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Applicability and challenges of nova classification in Indian dietary patterns: A narrative review

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Abstract
The current state of rapid urbanization, industrialization, and globalization in the world has resulted in intentional changes in the global food supply, and consequently, food systems have changed considerably over the past few decades leading to significant shift in food consumption globally (Popkin *et al*., 2020) [24]. One of the more significant consequences of this metamorphosis is the rise in the consumption of ultra-processed foods (UPFs), which are becoming an increasing focus of the poor nutritional quality of food circles and of association with a higher risk of non-communicable diseases (NCDs). The NOVA classification system is a system of food categorization based on the level and intent of industrial food processing – it has been widely adopted in nutrition epidemiology and public health research .NOVA framework has been well studied in the West but, not quite in an Indian context The dietary patterns of Indians are highly culturally diverse and multi-component dishes are commonplace and the food practices differ from region to region and may not necessarily fit into the NOVA categories (Shukla *et al*., 2017) [28]. We have foods which are a bit tricky to classify like dosa batter, packaged curd, paneer, masala mixes, and old fashion sweets. The review critically looks at the applicability of NOVA classification to the Indian dietary context, methodological limitations and cultural changes, and explores public health implications regarding the rise of UPF consumption in India.

Keywords: NOVA classification, ultra-processed foods, Indian dietary patterns, nutrition transition, food processing, public health nutrition

1. Introduction
Non-communicable diseases (NCDs), such as obesity and type 2 diabetes, hypertension and cardiovascular disease, have become a major global burden and nutrition-related behaviors are recognized targets for action. Conventional nutrient-based classifications that categorize foods according to their contents of some macro- and micronutrients have failed to effectively reflect the dietary complexity in modern food systems, and poor food-processing practices.

An alternative classification system, the NOVA system, was developed at the University of São Paulo, Brazil, and classifies foods based on how and to what degree they are industrially processed, and not just nutrient composition (Monteiro *et al*., 2019) [20]. NOVA has been embraced by many national dietary recommendations, international nutrition research efforts, as well as public health policy debates, especially since the groundbreaking experimental finding that ultra-processed diets alone cause overconsumption of energy and weight gain (Hall *et al*., 2019) [12].

The Indian context is indeed one of the intriguing yet complicated contexts for NOVA application. India is one of the most nutritionally diverse countries in the world, undergoing rapid nutritional transition which has resulted in the country facing the undernutrition and emerging diet-related NCDs. Ambiguities in classifications arising from traditional Indian culinary techniques (such as fermentation and multi-step preparations) as well as regional blends of spices and mixed dishes are not well captured by the Western and Latin American food environment-based framework.

This is a narrative review, which aims to:
(1) describe NOVA classification system and NOVA four food groups,

(2) discuss Indian dietary context, and the ongoing nutrition transition,
(3) debate the applicability of NOVA in Indian dietary patterns,
(4) identify methodological and cultural challenges, and
(5) discuss the public health implications and future research directions.

