

## ‘Nutrition Transition’: A Paradigm Shift in Uttrakhand

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### Abstract

**Aim:** The major aim of this review is to assess the nutrition transition in Uttrakhand toward, to its contribution to the emerging epidemic of chronic non-communicable diseases.

**Subjects:** The review examines the basic shift in eating preferences mainly attributable to shift in agriculture practices after the green revolution and urbanisation. Furthermore, the remarkable shift in the occupation structure in the state from farmers towards employment and services implies a reduction in energy expenditure. One consequence of nutrition transition has been decline in under nutrition accompanied by over nutrition leading to obesity and other NCD's. It basically attempting to relate the diet and lifestyle changes accompanying NCDs.

**Methods:** The review is based largely on various reliable documented data on population characteristics. The information is based on various review and documented report and data of the published literature.

**Results:** The results shows that the demographic changes, rates of urbanization and changes in dietary patterns are contributing factors that are leading to nutrition transitions and NCDs in hills. The major consequence of nutrition transition has been the decline in the rate of under nutrition accompanied by over nutrition leading to obesity and other degenerative diseases.

**Conclusions:** There are clear evidences of a demographic, epidemiological and nutrition transition in Uttrakhand. There is no single solution to the problem. A multidisciplinary approach is required to solve the present problem related to food and nutrition.

**Keywords:** Nutrition Transition; NCD's

### Introduction

Human diet and nutritional status have undergone a sequence of major shifts among each characteristic phase, defined as broad patterns of food use and corresponding nutrition-related disease. From the last three decades the dietary change seems to be accelerated, to various degrees, in different regions of the world. The World Health Report 2002 introduced the term ‘risk transition’ to describe the changes in consumption of tobacco, alcohol, nutrition and other lifestyles that promote the development of non-communicable diseases (NCDs) [1]. Two historic processes of change occur simultaneously with or precede the ‘nutrition transition’. One is the demographic transition and other is the epidemiological transition. The shift from a pattern of high fertility and mortality to one of low fertility and mortality (typical of modern industrialized countries) is considered as demographic transition. The shift from a pattern of high prevalence of communicable disease, associated with malnutrition, which leads to chronic and degenerative disease, associated with urban-industrial lifestyles is known as epidemiological transition [2,3].

It is widely accepted that globalization is playing an important role in the development of dietary patterns linked with the nutrition transition and the subsequent growth of diet-related chronic diseases in the developing world. The development of these dietary patterns has been influenced by changes in food demand and food supply. On the demand side, income growth, urbanization and changes in employment are important, on the other hand national income growth and urbanization are associated with increased consumption of fats and sweeteners resulting in a higher body mass index (BMI).

The Himalaya represents one of the tectonically unstable, ecologically fragile, economically underdeveloped, and the densely populated mountain ecosystems. With the growth of population and infrastructure, there is more connectivity and hence the area has undergone rapid urbanization. This facilitates growth of rural service

centers and increased access to markets. As a result major proportion of cultivated land and other areas are being encroached for the expansion of infrastructure, services and economic activities in the region [4]. Hence there is a regional shift from traditional crop farming and animal husbandry system to village-based production of fruits, vegetables, flowers and milk for sale both in the nearby and far-off urban markets. This has impact on the traditional resource development process and land use pattern. The shift in the physical activity pattern and dietary changes is major cause of demographic and socio economic changes.

### Demographic and Epidemiological Transitions in Uttrakhand

Uttarakhand is geographically and socio-culturally diverse state because of location and scattered population in hilly and plain region with higher population density in plain region; for example, four districts (Dehradun, Haridwar, Nainital, and Udham Singh Nagar) account for 55 percent of the state's population. Between 2001 and 2011, there was a decline in the population growth rate; however, the population density of the state increased from 159 persons per square kilometre in 2001 to 189 in 2011 [5]. An upward shift in population dynamics associated with socio economic development (i.e. rising economies, education, employment, improvement in health status and life expectancy and changes in life style) is described as the demographic transition. This has been accompanied by an epidemiological transition [6].

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There is an increase in degenerative diseases of aging and life-styles diseases such as hypertension, diabetes, stroke and other cardiovascular ailments even when life expectancy has risen. There are evidences which show the emergence of the epidemiological transition has often been associated with epidemics of chronic heart diseases (including hypertension, IHD, and cerebrovascular disease), cancers, type 2 diabetes mellitus, osteoporosis, neuro psychiatric disorders and other chronic diseases [7].

