

Infectious Diseases and Malnutrition Status in Nepal: an Overview

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ABSTRACT

This paper sheds light on infectious diseases and the status of malnutrition in Nepal, a Himalayan country located in South Asia. In spite of efforts by both Government and non-government sectors, infectious diseases are rampant in the countries constituting a major cause of morbidity and mortality, which in turn, impose a socio-economic and public health burden for the country. Intestinal parasitic infection has been implicated in the causation of malnutrition. Malnutrition associated with child mortality is more common among children aged less than five years. Nepalese women suffer from chronic malnutrition. People in rural areas are more affected by malnutrition than those in urban areas. This has been attributed to poverty, lack of education, and rampant infectious diseases.

INTRODUCTION

Nepal: country profile

Nepal is an underdeveloped and land-locked Himalayan country in South Asia situated between China in the north and India in the East, South and West. Nepal can be divided into three ecological regions (running east to west): mountains (3,000 to 8,848m), hills (1,000 to 3,000m) and *terai* or plain area (less than 1,000m) (Figure 1). Administratively, the country is divided into five developmental regions that consist of 14 zones, which in turn, comprise 75 districts. The districts are divided into electoral constituencies and each is further divided into municipalities and village development committees (VDC). One VDC consists of approximately 500 to 700 households. The total population of Nepal is 21.8 million (10.90 million male and 10.93 million female) (Table 1) (CBS, 1998). Ethnically the population can be grouped into *Tibeto-Burman* (characterized by round face, blunt nose, small eyes and no or very little facial hair) and *Indo-Aryan* (characterized by oval face, pointed nose, big eyes and presence of facial hair) (Wooley, Dennis & Sunderland, 1984). Some vital statistics on Nepal are shown in Table 1.

The majority of people live within a few hours walk either from a Hospital, Health Center, Primary Health Care Center (PHCC), Health Post (HP), Sub-Health Post (SHP) or a Clinic. These health service delivering units come under the District, Zonal and Regional Health authorities, all of which are under the Department of Health Services (DHS), Ministry of Health

(MoH) (DHS, 1997; Rai *et al.*, 2001b). Primary health care in rural areas is delivered through PHC-C, HC, HP and SHP. Lately, in bigger cities, private Medical Colleges and Nursing Homes have been established (Rai *et al.*, 2001b). Immunization coverage of children under one year of age for polio, DPT, BCG and measles vaccines is 80.6%, 80.4%, 100.0% and 87.8% respectively (NPC, 1998). Health research activities in the country fall under the jurisdiction of Nepal Health Research Council under the MoH.

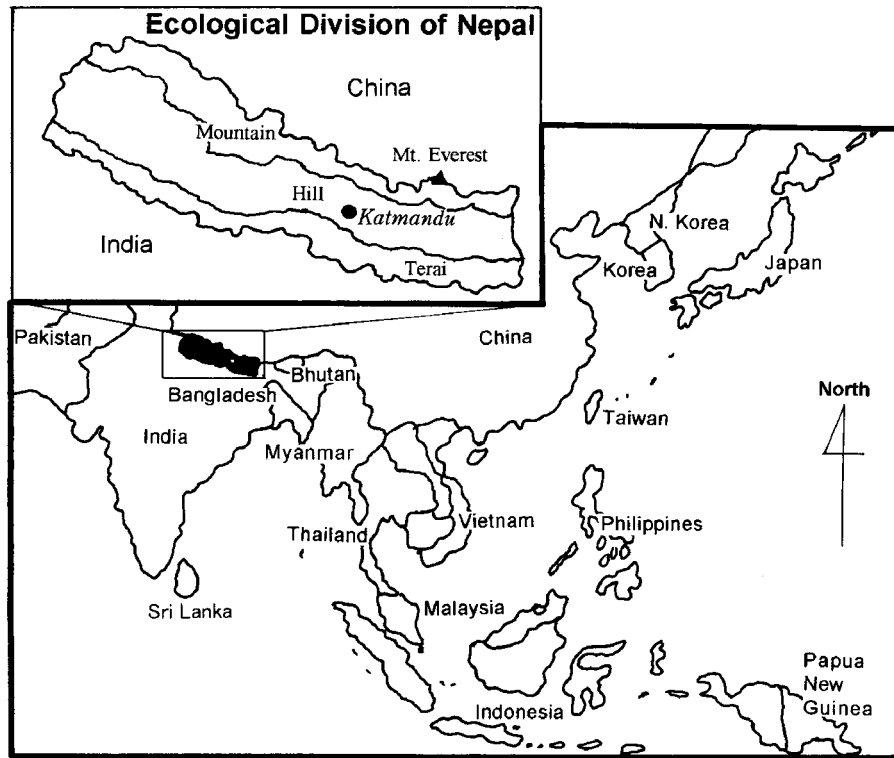


Figure 1. Map of Asia showing Nepal and its ecological divisions.