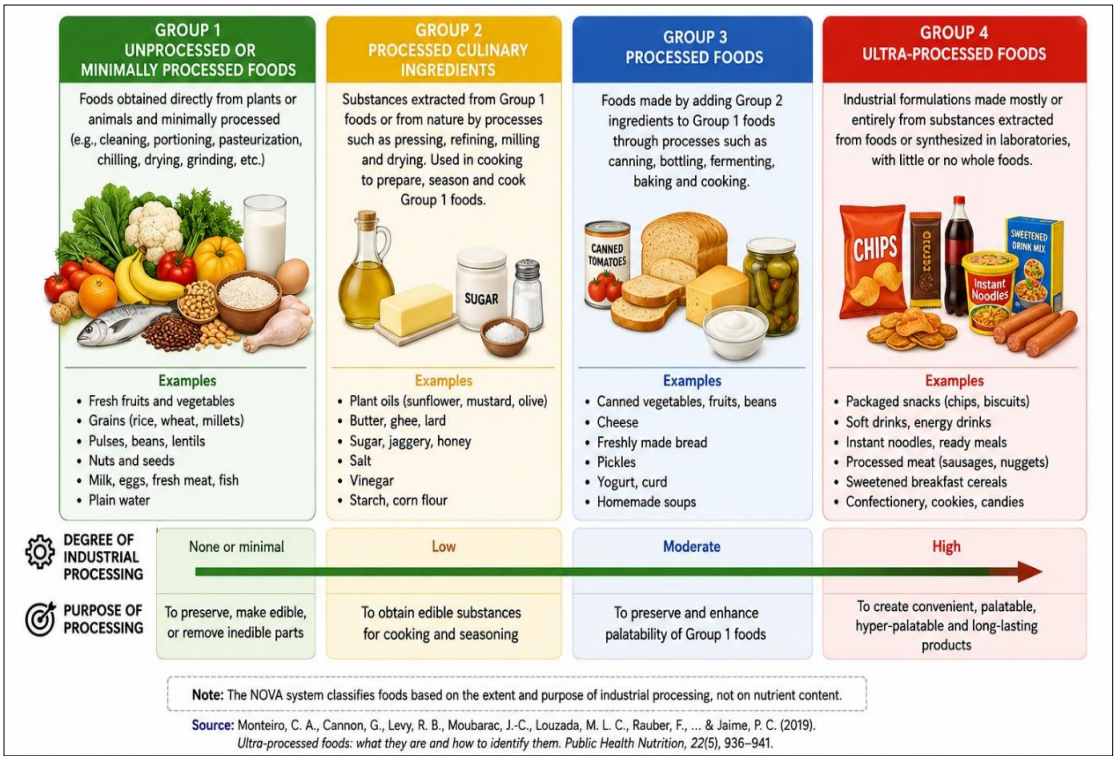

Fig 1: Nova food classification system: four groups organized by degree and purpose of industrial processing (based on monteiro *et al*., 2019) [20].

2. Evolution of the NOVA Classification System

Food classification systems were mainly based on nutrient content before the beginning of the 21st century, when foods were classified by the amounts of nutrient macronutrients (carbohydrate, protein, fat), vitamins and minerals present (Gibney *et al*., 2017) [9]. Nutrient composition alone did not sufficiently account for the increased prevalence of obesity and metabolic diseases with diet transitions, which generated the need to underpin the complex links between diet and chronic diseases through a systems-based approach. This stemmed from the awareness that the industrial food processing by which food additives, artificial colorings, preservatives, emulsifiers and flavor enhancers are added to the food can also have profound effects on the structure, taste and effects on health, effects not determined by nutrient analysis alone. The NOVA taxonomy is divided into four groups:

Group 1 (Unprocessed or minimally processed foods): Foods that are unaltered from their natural state or only minimally have been physically processed but not in a way that changes their nutritional composition significantly (e.g. dried or refrigerated foods). This includes fresh fruits, vegetables, legumes, whole grains, fresh meat, eggs and plain milk.

Group 2 (Processed culinary ingredients): Materials that are taken out of Group 1 foods or from the environment and then utilized in home cooking. Contains oils, butter, sugar, salt and flour. These are normally eaten in conjunction with at least one other item.

Group 3 (Processed foods): Relatively simple foods to which salt, sugar and/or oil have been added. Contains canned vegetables, cheese, freshly baked bread, and traditionally pickled foods. The purpose of processing is to make the food last longer, to improve the food appearance, flavor or texture, and to maintain the food identity.
Group 4 Ultra processed foods (UPFs): Industrial concoctions made primarily from refined food ingredients, additives, and ingredients designed and used only in industry (e.g., emulsifiers, flavor enhancers, artificial colors). They are formulated for great taste, ease of use, and great marketability. This includes sugary drinks, snack foods, instant noodles, processed meats, sweets and takeaway food. There are a number of epidemiological studies that have found association between high UPF consumption and other diseases such as obesity, hypertension, cardiovascular disease, metabolic syndrome, type 2 diabetes and all-cause mortality (Rico-Campà *et al*., 2019; Rauber *et al*., 2021; Canhada *et al*., 2020; Chen *et al*., 2020; Louzada *et al*., 2015) [3, 4, 16, 25, 26]. These associations were underpinned by a subsequent randomized controlled feeding study by Hall *et al*. (2019) [12] that showed a significantly higher caloric intake and weight gain in individuals allocated to UP diet compared to those in the MP diet, despite isocaloric isomacronutrient management.
Yet NOVA has received criticism in the scientific community due to the impact it has on the international community. The framework may be oversimplified as it

fails to take into account nutrient intake, portion sizes, cultural factors, and dietary patterns (Gibney *et al*., 2017, Astrup & Monteiro, 2022) [1, 9, 20]. There have also been points missing from some countries and food systems where they were being classified differently, so there is a need to sensitively apply the practices in other nations like India which are not Western.