Extreme weather conditions had been responsible for certain negative life-style practice and outcomes such as smoking (20%), tobacco chewing (12%), other form of tobacco use (27%), alcohol drinking (52%), low level of physical activity (67%), over weight (14%) and central obesity (18%), consumption of fruits and vegetables less than recommended (89%) among residents of Uttarakhand region [8]. Furthermore, 38.3% people of Uttarakhand are living below the poverty line. State is facing high prevalence rate of the some of the communicable and infectious diseases such as tuberculosis, malaria. The vulnerability for HIV/AIDS incidences are increasing day by day. Moreover these negative life-style practices leading to high prevalence of Non-communicable diseases. Data of a study depicted that over 8% people in Uttarakhand are suspected to have high blood pressure and 5.7% are diabetic [9].

The association between demographic changes and their impact on nutritional status of individuals and populations has increased the use of the term nutritional transition which characterize the shift in disease patterns towards diet or nutritional related NCD, including type 2 diabetes mellitus, CVD, stroke, high blood pressure, gout and certain cancers. The detail Demographic and Socioeconomic profile of Uttarakhand has been shown in Table 1.

## Agriculture and Production Shifts in Uttarakhand

The Himalayan Mountain ecosystem is currently experiencing unplanned and unregulated urban growth. Urbanization in Himalayan region is because of the rapid growth of road linkages, rural service centres and increased access to markets. Urban growth and resultant land use changes on sensitive mountain slopes are leading to depletion and destruction of nature. This on the other hand has increased

S. No	Indicator	Uttarakhand	India
1	Total Population(in thousands)*	67569	1128521
2	Decadal Growth Rate*	24.26	21.52
3	Population ratio (Urban/1000 Rural)*	360	385
4	Crude Birth Rate (Per 1000 Population)**	29.1	23.5
5	Crude Death Rate (Per 1000 Population)**	6.3	7.5
6	Life Expectancy at birth**	57.8(M)	62.3(M)
		57.5(F)	63.9(F)
7	Total Fertility Rate***	4.0	2.9
8	Infant Mortality Rate (Per 1000 live births)**	74	57
9	Maternal Mortality Ratio (Per 1000 live births)†	379	301
10	Sex Ratio (Females/1000 Males)*	919	933
11	Mean Age Of Marriage (Female)††	20.5	20.2
12	Population Below Poverty Line†††	38.3	27.5%
13	Literacy Rate*	63.7	64.8

Source: National Health Profile 2007, Central Bureau of Health Intelligence (\*Registrar General, India; \*\*SRS Bulletin, October 2007; †Statistical Report, RGI 2004; ††Statistical Report RGI, 2005; RGI; PCA; †††Planning Commission of India).

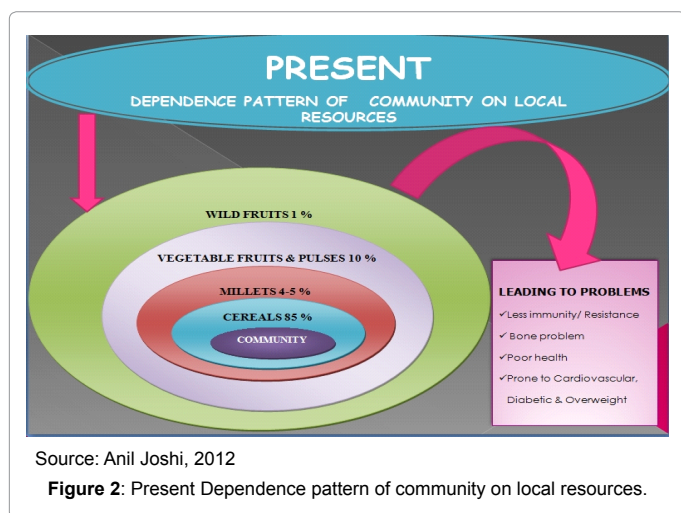
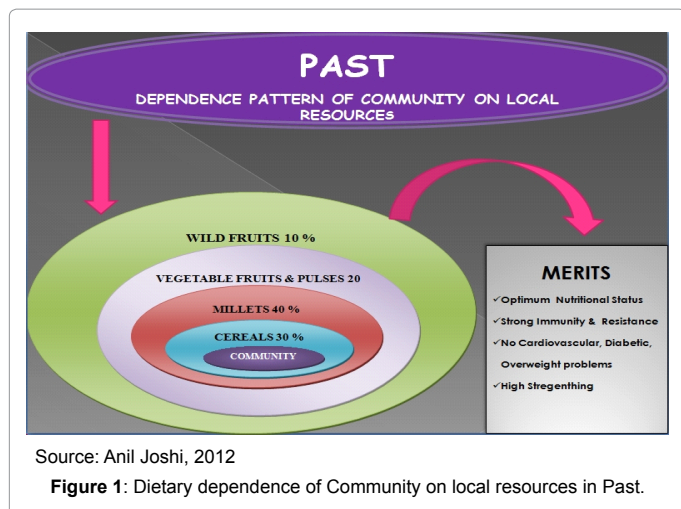
**Table 1:** Demographic and Socioeconomic profile of Uttarakhand as compared to India.

