

Food and nutrition security in the Hindu Kush Himalayan region

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Abstract

The status of food and nutrition security and its underlying factors in the Hindu-Kush Himalayan (HKH) region is investigated. In this region, one third to a half of children (<5 years of age) suffer from stunting, with the incidence of wasting and under-weight also being very high. The prevalence of stunting, wasting and under-weight in children is particularly high in some mountain areas such as Meghalaya state in India, the western mountains and far-western hills of Nepal, Balochistan province in Pakistan, eastern Afghanistan, and Chin state in Myanmar. Food habits in the HKH region are changing. This has led to a deterioration in traditional mountain food systems with a decline in agrobiodiversity. Factors such as high poverty and low dietary energy intakes, a lack of hygienic environments, inadequate nutritional knowledge, and climate change and environmental degradation are also influencing food and nutrition security in the HKH region. To achieve sustainable food and nutrition security in the mountains, this study suggests a multi-sectoral integrated approach with consideration of nutritional aspects in all development processes dealing with economic, social, agricultural and public health issues.

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Keywords: malnutrition; mountain food systems; agrobiodiversity; sustainability; nutrition security; systems analysis; Hindu-Kush Himalayan region

INTRODUCTION

Food and nutrition security is a basic human need. It is essential for living a healthy and productive life and fundamental to socio-economic development; nutritional status is accepted as an indicator of national development. Under-nutrition and related poor health, perpetuate poverty from generation to generation. Hence, food and nutrition security is a central issue on both national and global agendas. Several national and international initiatives have been undertaken to tackle the problems of food insecurity. The 'Zero Hunger Challenge' of the UN Secretary General calls for progress and unified action towards realising the aim of food and nutrition for all. The post-2015 framework further emphasised this. Three of the United Nations' Sustainable Development Goals (SDGs) are closely related to nutrition security: Goal 2 – End hunger, achieve food security and improved nutrition and promote sustainable agriculture; Goal 3 – Ensure healthy lives and promote well-being for all at all ages; and Goal 6 – Ensure access to water and sanitation for all. Addressing malnutrition effectively is also fundamental to meeting many other SDG targets.

The Hindu Kush Himalayan (HKH) region (Fig. 1) extends 3500 km across eight countries – Afghanistan, Bangladesh, Bhutan, China, India, Nepal, Myanmar and Pakistan – covering an area of 3 441 719 km², and accommodating 210.53 million people. This region is dominated by high mountains, vast glaciers, and large rivers. It is a source of ten large river basins – the Amu Darya, Indus, Ganges, Brahmaputra (Yarlungtsanpo), Irrawaddy, Salween (Nu), Mekong (Lancang), Yangtze (Jinsha), Yellow River (Huanghe), and Tarim (Dayan) – providing water to 1.3 billion people, one fifth of the world's population.¹ Although the Hindu Kush Himalayan (HKH) region has made progress in increasing the *per capita* calorie

intake in recent years, nutrition security remains unresolved. Malnutrition and hunger are widespread in the HKH countries; of the 795 million people under-nourished globally, 52% (415 million) are from HKH countries.² Hilly and mountainous terrain imposes an additional burden on people's health and nutrition and aggravates the problem of under-nutrition. A substantial proportion of the HKH population is facing malnutrition as a result of the effects of several socio-economic, environmental and cultural factors. A study revealed that over 30% of the population of the Garhwal Himalayas in Uttarakhand, India, suffers from under-nutrition.³ Likewise, a study conducted in Nepal⁴ revealed that the magnitude of under-nutrition is particularly high in mountain areas; and a study in Pakistan showed that the prevalence of stunting, wasting, and micronutrient malnutrition is higher in mountainous provinces.⁵ Micronutrient deficiencies are pervasive in the HKH region.⁶ Deficiencies of micronutrients not only lead to stunting, wasting, and under-weight but also to several other medical malfunctions.⁵ Micronutrient deficiencies (zinc, vitamin A, iodine, iron) affect the survival, growth, health, cognitive development,

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productivity and wellbeing of future generations; while malnutrition is responsible for poor health, low socio-economic development and high child mortality.⁵

There are aspects specific to mountain regions in the nutritional challenges. The poorest groups in the mountain regions suffer from alarming rates of under-nutrition. People in remote mountain areas periodically face shortages of food and receive insufficient food to meet their minimum energy and nutrient needs, and they are thus not able to enjoy a normal and healthy life. Infants with low birth weight caused by maternal malnutrition are at greater risk of illness and death, impaired cognitive development, and (for females) poor pregnancy outcomes later in life.^{4,7} Stunted baby girls grow into small mothers who in their turn deliver under-weight babies.⁷ Children suffering from malnutrition do not grow well and have more learning difficulties. Their immune systems are affected,⁵ making them less resistant to infection. In adulthood, the accumulated effects of malnutrition can reduce labour productivity, which in turn limits the earning potential of households and communities. At the individual level, severe malnutrition is clearly life threatening; at the community level, malnutrition results in reduced overall economic productivity.⁷

