

Globalization of Food Choices Negatively Impacting Sustainability of Traditional Food Systems: A Case of Uttarakhand Hills in North-western India

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Abstract The food we eat, being a primary source of both macro- and micronutrients, plays a huge role in our ability to keep our overall health and well-being in balance. It is also an essential component that links nutrition, agriculture, and ecology in the eco-nutrition framework. A better understanding of the relationships between food systems and human nutrition may offer opportunities for improving community health that are currently overlooked. The present communication presents the results of exploratory surveys on impact of globalization in contemporary food choices of Uttarakhand hills and potential role of native diversity in sustainable food and nutritional security on native communities with enabling policy support. A comparative assessment of rural-urban divide in terms of dietary choices and health have been discussed in view of advocating eco-nutrition model for a healthy human nutrition through biodiverse agriculture.

Keywords: *eco-nutrition, food-based approach to community nutrition and health, globalization of food choices, traditional food systems, nutrition transition*

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1. Introduction

Despite the success of the agriculture, providing enough food to feed the world, today we are faced with issues of malnutrition, both over- and under-nutrition. More than a billion people today, in developing countries, are underfed and suffering from acute malnutrition, while much of the developed world is at the same time facing a crisis of obesity caused by over-nutrition, the so-called development-driven obesity [1]. Worldwide 30% more people are now obese than those who are underfed. Overnutrition has been the result of an unhealthy lifestyle, leading to diet-related non-communicable diseases, such as cardiovascular disease, hypertension, cancer, diabetes, etc. The causes of these nutritional challenges are many and complex as are possible solutions [2].

Since the time of colonization, there has been a drastic decline in health and integrity of indigenous cultures, social structures and knowledge systems which are integral to our ability to respond to our own needs for adequate amounts of healthy indigenous foods (www.indigenousfoodsystems.org). The changing food systems brought about by the forces of globalization have led to both challenges and opportunities [3]. There is alarm

that local culture and food traditions are disappearing, where multinational and transnational corporations are increasingly controlling national food systems in addition, for most countries, micronutrient deficiencies are of concern. It is, however, being argued that "indigenous food sovereignty provides a restorative framework for health and community development and reconciling past social and environmental injustices in an approach that people of all cultures can relate to" (<https://www.indigenousfoodsystems.org/>).

An eco-nutrition model has been suggested for a healthy human nutrition that can be best achieved by an approach to agriculture that is biodiverse. However, such a model is sound in theory but very complex to achieve, as many complexities are involved, in reality [4]. Moreover, correlating agricultural biodiversity with human nutrition is generally difficult for a number of reasons including human diversity [5]. Further, the agricultural biodiversity has provided enormous nutrition and health benefits but overexploitation of some resources and widespread habitat loss has negatively impacted the dietary diversity, nutrition, and health of some groups of society [6]. The world is today faced with attempting to assess these impacts and seek a sustainable way forward [7]. New approaches have been explored aimed at integrating environmental and human health, focusing especially on the many interactions between agriculture, ecology, and human nutrition [1,4].

In recent past, there has been a drastic decline in health and integrity of indigenous cultures, social structures and traditional knowledge systems which are integral to our ability to respond to our own needs for adequate amounts of healthy indigenous foods. We are also often ignorant about the biological diversity that can be linked to our food systems which have been developed by farmers over millennia and which are adapted to local traditions, cultures and agro-ecologies. These links between production and consumption are important to sustainable food systems in order to have the richest possible food diversity on plates, sustainably sourced from the biological diversity that underpins agricultural systems.

Traditional foods and dishes are traditional in nature, and may have a historic precedent in a national dish, regional cuisine or local cuisine. The changing food systems brought about by the forces of globalization have led to both challenges and opportunities. In contrast to industrial food systems, the local food systems are operating with reduced food transportation and more direct marketing, leading to fewer people between the farmer and the consumer. As a result, relationships that are developed in local food systems emerge from face-to-face interactions, potentially leading to a stronger sense of trust and social connectedness between producers and consumers [8]. In addition to this, consumers can also encourage farmers to be environmentally friendly by teaching them about practices such as organic farming. As a result, some scholars suggest that local food systems are a good way to revitalize a community [9]. The decreased distance of food transportation has also been promoted for its environmental benefits [10]. Also, farmers can enjoy a better quality of life because producing healthier food will allow them to be paid more, and not live under the poverty line.

Facts about Indian cuisine and factors affecting food choices and nutrition: Indian cuisine consists of a wide variety of regional and traditional cuisines native to the Indian subcontinent. Given the range of diversity in soil type, climate, culture, ethnic groups, and occupations, these cuisines vary substantially from each other and use locally available spices, herbs, vegetables, and fruits. Indian food is also heavily influenced by religion, in particular Hindu, cultural choices and traditions. The cuisine is also influenced by centuries of Islamic rule, particularly the Mughal rule. Historical events such as foreign invasions, trade relations, and colonialism have played a role in introducing certain foods to this country. Indian cuisine has shaped the history of international relations; the spice trade between India and Europe was the primary catalyst for Europe's Age of Discovery. Indian cuisine has influenced other cuisines across the world, especially those from Europe, the Middle East, North Africa, sub-Saharan Africa, Southeast Asia, the British Isles, Fiji, and the Caribbean.

Early diet in India mainly consisted of legumes, vegetables, fruits, grains, dairy products, and honey. Staple foods eaten today include a variety of legumes (*dal*), whole-wheat flour (*atta*), rice, and pearl millet (*bajra*), which has been cultivated in the Indian subcontinent since 6200 BCE [11]. Over time, segments of the population embraced vegetarianism while an equitable climate permitted a variety of fruits, vegetables,

and grains to be grown throughout the year. A food classification system that categorised any item as *saatvic*, *raajasic*, or *taamsic* developed in Yoga tradition. The *Bhagavad Gita* proscribes certain dietary practices (chapter 17, verses 8-10).

Consumption of beef is taboo, due to cows being considered sacred in Hinduism. Beef is generally not eaten by Hindus in India except for Kerala, parts of southern Tamil Nadu and the north-east. India also has varied eating habits, dietary restrictions and eating etiquettes across different parts of the country.

Though food consumption is primarily required to meet our physiological needs for nutrients and energy, the wider influences guiding our diets are actually highly complex, and encompass a range of social, cultural, psychological, economic and environmental factors working alongside biological cues to control our consumption patterns.