incidence and severity of natural risks, such as, slope failures, disruption of hydrological system and water pollution, degradation of forests etc. within the urban ecosystems as well as in their surrounding areas. The nature of the terrain imposes severe limitations on the scale of productive activities as well as on the efficiency of infrastructural facilities in the region. As a result, biomass based subsistence agricultural constitutes the main source of rural livelihood [10].

More than 75 percent of regional population lives in rural areas and is solely dependent on this traditional agro-ecosystem even though the availability of arable land is severely limited and the productivity is considerably poor [4,11]. The remaining 25 percent regional population lives in urban areas. Uttarakhand has just 14% of the total land under cultivation and about 65% of population depends on agriculture for their livelihood. The total geographic area of Uttarakhand has been divided in to four physiographic zones on basis of mean altitude from the sea level. Tehri, Bhawar, and low lying valley up to 1000m (Zone A) have hot and humid climate and support crops like rice, wheat, pulses etc. The Subtropical Zone lies in between the altitude of 1000m to 1500m and is capable of growing a diverse range of crops including horticulture crops. The area lying in the altitude of 1500m to 2400m classify as Temperate region, and hence support a large number of temperate fruit cultivation, floriculture as well as medicinal plants. The region above the altitude of 2400m is further classified as Sub-Alpine as well as Alpine Zones. This region is not fit from agriculture point of view. This is the store house of medicinal plants and herbs.

During the late 1960s and early 1970s, a large area under legumes was substituted by high- yielding varieties of rice (*Oryza sativa*) and wheat (*Triticum aestivum*). The new technology of rice and wheat substantially changed the agricultural scenario. From past few decades the excessive use of inorganic fertilizers and irrigation for rice and wheat has created an imbalance in soil fertility and threatened the sustainability of the most productive food grain belt in South Asia [12]. Hence Pulses and Legumes are the effective source of process reversal. This can contribute significantly in gaining twin objectives of increasing productivity and improving the sustainability of the rice and wheat-based cropping system in the IGP [13-15].

Since the early 1960s, the average calorie availability in the developing world has increased from about 1950 to 2680 kcals/person/day while protein availability nearly doubled from about 40 to 70 g/person/day. Even after the increase in the production rate of food grain, the prevalence of undernourishment declined from 37 percent in 1970 to 17 percent in 2000, while 850 million people are still food insecure [16]. The production and productivity in hill districts of Uttarakhand is relatively quite low due to small land holdings, adverse geo-climatic condition and non-availability of agricultural inputs (both in terms of quantity and quality). Also the technology transfer to these areas is very difficult and the State is deficit in production of pulses and millets. It is precisely because of the long-term deficiencies caused by Green Revolution, millets are seeing a plausible revival across the state. Since agricultural income cannot sustain the families for more than four months in a year, each family has almost one or two persons working outside the state that remits regular money to sustain the family for the rest of the year. In addition, the region did not receive the attention it deserved till the inception of the state (2000-2001). Careful analysis and evaluation are required so that agriculture and related developmental strategies can be reoriented towards better use of local resources so as to contribute more effectively to improving the living standards of the rural poor and ensuring sustainable agriculture together with the conservation of genetic diversity of crops, cultivars, agro ecosystems



and landscapes [10]. Under these present circumstances, the major challenge before the state is to achieve economic prosperity without losing out on its biodiversity (Figure 1).