In mountain areas of the HKH region, nutritional deficiency disorders, such as protein-energy malnutrition and deficiencies of micronutrients, such as iodine, iron, and vitamin A, are the result of numerous factors, including insufficient or inadequate intake of food caused by poverty, and/or inappropriate feeding practices. Infections and parasitic diseases, which are linked to poor environmental sanitation and poor health and care practices and services, also contribute to micronutrient deficiencies.⁸

In terms of agricultural production, mountain areas have a low carrying capacity and often an inefficient utilisation of natural resources. They are physically isolated due to steep slopes and harsh conditions. The construction and maintenance of infrastructure is difficult and expensive, and the transport costs for food and non-food items are high. Lack of fuel can also affect the supply of food items and agricultural inputs to mountain areas, resulting in shortages and price inflation. The poor accessibility of mountain areas reduces access to social services, which has a negative effect on health and education standards and leads to the separation of mountain people from mainstream economies. Mountain communities have a greater dependence on the natural resource base, which has clear implications for ecological balance.

In addition, lack of an understanding of mountain communities by government institutions has led to inappropriate decision making and the undervaluing of indigenous knowledge, experience and economic systems.⁷ As a result, mountain people often have to adapt their livelihoods to policies, laws and interventions that compromise their access to food and productive resources, undermine their knowledge systems and social organisation, and marginalise them further.^{7,9}

Malnutrition is a vicious cycle and its effects can be transferred from generation to generation. A well-nourished, healthy workforce is a precondition for successful economic and social development. Nutrition is both an input to and an output of the development process. The impacts of malnutrition are higher among the poor, women, and children, leading to negative effects on immune functioning, cognitive development, child growth, reproductive performance, and work productivity.¹⁰ Under-nutrition and poor health have many social implications, in particular the poor nutrition of children has long-lasting consequences and can seriously impede national development.

Stunting and poor cognitive development share many risk factors. Not only does malnutrition put a child at risk of infection, but infections also contribute to the symptoms of malnutrition.

Sound nutrition is an essential aspect of social and economic development and an invaluable cross-cutting investment. Achieving nutrition security is a building block that can help developing countries meet their development goals related to health, education, gender equality, and poverty alleviation. For example, investment in girls' nutrition can help advance the status of women and increase gender equality. Attention to nutrition concerns can make agriculture more profitable by connecting it to the needs of consumers; it can also make environmental practices more sustainable by bringing them in line with traditional dietary patterns. Likewise, improved nutrition is an important first step in developing human capital and reducing poverty. Better nutrition status improves immunological integrity and helps prevent the development of non-communicable diseases such as diabetes.¹¹

The nature and causes of under-nutrition and malnutrition in mountain areas are often different from those in the plains due to the difficult topography, poor accessibility, poor market access, and inadequate public health systems. It is important to assess the status of under-nutrition and malnutrition and to identify causes and pathways to achieve food and nutrition security specifically for mountain areas. So far, there has been no systematic study of nutrition issues in mountain communities across the HKH region. This paper aims to assess the nutrition status and underlying causes of malnutrition of the mountain people in the HKH region, and identify options and strategies to improve nutritional status. The findings of the study are expected to be useful to government and non-government agencies in designing policies and programmes to improve food and nutrition security. The study has used secondary data from reliable sources of six HKH countries: Afghanistan, Bhutan, India, Nepal, Myanmar and Pakistan. Updated data from mountainous and hilly areas of China and Bangladesh were not available. The paper is divided into four sections presenting the context (introduction), the nutrition status, factors influencing nutritional status, and a suggested approach for integrating nutrition into the development process.

NUTRITIONAL STATUS IN THE HINDU KUSH HIMALAYAN REGION

Nutritional status in the HKH region is extremely poor; a large proportion of the population suffers from food insecurity and hunger (Table 1). In Pakistan, close to 61% of the population is food insecure in the mountain areas compared to 49% at national level (Table 1). Mountain areas have a *per capita* food deficit (in comparison to national food security line of 2350 kcal day⁻¹ capita⁻¹) of almost 50%, compared to a food surplus of about 18% in the plains.¹⁵ In Nepal, close to 60% of people in the mountains and 53% in the hills are food insecure, compared to 48% in the plains. In India, 18% of people are under-nourished in the mountain states, which is slightly less than at a national level (Table 1). Overall, food and nutrition insecurity is slightly lower in the mountain states of India as compared to national statistics (Tables 1–3), possibly due to the inclusion of extremely poor plain states such as Bihar, Jharkhand, Chhattisgarh and Orissa in the national level assessments. These states are poor both in terms of wealth, as well as in health and nutritional status.¹⁹

