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## Assessment of Magnitude of Malnutrition and Related Health Problems in Cold Desert Ladakh-India

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### Abstract:

*The present research work was carried out on nutrition intake, levels of malnutrition and related health problems in adults in cold desert of Ladakh. The investigation reveals that variation in the availability of nutrients in the diet due to harsh agro-climatic conditions; socioeconomic status and poverty has badly affected health of the people in different regions of Ladakh. Nutrition intake was examined in comparison to ICMR recommended dietary allowances. The analysis shows that the majorities of adult population is malnourished and are suffering from different nutritional deficiency diseases. Some remedial measures have also been suggested.*

**Key words:** Malnutrition; Standard requirement; Nutritional deficiency diseases

### Introduction

Nutrition plays an important role in the growth and development which are very important indicators of the state of health (Nath, 1997 and Kang, 1994). Inadequate amount of

nutrients in diet in comparison to Indian Council of Medical Research (ICMR) recommended dietary allowances leads to malnutrition and under nutrition (Doshi, 1995), which in-turn leads to not only low growth, under nutrition weight, increased risk of infectious diseases and deficiency diseases but also has a negative effect upon mental development (Verhasselt, 1997 and Mishra, 1985), poorer psychomotor development and fine motor skills, interact less frequently in their environments and fail to acquire skills at normal rates (Grantham, 1997). Malnutrition as a whole results in alteration of the basic metabolism of the body and leads various types of disorders in the body (Zutshl, 1988). Malnutrition continues to be a major public health problem throughout the developing world, particularly in southern Asia and sub-Saharan Africa. (Schofield, 1996 and FOA, 2004). Malnutrition produces dangerous weaknesses in the body, and lower resistance to all kinds of diseases organisms, more than half of the world's population suffers from nutritional deficiency. (Hussian, 2008). WHO cites malnutrition as the gravest single threat to the world's public health and estimates that about two third of the world population is struggling with conditions that make sickness and under nourishments the normal state of life (Bakshi, 1996). In India, 30 per cent of children are born with low birth weight and almost 50 percent remain underweight by the age of three (UNICEF, 2001). Besides income (Levinson, 1974) and life style and health related factors, socio-cultural, homographic health, ignorance, Poverty, Superstitions, traditional prejudices and frequent infections etc also contribute to the malnutrition and under nutrition (Chopra, 1989 and Henriets, 1981). Standard of nutrition varies from country to country and within regions of diverse agro-climatic conditions. Whatever standard is chosen, under nutrition and malnutrition is wide spread in India because of inadequate breast feeding and poor nutrition status (Jaffery, 1988). Several nutrition programmes have been launched by

the Government of India for the downtrodden sections of population in general and vulnerable sections of population in particular but these programmes have not been successful to raise the level of nutrition to the optimum level (Bagchi, 1994; Sachar and Gill 1993, Price, 1994). The incidence of endemic goiter in the mountains and sub-mountains regions is due to deficiency of Iodine in water and soil (Akhtar, 1980 & Zargar, 1997). So, the consideration of geographical factors in identification and assessment of deficiency diseases is very important (Patwardhan, 1966, Pelto, 1991). The present paper attempts to analyze not only the geographical distribution and assessment of magnitude of malnutrition as a health problem among the different regions of Ladakh but also attempts to identify the ecological causes that are directly or indirectly responsible.

### **Objectives of the study:**

The present research was carried out with the following objectives:

- 1- To examine regional variation in nutrition intake.
- 2- To find out levels of malnutrition in adults of Ladakh.
- 3- To analyze regional variation in incidence of nutritional deficiency diseases in Ladakh.
- 4- To provide a planning strategy for the development of human health in the area.

### **Overview of Literature:**

Impact of nutrition on health is not a recent approach in Medical geography but has attracted the attention of medical geographers for the last more than half a century, hence very good geographical literature is available regarding the nutrition and its health related aspects.