Some of the other factors that influence food choices include, i) biological determinants such as hunger, appetite, and taste, ii) economic determinants such as cost, income, availability, and iii) physical determinants such as access, education, skills (e.g. cooking) and time.

Nutritional problems like protein energy malnutrition (PEM), anaemia and vitamin A deficiency continue to plague a large proportion of Indian children. The diets and nutritional status of urban slum children in India is far away from being satisfactory. Further, enhanced prevalence of food-related non-communicable diseases like hypertension, type 2 diabetes, certain cancers, etc., are the result of nutrition transition from traditional healthy food to high calorie energy-rich but nutrient poor food. Reduced consumption of fruits and vegetables, and extremely low dietary diversity have been the primary reason for poor physical and mental health of Indian adults.

Food from Uttarakhand and recent nutrition transition: The traditional food from Uttarakhand is known to be healthy and wholesome to suit the high-energy necessities of the cold, mountainous region. It is a high protein diet that makes heavy use of pulses and vegetables. Traditionally it is cooked over wood, mostly in iron utensils. While also making use of condiments such as *jeera* (cumin), *haldi* (turmeric) and *rai* (brassicas) common in other Indian cuisines, Uttarakhand cuisine uses some condiments foraged from higher Himalayan ranges like *jambu* or *feren* (*Allium stracheyi*), *timur* or *timmer* (*Zanthoxylum armatum*), *gandhraini* (*Angelica glauca*), *kala* or *Bhotia jeera* (*Carum carvi*), *bhongira* (*Perilla frutescens*), *jakhia* (*Cleome viscosa*), etc. The people in Uttarakhand also prepare the dishes common in other parts of northern India but several preparations are unique to Uttarakhand tradition such as *thatwani* or *rus* (made from pulses mainly horsegram and black seeded soybean), *chudkani* (made from local black seeded soybean), *dubuk* (made from local black seeded soybean or horsegram), *chadanji* (made from black gram), *kapa* or *kapuli* (made from spinach and fenugreek leaves), etc. Among dressed salads and sauces, *kheere ka raita*, *nimbu mooli ka raita*, *daarim ki khatai*, *bhong ki chatni*, *aam ka fajitha*, etc. necessarily deserve a mention. The cuisine mainly consists of food from two different sub regions-Garhwal and Kumaon-though their basic ingredients are the same

[12]. Both the Kumaoni and Garhwali styles make liberal use of *ghee* (butter oil), lentils or pulses, vegetables and rice. They also use *badi* (sun-dried black gram balls) and *mungodi* (sun-dried green gram balls) as substitutes for vegetables at times. During festivals and other celebrations, the people of Uttarakhand prepare special dishes which include both salty preparations such as *bada* and sweet preparations such as *jhangora* (barnyard millet) *ki kheer*, *pua* and *singal*. Uttarakhand also has several sweets such as *singodi*, *bal-mithai*, *malai laddu*, etc. native to its tradition.

Despite Uttarakhand hills having a strong native food culture and traditions, there has been severe nutrition transition taking place during the past two decades or so. The phenomenon of globalization is having a major impact on the traditional food systems. Food systems are changing, resulting in greater availability and diversity of food, although access to this food is by no means universal. Many of these changes are closely associated with urbanization, increasing incomes, market liberalization and foreign direct investment. Beside others, this is bringing about a gradual shift in food culture (towards a more universal one), with consequent changes in dietary consumption patterns and nutritional status that vary with the socio-economic strata. Indeed, the lower socio-economic population groups, particularly from urban dwellings, drift towards poor-quality, energy dense but cheap and affordable foods.

In spite of nutrition transition trends in Uttarakhand hills, it is heartening that the traditional food habits are still playing a great role in contemporary food habits of the rural communities; therefore, the possibility of reversing the trends in favour of dietary diversification from dietary simplification looks promising. It was found that the root cause of both malnutrition and overnutrition/obesity is inadequate or improper nutrients. Consumption of an appropriate portion of food rich in essential nutrients can eliminate both pandemics.

Recently, we published the salient findings of some model case studies from traditional farming landscapes on the potential of local food systems in addressing community health and nutrition with regard to hilly areas of Uttarakhand state in north-western India [13,14], in overall framework of indigenous food sovereignty. Based on these, some policy considerations on food-based approaches for better community health and well-being in traditional farming agro-ecologies of Uttarakhand hills have been suggested [15]. The food-based approaches also include use of wild plant resources in agricultural systems, an important but undervalued supplement to household dietary diversity of native farming communities [16].

In the present communication, an exploratory survey on impact of globalization in contemporary food choices of Uttarakhand hills and potential role of native diversity in sustainable food and nutritional security have been discussed. A comparative assessment of rural-urban divide in terms of dietary choices was also documented from traditional farming landscapes of Uttarakhand hills. The outcome of the study is expected to better advocate an eco-nutrition model for a healthy human nutrition through biodiverse agriculture.

2. Materials and Methods

Exploratory surveys using structured, semi-structured and on-site personal observations were undertaken during 2016-18 following participatory approach. Information was documented from about 20 rural farming community sites representing three main hill agro-ecologies of Uttarakhand as indicated in our recent case studies [13,14,16]. Additionally, exploratory surveys were also undertaken from nearby urban dwellings, within the vicinity of 20-30 km, for a comparative assessment of rural-urban divide in terms of dietary choices, nutrition and health. The respondents from urban communities mainly comprised migrants from these rural farming communities, during the last 2-3 decades, in search of off-farm jobs, business, education of children, etc. These migrant populations were originally engaged in farming activities but have abandoned farming now, for the past one to two decades, and moved to nearby urban areas. An average 50 respondents/ households were surveyed per site from rural farming landscapes and nearby urban dwellings each i.e. a total about 1,000 households each from both rural and urban communities.

Data were recorded on consumption of specific healthy and nutritious foods; status of malnutrition, health aspects and prevalence of food-related non-communicable diseases; factors affecting food choices of young adults, and leading causes of obesity, the development-driven malnutrition, etc.

Some policy issues that might promote the potential of rural hill farming landscapes in addressing the sustainable food production, and use of native plant diversity in addressing community nutrition and health were also outlined using participatory approach.

