Table 4: Nutrient profile indicators of the overall diet by quintile of the contribution of ultra-processed products to total energy in food purchases in Bangladesh

Indicator	Quintile of the contribution of Group 3 products to total energy									
	1		2		3		4		5	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
% of energy from: Proteins (%)	14.9	0.1	14.1	0.1	13.8	0.1	13.4	0.1	11.6	0.1
Total carbohydrates (%)	50.0	0.4	49.5	0.3	49.6	0.3	49.6	0.2	50.2	0.3
Free sugars (%)	9.2	0.0	11.6	0.0	12.0	0.0	13.5	0.1	15.1	0.1-
Total fats (%)	35.1	0.4	36.4	0.3	36.6	0.3	37.0	0.3	38.2	0.3-
Saturated fats (%)	11.4	0.2	12.0	0.1	11.8	0.1	11.4	0.1	11.4	0.1
Na density (g/4184 kJ (1000 kcal))	1.1	0.4	1.4	0.3	1.5	0.3	1.6	0.3	1.6	0.3-
Fibre density (g/4184 kJ (1000 kcal))	11.2	0.0	10.1	0.0	9.7	0.0	9.1	0.0	8.0	0.1-
Energy density* (kJ/g)	7.5	0.4	8.4	0.4	8.8	0.4	8.8	0.4	9.6	0.4-
Energy density* (kcal/g)	1.8	0.1	2.0	0.1	2.1	0.1	2.1	0.1	2.3	0.1-
Total energy (kJ/d)-	10 008	254	9548	180	9665	164	9247	153	8134	147
Total energy (kcal/d)-	2392	60.6	2282	43.1	2310	39.2	2210	36.6	1944	35.1

*Drinks excluded.

- From store-bought food which represents 70–72% of all food expenditures for quintiles 1–4 and 65% for quintile 5.

- Significant linear trend across all quintiles ($P,0?01$).

3.2 Discussion

In the current study, we use a novel food classification based on the kind, scope, and intent of food processing to national data on 2023 household food purchases in Bangladesh. Our goal has been to examine how chemical composition of processed foods contribute to the Bangladeshi

diet and evaluate how they relate to nutritional quality. Brazil has published results from a prior study that used the same classification and comparable techniques(HOLTZ, Marcos, 2024). These differ greatly from those in Bangladesh. In India, Group 1 foods and Group 2 ingredients accounted for 42.5% and 37.5 percent of the total, or 80%, respectively. This was more than twice as much as the 25.6% and 12.7%, or

38.3%, found in Bangladesh. Other notable distinctions between Indian and Bangladeshi diets can be seen in household spending. The three Group 1 foods that provide the most energy in India is rice (16.6%), meat and poultry (8.2%), and beans (6.3%). Meat and poultry (6.6%), milk and plain yoghurt (6.3%), and fruits (3.6%) are the top three foods in Bangladesh. Grains like rice and corn make up a very small percentage (1.7%). In comparison, India had five times the energy percentage of plant oils (11.3%) and table sugar (12.4%) compared to Bangladesh (2.3% and 2.3%, respectively). According to these data, cooking and food preparation were still commonplace in India at the time of the polls, while only a small percentage of Bangladeshis routinely cooked and prepared meals at home, preferring to eat ultra-processed, ready-to-eat foods. The energy percentage of ready-to-eat/heat dishes and meals in Bangladesh (4.6%) was nine times that in India (0.6%), even when food consumed outside the home and takeout items were excluded. Soft beverages, juices, candies (confectionery), chocolates, ice creams, fruit preparations, cakes, and biscuits accounted for almost 75% of the free sugars consumed in Bangladesh. These ready-to-eat or ready-to-drink sugary snacks made up 19.2% of all the energy that Bangladeshi households purchased. In India, only 6.6% of total energy came from the same items. Soft drinks and sweetened juices were consumed four times more frequently in Bangladesh (6.3%) than in India (1.6%) (8). Because of their nature, Group 3 goods are likely to be eaten as snacks. In Bangladesh in 2023, snacks made up 23% of total energy intake, which was higher than breakfast consumption. Chemical composition of processed food consumption was found to be positively correlated with family income in India. The energy proportion of Chemical composition of processed items in Bangladesh, however, varied relatively little by income level, from 60.3% in the lower income group to 62.8% in the upper income group (data not shown). Perhaps the main factor at play here is the increased relative cost of Chemical composition of processed foods in Bangladesh and India were contrasted.

The nutritional value of highly processed foods: The information in this research shows that chemical composition of processed items is often unhealthy when compared to traditional nutrient indicators. In fact, a diet consisting solely of Group 3 goods has much higher fat and sodium, nearly six times the number of free sugars, and less than half the dietary fiber when compared to a diet consisting of Group 1 foods and Group 2 elements. Saturated fat does not differ significantly. Most significantly, the chemical composition of processed foods-only diet has more than twice the energy density of the other one. The analysis and findings of this and other studies have been influenced by the significant discovery that resulted from these results. The majority of Group 2 ingredients include sugar, carbohydrates, oils, and processed fats. They

are therefore high in energy and low in many nutrients when consumed alone. Since they can obviously be consumed in excess, it becomes sense that suggestions aimed at enhancing public health should specifically target them. They aren't eaten by themselves, though. They are paired with Group 1 foods as culinary ingredients. According to the current study and the Indian one (Rolls, 2017), diets mostly composed of Group 1 items and Group 2 ingredients are significantly lower in energy density than diets primarily composed of Group 3 products. They are also higher in dietary fiber and lower in fat, free sugars, and sodium. This finding is counterintuitive, which is why we highlight it here. We think that this result is crucial for establishing public health nutrition policies, dietary guidelines, and programs and interventions aimed at preventing and controlling disease as well as safeguarding and enhancing overall well-being.