### Dietary Trends Changes in Uttarakhand

The diet of the developing world is shifting rapidly, particularly with respect to fats, caloric sweeteners and animal source foods [17]. At the beginning of the 1960s, nearly 40% of the population in developing countries was chronically undernourished, while over-nutrition and obesity were very minor. The nutrition transition in many of these countries could be a harbinger for dietary changes. The rapid shift towards higher dietary energy supply (DES) levels and increases in animal food consumption been associated with a rapidly rising prevalence of overweight, obesity and non-communicable diseases. Due to the acceleration of the nutrition and lifestyle transition the incidences of overweight and obesity have gather pace.

A rapid nutrition transition is the result of urbanization, high income growth, changes in the population structure (ageing) as well as changes in the food systems (marketing, processing and distribution systems). The nutrition transition also accompanied by the transition towards more sedentary lifestyles which is driven by urbanization and changes in the food distribution (supermarkets) and processing (convenience food) systems.

Lifestyle of mountain community reveals some facts regarding community dependence on rural resources. The nutritional needs earlier were totally met out within local ecosystem. It is a fact that there is some relationship between climatic zone, resources and human physiology. Any climatic zone has its impact on human body. Since ages, community is main dependence has always been on Agri-product and horticulture but significant part of their food used to come from wild edible fruits. Due to agriculture policies adopted during green revolution, the traditional agriculture with diverse crops and cropping patterns is under great threat all over the country including Uttarakhand [10]. These policies favoured the production of wheat and rice and neglected the traditional food crops. Hence many parts in Uttarakhand are becoming food insecure because of decline in net sown area and per capita food availability and access to food especially in the hilly districts. The availability of pulses and cereals has significantly declined. The region also suffers on account of heavy soil erosion and significantly lower yields as compared to the national average. Since agricultural income cannot sustain the families for more than four months in a year, each family has almost one or two persons working outside the state that remits regular money to sustain the family for the rest of the year. In addition, the region did not receive the attention it deserved till the inception of the state (2000-2001). Under these present circumstances, the major challenge before the state is to achieve economic prosperity without losing out on its biodiversity.

Figure 1 depicted the dependence of the population on the local resources in the past. There was 30% were dependent on cereals while 40% population were dependent on millets and pseudo millets grown locally. Vegetable and fruits used to contribute about 20%. Ten percent food in the form of wild vegetable, edible fruits etc. used to come from forests. This was most significant contribution as it was full of mineral, proteins and water elements. This used to form complete nutritional needs of community.

With the advancement of time the first thing that hampered village's security was food quality as well as nutritionally balanced diet. The dependence shifted from millets and pseudo-cereal to cereals. Poor scientific understanding of traditional farming systems and related socioeconomic issues, urbanization etc are seriously impeding the identification of solutions for sustainable agricultural development in Uttarakhand.

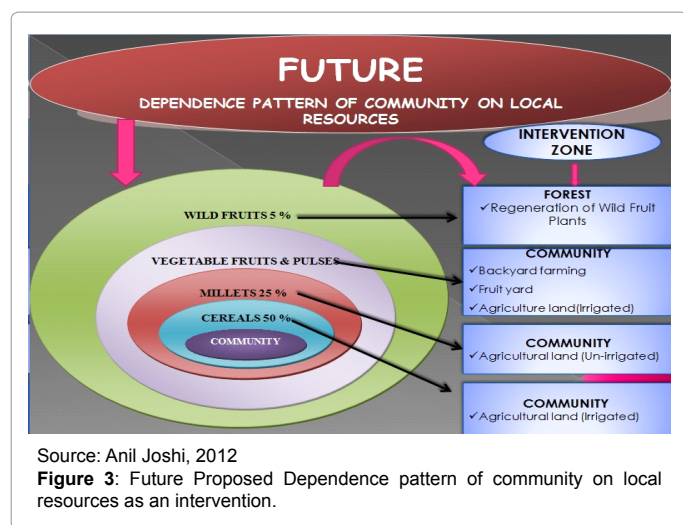
Contribution of pulses, vegetables and fruits has drastically gone down in present food scenario as shown in Figure 2. There has been poor consumption of millets/pseudo/cereals/fresh vegetables in recent past. Contribution of wild edible food has become totally insignificant today. Changing food habits particularly after invasion of other crops there has been a sharp fall in health and nutritional status of rural mountain community. Changing food habits particularly after invasion of other crops there has been a sharp fall in health and nutritional status of rural mountain community. With the change of food habits, there has been major decline in crop diversity from the villages which ultimately led to quality food intake and hence the quality of life.