The outcome of the exploratory surveys will have intended use in generating empirical research data through in-depth study duly showcasing the eco-nutrition model based on biodiverse agriculture at regional and national level.

3. Results

- Availability of food for optimal health and well-being in three predominant hill agro-ecologies

Exploratory observations on availability of naturally available native plant food resources in three predominant hill agro-ecologies indicate that the traditional farming landscapes with crop-livestock mixed farming situations had better opportunity for optimal health and well-being followed by higher elevation pastoral nomadic communities and river valleys (Table 1).

- Consumption of specific healthy and nutritious foods in rural and urban communities of Uttarakhand hills

Consumption of specific healthy and nutritious foods by rural and urban communities of Uttarakhand hills is presented in Table 2. It is evident from Table 2 that consumption, particularly, of milk and milk products; pulses and beans, and leafy vegetables was more in rural farming communities compared to the urban populace. Consumption of eggs and meat is, however, low in rural communities compared to urban population except the

rural communities of higher Himalayan nomadic pastoralists, the *Bhotia* tribes, who consume more meat in their diet.

Consumption of wild plant resources, mainly as fruits and vegetables, is more in rural farming communities, greatly adding to their dietary diversity.

- Malnutrition and incidence of food-based non-communicable diseases in Uttarakhand hills

The status of malnutrition and food related non-communicable diseases in rural and urban communities of Uttarakhand hills is presented in Table 3. Exploratory survey data revealed that child malnutrition was much low in rural farming communities compared to their urban counterpart. Likewise, the infant and maternal mortality was also low in rural farming communities than the urban population. Prevalence of anaemia, obesity, tuberculosis, and incidence of food-related non-communicable diseases

like hypertension, type 2 diabetes, certain cancers was also recorded much low in rural farming communities than their urban counterpart.

- Factors influencing food choices of young adults in Uttarakhand hills

The key driver for eating has been considered as hunger but what we choose to eat is not determined solely by physiological or nutritional needs. The other factors that influence food choice have been reported to include, social determinants (such as culture, family, peers and meal patterns); biological determinants (such as hunger, appetite and taste); economic determinants (such as cost, income, availability); physical determinants (such as access, education, cooking skills and time); psychological determinants (such as mood, stress and guilt); attitudes, beliefs and knowledge about food, etc.

Table 1. Exploratory observations on relative abundance of food for optimal health and well-being in three predominant hill agro-ecologies

Foods for health and well-being	Traditional rainfed farming areas (crop-livestock mixed-farming)	Mountainous regions- alpine meadows/bugyals (nomadic pastoralists)	River valleys (improved farming)
• Abundant omega 3 fats especially from plant sources	High	Medium	Low
• Diet consisting of nutrient dense, mineral rich plant foods with emphasis on dark green leafy vegetables, fruits, nuts, etc.*	High	Medium	Low
• Intermittent fasting and remaining in a state of 'lightness.'***	High	Medium	Low
• Eating foods in their whole and natural state	High	High	Low
• Avoidance of synthetic/man-made 'foods' such as additives, preservatives, artificial sweeteners, margarines, etc.	High	High	Medium
• Avoidance of refined sugar and refined carbohydrates	High	High	Medium

*Mg, present most in leafy vegetables, is absolutely essential for the nervous system.

**Digestion comes at a huge energetic/metabolic cost. Eating a nutrient dense but calorie sparse diet allows this energy to be dispersed elsewhere in the body, such as the brain and nervous system.

Table 2. Percent distribution of adult men and women age 18-50 by frequency of consumption of specific healthy and nutritious foods in rural and urban communities

Type of food	Frequency of consumption							
	Rural				Urban			
	D	W	O	N	D	W	O	N
Milk and milk products	62.0	24.5	13.5	0.0	10.5	33.5	54.0	2.0
Pulses or beans	72.5	22.0	5.5	0.0	24.0	43.5	29.5	3.0
Leafy vegetables	61.5	33.5	5.0	0.0	4.5	36.5	58.0	1.0
Fruits	8.0	24.5	67.5	0.0	2.0	15.5	79.5	3.0
Eggs and meat	1.0	16.5	49.5	33.0	8.0	35.5	46.5	10.0
Wild plant food resources	20.0	60.5	19.5	0.0	1.5	15.5	71.0	12.0

D= Daily; W=Weekly; O=Occasionally; N=Never.

Table 3. Exploratory survey on malnutrition and health of rural and urban communities of Uttarakhand hills

Indicators of malnutrition	Rural communities	Urban communities
Child malnutrition (stunted/wasted/under-weight combined; %)	8.5	25.5
Infant mortality (no. per 1,000 live births)	4.5	12.5
Maternal mortality (no. per 1,00,000 live births)	20.5	160.5
Prevalence of anaemia (<18 yrs age group; %)	8.0	39.0
Prevalence of anaemia (18-50 yrs age group; %)	8.5	23.5
Prevalence of obesity (18-50 yrs age group; %)	3.6	21.5
Tuberculosis (no. per 1,00,000 population)	12.0	102.0
Incidence of food-based non-communicable diseases (hypertension, Type-2 diabetes and certain cancers included; %)	5.0	24.0

Table 4. Factors influencing food choices of young adults of Uttarakhand hills

Determinants of food choices	Influence of food choices on young adults
Social	
• Culture, family, peers and meal patterns	What people eat in Uttarakhand is mainly formed and constrained by circumstances that are essentially social and cultural. Cultural influences lead to the difference in the habitual consumption of certain foods and in traditions of preparation. Cultural influences are, however, amenable to change: rural youths migrating to urban areas, individuals often adopt particular food habits of the urban culture.
Biological	
• Hunger, appetite, taste	The physiological needs provide the basic determinants of food choice. The low energy density diets of rural farming communities generate greater satiety than high energy density diets of urban communities. 'Taste' has been consistently reported a major influence on food behaviour of both rural and urban communities. This includes not only taste <i>per se</i> but also smell, appearance and texture of food.
Economic and physical	
• Cost, income, availability, access, education, skills, time	Accessibility to shops is an important physical factor influencing food choice. The native food resources are rarely available to urban consumers. Healthy food tends to be more expensive for urban communities even when available within towns and cities. The level of education was found to influence dietary behaviour during adulthood. Nutrition knowledge and good dietary habits are, however, not strongly correlated. Conveying accurate and consistent messages through various media, on food packages and of course via health professionals considered important for healthy food choices.
Physiological	
• Mood, stress and guilt; stress; guilt	As stress level is more on urban youth, hence effect on food choices is more on urban communities. The prolonged or frequent stress experienced by urban youth could possibly result in adverse dietary changes, increasing the possibility of weight gain and consequently cardiovascular risk. Increasing attempts by urban youths to restrict intake of certain foods was recorded to increase the desire for these particular foods, leading to what are described as food cravings. Urban women more commonly report food cravings than do men.
Attitudes, beliefs and knowledge about food	'Health aspects', 'taste', 'habit' and 'price' were the main determinants of food choices. It was 'taste' and 'habit' for rural youths, and 'taste' and 'price' for urban youths that appeared important. The rural and urban youths are not aware much to consider nutrition/healthy eating as a highly important factor when choosing their food choices. In rural farming communities, there is better opportunities, occurring naturally, for a healthy and nutritious diet in terms of household dietary diversity but for urban youths the diet is not wholly adequate in terms of, for example fat, or fruit and vegetable consumption. Thus, a perceived need to undertake change is a fundamental requirement for initiating dietary change.