McCarrison (1921) conducted a number of experiments to show relationship between diet and human physique and concluded a positive correlation between quality of food and weight, same was found by Sukhatme (1970), Gopalan (1970), Vasantha (1998) and Mahgoub, (2006) in their study show that malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, poor mental performance, poorer psychomotor, psychological physical work capacity and other problems leading to various degrees of malnutrition and no tendency for them to catch-up in their mental function even of the same community, even after a period of two years. while Roa (1974) and Mishra (1985) stressed upon the rural urban variation of malnutrition and even urban slums and attributed it to lack of nutrients in the diet, poverty, ignorance about balanced diet, poor sanitation and hygiene that in their respective studies found that twenty six percent and twenty two percent PEM is more prevalent in rural areas as the urban. These findings were also supported by Tandon (1972) while analyzing the nutritional status in rural population of Kumaon Hill area and found substantially poor intake of proteins in sixty percent of the families, established wide prevalence of malnutrition. Rather (2004) identified that about twenty nine percent children are suffering from various deficiency disease and the average weight was less by 3 ½ kg than the standard weigh recommended by ICMR in the hilly district of Gurez areas of J&K state Narasinga (1999) pointed out that PEM, Vitamin A deficiency; Anemia and Goiter especially among young children, women, and pregnant women were found most serious due to inadequate availability of protective foods and infective morbidity owing to poor environmental sanitation. Leading to prevalence of PCM in children 1-5 years of age in the form of Kwashiorkor and Marasmus and concluded that nearly a million children die every year due to PCM. Chatterjee (1976)

Melinda Meade (1977) in his study revealed that the disease is the outcome of mal-adaptive interaction among population, Environment, and culture, which can be fully understood by the Learmonth (1982) study who have exposed positive relationship of cultural factors and the occurrence of Diseases in India and Freund's (1990) who revealed that most severely malnourished are either not brought to the health centre's even when they are accessible or are treated with traditional medicine when health facilities are inaccessible and the whole complex of social-cultural factors are responsible to high mortality. Sivaramakrishanan (1993) ascribed it to the influence of traditional medicine and of cultural belief. Akhtar (1981) found high prices most hazardous factors in zambis Lusaka. He concluded that forty percent of the residents consider high prices of food as most hazardous to health.

Aggarwal (1986) showed that infection tendency of the children and income of the family emerged as the foremost determinants of malnutrition. Subramanian (2004) investigated the effect of socioeconomic status (SES) and nutrition in India and concluded that under nutrition and over nutrition were epidemics of the impoverished and the affluent in India. Akhtar (1980) revealed that eighty percent of the preschool children in India suffer from Malnutrition due to poor socioeconomic status (SES) and lack of awareness about balanced diet that is why Agrahar (2005) stressed upon nutritional education is important in guiding the tribes of Meghalaya to a new milieu of food choices in particular and to India in general.

Zargar (1997) examined that 46.39 percent of the Population in Pulwama and 52.32 percent in Anantnag is the prevalence rate of goiter and confirmed that lack of Iodine in the diet was probably the cause of goiter. Mayer (2007) in his research paper, "Regional Analysis of Diet and Nutritional Anemia in Kashmir Valley", pointed out that the highest prevalence of anemia was found in Srinagar city with 6.5 percent followed by Anantnag with 6percent percent ,Pulwama

with 5.5percent and Kupwara, Budgam and Baramulla with 5 percent,4.7 percent, 4.5 percent respectively. The main cause responsible was identified as diverse agricultural activities.

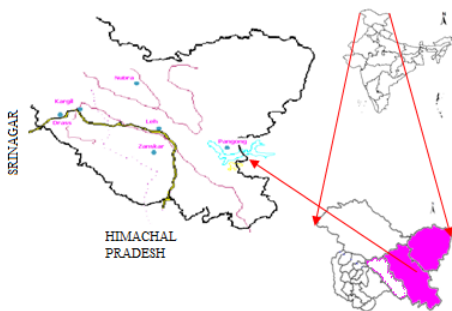
Dilip Kumar (2005) in Nutritional Status of Adolescent Girls in a Rural Area of North 24 Parganas, District West Bengal, found that prevalence of common nutritional deficiency disorders were anemia (44.8percent), dental caries (25.9percent), angular stomatitis (15.4percent) etc