3. Indian Dietary Patterns and the Nutrition Transition

Historically, dietary practices in India have been very diverse, influenced by geography, culture, religion, socioeconomic factors and regional food preferences (Popkin *et al*., 2020) [24]. Traditional Indian diets was plant-based, predominantly made up of whole grains, pulses, legumes, vegetables, fruits, fermented foods, and self-prepared foods using locally available ingredients and traditional food preparation methods.

The Indian food environment (food systems) has in recent decades undergone several changes collectively known as the 'nutrition transition' (Popkin *et al*., 2020; Drewnowski & Popkin, 1997; Shetty, 2002) [6, 24, 27], including rapid urbanization, industrialization, globalization and rising income. This shift refers to the gradual movement away from traditional less processed food options and toward a more refined carbohydrate diet which has many more processed convenience foods, unhealthy fats and added sugars.

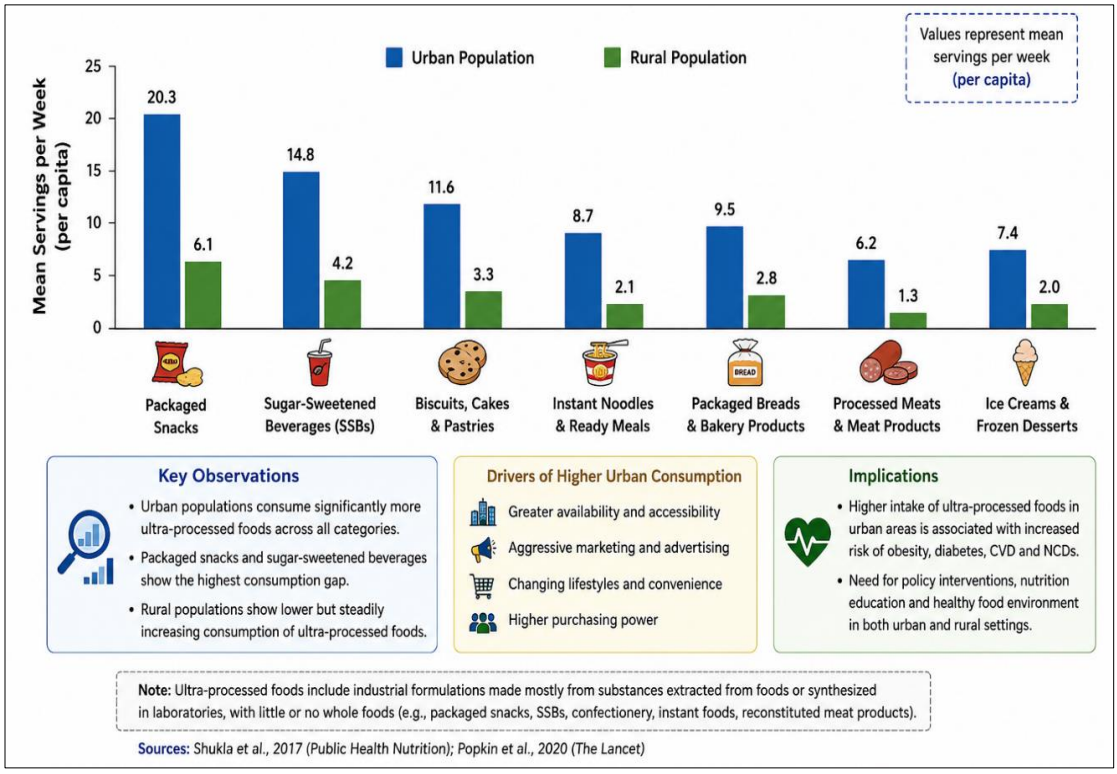

Fig 2: Illustrative comparison of ultra-processed food consumption patterns between urban and rural Indian populations across selected food categories (based on Shukla *et al*., 2017; Popkin *et al*., 2020) [24, 28]

3.1 Urbanization and Lifestyle Changes

One of the key trends in the food system transition in India is the rapid urbanization process. The lifetimes, work habits, food availability, and food preparation method have changed with increasing rural-to-urban migration (Martins *et al*., 2021) [18]. Urban dwellers are more exposed to supermarkets, convenience stores, fast food chains, food delivery services on the internet and to other marketing strategies for packaged food and ultra-processed food products (Monteiro *et al*., 2019) [20]. These environmental changes have significantly impacted on habits of purchasing food and eating behaviors, especially that of younger age groups. Dietary transition seems to particularly affect the young adult and adolescent population. Harris *et al*. (2020) [11] reported increased consumption of fast food, packaged snack food and processed beverages and commercially prepared meals among the urban Indian youth. College kids and working young adults are so accustomed to eating restaurant meals and packaged foods frequently that it has become the norm due to the pressure of college, the influence of peers, digital marketing, and the growing availability of food delivery apps.