Table 5. Ranking of major food-based causes of obesity (over-nutrition) in native hill communities of Uttarakhand

Cause (s) of obesity	Description	Ranking
Genetics	Genetic components do affect ones susceptibility to gaining weight. Some people appear to be genetically susceptible to weight gain and obesity.	4
Food addiction	Addiction is a complex issue that can be very difficult to overcome. Junk foods are reported to stimulate the reward centres in the brain.	3
Aggressive marketing	Junk food producers are very aggressive marketers and they sometimes try to market very unhealthy products as healthy foods. These companies also make misleading claims and often target their marketing specifically towards children.	1
Food availability including engineered junk food	One important factor that dramatically influences obesity is food availability, which has increased massively in the past few centuries. Food, especially junk food, is everywhere now. As finding fresh, whole foods may be difficult or expensive, leaving people no choice but to buy unhealthy junk foods. Further, the stores are filled with processed engineered junk foods that are hard to resist. These products also promote overeating.	2
Added sugar	Added sugar may be the single worst aspect of the modern diet. Added sugar is half glucose, half fructose. People get glucose from a variety of foods, including starches, but the majority of fructose comes from added sugar.	5
Misinformation	Excess fructose intake may cause insulin resistance and elevated insulin levels. It also doesn't promote satiety in the same way glucose does. For all these reasons, sugar contributes to increased energy storage and, ultimately, obesity.	
	Many websites, for example, spread inaccurate or even incorrect information about health and nutrition. Some news outlets also oversimplify or misinterpret the results of scientific studies and the results are frequently taken out of context. Other information may simply be outdated or based on theories that have never been fully proven. Food companies also play a role. Some promote products, such as weight loss supplements, that do not work. Weight loss strategies based on false information can hold back your progress. It's important to choose your sources well.	6

Table 4 presents the various factors affecting food choices of young adults of Uttarakhand hills. Taste among biological, and cost, income, availability and access among economic and physical determinants were found important for food and dietary choices among young adults. Food culture and traditions were also important more particularly for rural farming communities.

- Exploratory survey on leading causes of obesity in Uttarakhand hills

Ranking of leading causes of obesity in rural farming and urban communities are listed in Table 5. Food availability including availability of engineered junk foods, aggressive marketing and food addiction were recorded as important causes of obesity both in rural and urban settings.

- Policy considerations for adopting eco-nutrition model based on biodiverse agriculture in Uttarakhand State policy on agriculture

Our past case studies have revealed that the traditional food systems with high dietary diversity has the power to provide the desired nutrition for a perfect physical and mental health that keeps the body and mind away from nutritional stress. As the traditional food habits are still playing a great role in contemporary food habits of the native communities, the possibility of reversing the trends in favour of dietary diversification from dietary simplification looks promising with enabling policies. Using participatory approach the following policy considerations showcasing potential of biodiverse food system of Uttarakhand hills were identified:

1. Initiatives and research interventions for a diverse production system: The micronutrient superiority of landrace cultivars complemented with wild plant food resources in traditional hill farming has been revealed by our past case study findings. The diversity of crops as well as diversity within crops are considered important for nutrition and dietary diversity choices of the hill farming communities. We therefore need more diversity deployed in hill farming systems rather than uniformity and monoculture as advocated by corporate agriculture.

2. Documenting the indigenous knowledge and innovations: The traditional innovations and food systems need to be properly documented so that policymakers know what is at stake by ruining an ecosystem, not only for the native peoples living there, but also for everyone. We found that malnutrition is not the result of food scarcity but foods poor in essential nutrients. Although the problem of diminished food sovereignty and food insecurity is one that affects all people, not just rural communities, the rural peoples are uniquely situated to offer solutions. Armed with ancient traditional knowledge and a deep connection to their lands, rural communities, and particularly elderly women are now developing projects and building networks to revitalize local food capacity and strengthen food sovereignty.

The indigenous knowledge and innovations, therefore, needs to be properly documented and made use to bring sustainability in production systems.

3. State support to indigenous food sovereignty movements and promoting community-supported agriculture: The development of sustainable agriculture will require a more radical transformation of agriculture, one guided by the notion that ecological change in agriculture cannot be promoted without comparable changes in the social, political, cultural, and economic arenas that help determine agriculture. The organized peasant and indigenous-based agrarian movements—such as the international peasant movement La Vía Campesina and Brazil's Landless Peasant Movement (MST) - have long advocated for genuine agrarian reforms to access and control of land, water, and biodiversity that are of central importance for communities in order to meet growing food demands. Moving toward a more socially just, economically viable, and environmentally sound agriculture will be the result of the coordinated action of emerging social movements in the rural sector in alliance with civil society organizations that are committed to supporting the goals of these farmers' movements.

4. Promoting wild food resources as component of dietary diversity: Dependence of local farming communities of Uttarakhand hills on diverse plant resources including wild plant food resources, as observed in our past case study researches, suggests that these plant species are protected, and in this way an effective mechanism of sustainability established that rural communities can employ to maintain a cosmic balance with the ecosystem.

Use of wild plant food resources in traditional farming as component of dietary diversity, therefore, needs to be encouraged and wild habitats and common property resources (CPRs) duly protected through enabling policy support.