Kumar, K. (1995) in a study in Peru revealed that higher rates of malnutrition were observed among children under the age of five living in mountainous areas (43.7 percent) suffered from acute malnutrition as compared to the national average of 36.5 percent for the same age group. Similarly, 13.4 percent of mountain children suffered from chronic malnutrition (stunted children) compared to a national average of 10.8 percent. Kuhnlein and Pelto (1997) also pointed out the same reasons of severe malnutrition among them poverty, poor food practices, low agricultural productivity, lack of awareness regarding balanced diet and nutritive values and diet diversification emerged as the foremost and Scrimshaw & Schürch (1998) *study on birth weight reduction at high altitudes* has shown discernible reduction of birth weight in babies born at high altitudes. Thus enriching the previous rationale. Chapagain, e tal. (2005) in their study, *“A Study on Nutritional Status of Under Five Jirel Children of Eastern Nepal”* revealed that among 309 children including 167 male and 142 female, 12.62 percent were severely malnourished. 37 percent were found having mild to moderate malnutrition, and attributed it with poor nutrition intake even of national averages. Jarnail Singh, & e,tal.(2010) in their research paper, *“Persisting Malnutrition in Chandigarh: Decadal Underweight Trends and Impact of ICDS Program”*, surveyed a total of 803 under-five children, 547 children between 12-23 months age, and 218 women with an infant child were studied and compared with another methodologically similar study (1997) from Chandigarh

and Reproductive and Child Health Rapid Household Survey (1998) to draw decadal trends, concluded that Prevalence of underweight among under-five children remained almost stagnant in the last one decade from 51.6percent (1997) to 50.4percent (2007). There was insignificant difference ( $P=0.3$ ) in prevalence of underweight among children registered under ICDS program (52.1percent) and those not registered (48.4percent) in 2007. The other health and service provision indicators had mixed results in the past decade. The reason being Health services utilization was poorest in urban slums. Wengreen and Cara (2009) in their longitudinal observational on *change in diet, physical activity, and body weight among young-adults during the transition from high school to college* found that The average BMI at the baseline assessment was 23.0 (standard deviation (SD) 3.8). This research provides further support for the implementation of education or other strategies aimed at helping young-adults entering college to achieve or maintain a healthy body weight. Monckeberg studied the groups living under poor socioeconomic conditions are showing low intellectual performance and correlation of animal protein calorie intake also observed the same relationship.

## Study area

Ladakh covering an area of about 85000 Km<sup>2</sup> constitutes almost 70 percent of geographical area of J&K state stretches between 32° 26' to 35° 10' N. latitude and 75° 30' to 79° 10' E. longitude. It is bounded on the north by China, in the east by Tibet, in the North West by Gilgit and Askardu and in south by Himachal Pradesh state of India. It is a vast arid table land, located at an altitude of 8000 meters. It is deprived of vegetation and often been termed as the" Roof of



the world” where people live at a height ranging between 2,800 to 5,000 meters above mean sea level. It is exceptionally cold and dry, with an annual rain fall of less than 12 cm and temperature dropping to as low as  $-43^{\circ}\text{C}$  and making it second coldest place in the world. The area is inhabited by 1, 85,000 population as per 2001 Census and is dominated by Buddhist and Muslim population. The Buddhists and Muslims are found more or less equal in number with preponderance of Buddhist in north and east and Muslims to south and west.

The climate of Ladakh is very cold, arid and dry. In winter temperatures are extremely low. The mean maximum temperature is  $12.27^{\circ}\text{C}$  and mean minimum temperature is  $-4.24^{\circ}\text{C}$ . Average annual rainfall 3.15 cms. (Hussian 1998)

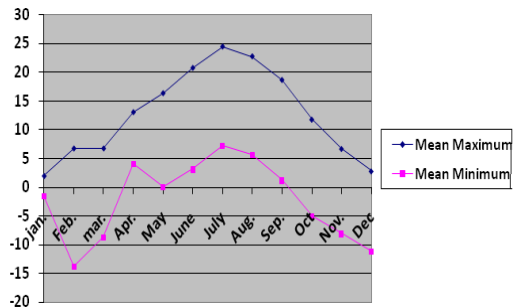


Fig.1.2

## Data Base and Methodology:

The present research paper was based mainly on primary data and partly on secondary data. The methodology was used under the following steps;

### Step -I

#### Selection of Sample villages and Sample Households:-.

The study area was divided into six geographical regions, Three in Kargil district and three in Leh district. Stratified random sampling technique was applied for the selection of sample villages and households. Nine (9) sample Villages from Kargil and nine (9) from Leh Districts of Ladakh were selected but keeping in view that all the regions should have equal representation so 3 sample villages were selected from each



region. 200 households from 18 sample villages were selected in proportion to total number of households from each sample village.