3.2 Cultural Complexity and Mixed Dishes

But even after such shifts, Indian dietary habits have been found to be very heterogeneous and are very rich with cultural aspects. Indian meals are generally a mixture of food products which consist of one or all of the cereals, pulses, vegetables, oils, spices, milk and fermented products are cooked in various ways unlike the meals taken in the west, where one usually consists of one single food product (Shukla *et al*., 2017) [28] Foods like khichdi, dosa, idli, pulao, biryani, curries, parathas, chutneys or sweets are a combination of ingredients varying degrees with the amount and extent of processing options which make the classification within NOVA difficult.

For a long time fermentation, roasting, grinding, drying and pickling have been part of Indian food culture. The methods can be similar to those of the industry but do not mean a loss of nutritional quality. For instance, there are large extent of

microbiological changes in foods like idli or dosa batter, but they still have a high nutritional and cultural value.

3.3 Double Burden of Malnutrition

A notable aspect of India's nutrition transition is the two sides of the coin the 'double burden of malnutrition' (Popkin *et al*., 2020) [24]. The prevalence of obesity, diabetes and cardiovascular diseases in urban settings is rapidly on the rise while micronutrient deficiencies and undernutrition remain significant public health challenges especially among lower socio-economic groups (LMSE) and women (Kapil *et al*., 2014) [15]. Eating more ultra-processed food high in calories and low in nutrients may worsen both components of the "double burden of malnutrition."

4. Methodology

The study was based on a narrative review to critically analyze the application of the NOVA food classification system in Indian diet. Narrative reviews are well suited to discussing topics across disciplines, exploring part of a broader whole or when concomitant qualitative approaches are needed, as large-scale quantitative pooling of primary data from individual studies is inappropriate (Ferrari, 2015; Greenhalgh *et al*., 2018).

4.1 Literature Search Strategy

A thorough literature search was carried out using several electronic bibliographic databases such as PubMed/MEDLINE, Scopus, Web of Science and Google Scholar. Search was conducted from the beginning date to December 2023. The key words used were: NOVA classification, ultra-processed foods, food processing, Indian dietary patterns, nutrition transition India, non-communicable diseases India, food composition India, and fermented foods India. Search terms were combined using Boolean operators (AND, OR) to allow for the further refinement of search results. To locate added relevant sources that might not have been found in searches of the databases, reference lists of found articles were also manually scanned.

4.2 Inclusion and Exclusion Criteria

Studies were selected if they (i) were published in peer-reviewed journals or were official reports from government or international agencies; (ii) were written in English; (iii) examined the NOVA classification system, food processing levels, and food UPF consumption/dietary assessment methodologies; or (iv) provided foundational epidemiological study evidence linking UPF consumption of food processing with non-communicable diseases in any global setting where it was directly relevant to this study's Indian context. Studies were not included when they (i) were published only in abstract form; (ii) were either poorly or insufficiently methodologically described; or (iii) only involved non-Indian populations of no broader theoretical interest to the NOVA framework.

4.3 Data Extraction and Synthesis

Selected literature was explored in order to extract relevant data which was then synthesized thematically. A set of key themed areas were identified beforehand based on the objectives of the review, and these included: (i) the structure and evolution of NOVA classification system; (ii) Indian dietary patterns and the nutrition transition; (iii) applicability and methodological challenges of NOVA in the Indian context; (iv) public health implications of UPF consumption in India; and (v) future research and policy priorities. Thematic synthesis was conducted narratively, with a comparative analysis of the results of each study, looking for patterns, deviations and gaps in research. As this is a narrative review, a formal quality assessment tool (e.g., CASP or GRADE) was not used, but the reviewer gave preference to peer-reviewed and indexed journals and higher-citation sources to facilitate credibility with the evidence synthesized.