5. Participatory approaches and cross-sectoral collaboration and advocacy agenda for food-based approach towards community nutrition and health: To achieve sustainable reductions in under-nutrition and other forms of malnutrition, national policies and programmes must be complemented by effective community-based actions. A key dimension of this strategy is enabling households to maximise food security and nutrition with existing household resources, while also striving to increase such resources. This requires a process of effectively mobilising communities and shifting from a centralised to a more decentralised approach, with wider participation on the part of the community.

The general ignorance of the nature and use of nutrient-rich traditional food resources over the years has resulted in these foods being left out of most nutritional strategies put in place to address food security and nutrition problems of the population. Beside research-oriented activities, advocacy is an important thrust area of local institutional collaboration. There is also a need to re-assess existing food and nutrition-related health and agriculture policy at local, regional and national level, harmonize such policies and develop cross-sectoral implementation strategies that would positively impact on food security, nutrition and health of the native communities.

There is lack of credible data and information on the compositional attributes of traditional food resources which has greatly hampered efforts to inform and educate the population on the nutritional and healthful attributes of these foods. Developing the food composition database will be vital for effective advocacy tools and critical for policy and programme development across agriculture, food, nutrition and health sectors.

Potential barrier and facilitator to food-based approaches of community nutrition and health are presented in [Table 6](#).

6. Enhanced market access and value chain development for traditional food resources: Traditional varieties of different crops not only have different genetic attributes than modern varieties; they also have several consumption characteristics such as taste, aroma, cooking quality, nutrition, etc. In part for this reason - and in part, by virtue of commitments to environmental values - there is scope for development of local and distant markets in which traditional varieties command a price premium. Labelling systems can assist in creating such markets. Again, this could not only provide direct rewards to growers, but also help to raise public consciousness of the importance of diversity and the need for public policies to sustain it.

Table 6. Potential barrier and facilitator to food-based approaches of community nutrition and health

Potential barriers	Native food choices as facilitators to potential barriers
• Food availability	Growing a range of local crops and their distinct landraces supplemented by wild plant food resources help provide much diversity in the diet of traditional farming communities. The traditional food choices with high dietary diversity has the power to provide the desired nutrition for a perfect physical and mental health, and keep the body and mind away from nutritional stress. The traditional food, available in plenty, therefore is healthy and wholesome.
• Access to diverse foods	Farming is subsistence and rural communities consume whatever they produce with only surplus produce traded locally. There is indigenous food sovereignty prevailing in native farming communities without formal organized movement and policy support.
• Cost	The native crop produce are invariably cheaper when traded locally, mostly in barter system, but also have the potential to fetch premium price in local and distant markets after proper processing, packaging, labelling, etc.
• Sociocultural factors	What people eat in Uttarakhand is mainly formed and constrained by circumstances that are essentially social and cultural. Cultural influences lead to the difference in the habitual consumption of certain foods and in traditions of preparation. Spirituality in food systems is deeply ingrained in traditional organic/biodynamic farming.
• Difficulties in achieving adequate intakes of some micronutrients (e.g., iodine, folate, iron)	The food culture of Uttarakhand hills is highly knowledge based, the experiential traditional ecological knowledge (TEK) has helped the communities consume foods rich in all desired macro- and micronutrients. Intake of fruits, vegetables, whole grains, animal products, wild plant resources, etc. all contributing to enough intake of vitamin D, folate, iron and others matching the recommended intakes.
• Bioavailability of certain nutrients	The TEK related to household food processing and preparation methods can be used to enhance the bioavailability of micronutrients in largely plant based diets of hill farming communities.
• Competition with new/introduced processed foods	The rural communities have limited access to introduced processed foods, the local markets not that developed for introduced processed foods. However, the deterrent of traditional foods to western diets has caused a rise in obesity, cardiovascular disease, diabetes, and other health issues that have increased in the last decade because of the availability of unhealthy fast foods particularly in urban populace of Uttarakhand hills. These are the risk of globalization when it comes to health and diets. It damages and shifts the developmental, cultural and behavioural norms of the society. It changes food preferences, particularly of young adults.

Further, enhanced marketability and making them easily available in local markets through proper processing/packaging can add value to local food resources and increasing their value in household food choices and family diets. Markets can play an important role in mainstreaming local foods in household diets and integration on nutritional contribution of traditional food resources to the well-being of the rural and urban poor in the region.

In many instances it may be difficult to secure stable markets for raw agricultural products. This is particularly the case for crops requiring processing before they can be used. In these cases it may be possible to enhance the benefits to farmers of local varieties by processing them for particular markets.

The native crops viz. finger millet or *madua*; rice; local black-seeded soybean or *bhat*; *gahat* or horse gram, etc. from traditional hill farming areas have a greater potential for value chain development and other marketing interventions. But it has to be the surplus produce after household consumption that needs to be traded.

7. Integrating local nutrient-rich food in mid-day meal programme in line with lessons learnt from Brazilian experience on school feeding programmes: In line with success of Brazil's school feeding programme, the traditional and healthier eating habits of Uttarakhand hills can also be rescued. Several of farmers' local crops offer more fibre, more vitamin B and complex carbohydrates. Through policy advocacy activities, the school students should be made familiar and comfortable with what they are eating.

Further, like Brazilian programme, a substantial amount of Ministry of Human Resource Development (MHRD) budget can be diverted to small holder farmers for local purchasing of native healthy food to school feeding programmes (mid-day meal scheme). In Brazil, 40 per cent of food served to students is from local farmers and

processors. The Brazilian experience has proved that small-holder agriculture can produce good quality processed products - the kind of value-added products that can make farming more profitable. The small farms were able and capable of producing quality and good dignified products that could positively contribute to the Brazilian school feeding programme.

Is the country, in general, and traditional farming areas like Uttarakhand hills, in particular, ready for the change?

8. Policies that encourage part-time farming: One should recognize that farming need not be an all-or-nothing occupational choice. Our past case studies from traditional crop-livestock small-scale farming areas of Uttarakhand hills, it was revealed that a small fraction of households (10%) earn their livelihoods entirely from farming; about 50% households earn most of their cash income from farming, and 40% households derive most of their cash income from non-farm sources. The expansion of non-farm employment at community level will never eliminate farming.