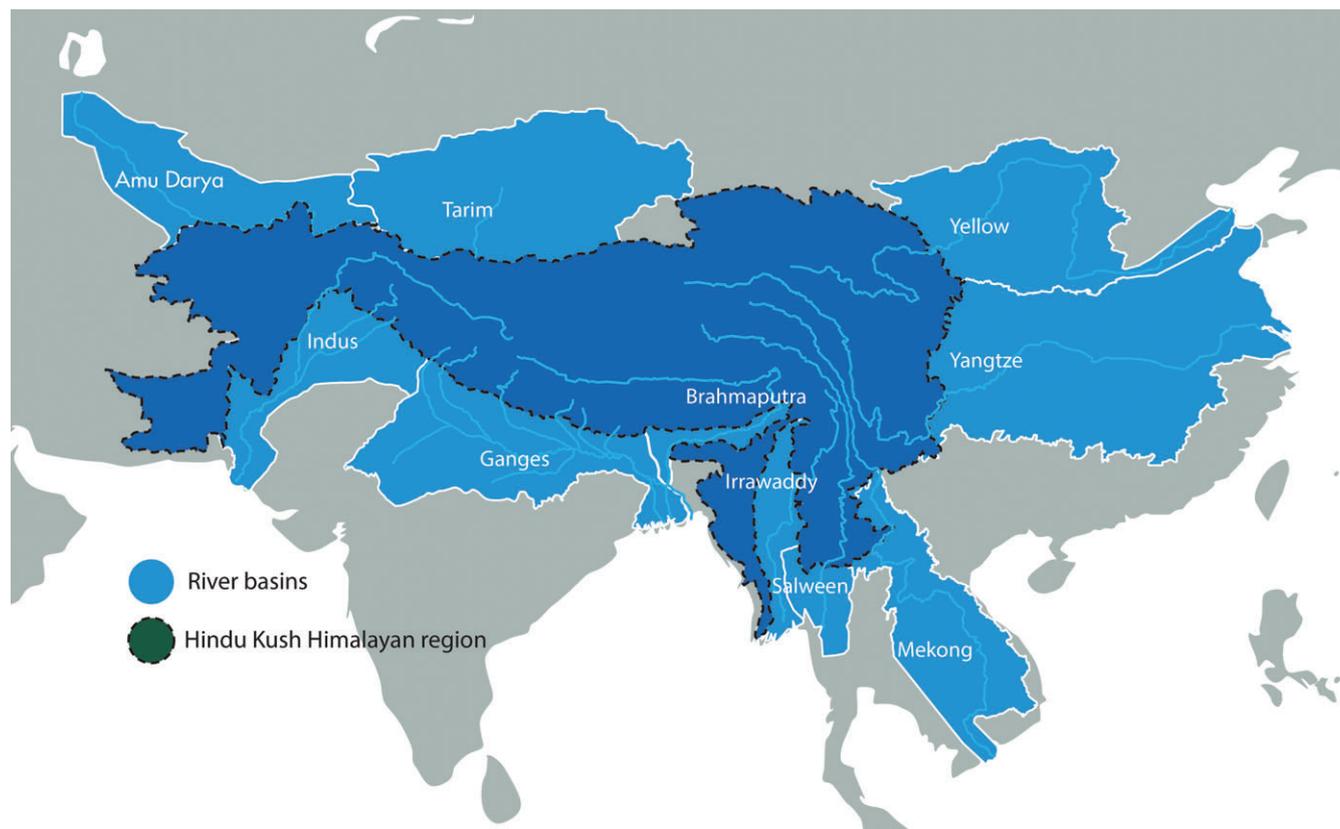


Figure 1. Hindu Kush Himalayan Region.

Table 1. Food (in)security in the Hindu Kush Himalayan region

Country	Indicator	Mountains/hills	National data
Afghanistan*	% households not meeting their caloric needs	–	35
	% of households having very poor dietary diversity	–	46
Bhutan*	% population below national food poverty line	–	12
India**	% undernourished population	18	20
Nepal	% of population food insecure	59.5 (mountains) 52.8 (hills)	50.8
Myanmar	Incidence of food poverty (%)	25 (Chin state)	4.8
Pakistan	% of population food insecure	60.7	48.6

*Whole country is mountainous and hilly.

**Based on data from two Himalayan states, e.g. Assam and West Bengal.

Data presented in the table are recommended for comparison of mountain areas with national statistics within respective countries. Cross-country comparison is not recommended because all countries followed different methods of food (in)security assessment.

Sources: References 12 to 18.

Prevalence of under-weight, stunting, and wasting in children under 5 years of age

Another clear indicator of problems with nutrition security in the HKH region is the high prevalence of stunting, wasting, and under-weight in children under the age of five years (Table 2).