Table 1. Some basic statistics of Nepal*

Total area	147,181 sq. km (roughly brick shaped)
Population	21,126,636 (as of 1996).
Mean family size	5.5 persons per family.
Population growth rate	2.1 percent.
Literacy rate	52 percent.
Life expectancy at birth	57 years.
Total fertility rate	4.1 (<i>Children per women</i>).
Crude birth rate	36.9
Crude death rate	11.6
Infant mortality rate	Urban: 50 & Rural: 79 per 1,000 live births. (<i>Highest in Mountain & Far-western areas</i>).
Under-five mortality rate	91 per 1,000 live births.

*CBS, 1991; 1998; NDHS Fact Sheet, 2001.

INFECTIOUS DISEASES

Infectious diseases are rampant in Nepal. About 70% of all health problems and deaths in Nepal are attributed to infectious diseases (NPC, 1998). Many children die from easily preventable and treatable diseases such as diarrhea and/or dysentery, and acute respiratory infections. Recently, Ono *et al.* (2001) reported various types of organisms (bacteria, viruses and parasites) associated with diarrhea in Nepal. Cholera outbreaks occur during the rainy summer season (Ise *et al.*, 1994; Bista, 2001). Of the various infectious diseases, intestinal parasitosis alone constitutes one of the major public health problems in Nepal. Roughly, over 60% of Nepalese are infected with one or more than one species of parasites (Estevez, Levine & Warren, 1983; Rai & Gurung, 1986; Rai *et al.*, 2000a; 2001b; Ishiyama *et al.*, 2001). In some rural areas, infection rate can be over 90% (Estevez, Levine & Warren, 1983; Rai & Gurung, 1986; Rai *et al.*, 2000a; 2001b). Soil-transmitted helminthes are most common (Rai *et al.*, 1986; 1994; 1998; 2000a) and the soil even in the capital city is contaminated with helminth eggs (Rai *et al.*, 2000b). Nearly half of the apparently healthy Nepalese (Rai, 1999) and most of the meat animals (Rai *et al.*, 1996) are infected with *Toxoplasma gondii*.

Vector-borne diseases such as malaria, leishmaniasis and Japanese encephalitis are endemic in the *terai* region and in settlements/villages on the river banks between hills (Rai *et al.*, 2001, Bista, 2001). Other viral diseases like hepatitis, Herpes, Measles, Mumps, Rubella Hantavirus are also common (Rai *et al.*, 2001b, Bista, 2001). The annual incidence rate of tuberculosis has been estimated to be 1.05 smear positive cases per 1,000 (NTC, 1994). Prevalence of leprosy in certain areas is as high as 3.61 per 1,000 (Bhat, 1991). Mycotic infections are also prevalent. Emergence of drug resistant microbes has further intensified the problem of infectious diseases (Rai *et al.*, 2001b).

In addition to common diarrheagenic parasites and emerging parasites such as *Cyclospora* and *Cryptosporidium* have also been reported (Hoge *et al.*, 1995; Ono *et al.*, 2001). Many emerging infectious diseases (Rai *et al.*, 2001b) are however undetected. Outbreaks of diseases like diarrhea, dysentery, cholera, enteric fever, jaundice occur frequently (Rai *et al.*, 2001b, Bista, 2001) and are attributed to a contaminated drinking water supply (Adhikari *et al.*, 1986). Keeping in view the rapid spread of HIV infection in Nepal, many opportunistic infections are likely to pose a great challenge in the future (Rai *et al.*, 2001b; Rai, 1999; Hoge *et al.*, 1995; Ono *et al.*, 2001).

NUTRITIONAL STATUS

Worldwide, over 800 million people are estimated to lack access to food to meet their daily basic needs for energy and protein, while more than 3 billion people are deficient in essential micronutrients such as iron, vitamin A and iodine (WHO, 1997). More than half the deaths of children less than 5 years old in developing countries is associated with malnutrition. Rice *et al.* (2000) reported malnutrition as an underlying cause of child deaths associated with infectious diseases in developing countries.

As in other less developed countries, in Nepal too malnutrition constitutes an underlying cause of child deaths associated with infectious diseases (Rai *et al.*, 2001b; NDHS, 2001). Intestinal parasitic infection has been implicated in causing of malnutrition (Rai *et al.*, 1998; 2000a).