Traditional agriculture in Uttarakhand hills is highly labour-intensive and is often not providing a full-time employment year-round to the labour force involved. Women comprise about 50% of family labour force involved in agricultural operations and the village youths, the rural labour force, is often not predominantly engaged in agriculture. Many youths also see traditional agriculture as an activity not worth the effort. It used to be family labour mainly involved in agriculture operations in past. Out-migration of family labour in search of off-farm jobs to urban areas now is adversely affecting agriculture in the region. Policies that help to generate part-time, off-farm employment opportunities at community level in rural areas can, therefore, help sustain small farms. So can policies that promote agriculture-friendly tourism, thereby internalizing another positive externality often generated

by small-farm landscapes including the scenic beauty of Uttarakhand hills. In supporting small farms, such policies could help to sustain agricultural biodiversity, especially if accompanied by other policies that recognize and reward the social value of its in situ conservation.

The off-farm job opportunities at community level can be weaving, milling, food processing, eco-tourism, etc. Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) of India, as a concept, has been a welcome initiative in this direction though there is a need to address problems in its proper implementation.

4. Discussion

- Observations on food for optimal health and well-being in three predominant hill agro-ecologies

The traditional communities with crop-livestock mixed farming in Uttarakhand hills have a better opportunity for more natural and healthy native food choices (Table 1). 'You are what you eat' is the old cliché that we are no doubt familiar with, but have we ever realised just how profound this notion is and applied it in our life? We eat habitually and not intentionally. We eat without conscious thought as to what this food is doing within our body beyond the momentary taste sensation in the mouth. And all because we have become so disconnected from the natural world and where our food comes from.

We have somehow come to a point in the human experience where we no longer intuitively know what is correct for us to eat. As a culture, we tend to generally accept that some foods are good and some are bad for us but beyond this level of understanding, there is no deeper meaning behind the way we eat. Why is it that human beings are the only species on Earth to have this problem? There is not a single animal living in its natural environment that is overweight or suffering a chronic illness as a result of their diet. They just know what to eat. They are in touch with the innate intelligence that drives their food choices, and as a result, they thrive. If this alone doesn't show how spiritually disconnected we have become, I don't know what will.

Just a few decades ago, the way human looked at food was largely influenced by local culture, tradition and seasons. Local produce, fast becoming a rare and expensive commodity, was once the natural diet of millions. What is now referred to as the 'slow food movement' was just the way of the world. But now that we have moved into an era when everything under the sun is accessible to us, one would think that we would be better equipped to understand that we should or should not eat. Unfortunately, that is not the case. The truth is, with the steady stream of half-baked research coming our way through on-line or print media, we have regressed to a state of confusion [17,18]. Differentiating between good foods and bad foods is a big challenge.

- Consumption of specific foods by rural and urban communities and its impact on community nutrition and health

In the present era of globalization, a mix of market and traditional food is common for most people, but traditional food remains an important source of many nutrients.

When traditional foods are included in the diet, benefits reported are, low calories; low saturated fat; more lean meat and fish; more iron, zinc, calcium, magnesium; more Vitamin A, and strengthened cultural capacity and well-being.

Table 2 reveals that the food consumption of young adults in terms of healthy food choices was better for rural farming communities compared to their urban counterpart. The traditional hill crops viz. rice (many native landraces varying in their nutrition profile), millets (finger millet, barnyard millet, foxtail millet), legumes or pulses (local black seeded soybean, horse gram, common bean or rajmash, etc.), oilseeds (mustard and sesame), milk and milk products (yoghurt, butter oil or ghee), several leafy vegetables (spinach, fenugreek, leafy brassicas, etc.), fruits (citrus and other temperate fruits) are source of healthy nutrition. The wild plant resources, largely consumed by rural communities, as fruits and vegetables, from traditional farming landscapes and nearby agro-forestry systems (CPRs) also form an important component of their dietary diversity. The native crops, and fruit and vegetables are generally low in calories but nutrient dense, which means they are packed with vitamins, minerals, antioxidants, fibre, etc.

Farming communities in hilly areas of Uttarakhand state traditionally grow diverse crops as polyculture. Most of these native crops and their traditional landraces/farmers' varieties form the "functional foods" to hill farming communities with nutraceutical properties and high nutritional value.

Of the three main agro-ecologies of Uttarakhand [13,14,16], the small-scale crop-livestock mixed-farming systems represents about 70% cropped area under rainfed farming. The farming situations could be characterized by high household food production and dietary diversity. Whatever the rural farming communities produce they largely consume it. In the mixed crop-livestock farming system of the hills, there still exists a dynamic relationship among common property resources (CPRs), native crops and livestock. The livestock substantially contribute to household cash income whereas the surplus crop produce, if any, is sold locally, contributing very little to the household cash economy. The farming communities largely rely on plant based vegetarian food, the wild plant resources forming an important component of the household dietary diversity and livelihood.

In spite of nutrition transition trends in many other parts of Uttarakhand, it is widely acknowledged that in the traditional farming landscapes rich in crop and livestock diversity and use of wild plant resources, the food traditions are still prevailing in the life of rural households to a greater extent. This is indeed heartening that the traditional food habits are still playing a great role in contemporary food habits of the target communities; therefore, the possibility of reversing the trends in favour of dietary diversification from dietary simplification looks promising. It was found that the root cause of both malnutrition and overnutrition/obesity is inadequate or improper nutrients. Consumption of an appropriate portion of food rich in essential nutrients can eliminate both pandemics. In a comparative study of the connection between household production and the food local communities consume, and the physical, emotional and

mental health of the three representative farming agro-ecologies of Uttarakhand hills, a clear linkage could be established. The high production and dietary diversity of traditional farming areas with small-scale crop-livestock mix farming recorded least incidence of food-based non-communicable diseases like hypertension, type 2 diabetes, certain cancers, and everything from ADD to bipolar diseases, and to depression. A critical analysis of the food choices of the native communities in such farming situations indicate that they largely depend on plant-based vegetarian diet. The wild plant resources also form important component of their dietary diversity [13,14,16]. The wild plant resources, generally consumed in live form as fruits and vegetables, make the communities physically and mentally agile and active. It is not the quantity of the wild plant resources but their mere forming the part of dietary diversity of rural farming communities matters most [16].