5. Application of NOVA Classification in the Indian Context

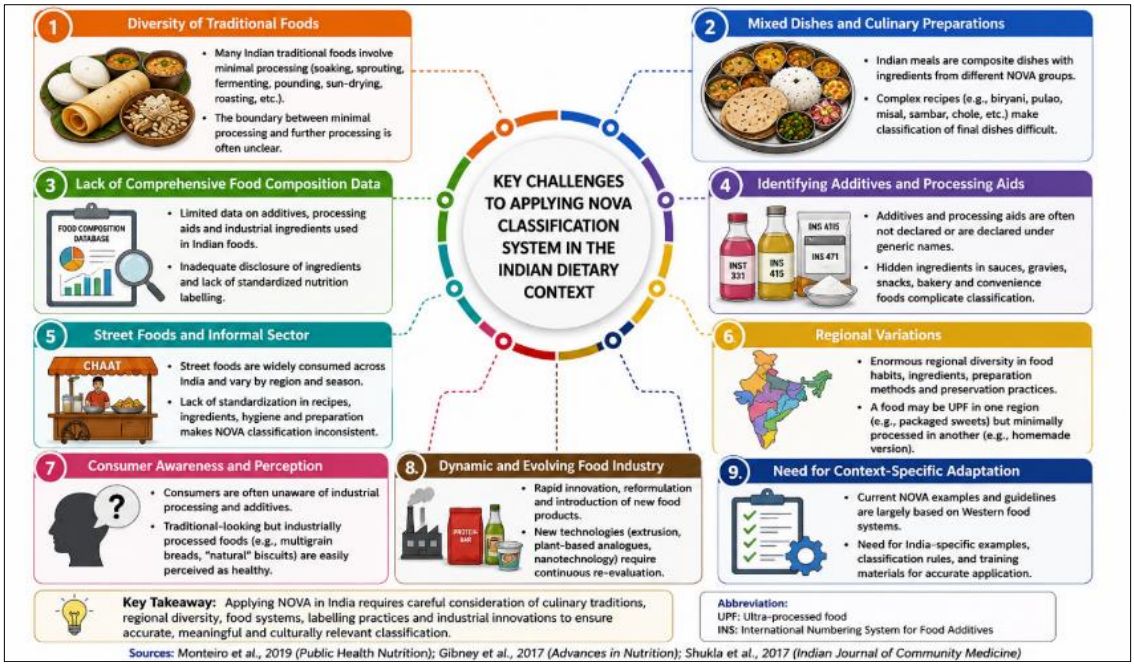

Fig 3: Key challenges to applying the NOVA classification system within the Indian dietary context *(based on Monteiro et al., 2019; Gibney et al., 2017; Shukla et al., 2017)* [9, 20, 28]

Figure 3. Key challenges to applying the NOVA classification system within the Indian dietary context

The methodological, cultural and practical challenges arising from diversity and complexity of Indian diets are perceived to be very high when applying the NOVA framework in Indian food system.

5.1 Mixed Dishes and Composite Foods

The categorization/combination of composite dishes is one of the major issues in NOVA classification in India. Indian dishes are usually made using a combination of NOVA groups such as cereals, pulses, vegetables and spices, oils, sources of dairy and fermented foods in one recipe together (Monteiro *et al*., 2019) [20]. There is frequently a grey area for certain foods like khichdi, biryani and curry foods that includes a number of ingredients both from NOVA Group 1 to NOVA Group 3. Not all researchers use the same methods to classify dishes, so many studies can store certain dishes under different categories, creating variability and making the results scientifically questionable.

5.2 Fermented Foods

Fermentation plays a prominent role in the traditional food culture of India in the preparation of idlis, dosa batter, dhokla, curds, pickles and other traditional fermented drinks etc. (Shukla *et al*., 2017) [28] Fermented foods, which are microbiologically transformed products, may preserve a significant nutritional and/or cultural value. However, the NOVA classification is not always able to differentiate the traditional artisanal fermentation processes used to increase the nutritional bioavailability from the industrial processes and can result in misclassification and undervaluation of the nutritional values of traditional foods from such fermentation processes (Gibney *et al*., 2017) [9].

5.3 Packaged Traditional Foods

Another issue to consider is that of commercialization of traditionally home-prepared foods. The hidden line between NOVA group 3 (not often) and 4 (eat seldom or avoid) is often not that straightforward in packaged food products like packed atta (wheat flour), ready to make dosa batter, flavored yoghurt, paneer, namkeen, masala package, ready to cook upma mix, and packed chutney. The nutritional quality of the industrial flour obtained from the whole grain and the industrial flour obtained from the traditionally milled grain is comparable; however, the NOVA score may vary, based on the classifier's interpretation.

5.4 Street Foods

The street food forms a substantial part of food make up in India in all economic and social strata. Fried food and snacks like pani puri, pav bhaji, momos are consumed by people both in urban and rural areas, as well as chaat (Shukla *et al*., 2017) [28]. This is because there is usually significant inter-product variability in these foods concerning manufacturing techniques, quality, and industrialization. The depth of information is usually not assessed with enough detail to classify the street foods into NOVA categories, as such detail is usually not provided on dietary survey instruments.