Nutritional status of Nepalese children under 5 years

Malnutrition is a major public health problem in Nepal particularly in rural areas. The most significant nutritional disorders are protein-energy malnutrition, vitamin A deficiency, iodine deficiency disorders (IDD) and iron deficiency anemia (NMSS, 1998). According to the Nepal Demographic & Health Survey (NDHS, 2001), half (51%) of the children under 5 years were stunted and 21% severely affected with 10% of children wasted and 1% severely wasted (Table 2).

Table 2. Nutritional status of Nepalese*

Parameters	Overall	Urban areas	Rural areas
Children under 5 years:			
Stunned	51%	37%	52%
Wasted	10%	8%	10%
Underweight	48%	33%	49%
Women aged 15 to 49 years:			
Thin (BMI <18.5)	27%	17%	28%
Height below 145cm	15%	13%	16%

*NDHS Fact Sheet, 2001.

Overall, 48% children were underweight with 13% severely affected. Poor nutritional status of children in rural areas is well correlated with the high infant mortality (Urban: 50 and Rural: 79) and under-five mortality (Urban: 66 and Rural: 112) in rural areas (NDHS, 2001). There has been little progress in the nutritional status of children in Nepal in the last decade.

The Nepal Micronutrient Status Survey (NMSS, 1998) revealed that more than 1% of all school-age children suffered from night blindness and the prevalence increased with age. This finding indicates that vitamin A deficiency affects all ages in the Nepalese population. Vitamin A deficiency was found more common in the Eastern part (particularly in the plain areas) of the country (NMSS, 1998) but the factors attributed to this problem remain to be investigated. Keeping in view this fact, a nationwide vitamin A supplement program is underway. Vitamin A deficiency in Nepal has been found to be associated with intestinal parasitosis. Rai *et al.* (2000a) have shown a significant difference in vitamin A levels among school-aged children who tested positive or negative for intestinal parasitic eggs (Table 3). Further, they have also shown a significant increase in vitamin A levels after deworming, proving the role of intestinal parasites in causing vitamin A deficiency. The same study also revealed a significantly higher level of β -carotene in helminth eggs negative subjects compared with positive subjects. The serum retinol and β -carotene levels observed in this study among parasite egg positive subjects, however, were not at low levels. This appeared to be due to the low incidence (less than 12%) of mixed

helminth infection. Only one child (13/F) with night blindness and infected with both roundworm and whipworm had low serum retinol level (26.3 µg/dl) (Rai *et al.*, 2000a). Both roundworm (Curtale *et al.*, 1994) and whipworm (Atukorala & Lanerolle, 1999) reportedly cause low serum vitamin A level. Rai *et al.* (1998) also showed a significant increase in blood hemoglobin (Hb) and serum total protein concentrations post anti-parasitic treatment. Previously, Curtale *et al.* (1995) also reported an association of xerophthalmia and blindness with worm infections among the Nepalese. Hookworms, one of the major causes of anemia in the developing world, have re-emerged in Nepal in recent years (Rai *et al.*, 1997).

Nutritional Status of Nepalese Adults

The body mass index (BMI) of Nepalese is low for both sexes (Ohno *et al.*, 1998). Women in the age group of 15-49 years have been found to be suffering from chronic energy deficiency (Table-2) (NMSS, 1998). One-fourth (27%) of the women in Nepal have a BMI of less than 18.5 kg/m². One in seven women with height of < 145 cm is likely to suffer from under-nutrition. Nepalese mothers consume insufficient micronutrients (DHS, 1997). Iodine deficiency disorders (IDD) has been a major public health problem in Nepal for decades. The prevalence of clinical IDD as indicated by goiter was observed to be very high with a total goiter rate of 50% among women and 40% among school-aged children (NMSS, 1998). This study revealed that the prevalence of low urinary iodine excretion values has decreased recently and this has been attributed to nationwide distribution of iodized salt.

Nutritional anemia is a severe public health problem in Nepal. It has been found that 78% of pre-school children, almost 68% of women and 75% of pregnant women are anemic (NMSS, 1998; NDHS, 2001). Severe anemia (blood Hb level of less than 7g/dl) was observed in 2.2% women and 3.1% children of 6–23 months. As in the case of vitamin A, low blood Hb among the Nepalese, particularly among women, has been found to be associated with intestinal helminth infections (Curtale *et al.*, 1993) particularly with hookworms (Curtale *et al.*, 1994; Rai *et al.*, 1997). Hirai *et al.* (1993) in a study conducted among Nepalese aged 10 to 72 years, found an average retinol level of 534ng/ml and 420ng/ml among males and females, respectively. These values were higher than those of Hispanics but lower than those of Americans (Hirai *et al.*, 1993). In another study, Hirai *et al.* (1996) observed a tendency for Nepalese with an increased triglyceride level to be deficient in essential fatty acids (linoleic acid and linolenic acid). In some areas, however, iron intake was low and about half of the young women had serum iron/total iron binding concentration ratios that were equal or below 16% indicating iron deficiency (Ohno *et al.*, 1998). Also observed was a strong positive correlation between low intake of energy and protein with iron intake.