The prevalence of stunting, wasting and under-weight in children in the mountain states of India is slightly lower than in the plains areas but still very high at close to 43%, 16% and 35%, respectively, with marked differences between states (Table 3). Among the mountain states, the level of prevalence of under-weight, stunting, and wasting is highest in Meghalaya, with the incidence of stunting also very high in Uttaranchal, Arunachal Pradesh, and Assam; wasting in Himachal Pradesh, Uttaranchal,

and Tripura; and under-weight in Himachal Pradesh, Uttaranchal, Assam, and Tripura. In Meghalaya, almost half of the children under the age of 5 years are under-weight, while in Tripura almost a quarter of children under 5 years of age exhibit wasting.

In Nepal, the prevalence of under-weight and stunting is significantly higher in mountain areas than in the hills and plains. The proportion of stunted children in the eastern, central and western mountain regions ranges from 45% to nearly 60% (Table 4). The prevalence of wasting and under-weight is higher in the western mountains and mid- and far-western hills than in other sub-regions (Table 4).

In Pakistan, the percentage of stunted and wasted children is slightly higher in mountain areas than in plains areas, with a

Table 2. Prevalence of stunting, wasting, and underweight in children under 5 years of age in the Hindu Kush Himalayan countries

Country	Stunting (%)*	Wasting (%)**	Underweight (%)***
Afghanistan	40.9	9.5	25.0
Bhutan	33.5	5.9	12.7
India	48.0	19.8	42.5
Nepal	40.5	10.9	28.8
Myanmar	28.6	7.7	28.8
Pakistan	44.4	10.7	29.4

*Height-for-age: children under age 5 years < -2 SD from the international reference median value.

**Weight-for-height: children under age 5 years < -2 SD from the international reference median value.

***Weight-for-age: children under age 5 years < -2 SD from the international reference median value. Description of height-for-age, weight-for-height and weight-for-age also applies to Tables 3–7. Sources: References 19 to 24.

Table 3. Prevalence of stunting, wasting, and underweight in children under 5 years of age in the mountain states of India

State	Stunting (%)	Wasting (%)	Underweight (%)
Himachal Pradesh	38.6	19.3	36.5
Jammu & Kashmir	35.0	14.8	25.6
Uttaranchal	44.4	18.8	38.0
Arunachal Pradesh	43.3	15.3	32.5
Assam	46.5	13.7	36.4
Manipur	35.6	9.0	22.1
Meghalaya	55.1	30.7	48.8
Mizoram	39.8	9.0	19.9
Nagaland	38.8	13.3	25.2
Sikkim	38.3	9.7	19.7
Tripura	35.7	24.6	39.6
Average of mountainous and hilly states	41.0	16.2	31.3

Source: Reference 19.

particularly high prevalence of stunting (82%), wasting (13%), and under-weight (37%) in the mountain province of Balochistan (Table 5). The mountain/plain differences are less marked than elsewhere as the indicators for the whole country are poor.

In Afghanistan almost all of the geographical area is either mountainous or hilly and it is not possible to separate the statistics for mountain and non-mountain areas, but differences can be seen within the mountain areas. The prevalence of stunting is very high in the north-eastern, north-western, and eastern regions, ranging from 45% to 53%, with particularly high values for stunting (53%), wasting (18%), and under-weight (41%) in the eastern region (Table 6).

In Myanmar, the prevalence of stunting and wasting is higher than the country average in all of the mountain states except Kachin; while the percentage of under-weight children is high in the Chin and Shan states (Table 7).

Prevalence of under-weight and body mass index in women aged 15–49 years

The percentage of under-weight women aged 15–49 years is relatively high in the HKH countries, with rates of 9%, 36%, 18%

Table 4. Prevalence of stunting, wasting, and underweight in children under 5 years of age in ecological zones of Nepal

Country/region	Stunting (%)	Wasting (%)	Underweight (%)
Ecological zone			
Mountains	52.9	10.9	35.9
Hills	42.1	10.6	26.6
Terai (plains)	37.4	11.2	29.5
Sub-regions of ecological zones of hills and mountains			
Eastern mountains	45.0	8.4	23.5
Central mountains	45.5	7.9	34.7
Western mountains	59.5	13.2	42.0
Eastern hills	45.5	10.5	28.6
Central hills	31.3	15.0	22.5
Western hills	36.0	7.6	16.8
Mid-western hills	51.7	8.0	37.1
Far-western hills	57.5	13.7	39.7

Source: Reference 21.

Table 5. Prevalence of stunting, wasting, and underweight in children under 5 years of age in plain and mountain areas of Pakistan

Country/region	Stunting (%)	Wasting (%)	Underweight (%)
Plain areas (overall)	43.9	10.5	29.8
Mountain areas (overall)	47.7	11.7	26.7
Mountain provinces			
Balochistan	81.9	13.2	37.4
Gilgit-Baltistan	36.1	8.2	12.8
Khyber Pakhtunkhwa	41.3	11.7	25.3

Source: Reference 22.