### **Step -II Dietary Surveys**

**Dietary survey of Adults-** Dietary survey of 200 households was carried out by interview method to obtain data about food items in quantities consumed per person per day for a period of 10 days preceding the date of interview. Adult (males and females) that too in same ratio from each household were taken into account during diet survey and the average of the two was taken as an average food intake by an adult Ladakhi. Food intake in quantities was then converted into nutrition values of proteins, fats, carbohydrates, vitamins, minerals and calories with the help of nutrition conversion chart of 2009 formulated by nutrition expert committee constituted by ICMR. Total energy intake in Kcal. / Person / day was calculated and then compared with standard requirement to calculate percentage departure by the formula.

$$\frac{\text{Surplus or Deficiency}}{\text{Standard requirement}} \times 100$$

Standard nutrition requirement was taken as average of adult male and female doing moderate work as recommended by ICMR. Households having negative %age departure of each region were classified as malnourished and categorized into different grades of malnutrition by the following method.

<u>Grades</u>	<u>% age Departure (-)</u>
Normal	< 20%
Moderate	30 – 40%
Severe	> 40%

### **Step – III Health survey:-**

## **Health Survey of Adults**

During households survey all the patients suffering from various diseases in general and nutritional diseases in particular were noted on the basis of prescriptions they had obtained from different medical practitioners and Health care facilities in order to examine regional incidence of nutritional deficiency diseases in Ladakh.

**Table 1 - List of Regions, Sample villages and Sample House holds**

<b>Regions</b>	<b>Sample Villages</b>	<b>No. of House holds Surveyed</b>
<b>Kargil</b>	Panikhar, Sankoo, Hardas	45
<b>Drass</b>	Chokal, Bimbat, Vibu	20
<b>Zaskar</b>	Lungmi, Testa, Padam	35
<b>Leh</b>	Shey, Chashut, Chuglamsar	45
<b>Nubera</b>	Panamik, Diskit , Chiktan	40
<b>Pangong</b>	Chag, Thangla , Pangu	15
<b>Total</b>	18	200

## **Results and Discussions**

### **Agricultural production and Food Products in Ladakh:**

Micro level variation in agro-climatic conditions and physical setting play an important role in the cultivation of crops. Agriculture is very scanty in whole Ladakh Division. About 78% land holding fall 0.5 to 2.0 ha. giving a very pessimistic and deplorable condition (sagwal). Among the Cereals, wheat and Barley hold an important place in all the six geographic regions of Ladakh. Barley and its byproducts are used in various ways in the diet. Wild Variety of wheat commonly known as Grim is grown everywhere. Vegetables like cabbage, radish, and potatoes are also grown in different areas. Grim is the staple food of the people. Grim flour is roasted and used while taking tea or Chang (A type of dish). Apple, Apricot and Plum are grown in many parts of Ladakh.

Hardas in Kargil and Nubra in Leh are famous for Apricots while as Batalik region is famous for Grapes. Tea is

very common and is taken several times during day. Milk and milk products also constitute important part of food. There is the scarcity of fruits, milk, milk products, vegetables, and other food items in the area especially during winter months.

**Table 2-Diet intake in Ladakh /Person/10 days (by Regions)**

Regions	Rice (gm)	Wheat (gm)	Pulses (gm)	Vegetables (gm)	Milk (gm)	Mutton (gm)	Eggs (no's)	Fruits (gm)	Butter (gm)
Zaskar	251	281	28	72	120	18	0.2	65	9
Kargil	366	290	50	115	200	80	0.5	150	25
Drass	137	222	19	65	140	35	0.1	122	21
Average for Kargil	251	264	32	84	153	44	0.25	112	18
Leh	365	427	115	120	250	100	1	110	19
Nubra	276	360	94	80	170	83	0.5	72	13
Pangong	166	205	55	16	90	22	0.2	50	10
Average for Leh	269	330	88	72	170	68	0.5	77	14
Average for Ladakh	260	297	60	78	161	56	0.37	94	16

Source: - Field work 2008

Note: The approximate nutritive value of the diet is: Calories 3000; proteins 90 g; carbohydrates 450 g; fat 90 g; calcium 1.4 g ; phosphorus 2.0 g ; iron 47 mg ; carotene and vitamin A 8,400 I.U. vitamin A; thiamine 2.1mg ;riboflavin 1.8 mg; Nicotinic acid 22mg,;vitamin C 240mg.

### **Nutrition Intake:**

There exists marked variation in the availability of nutrients of diet (table 4). The table reveals that the overall energy consumption of Ladakh is 1539.71k.cal./person/day and varies from district to district. The energy consumption of Kargil district of Ladakh is 1558 k.cal/person/day as compared to 1521.43 k.cal/person/day for Leh district.