Nepal is the only country in South Asia with a very high reproductive risk index according to the PAI Report (2001). Nepalese woman have an average of more than 5 children and are 99 times more likely to die during pregnancy or childbirth than women in very low risk developed countries like USA, Canada, Britain, Japan and Australia. The maternal mortality rate remains very high (5.39 per 1000 live births) (CBS, 1991; 1998; DHS, 1997), and this is attributed mainly to the lack of medical facilities and social factors including illiteracy (Thapa, 1996). As shown in Table 2, most Nepalese women aged 15 to 49 suffer from chronic energy deficiency (NMSS, 1998).

ASSOCIATION OF POVERTY-LACK OF EDUCATION-MALNUTRITION-INFECTIOUS DISEASES

Poverty further intensifies health problems in Nepal. Poverty stricken people cannot afford middle and higher levels of education. Hence, the overall literacy rate in the country is only 52%. This means that half of the people cannot read and write and therefore, cannot read and understand health messages in pamphlets, posters, newspapers or booklets. Even literate people have only a very elementary knowledge of health and sanitation. This situation allows the prevalence of numerous easily preventable and/or treatable infectious diseases in Nepal. Poverty leading to macro- and/or micronutrient deficiencies leads to further vulnerability to infectious diseases. It is known that both macronutrients and micronutrients such as vitamin A and E play an important role in the resistance against infectious diseases. The strong impact of maternal education on nutritional status of children has been observed in Nepal: 53%, 41%, 31% and 22% malnutrition rates were observed in children born to respectively, illiterate mothers, mothers with primary level (up to 3 class) schooling, middle school level (up to 7 class), high school (up to 10 class) and college level (NDHS, 2001). Thus, the vicious cycle of poverty-education-malnutrition-infectious diseases is manifested in Nepal.

Table 3. Serum retinol level ($\mu\text{g}/\text{dl}$) in helminth infected and non-infected children (n=145) in Nuwakot, Nepal*

Sex	Helminth eggs in stool	Total n	Retinol ($\mu\text{g}/\text{dl}$) (Mean \pm SD)	P value
M	Positive	69	51.63 \pm 21.93	P<0.001
	Negative	35	70.00 \pm 22.43	
F	Positive	23	52.94 \pm 21.72	P<0.05
	Negative	18	69.27 \pm 17.39	

*Rai *et al.*, (2000a)

It has been observed that food consumption and average energy intake of the Nepalese, in some areas are adequate (Ohno *et al.*, 1998). However, a significant loss of nutrients is associated with infections particularly intestinal parasitic infections (Rai *et al.*, 1998; 2000a). Intestinal parasites, even in low or moderate number, cause persistent and poor nutritional status, particularly in children, by causing subtle reduction in appetite, digestion, absorption, and acute-phase status and increasing intestinal nutrient losses (Lun & Northrop-Clewes, 1993). In the case of vitamin A deficiency, it is caused either by chronic low intake of vitamin A rich foods (Shankar *et al.*, 1996) and/or parasite infections (Lun & Northrop-Clewes, 1993; Curtale *et al.*, 1994; 1995; Friis *et al.*, 1997; Atukorala & Lanerolle, 1999; Rai *et al.*, 1998; 2000a).

HEALTH WORKERS

Nepal does not have sufficient health workers to combat nutrition and related health problems. As most doctors, are concentrated in the bigger cities, many district hospitals are without

doctors. Lack of supplies, subordinates and facilities, and feeling of isolation and deprivation of opportunities for self-development in the rural areas are some of the factors that hence contributed to doctors not wanting to serve outside the city. However, it is hoped that many medical graduates as well as other categories of health workers about to graduate from various newly established medical colleges and institutions in the country will contribute towards solving this problem in the near future.

REMEDIES

It is good that there are health centers providing services even in remote rural areas that are readily accessible to all. However, the pace of health sector expansion has not been matched by domestic growth in Nepal. Hence, there has been a gap between the finance required for health sector operation and the availability of domestic resources (Smithson, 1995). Many health service centers in Nepal are poorly utilized primarily due to the lack of trained health workers and/or insufficient medical supplies (Chalker *et al.*, 1990; Opptiz, 1993). External assistance has partially filled the gap but at the expense of dependency on foreign aid (Smithson, 1995). Keeping in view these facts, a comprehensive but achievable and sustainable program should be implemented to alleviate poverty and combat the rampant infectious diseases and nutrition related health problems in Nepal. Last but not the least, local participation in all these efforts should be encouraged.

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