5.5 Lack of Standardized Indian Food Composition Database

One of the key constraints at a systemic level is the lack of a holistic, standardized Indian food composition database (FCDB) with particular focus on NOVA. A major limitation in Indian nutritional epidemiology is the widespread reliance on self-reported 24-hour dietary recalls and FFQs; this methodological constraint causes misclassification bias and impairs the comparability of findings across different studies (Slimani *et al*., 2009; ICMR-NIN, 2020; FSSAI, 2020) [30].

6. Public Health Implications of Ultra-Processed Food Consumption in India

The increasing trend towards eating ultra-processed products in India poses a huge public health problem. The twin forces of urbanization, globalization of food markets, changing lifestyles, and intense commercial marketing of foods have all fueled a growing trend of replacement of traditional minimally processed foods by convenience foods produced by the commercial food industry (Popkin *et al*., 2020) [24].

Figure 4. Illustrative representation of health outcomes associated with ultra-processed food consumption in India, expressed as estimated prevalence indicators (based on Monteiro *et al*., 2019; Rauber *et al*., 2021; Kapil *et al*., 2014) [15, 20, 25].

6.1 Obesity and Metabolic Disorders

The high caloric density, high content of added sugars, added sodium, and unhealthy saturated or trans fats, and low fiber content, are some of the main features of ultra-processed foods, along with the lack of vitamins and minerals (Monteiro *et al*., 2019) [20]. The products could also displace nutrient-rich traditional foods, leading to micronutrient deficiencies in parallel to overnutrition. As shown in experiments by Hall *et al*. (2019) [12], this hyper-palatability and low satiety signal arising from UPFs can lead to greater calorie intake.

The prevalence of metabolic diseases associated with sedentary lifestyles and energy-dense foods (Mohan *et al*., 2018; Patel *et al*., 2011) [19, 23] is on the rise in India, which is on the verge of becoming the global diabetes capital. Excess consumption of sugar-sweetened beverages, refined flour foods, processed snack foods and fast foods leads to insulin resistance, hyperglycemia and obesity (Monteiro *et al*., 2019; Rauber *et al*., 2021; Basu *et al*., 2013) [2, 20, 25].

6.2 cardiovascular disease

Epidemiological data have consistently linked excessive consumption of UPF to hypertension, dyslipidaemia, cardiovascular mortality and pro-inflammatory markers (Rico-Campà *et al*., 2019; Canhada *et al*., 2020; Srour *et al*., 2019) [3, 26, 31]. Sodium and trans-fat present in the UPFs have been revealed as risk factors for cardiovascular disease, a major killer of urban Indians, along with refined sugars (Gupta *et al*., 2016; Singh *et al*., 2013) [10, 29].

6.3 Micronutrient Deficiencies and the Double Burden

Ultra-processed foods tend to be low in micronutrients such as iron, zinc, calcium, folate, and vitamins in particular that are essential for correct physiological functions (Monteiro *et al*., 2019) [20]. This nutritional inadequacy is of grave concern especially in India where micronutrient deficiencies and anemia are widespread among children and women of reproductive age (WRAP) (Kapil *et al*., 2014) [15]. In situations of excessive energy intake, increasing consumption of calorific with low micronutrients processed

foods poses a threat for further undermining micronutrient status.

6.4 Marketing and Digital Exposure

A further public health issue is commercial marketing of ultra-processed products designed for children and adolescents, which is especially appealing via digital media channels, celebrity endorsements and attractive packaging (Popkin *et al*., 2020) [24]. With the "newfound" acceptance of food delivery applications, higher calorie foods along with foods prepared off-site were further given greater and accessible access, especially among those populations who live in urban areas.

7. Challenges and Limitations of the NOVA Classification System

Despite the enormous influence it has in the world, the NOVA classification has some substantive conceptual and methodological criticisms which are particularly relevant in the Indian context.

One major worry is that there is a processing continuum which we cannot easily define, hence creating confusion in defining foods into distinct categories (Gibney *et al*., 2017) [9]. In preparing and declaring labels for composite or fortified foods, commercially prepared traditional foods, and foods prepared from two or more NOVA groups, there is often confusion regarding which groups the foods belong to. This indetermination leads to uncertainty in the allocation of NOVA groups, that decreases comparability of findings from epidemiological studies.