Intake of proteins and fats is to some extent satisfactory but below to the national average. The protein intake in Kargil was 52.96 g while it was 46.63 g in Leh, the overall protein requirement of the Ladakh region as a whole is low (49.63g) below the national average of 60g . High intake of proteins and fats was attributed to the fact that majority of the population is non vegetarian and consumed milk and meat.

Vitamin A and iron intake was low due to less consumption of green leafy vegetables because of the non availability during winter. This results in deficiency of vitamin A in the body and leads to Night blindness and Anemia which are prevalent in both the districts of Ladakh. The consumption of vitamin A and Iron in Kargil was 434.46ug/person/day while it shows a down slope in Leh with 389.67 ug. Thus the overall intake is far from the national average which accounts for 600ug /person/day.

The overall intake of calcium was low as compared to national average recommended by ICMR which is 400mg. Calcium intake was satisfactory in Kargil (389.6mg) district because of large availability of milk and milk products while as it was low in Leh (290.68mg).

**Table-3 I.C.M.R. Recommended Dietary Allowance for Indians 2009**

Group	Particulars	Body wt. (kg)	Net energy (Kcal)	Protein (mg)	Fat (mg)	Calcium (mg)	Iron (mg)	Vit.A		Thymine (mg)	Riboflavin	Nicotinic (mg)	Pyridoxine (mg)	Ascorbic acid (mg)	Folic acid (ug)	Vit. (B-12)
								Retinonal Ug	B - carotene ug							
Man	Sedentary work		2425							1.2	1.4	16				
	Moderate work	60	2875	60	20	400	28	600	2400	1.4	1.6	18	2.0	40	100	1.0
	Heavy work		3800							1.6	1.9	21				
Woman	Sedentary work		1875							0.9	1.1	12				
	Moderate work	50	2225	50	20	400	30	600	2400	1.1	1.3	14	2.0	40	100	1.0
	Heavy work		2925							1.2	1.5	16				
	Pregnant woman		+300	+15	30	1000	38	600	2400	+0.2	+0.2	+2	2.5	40	400	1.0
	Lactation															
	0-6 months	50	+550	+25	45	1000	30	850	3800	+0.3	+0.3	+4	2.5	80	150	1.5
	6-12 months		+400	+18						+0.2	+0.2	+3				
Infants	0-6 months	5.4	108/kg	2.05/KG		500				55ug/kg	65ug/kg	710ug/kg	0.1	25	25	0.2
	6-12 months	8.6	98/kg	1.65/KG				350	1200	50ug/kg	60 ug/kg	650 ug/kg	0.4			
Children	1-3 years	12.2	1240	22			12	400		0.6	0.7	8			30	
	4-6 years	18.0	1890	30	25	400	18	400	1600	0.9	1.0	11		40	40	0.2-1.0
	7-9 years	26.8	1950	41			26	600	2400	1.0	1.2	13			60	
Boys	10-12 years	35.4	2190	54			34			1.1	1.3	15				
Girls	10-12 years	31.5	1870	57	22	600	19	600	2400	1.0	1.2	13	1.6	40	70	0.2-1.0
Boys	13-15 years	47.8	2450	70			41			1.2	1.5	16				
Girls	13-15 years	46.7	2060	65	22	600	28	600	2400	1.0	1.2	14	2.0	40	100	0.2-1.0
Boys	16-18 years	57.1	2640	78			50			1.3	1.6	17				
Girls	16-18 years	49.9	2060	63	22	500	30	600	2400	1.0	1.2	14	2.0	40	100	0.2-1.0

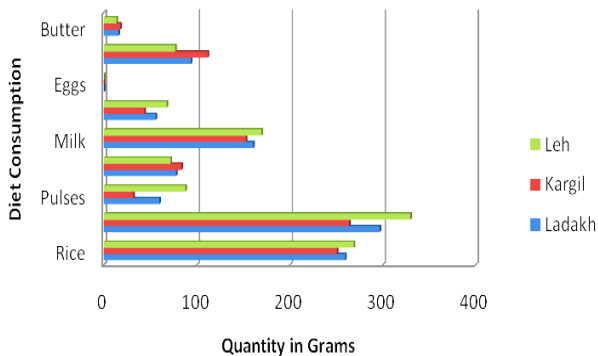
**Table 4 - Surplus / Deficiency and Departure of Nutrients from Standard Requirements among Adult Ladakhis (2012)**