Table 6. Prevalence of stunting, wasting, and underweight in children under 5 years of age in regions of Afghanistan

Region	Stunting (%)	Wasting (%)	Underweight (%)
North-east	44.6	8.5	27.8
North-west	45.7	5.9	22.6
East	52.6	18.0	41.3
Central	37.4	8.4	24.1
West	31.0	5.6	16.7
South-east	35.0	7.9	27.6
South-west	39.9	10.1	23.6

Afghanistan: The whole country is mountainous and hilly.

Source: Reference 20.

and 14%, in Afghanistan, India, Nepal, and Pakistan, respectively, compared to a world average of 10%.

Within India, the prevalence of under-weight women is slightly less in the mountain states overall (30%) than in the plains (36%), although higher in Assam and Tripura (37%) (Table 8). The average body mass index (BMI) is similar in both mountain and plains states and falls within the normal range. In Nepal, the prevalence

Table 7. Prevalence of stunting, wasting and underweight in children under 5 years of age in mountain states of Myanmar

Mountain state	Stunting (%)	Wasting (%)	Underweight (%)
Chin	51.8	8.2	35.8
Kachin	28.4	3.8	17.9
Rakhine	36.1	8.2	12.8
Shan	42.9	10.3	41.6

Source: Reference 23.

Table 8. Percentage underweight and body mass index (BMI) of women aged 15–49 years

Country	Mountain area	Underweight (%)*	BMI**
Afghanistan	National	9.2	ND
India	Himachal Pradesh	29.9	20.8
	Jammu & Kashmir	24.6	21.4
	Uttaranchal	30.0	20.8
	Arunachal Pradesh	16.4	21.1
	Assam	36.5	20.0
	Manipur	14.8	21.5
	Meghalaya	14.6	21.0
	Mizoram	14.4	21.2
	Nagaland	17.4	20.8
	Sikkim	11.2	22.1
Nepal	Tripura	36.9	19.9
	Mountains	16.5	21.0
Pakistan	Hills	12.4	21.8
	Balochistan	9.0	24.0
	Gilgit-Baltistan	5.4	22.5
	Khyber Pakhtunkhwa	6.3	25.9

*Weight-for-age: women aged 15–49 < -2 SD from the international reference median value.

**BMI categories: underweight = <18.5; normal weight = 18.5–24.9; overweight = 25–29.9; obese = ≥30

ND, no data.

Source: References 19 to 22.

of under-weight women is higher in the mountains than in the hills (17% compared to 12%), with the proportion highest in the western mountains, and mid- and far-western hills, but both with an average BMI in the normal range. In contrast, in Pakistan, the prevalence of under-weight women is low, and significantly lower in the mountain provinces than in the plains at 9%, 5%, and 6% in Balochistan, Gilgit-Baltistan and Khyber Pakhtunkhwa, respectively (Table 8). The BMI statistics indicate that the women in Khyber Pakhtunkhwa are slightly overweight.

FACTORS INFLUENCING NUTRITIONAL STATUS IN THE HINDU KUSH HIMALAYAN REGION

Nutritional security has mainly two determinants: food intake (quantity and quality) and health status. These determinants are influenced by various underlying factors.²⁵ These factors are complex, as they encompass economic, social, biological, and public health issues. Some key factors influencing determinants of food and nutrition security in the HKH region are outlined in the following sections.

Table 9. Incidence of poverty in the HKH region

Country	Population below the poverty line in 2009			
	Million people		%	
	Overall	Mountain regions	Overall	Mountain regions
Afghanistan*	8	6.3	33	42
Bhutan**	0.7	0.7	–	23
India	415	24	36	34
Nepal	9	4.7	31	40
Myanmar	15.9	ND	32	ND
Pakistan	42.4	12.5	25	32

ND, no data.

*Almost all the geographical area of Afghanistan is mountainous and hilly; the study by Hunzai *et al.*³¹ classified some areas with low hills as 'plains'.

**The whole geographical area of Bhutan is mountainous.

As per the definition adopted by Hunzai *et al.*,³¹ a person is poor if his/her spending is lower than the amount of money necessary to purchase the basket of basic goods. The food poverty lines constructed were based on the value of everything consumed, rather than direct expenditure, and included consumption of home produce.

Source: Reference 31.

High poverty and low food energy intake

Poverty is one of the major causes of maternal and child malnutrition, as financial resources are needed to buy high-quality nutritious food. High levels of poverty and vulnerability in the HKH region are a fundamental challenge to achieving food and nutrition security for all. Household choice and consumption of food are largely determined by household income and the price of food products.²⁶ Generally, low income groups prefer to buy low-priced, energy-dense foods, regardless of the overall nutritional value.²⁷ Poverty rates are generally higher in the mountain areas of the HKH than on the plains²⁸ (Table 9) and people have a very limited choice of food items due to their low income levels.