A direct relationship could be established between food consumption and its effect on health of rural and urban communities (Table 3). Our past case studies on household production and dietary diversity of different representative farming situations in Uttarakhand hills also indicated that high production and dietary diversity is linked with better community health and nutrition [13,14]. Further, the traditional farming innovations are sustainable in terms of food production and spirituality in food system deeply ingrained.

It has been emphasized that better and balanced nutrition in the human diet depends not only on growing a diversity of crops but also on the diversity within the crops. The micronutrient superiority of landrace cultivars complemented with wild food resources in traditional hill farming has been revealed by our earlier case study findings [13,14]. Intake of one variety rather than another can be the difference between micronutrient deficiency and micronutrient adequacy in traditional farming. The micronutrient superiority of some lesser-known cultivars and wild varieties over others has been confirmed by certain past researches [1,19]. Unfortunately, we lack detailed information about such diversity within most crops at the cultivar level and the role it plays in nutrition because of the general neglect by researchers/professionals [20] and much of the evidence is anecdotal.

Coates et al. [21] suggest that dietary diversity can be used as a proxy indicator for nutrient adequacy. Adequate human nutrition thus involves regular intake of a wide range of nutrients, some of which must be consumed on a frequent basis, even if in small quantities. We believe that the trend in nutrition transition can be slowed down and certain approaches are needed to move the nutrition transition in a more positive direction.

- Determinants of food choices of young adults

The cultural and social context of food choices of adult youths are considered important (Table 4). Traditional foods are foods and dishes that are passed through generations and have been consumed through many generations. Traditional foods often generally have a historic precedent in a local cuisine. On a larger scale, food is an important part of culture. It also operates as an expression of cultural identity. Food traditions and culture are still maintained in rural farming communities of

Uttarakhand hills and food still plays an important role in the lives of rural farming families.

The way fast-food is changing the world, Uttarakhand hills in India are no different. Many fast food brands coming to India including Uttarakhand are seen as a growing market, but the youth of tomorrow don't need to prove that by being unhealthy. Given a choice, most of the urban and even the rural youths are increasingly tempted to eat a fast food dish instead of a highly nutritious and home-made meal with all of the best dishes. But what is also a little unsettling is that even some elderly people feel also the same way. However, the traditional food, besides being a part of our cultural identity, is also the healthier choice.

In Uttarakhand hills almost every month there is a festival with specific traditional food recipes made. The community or family celebrations or a major festive event helps develop relationships and if combined with traditional food reinforces cultural identity. Culture, emotions, and bonding are all integral parts of preparing and eating a meal. We are at risk that our busy lifestyle, work pressures and in some cases economic problems are causing us to overlook the importance of social eating. We need to make social eating more of a priority in our eating habits. The connections that food can create between people are too valuable to overlook.

Kuhnlein et al. [22] rightly stated that "The dimensions of nature and culture that define a food system of an indigenous culture contribute to the whole health picture of the individual and the community-not only physical health but also the emotional, mental and spiritual aspects of health, healing and protection from disease." Kuhnlein et al. [22] further assert that "indigenous people never separated food from medicine, depending upon which part of the plant is used, the season of the year and physiological condition of the person using the crop, the same plant can be consumed as food or medicine." Further sustainability of the environment happened to be one of the critical issues in the food acquisition and consumption of indigenous communities world over [23].

Social support, that is seen more in rural farming communities, can have a beneficial effect on food choices and healthful dietary change [24]. Because family and friends can be a source of encouragement in making and sustaining dietary change, adopting dietary strategies which are acceptable to them may benefit the individual whilst also having an effect on the eating habits of others [25].

Although the majority of food is eaten in the home in rural communities, an increasing proportion is eaten outside the home, in urban settings, e.g. in schools, at work and in restaurants. The venue in which food is eaten can affect food choice, particularly in terms of what foods are on offer. However, the availability of healthy food at home and 'away from home' increases the consumption of such foods. Access to healthy food options is limited in many work/school environments. This is particularly true for those with irregular hours or with particular requirements, e.g. vegetarian [26]. In urban communities, with the majority of adult women and men in employment, the influence of work on health behaviours such as food choices is an important area of investigation [24].

Our physiological needs provide the basic determinants of food choice. The traditional cuisines of Uttarakhand are the foods high in protein seem to make us feel more satiated. The traditional foods high in fibre viz. minor millets, beans and pulses, and fruit and vegetables also enhance feelings of satiety as the protein rich diet has been reported to be most satiating [27].

Cost of food is also an important determinant of food choice particularly for urban youths. Whether cost is prohibitive depends fundamentally on a person's income and socio-economic status. Low-income groups have a greater tendency to consume unbalanced diets and in particular have low intakes of fruit and vegetables [28]. However, access to more money does not automatically equate to a better quality diet but the range of foods from which one can choose should increase.

Accessibility to shops is another important physical factor influencing food choice, which is dependent on resources such as transport and geographical location. However, improving access alone does not increase purchase of additional fruit and vegetables, which are still regarded as prohibitively expensive [29].

Studies indicate that the level of education can influence dietary behaviour during adulthood [30]. However, nutrition knowledge and good dietary habits are not strongly correlated. This is because knowledge about health does not lead to direct action when individuals are unsure how to apply their knowledge. Furthermore, information disseminated on nutrition comes from a variety of sources and is viewed as conflicting or is mistrusted, which discourages motivation to change [31]. Thus, it is important to convey accurate and consistent messages through various media, on food packages and of course via health professionals.

Psychological stress is a common feature of modern life and can modify behaviours that affect health, such as physical activity, or food choice. The effect of stress on food intake depends on the individual, the stressor and the circumstances. In general, some people eat more and some eat less than normal when experiencing stress [32].

The level of stress was recorded more in urban communities. Studies suggest that if work stress is prolonged or frequent, then adverse dietary changes could result, increasing the possibility of weight gain and consequently cardiovascular risk [33].

Today it is also recognised that food influences our mood and that mood has a strong influence over our choice of food. In both the areas of food safety and nutrition, our understanding of consumers' attitudes are poorly researched [34]. A better understanding of how the rural and urban public perceive their diets would help in the design and implementation of healthy eating initiatives.

The youths in Uttarakhand hills are now increasingly addicted to alcohol. Alcohol seems to stimulate appetite in the short-term and therefore drinking alcohol is likely to encourage you to eat more. Alcoholic drinks are also calorific, so you should cut down on alcohol consumption if you are trying to control your weight.