### Trends of Non-Communicable Diseases

Nutritional inadequacy is the major risk factors of many non-communicable diseases. A recent Non-communicable disease risk factors survey in Uttarakhand by Ministry of Health & Family Welfare, Government of India (2007-2008) [8] under Integrated Disease Surveillance Project (IDSP) found that there are significant unhealthy life-style trend in people of state such as smokers (20%), tobacco chewing (12%), other form of tobacco use (27%), binge alcohol drinking

Non-communicable diseases	Reported Prevalence in Percentage
<b>Hypertension</b>	
MHFW-NCD Risk Survey (2008) <sup>1</sup>	4.4
MHFW-NPCDCS Survey-2010 <sup>2</sup>	>8
Bansal et al. (2012) <sup>3</sup> (Rural pilot study)	29.35
Pooja and Yashoda (2013) <sup>4</sup> (Rural pilot study)	40.6
<b>Diabetes</b>	
MHFW-NPCDCS Survey-2010 <sup>2</sup>	5.7
ICMR (2008) <sup>1</sup>	1.2

Table 2: Reported Prevalence Non-Communicable morbidities in Uttarakhand.



(52%), low level of physical activity (67%), over weight (14%) and central obesity (18%), consumption of fruits and vegetables lesser than recommended (five servings per day) (89%). Increased consumption of tobacco and alcohol and reduced physical activity, overweight/obesity and less than recommended consumption of fruits may be the significant determinants for occurrence of NCDs in the state.

On an average only three days in a week people consumed fruits against vegetables 5 days a week. Physical inactivity is the leading cause of diabetes, hypertension and coronary heart disease. In Uttarakhand, 67% of population (92% of urban and 58% of rural respondents) was in low category of physical activity. About 46% of the population was detected with pre-hypertension stage and one-fifth was in stage-I and stage-II hypertension. According to BMI, 15% of population was in the category of overweight and 28% of population was recorded as underweight. However, 18% of population with 21% of females and 15% of males in Uttarakhand was in the category of central obesity. The prevalence of smokers, smokeless tobacco users and alcohol drinkers increased with age and decreasing with level of education. The habits of tobacco and alcohol use starts at early young age which contributes to the high risk of NCD at later age. Besides that, two-third of population was found in the category of low physical activity. More female respondents were in the category of low physical activity as compare with males. They are the major contributing factors for NCDs and other degenerative diseases. Overall, NCD risk factors were prevalent across all the socio-demographic categories of population in Uttarakhand. (IDPS, 2008). Unless interventions are made to prevent and control NCDs, their burden is likely to increase substantially in future. Considering the high cost of medicines and longer duration of treatment NCDs constitute a greater financial burden to low income groups (Table 2).

Because of negative life style practices there are increasing trend in prevalence of non-communicable morbidities; presently over 8% people in Uttarakhand are hypertensive and 5.7% are diabetic. Therefore, a sound healthcare infrastructure is required to meet healthcare needs of the people in state.

## Conclusion

Local crop, their numerous varieties, wild edible plant species and traditional knowledge through millennia are the pillars of sustainability of the life of Uttarakhand hills. The shift in consumption patterns and lifestyles has already resulted in a rapid increase in the prevalence of overweight, obesity and related NCDs. Nutritional changes results in the following compounding factors i.e. a phenotypic and genotypic predisposition leading towards obesity and NCDs. The phenotypic predisposition is the result of rapid transition from hunger and undernourishment towards over nutrition. The genotypic predisposition may be an important element in certain population or ethnic groups which increases their risk of NCDs at levels much below those observed in the population at large.

The solution of this big problem of nutritional transition in Uttarakhand is simple i.e. "Local need meet locally". Local nutritional needs can be met out locally by simply reviving old systems. The new science and technology knowledge can be imparted through appropriate measures. The role of science is to identify problems and their appropriate solutions. Review of resource status, introduction of better variety of food and value addition in local food to increase palatability must be immediately initiated. The depleting resources can be recovered by their promotion and available ones can be utilized for consumption through value addition (Figure 3).

A perfect model encompassing nutritional issue, health, local resources and income prospects will be more suitable for replication. Since India live in villages and its economic strength lies in its health of rural resources, focus on local ecology and economy of the region will be on time approach. A multidisciplinary approach should solve the present problem of nutrition and income. Ecology and economical aspects of rural Himalayas will have to be addressed together. There is a need to design and devise policy measures that help to avoid adverse nutritional outcomes as soon as possible.

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