In a case study conducted in Kailali district in Nepal, more than 60% of mothers reported being unable to feed their child nutritious foods such as eggs and meat because they could not afford them.²⁹ Poverty impacts on all aspects of nutrition and food insecurity including inadequate access to safe drinking water, poor hygiene, poor housing and health services, and poor knowledge, trapping families in poverty from one generation to the next.³⁰

Drinking water, sanitation, and hygiene

Nutritional status is strongly influenced by access to an adequate quantity and quality of water and a sanitary environment. Water and sanitation are critical for health. Despite many efforts, access to safe drinking water and sanitation remains limited in the HKH region (Table 10). Except for Bhutan, a significant proportion of the population in HKH countries depends on unimproved and unsafe water sources. The situation is most serious in Afghanistan and Myanmar, where 45% and 19% of the population, respectively, still use unsafe water.

Similarly, a significant proportion of the population in the region is deprived of improved sanitation facilities, with the situation most serious in Afghanistan where less than half of the population has access to some form of improved sanitation facilities. A significant proportion of the mountain population still practises open defaecation: 32% in India and Nepal, 23% in Pakistan, and 13% in Afghanistan.

Table 10. Access to safe drinking water and sanitation

Country/region	Source of drinking water (%)				Sanitation facilities (%)			
	Improved sources		Unimproved sources		Improved	Shared	Unimproved	Open defaecation
	Piped onto premises	Other	Surface water	Other				
Afghanistan	12	43	6	39	32	12	43	13
Bhutan	58	42	0	0	50	28	20	2
India – mountain states	–	87	–	13	43	2	23	32
Myanmar	8	73	5	14	80	12	4	4
Nepal	24	68	2	6	46	18	4	32
Pakistan – mountain administrative units	37	48	10	5	61	8	7	23

No mountain-specific data for Myanmar were available; the national level data were used as a proxy.
Source: References 23, 24, 32, 33.

Water and sanitation are linked to human health and nutrition. Inadequate access to safe drinking water and poor hygiene have been found to be associated with an increased incidence of waterborne and infectious diseases and malnutrition in children, women, and adults across the HKH region.^{5,13,18} Poor people suffer most, as they have the least capacity to invest in water and sanitation.

Nutrition knowledge of women and education

Women play an important role in child nutrition and in ensuring family health. In addition to having adequate access to a diverse array of foods, a mother's knowledge about nutrition, breast feeding, and caring practices, and access to health services and ability to ensure a healthy environment (hygiene and sanitation), are also important in achieving nutrition security. Evidence from the Nepal Himalayas²⁹ shows that mothers with no education are less likely to be able to provide their children with a minimum acceptable diet compared to mothers with some formal education. Women need knowledge about nutrition as well as skills; their knowledge on nutrition and hygiene is key to preventing child under-nutrition. In the HKH region, there is a strong association between the level of mothers' education and child nutrition: the higher the education level, the lower the rate of child stunting, wasting, and under-weight (Table 11).

Decline in agro-biodiversity

The rapid socio-economic changes occurring in the HKH region are also influencing changes in agricultural practices, cropping systems, choice of crop varieties, and land use, as well as food consumption patterns. Nutritious crops like amaranth, buckwheat, minor millet, finger millet, proso millet, foxtail millet, sorghum, barley, and sweet potatoes were traditionally grown in the hills and mountains of the HKH and played a key role in mountain agriculture and food and nutrition security, but production is dropping rapidly. High-yielding varieties (HYVs) of rice and wheat have replaced crops such as sorghum, buckwheat, millet, barley, and oats, leading to a decline in agro-diversity. The traditional crops are gradually disappearing due to a number of factors including lack of awareness about their nutritional value among farming communities, lack of local market prospects for the produce, and an increasing demand for crops such as rice, wheat and maize. In Khyber Pakhtunkhwa Province in Pakistan, barley, sorghum and millet used to be grown extensively, but the area under these crops has

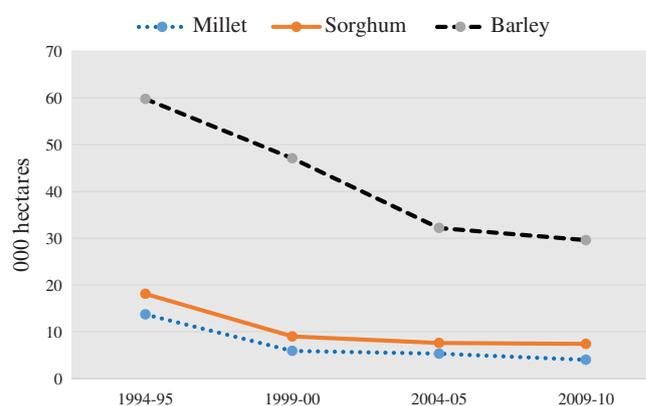


Figure 2. Decline in area under cultivation of traditional crops in Khyber Pakhtunkhwa, Pakistan.
Source: Reference 37.

halved in recent years (Fig. 2). Similarly, In India, the production of sorghum decreased by 43% (from 11.4 million tonnes to 6.4 million tonnes) between 2009 and 2013.³⁵ In most of the mountainous states in India, particularly Jammu and Kashmir, Himachal Pradesh, Sikkim, and Tripura, the area under pulses (excluding gram and tur) decreased substantially in 2011/2012 compared to 1990/1991.³⁶ Pulses are often called the protein of the poor, but the decline in pulse production has increased the price, so that many poor people cannot afford to buy adequate amounts. The decline in production of these rich protein sources may have long-term impacts on local dietary diversity and eventually nutrition security.