Rouf Ahmad Dar, G. M. Rather- Assessment of Magnitude of Malnutrition and Related Health Problems in Cold Desert Ladakh-India

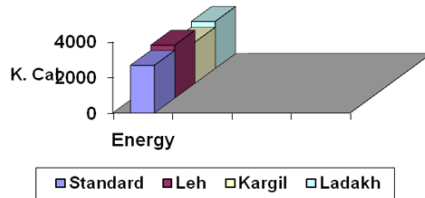
Village	Energy (K.Cal)/d	Protein (g)/d	Fats (g)/d	Calcium (mg)/d	Iron (mg)/d	Vit.A retinal µg/d	Thy- mine mg/d	Riboflavin- in mg/d	Ascorbic acid (mg/d)
<b>Std. Requirement</b>	<b>2875</b>	<b>60</b>	<b>20</b>	<b>400</b>	<b>28</b>	<b>600</b>	<b>1.2</b>	<b>1.4</b>	<b>40</b>
Consumption	1,733	57.22	16.62	262.17	21.19	398.98	1.92	1.69	27.26
Surplus (+) / Diff. (-)	-1,142	-2.78	-3.38	-137.83	-6.81	-201.02	0.72	0.29	-12.74
% departure	<b>39.72</b>	<b>4.64</b>	<b>16.9</b>	<b>34.45</b>	<b>24.32</b>	<b>33.50</b>	<b>60.16</b>	<b>20.71</b>	<b>31.85</b>
Consumption	1830.9	66.86	32.90	416.08	21.14	-595	1.33	3.30	44.9
Surplus (+) / Diff. (-)	1,0441	-6.86	-12.90	-16.08	6.86	5	-0.13	-1.9	-4.9
% departure	<b>363.16</b>	<b>11.43</b>	<b>64.5</b>	<b>4.02</b>	<b>24.5</b>	<b>0.834</b>	<b>0.10</b>	<b>135.71</b>	<b>12.25</b>
Consumption	1112.15	34.8	18.12	274.57	11.65	309.41	0.63	0.78	28.37
Surplus (+) / Diff. (-)	-1762.8	-26.2	-1.88	-125.4	16.35	-290.5	-0.5	-0.62	-11.36
% departure	<b>61.30</b>	<b>43.66</b>	<b>9.4</b>	<b>31.35</b>	<b>58.39</b>	<b>48.43</b>	<b>41.67</b>	<b>44.28</b>	<b>28.4</b>
Consumption	1517.4	50.8	24.45	284.4	16.19	392.54	0.91	1.06	30.83
Surplus (+) / Diff. (-)	-1357.6	-9.2	-4.45	-115.6	-11.81	-207.6	-0.29	-0.34	-9.17
% departure	<b>47.22</b>	<b>15.33</b>	<b>22.25</b>	<b>28.9</b>	<b>42.17</b>	<b>34.57</b>	<b>24.17</b>	<b>24.28</b>	<b>22.92</b>
Consumption	1519.77	60.06	28.73	355.54	20.28	521.89	1.8	1.3	44.85
Surplus (+) / Diff. (-)	-1355.23	-0.6	8.73	-44.46	-7.72	-78.11	0.6	-0.1	4.85
% departure	<b>47.13</b>	<b>1</b>	<b>43.65</b>	<b>11.12</b>	<b>27.57</b>	<b>0.16</b>	<b>50</b>	<b>7.14</b>	<b>12.12</b>
Consumption	864.07	41.36	37.14	214.82	40.63	268.57	1.12	0.82	21.68
Surplus (+) / Diff. (-)	-2010.93	-18.64	17.14	-185.18	12.63	-331.43	-0.08	-0.58	-18.32
% departure	<b>69.94</b>	<b>31.06</b>	<b>85.7</b>	<b>46.29</b>	<b>45.10</b>	<b>55.23</b>	<b>6.67</b>	<b>41.42</b>	<b>45.8</b>

Source: computed from food intake by the Scholar (2012)