An additional criticism is that NOVA may be giving the impression that there is a linear inverse correlation between the degree of processing and nutritional quality, which is not necessarily true (Fardet *et al*., 2015) [7]. Some of the processes like pasteurization, fortification and freezing help in improving the safety and extend the shelf life of foods, with improved nutrient bioavailability without negative health impacts. Processed foods prepared at home using too much fat or sugar or salt may, however, have similar health risks as some processed foods. The patterns of UPF consumption in India are further complicated by socioeconomic factors that affect food choice. In some urban settings, access to fresh foods is limited, and former simple food preparation time is now limited, thus making ultra-processed foods a convenient and affordable food choice for lower-income urban households (Popkin *et al*., 2020; Darmon & Drewnowski, 2015) [5, 24]]. Thus, public health messages emphasizing the importance of limiting UPF consumption should take into account the structural factors affecting food selection (WHO, 2018, Nishida *et al*., 2004) [22]. Proponents of NOVA believe that such criticisms do not preclude the ability of the framework to also reflect other commercial, industrial, and structural drivers of diet patterns that are not addressed in for example nutrient-only frameworks (Monteiro *et al*., 2019; Moubarac *et al*., 2014; Stuckler *et al*., 2012) [20, 21, 32]. The classification system is continually evolving and needs to be developed in a culturally responsive way to work in non-Western dietary contexts (Imamura *et al*., 2015; Martinez Steele *et al*., 2017) [14, 17].

8. Future Directions

This review suggests a number of research and policy priorities. First, there is an urgent need to construct a comprehensive and standardized Indian food composition database with NOVA classification guidelines, which would allow a more accurate and closer comparison between various studies. Secondly, mixed method research with qualitative enquiry of food practices in addition to quantitative dietary assessment might better capture the cultural complexity of eating behaviors in India.

Finally, well-designed longitudinal prospective studies are required to establish underlying temporal links between UPF consumption and health outcomes of interest that are unique to Indian populations and factor in the context of the double burden. Fourth, exploring adaptations and extensions of the NOVA framework that are culturally appropriate for Indian foods, which may include further categories and/or subcategories for traditional fermented foods, composite foods and regionally specific foods, is warranted.

From a policy perspective, there is a need for India to consider regulations on front-of-pack labeling based on scientific evidence, a tax on sugar sweetened beverages, limits on marketing of UPFs to children, and public nutrition education programs that encourage consumption of traditional nutritious low technology processed foods. Effectively implementing this will need culturally sensitive approaches that take account of regional culinary diversity, as well as economic and social disparities.

9. Conclusion

The NOVA classification system offers a valuable conceptual tool to understand the relationship of different population health outcomes to industrial food processing. Its use in nutrition epidemiology, nutrition guidelines and public health policies in different parts of the world indicates its usefulness in highlighting that dietary patterns are determined by much more than nutrient contents of foods.But, implementation of NOVA in the Indian context poses several methodological and cultural issues. All these cultural factors, including cultural diversity, traditional food processing methods, composite dishes, regional food diversity, and the lack of standardized NOVA-aligned food composition tables, contribute to the difficulty of achieving precise and comparable NOVA-based dietary assessments in India. The conceptual architecture of the framework has been designed mainly in the Western & Latin America food context and needs to be adapted to adequately capture the complexity of Indian food.To tackle these challenges, there will be a need for a coordinated move from the fields of nutrition research, nutrition policy formulation, and nutrition/food public health practice towards developing culturally suitable classification tools, enhancing the methodologies of dietary assessments and designing culturally and socio-economically sensitive interventions. Given the increasing burden of non-communicable diseases due to poor diet in India, this research agenda is relevant and very urgent.

Conflict of interest: No

References

1. Astrup A, Monteiro CA. Does the concept of "ultra-processed foods" help inform dietary guidelines, beyond conventional consideration of nutrient composition? Adv Nutr. 2022;13(5):1473–1480. DOI:10.1093/advances/nmac071.