The nutritional value of millet, sorghum, and buckwheat is higher than that of white rice.³⁸ Millet is unique among the cereals because of its richness in calcium and potassium,³⁹ dietary fibre – which is higher than that found in wheat, rice, maize, or sorghum^{40,41} – and polyphenols and protein.⁴² It also contains significant amounts of essential amino acids, particularly the sulfur-containing amino acids (methionine and cysteine), and is higher in lipid content than maize, rice, or sorghum.⁴³ Some studies have reported that millet is a good source of oil, rich in linoleic acid and tocopherols.^{44,45} Sorghum contains high levels of micronutrients like iron (more than 70 ppm) and zinc (more than 50 ppm), which are essential for reducing anaemia and stunting,⁴⁶ and can help in reducing micronutrient deficiency. Replacing these traditional crops with rice and wheat and changing consumption patterns has significant implications for nutrition.

Table 11. Malnutrition of children by different educational background of mother

Country	Year	Mother's education	Percentage of children under 5 years			Female literacy rate (%) [*]
			Stunting	Wasting	Underweight	
India	2005/2006	No education	57	23	52	51
		<5 years complete	50	21	46	
		5–7 years complete	46	19	39	
		8–9 years complete	41	18	35	
		10–11 years complete	33	14	27	
Nepal	2011	≥12 years complete	22	13	18	49
		No education	48	13	38	
		Primary	41	11	26	
		Some secondary	32	6	19	
Pakistan	2012/2013	School leaving certificate and above	26	10	13	43
		No education	55	14	39	
		Primary	46	9	28	
		Middle	31	8	18	
		Secondary	21	7	14	
		Higher	21	6	10	

^{*} Female literacy rate, aged 15 years and over.
Source: References 19, 21, 22, 34.

Changing diets

Food habits and diet in the HKH region have been undergoing changes in recent years due to socio-economic development, with access to roads, schools and markets increasing, as well as access to radio, television and general information.⁴⁷ Changes are mainly seen in food grains, snacks and drinks. The shift is from home grown to purchased food and drink; from 'coarse' grain (such as the various millets, buckwheat, and amaranth) to 'fine' grain (white rice and white flour); and from traditional snacks and drinks to potato chips, instant noodles, and soft drinks. The change is fuelled by many factors, not least the intense publicity for industrial food. Changes are more prominent in middle and lower elevation villages, where road connections are better and market connections have been established. The consumption of traditional coarse grains is often considered as 'backward' in the new socio-cultural value system.⁴⁸ Rice and wheat have become the main foods, a process further reinforced by the decrease in agricultural production of alternatives, supply of high-yielding varieties (HYV) seeds at subsidised prices, supply of free food (often rice and wheat) by the government, and low prices and inadequate incentives for growing traditional crops⁴⁸.

The replacement of coarse grain with fine grain, and traditional homemade healthy snacks with low-nutritional value processed foods and drink, has important implications for nutritional status. While total calorie intake has increased over the years, nutritional status has deteriorated.⁴⁷ Reduced consumption of traditional foods and decreasing activity levels lay the ground for obesity and related chronic diseases. An additional risk factor for chronic disease is poverty,^{49,50} and poverty also plays a role in the move to low-quality, high-calorie, low-cost, mass-produced food. Foods from indigenous crops, wild vegetable and fruit species, and animal sources are important sources of micronutrients. However, their consumption has also been reduced due to the modernisation of food patterns and changes in dietary patterns.

The change in agricultural practices and food habits is further reinforced by the trend towards out-migration and labour-for-cash

income. The rate of out-migration in most areas of the HKH region is very high. While out-migration brings additional financial resources and increases purchasing power to buy food, it can also increase local labour shortages, affecting food production, thus leading to increasing dependency on purchased food from the lowlands. In some mountain areas, agricultural land is being left fallow,^{51,52} which reinforces the replacement of nutrition-rich local foods with low nutrition purchased foods.