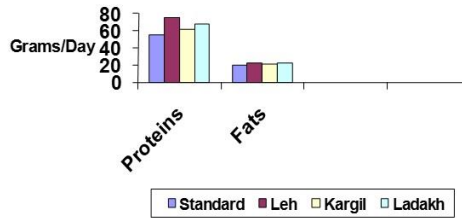
Diet Intake /Person/10 days



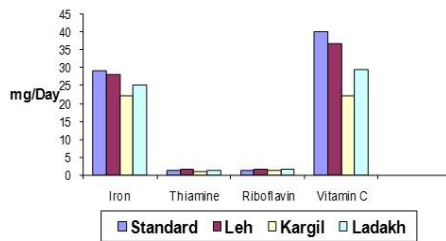
**Energy Consumption in Ladakh Region**



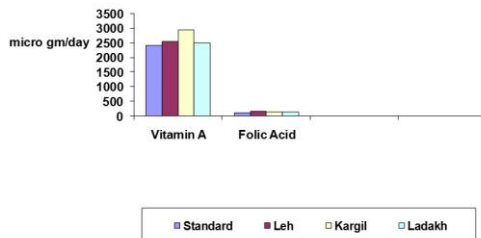
**Nutrient Intake**



**Nutrient Intake**



**Nutrient Intake**

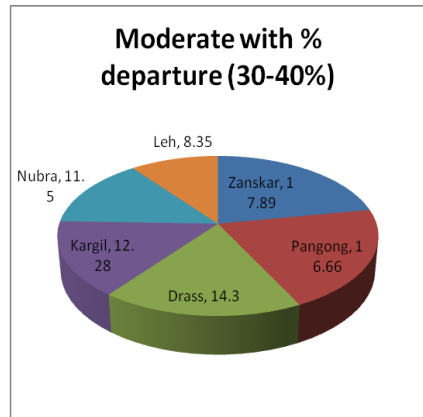
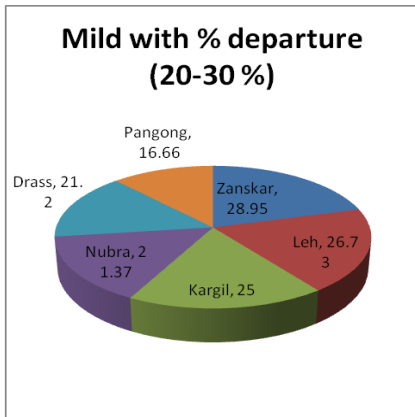


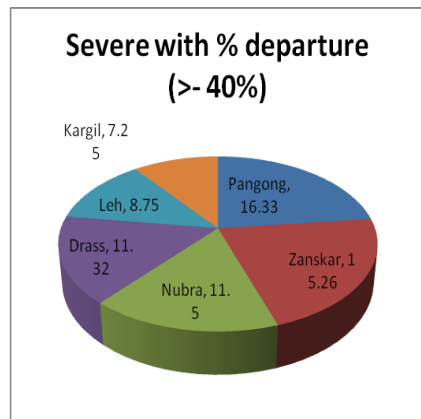
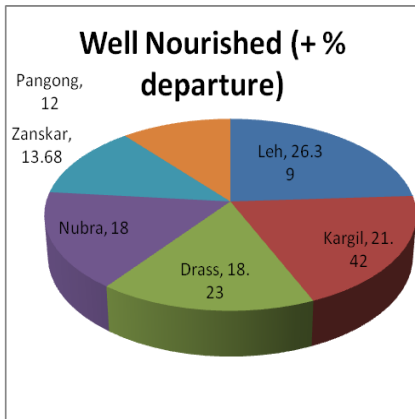
**Levels of Malnutrition:**

Analysis of data reveals regional contrasts in different grades of malnutrition. People from Zanskar and Pan gong regions are the most victims as indicated by severe degree of malnutrition. However the results were to some extent better but not satisfactory among other regions. In Leh 26.39 per cent of households were found well nourished as compared to only 21.42 per cent in Kargil. Other grades of malnutrition also shows regional contrasts (table 4)

**Table 5 -Nutritional Grades by Regions in Ladakh**

Regions	Normal with % departure (< -20 %)	Mild with % departure (20-30 %)	Moderate with % departure (30-40%)	Severe with % departure (>- 40%)	Well Nourished (+ % departure)
Zanskar	30.22	22.95	17.89	15.26	13.68
Kargil	35.35	25	12.08	7.25	20.32
Drass	20.25	24.35	21.25	11.5	22.65
Leh	38.11	26.23	11.34	8.23	16.09
Nubra	34.9	21.1	11.5	14.5	18
Pangong	33.13	16.48	16.36	16.03	18
<b>Total</b>	<b>31.1</b>	<b>24.03</b>	<b>16.21</b>	<b>9.3</b>	<b>19.36</b>