2. Basu S, McKee M, Galea G, Stuckler D. Relationship of soft drink consumption to global overweight, obesity, and diabetes: A cross-national analysis of 75 countries. Am J Public Health. 2013;103(11):2071–2077.
3. Canhada SL, *et al*. Ultra-processed foods, incident overweight and obesity, and longitudinal changes in weight and waist circumference: The Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). Public Health Nutr. 2020;23(6):1076–1086.
4. Chen X, *et al*. Consumption of ultra-processed foods and health outcomes: A systematic review of epidemiological meta-analyses. Nutr J. 2020;19(1):86.
5. Darmon N, Drewnowski A. Contribution of food prices and diet cost to socioeconomic disparities in diet quality and health: A systematic review and analysis. Nutr Rev. 2015;73(10):643–660.
6. Drewnowski A, Popkin BM. The nutrition transition: New trends in the global diet. Nutr Rev. 1997;55(2):31–43.
7. Fardet A, *et al*. Current food classifications in epidemiological studies do not enable solid nutritional recommendations for prevention of diet-related chronic diseases: The impact of food processing. Adv Nutr. 2015;6(6):629–638.
8. Food Safety and Standards Authority of India. State of food safety and nutrition in India report. New Delhi: Ministry of Health and Family Welfare, Government of India; 2020.
9. Gibney MJ, Forde CG, Mullally D, Gibney ER. Ultra-processed foods in human health: A critical appraisal. Am J Clin Nutr. 2017;106(3):717–724.
10. Gupta R, Mohan I, Narula J. Trends in coronary heart disease epidemiology in India. Ann Glob Health. 2016;82(2):307–315.
11. Harris J, Phuong HN, Lan MT, Phuong NH. Nutrition transition in Vietnam: Changing food supply, food prices, household expenditure, diet and nutrition outcomes. WorldVeg Staff Publ. 2020.
12. Hall KD, *et al*. Ultra-processed diets cause excess calorie intake and weight gain: An inpatient randomized controlled trial of ad libitum food intake. Cell Metab. 2019;30(1):67–77.e3.
13. Indian Council of Medical Research, National Institute of Nutrition. Dietary guidelines for Indians. 2nd ed. Hyderabad: ICMR-NIN; 2020.
14. Imamura F, *et al*. Dietary quality among men and women in 187 countries in 1990 and 2010: A systematic assessment. Lancet Glob Health. 2015;3(3):e132–e142.
15. Kapil U, *et al*. Coexistence of undernutrition and overnutrition in India. Indian J Community Med. 2014;39(3):140–141.
16. Louzada MLC, *et al*. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. Prev Med. 2015;81:9–15.
17. Martinez Steele E, *et al*. The share of ultra-processed foods and the overall nutritional quality of diets in the US. Popul Health Metr. 2017;15(1):6.
18. Martins CA, *et al*. Ultra-processed food consumption and obesity in Brazilian adults. Cad Saude Publica. 2021;37(3):e00094220.
19. Mohan V, *et al*. Secular trends in diabetes prevalence and its risk factors in India: The ICMR-INDIAB study. Diabetes Res Clin Pract. 2018;142:136–145.
20. Monteiro CA, *et al*. Ultra-processed foods: What they are and how to identify them. Public Health Nutr. 2019;22(5):936–941.
21. Moubarac JC, *et al*. Food classification systems based on food processing: Significance and implications for policies and actions. Curr Obes Rep. 2014;3(2):256–272.
22. Nishida C, *et al*. The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases. Public Health Nutr. 2004;7(1A):245–250.
23. Patel V, *et al*. Chronic diseases and injuries in India. Lancet. 2011;377(9763):413–428.
24. Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition and the changing nutrition reality. Lancet. 2020;395(10217):65–74.
25. Rauber F, *et al*. Ultra-processed food consumption and risk of obesity: A prospective cohort study of UK Biobank. Eur J Nutr. 2021;60(4):2169–2180.
26. Rico-Campà A, *et al*. Association between consumption of ultra-processed foods and all-cause mortality: SUN prospective cohort study. BMJ. 2019;365:l1949.
27. Shetty PS. Nutrition transition in India. Public Health Nutr. 2002;5(1A):175–182.
28. Shukla N, *et al*. Dietary patterns and their relationship with obesity among urban adolescents in central India. Int J Community Med Public Health. 2017;4(4):1310–1315.
29. Singh GM, *et al*. The age-specific quantitative effects of metabolic risk factors on cardiovascular diseases and diabetes: A pooled analysis. PLoS One. 2013;8(7):e65174.
30. Slimani N, *et al*. Structure of the standardized computerized 24-h diet recall interview used as reference method in the 22 centers participating in the EPIC project. Comput Methods Programs Biomed. 1999;58(3):251–266.
31. Srour B, *et al*. Ultra-processed food intake and risk of cardiovascular disease: Prospective cohort study. BMJ. 2019;365:l1451.
32. Stuckler D, *et al*. Manufacturing epidemics: The role of global producers in increased consumption of unhealthy commodities including processed foods, alcohol, and tobacco. PLoS Med. 2012;9(6):e1001235.
33. World Health Organization. Obesity and overweight. Geneva: World Health Organization; 2018.