Climate change and environmental degradation

The forests, rangelands and other natural resources in the HKH region are all experiencing degradation and loss. The decrease in forest area and soil quality, increase in mono-cropping, rapidly changing climatic conditions, and water stress are all putting a strain on the agricultural systems. There is a growing water shortage in the HKH region, manifested in decreasing stream discharge, reduced groundwater recharge, drying of springs, and accelerated soil erosion. Land use changes and the resultant hydrological disruptions have had a direct adverse impact on irrigation potential, which has reduced considerably over the last three decades. The changing climatic conditions are expected to change the conditions for food production by influencing cropping patterns, crop rotation, yields and cropping intensity, and increasing the vulnerability of local communities to climate change. In the Uttarakhand Himalayas, the productivity of agriculture has declined by nearly 25% and *per capita* food productivity has followed a decreasing trend for the last three decades (from 1981 to 2012).⁵³ These changes have serious implications for food and nutrition security. Climate change impacts have particular implications for the food security of children and women in the mountains, especially the projected increase in precipitation variability and extreme events and the related increase in floods, droughts, landslides and other disasters. At times of disaster, women, particularly mothers, tend to skip meals to feed other family members.¹⁴ During floods, the incidence of waterborne diseases also increases, adding to the challenges of food and nutrition security.

ACHIEVING SUSTAINABLE FOOD AND NUTRITION SECURITY: AN INTEGRATED APPROACH

Food systems in the HKH region are changing, agrobiodiversity is declining, and food consumption patterns are changing. The low price of subsidised rice has led to a decrease in consumer demand for traditional crops. The increasing consumption of white rice, wheat flour, instant noodles, and other high-energy low-nutrient refined foods, and declining consumption of nutrient-rich traditional foods such as sorghum, barley and millet, is impacting on nutrition and health. These shifts in diet have important nutrition and health implications and can lead to both under-nutrition and over-nutrition (obesity). Improving agricultural performance can have a positive impact on nutrition outcomes. However, improvements in agriculture alone will not be effective in combating malnutrition unless other mediating factors are in place. Interventions to improve education, health, sanitation, household infrastructure, and care and feeding practices are critical. In remote mountain areas, where the majority of people still mostly consume food they produce themselves, the emphasis should be on promoting the cultivation of nutrition-rich traditional crops. Policy strategies to promote these crops need to be put in place, including policy incentives, market facilities, and value chain development. Dietary diversity, food fortification, micronutrient supplementation, and building knowledge and awareness of the costs and value of the changes in dietary pattern are all necessary to improve nutritional status.

Malnutrition is a multi-dimensional problem that demands a multi-sectoral integrated approach. Nutrition needs to be mainstreamed into all development processes dealing with economic, social, agricultural, and public health, and targeted nutrition programmes must be combined with poverty alleviation programmes. Unless a concerted systems effort is made to improve the nutritional status in the HKH, the achievement of the SDGs will be at risk.

Key elements of an integrated systems approach

The key elements of an integrated systems approach to improving nutritional status are as follows:

- *Mainstream nutrition security across all development programmes:* Integrate nutrition security into development policies and programmes and make it a strategic priority to support nutrition goals. Prioritise nutritionally high-risk households, individuals (such as children, pregnant women, lactating mothers), communities, and areas.
- *Leverage agriculture for nutrition and health:* Agriculture has enormous potential to support improvements in nutrition. However, mountain agriculture is largely rain-fed and water is a limiting factor in improving agricultural productivity. Climate change has further added to the water stresses in the HKH region. Irrigation facilities need to be expanded where possible through financial and technical assistance to improve agricultural production. Efforts need to be made to incorporate nutritional aspects into agricultural policies and strategies, to promote value addition of local products and strengthen market facilities, and to reduce post-harvest food losses by improving processing, storage, and distribution systems.
- *Rejuvenate local production systems:* The priority should be to strengthen local food systems to reduce external dependencies and vulnerabilities by promoting traditional nutritious food

crops. Generally, these crops are also more resilient to climate induced stresses. Efforts should be made to conserve and promote local agro-biodiversity through community-based education for youth, and enhancing access to local seed resources through community seed banks.

- *Support dietary diversity:* Dietary diversity is important for improving nutritional status, particularly the provision of micronutrients. Dietary diversity including fruit and vegetables and animal products needs to be promoted.
- *Improve access to safe drinking water, sanitation, and hygiene:* Access to adequate safe drinking water and sanitation are essential for survival. It is necessary to improve mountain people's access to safe drinking water and improved sanitation facilities to reduce the occurrence of waterborne diseases.
- *Regulate beverage and food marketing:* Regulations should be considered to minimise the promotion of less-healthy foods and beverages, particularly sugar-sweetened high calorie beverages and nutrient-poor fast foods.
- *Strengthen knowledge on nutrition, child care, and food preparation:* Nutrition education, awareness programmes on food preparation, and improved feeding behaviour, breastfeeding, and child-care practices need to be strengthened. Nutrition education could be included in primary and secondary schools. As women play an important role in family nutrition, they need to be empowered with nutrition knowledge and control of resources to enable them to make good nutrition decisions.
- *Biofortification of selected cereal crops:* As cereals contribute a large part of most diets, the fortification of staple grains with vitamins and minerals should be considered to meet micronutrient needs.

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