Creating a nutritious diet for Bangladeshis: According to our findings, chemical composition of processed food sources and dietary patterns, like those in Bangladesh, surpass WHO upper limits for fat, free sugars, and sodium while falling short of recommended dietary fiber levels. More importantly, the higher the energy density of the diet, the more ultra-processed goods are ingested. As the percentage of chemical composition of processed foods rises, diet quality generally declines. Nonetheless, an analysis of the quintile of Bangladeshi households with the lowest chemical composition of processed product consumption, which accounts for 33.2 percent of total energy, reveals that these diets are not far from WHO guidelines. They have enough dietary fiber (11.2 vs. 11.1 g/4184 kJ (1000 kcal)) and protein (14.9 vs. 10–15%). They just surpass the upper limit for Na (1.1 v. 0.9 g/4184 kJ (1000 kcal)) and fall below the recommended upper limit for free sugars (9.2 v. 10%). The area where they diverge is in fat (35.1% versus a maximum of 30%). Additionally, saturated fat is a little over the upper limit (11.4 vs. a 10% upper limit). The energy density, at 7.53 kJ (1.80 kcal)/g, is nevertheless significantly higher than the WCRF/AICR-recommended goal of 5.23 kJ (1.25 kcal)/g. It would be feasible to modify the Group 1 food composition in order to modify the diets of this fifth of Bangladeshis. For example, without making any additional adjustments, choosing lean meat cuts and 1% low-fat milk would reduce the consumption of saturated fat from 11.4 to 9.9% of total calories. Consuming less saturated fat would be achieved by switching from red to white meat and fish, or by replacing some meat with legumes. Only by reducing the frequency of consumption of certain ultra-processed products would it be possible to make additional changes to bring the nutritional indicators of this fifth of the Bangladeshi population well within WHO recommendations for fat, saturated fat, free sugars, and sodium, as well as to get closer to the WCRF/AICR goal for energy density. For instance, dietary

energy from chemical composition of processed foods would be less than one-third of total energy if sugared drinks, sweets, and salty snacks—which account for 8.5% of this group's total energy were only seldom, if at all, consumed. The study's primary conclusion is that, in terms of energy content, 80% of Bangladeshis consume diets that contain more than 50% chemical composition of processed foods. Without drastically cutting back on ultra-processed foods, these diets cannot be changed to comply with WHO guidelines and other recommendations meant to prevent and control obesity and related chronic diseases. This would entail a significant shift away from the use of Group 3 products that are ready to eat or reheat and toward the preparation and cooking of meals using Group 1 foods and Group 2 ingredients.

IV. LIMITATIONS

Due to the constraints of utilizing family food purchases as a proxy for individual food consumption, the current study had three major limitations. First, not all of the food that is bought is always eaten. Given that perishable Group 1 foods account for the majority of food waste, the real consumption of Group 3 products in Bangladeshi diets is probably considerably higher than what is depicted here. Second, takeout, home delivery and restaurant transactions are not included in the data analysis. Since a large portion of these purchases are likely to consist of chemical composition processed goods, their inclusion in the calculations would generally increase the proportion of these goods in Bangladeshi diets. We have given all nutritional indicators in relative rather than absolute terms in order to mitigate the aforementioned constraints about the dietary impact of chemical composition processed items. The most significant conclusion drawn from our research is that diets' overall quality declines as the percentage of highly processed goods rises. Only in the event that the association compared to the relationship seen for foods purchased from stores and consumed, the relationship between nutrient indicators and the percentage of chemical composition processed items in wasted foods, as well as in foods purchased from restaurants or fast-food outlets, was significantly different. A further drawback is that households, not people, were used as the unit of analysis for food purchase surveys. Our findings cannot be applied to every member of the household. This restriction pertains to the proportion of chemical composition processed foods in the diet as well as how they affect the general diet's quality. In order to clearly distinguish between the intakes of Group 1 foods, Group 2 ingredients, and Group 3 chemical composition processed products, future research on the prevalence and effects of chemical composition processed products should employ updated food frequency and 24-hour recall questionnaires. These new tools should then be used to survey entire diets. Confirming our findings from home food

purchases will require these surveys. In order to better understand the effects of consuming ultra-processed food, such surveys should also gather information on BMI and disease outcomes.

V. CONCLUSION

The current study demonstrates that chemical composition processed foods account for 61.7 percent of Bangladesh's dietary energy, as determined by the 2023 national household food expenditure survey. We also show that, when compared to a combination of less processed meals and processed culinary components, chemical composition processed goods are often unhealthy. Our earlier argument that diets heavy in or dominated by chemical composition processed foods cannot satisfy WHO and other dietary guidelines intended to prevent and control obesity and chronic diseases is supported by the findings given here. The only Bangladeshi population that is even close to meeting all nutrient targets for preventing obesity and chronic non-communicable diseases is the one-fifth that eats 33.2 percent of their energy from chemical composition processed foods. At least for Bangladesh, a preliminary finding is that less than one-third of the energy in a healthy diet would come from highly chemical composition processed foods. Only if diets are centered mostly on meals and dishes made with minimally processed foods and processed culinary components will this be possible. The chemical composition of processed foods has significant implications for public health in Bangladesh. Addressing these challenges requires coordinated efforts across government, industry, and civil society to reduce health risks and promote sustainable dietary practices.

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