Try to include lots of low energy dense foods (such as fruit and vegetables, wholegrains, foods with lots of water added when cooking, such as soups and stews, and lower fat foods) in your diet. Choosing these kinds of foods

means that you can reduce calorie intake without having to have smaller portions.

- Leading causes of obesity

People gain weight when they eat more calories than they burn through physical activity. Obesity is generally caused by eating too much and moving too little. If you consume high amounts of energy, particularly fat and sugars, but don't burn off the energy through exercise and physical activity, much of the surplus energy will be stored by the body as fat.

Obesity is a serious concern because it is associated with poorer mental health outcomes, reduced quality of life, and the leading causes of death worldwide, including diabetes, heart disease, stroke, and some types of cancer.

Table 5 lists the important causes of obesity. The traditional food of Uttarakhand is low calorie and incidence of obesity is negligible in rural farming communities. Aggressive marketing of junk food, in recent decades, can be viewed as the leading causes of obesity, if any, in rural communities of Uttarakhand. Research shows that consumption of energy-dense foods high in fat or sugar often increases in response to viewing a junk food advertisement, with the greatest consumption seen in obese children. Aggressive advertising of junk foods can be linked to increased brand recognition that fosters positive attitudes towards unhealthy foods in children, due to the use of bright colours, cartoon characters and popular celebrity figures to attract attention. More and more people are opting to eat junk food as it appeals to our base needs. Junk food has been reported to stimulate the reward centres in our brain, which means we are primed to consume more of it. Your body releases "feel-good" chemicals when you eat these foods, so it's no wonder they have increased in popularity.

Food availability, particularly for urban populations, and food addiction are other important factors responsible for obesity linked with enhanced junk food consumption.

Genetic causes of obesity were found to be less important to hill communities than the environment and behavioural causes.

In order to reduce your risk of obesity, it is essential to reduce your intake of these unhealthy processed foods and replace them with fruit, vegetables, legumes, whole grains and nuts.

- Policy considerations supporting rich food culture, nutrition, agriculture and ecology

Food is the primary source of both macro- and micro-nutrients needed to sustain life, and it is the essential component that links nutrition, agriculture, and ecology in the eco-nutrition framework. Food-based approaches to address community nutrition and health is rather easy to adopt and implement with the willing political support and enabling policies in areas with rich food culture and traditions where enhanced use of native plant diversity in contemporary food choices is a huge possibility. The benefits of food-based approaches may include nutritional improvement, food security, cost-effectiveness, sustainability, and human productivity. Food-based approaches require additional inputs, including nutrition education, gender considerations, and agricultural planning. Although some forms of malnutrition can be addressed via supplements, food-based approaches are optimal to achieve sustainable solutions to multiple nutrient deficiencies [4].

The hilly areas of Uttarakhand with strong native food culture and healthy traditional food choices can easily showcase the interrelationship between nutrition and human health, agriculture and food production, environment and economic development. The political will and a number of enabling policies to take the eco-nutrition approach forward have been shortlisted in the results section of this communication.

Eco-nutrition looks at the impact of our eating habits on both the human body and the environment. The decisions we make to produce, buy and cook the food we eat have consequences within the complex ecosystem which is the human body, we are what we eat, and every mouthful of food we consume has the potential to enhance or degrade our health [35].

Latham [36] asserts that social and economic inequity are the basis for widespread hunger and malnutrition and underscores the fundamental importance of addressing nutritional problems through multifaceted solutions and interdisciplinary approaches, including community agriculture and food-based approaches. He argued against the current wide advocacy for, and use of, high-tech commercial products to reduce malnutrition. He highlighted the fallacy and danger of massive vitamin A supplementation programmes to reduce the risk of vitamin A deficiency and expressed alarm on the increasing use of commercialized and imported ready-to-use therapeutic foods (RUTFs) as top-down 'magic-bullet' foods to address and even prevent malnutrition, claiming that they are only effective in the treatment of children with severe acute malnutrition. Preferable solutions, he argued, lie in improved local agriculture and affordable home-based nutritious diets. He pointed to the huge advantages that food-based approaches have over medicinal strategies and reaffirmed that food-based approaches are viable, affordable, sustainable and long term, have social, cultural, economic and environmental benefits, and are local and not top down.

The solutions to nutrition problems are not found in narrowly defined, single agricultural projects, but rather in large changes to food systems that are not necessarily suitable for evaluation through experimental designs [37]. Programmes and policies aimed at changing food systems in particular need to do more than pursue curative approaches that do little to affect the underlying determinants of nutrition problems. Several characteristics of contemporary food systems that are likely to influence the nutrition of current and future generations have been identified and discussed by Pinstrup-Andersen [37]. While food systems affect human nutrition, human nutrition also affects food systems, there are multiple pathways through which the food system affects human nutrition. Understanding these pathways and how they operate is essential to designing agricultural and other food system policies to achieve nutrition goals. A better understanding of the relationships between food systems and human nutrition may offer opportunities for improving nutrition that are currently overlooked. Whether such opportunities are captured will depend on possible trade-offs with the achievement of other development goals, as well as on policy goals and political factors [37].

The small-scale traditional hill farming landscapes of Uttarakhand has the potential for sustainable food production which can always be linked with nutrition and health of local communities in eco-nutrition model [38]. Large scale, industrial food production with enhanced focus on high yields, uniformity and profits as its main objectives, nutritional value of food is not a priority. This, in fact, has led to a loss of much of the nutritional value of the food we eat today. Modern methods of food production no longer meet the health needs of the consumer; increasing reliance on industrial food production to meet our needs is not good for our health, or the health of our environment [39]. Eco-nutrition promotes ways of eating which are ethical, sustainable and nourishing to the body.

5. Conclusions

Traditional food system plays a significant role in maintaining the well-being and health of native communities. The traditional food choices include enhanced consumption of fruits, vegetables, and whole grains. By embracing traditional diets we can rediscover the joy in eating, as traditional diets are a delicious and pleasant way of enjoying healthy food for the rest of our lives. The deterrent of traditional foods to western diets has caused a rise in obesity, cardiovascular disease, diabetes, and other health issues have increased in the last decade because of the availability of unhealthy foods. These are the risk of globalization when it comes to health and diets. It damages and shifts the developmental, cultural and behavioural norms of its society. It changes food preferences.

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