### Spatial Pattern of Nutritional Deficiency Diseases:

Incidence of deficiency diseases shows considerable variation from Region to Region because of variation of nutrition. Near about 300 persons from 200 households were found suffering from different diseases out of which near about 25% of were suffering from various nutritional deficiency diseases. The most prevalent nutritional deficiency disease reported was Anemia with an incidence of 23% to total cases. The incidence of scurvy was also very high with an incidence of 20.15 per cent. Near about 19.38 per cent were suffering from night-blindness followed by beriberi (18.60%) and pellagra (10.85%). Incidence of night blindness was very high in the regions of Zaskar and Drass and low in the regions of Nubra, Leh and Kargil. This can be explained because in the regions of Nubra, Leh and Kargil people practice pastoral activity and take milk as one of the constituents of food daily. Incidence of scurvy was very high in the regions of Zaskar, Pan gong and Leh because of lack of fruits. However incidence of beriberi and pellagra has not shown considerable contrasts in all the six regions (Table 6).



## **Spatial Pattern of Nutrition Deficiency Diseases in Ladakh**

There exists marked regional variation in the Incidence of bad housing related diseases in Ladakh because of variation of ventilation and sanitation. Of the 300 populations from 200 households found suffering from different diseases, near about 106 comprising 35% of total were reported suffering from various diseases related to bad nutrition conditions . The most prevalent nutrition deficiency diseases reported was Anemia with an incidence of 24.53 % to total cases followed by Night blindness was also very high with an incidence of 20.76 per cent. Near about 17 per cent was suffering from Beri Beri., Scurvy (18.87%), Pellagra (10.37%) and rickets among children with (8.49%). Incidence of Anemia and night blindness was very high in the regions of Zanskar and Drass and Pan Gong and low in the regions of Nobra, Leh and Kargil. This can be explained because of very poor purchasing power parity visa a vice harsh agro climatic conditions in first three regions while as people in other three regions practices pastoral activity and consume lot of milk and fruits as prior regions. Incidence of Scurvy and Pellagra was very high in the regions of Zanskar, Pan Gong and Drass because of bad environmental sanitation and poor hygiene and non availability of milk and dairy products. (Table6).

**Table 6 - Incidence of Nutrition Deficiency Disease.**

Regions	No. of reported Cases	Anemia	Night blindness (%)	Beriberi (%)	Scurvy (%)	Pellagra (%)	Rickets (%)
Zanskar	23	7 (30.44)	6 (26.08)	2 (8.69)	4 (17.41)	2 (8.69)	2 (8.69)
Kargil	14	3 (21.42)	2 (14.29)	3 (21.43)	3 (21.43)	2 (14.29)	1 (7.14)
Dras	21	5 (23.81)	4 (19.05)	4 (19.05)	4 (19.05)	4 (19.05)	2 (9.52)
Avg. for Kargil	58	15 (25.86)	12 (20.69)	9 (15.52)	11 (18.96)	6 (10.35)	5 (8.62)
Leh	13	2 (15.38)	2 (15.38)	3 (23.08)	3 (23.08)	2 (15.38)	1 (7.70)
Nobra	11	2 (18.18)	2 (18.18)	3 (27.28)	2 (18.18)	1 (9.09)	1 (9.09)
Pan gong	24	7 (29.17)	6 (25.00)	3 (12.50)	4 (16.67)	2 (8.33)	2 (8.33)
Avg. for Leh	48	11 (22.92)	10 (20.84)	9 (18.75)	9 (18.75)	5 (10.41)	4 (8.33)
Total for Ladakh	106	26 (24.53)	22 (20.76)	18 (16.98)	20 (18.87)	11 (10.37)	9 (8.49)

Source: Based on data obtained from field work-2012

**Table 7 - Incidence of diseases by ranks.**

	Anemia	Night blindness	BeriBeri	Scurvy	Pellgra	Rickets	sum ranks	Composite Value
Zanskar	1.5	1.5	6	2.5	3	2	16.5	2.75
Kargil	4	6	3.5	2.5	3	5	24	4
Drass	3	3	1	2.5	3	2	14.5	2.41
Leh	5.5	4.5	3.5	5	3	5	26.5	<u>4.41</u>
Nobra	5.5	4.5	3.5	6	6	5	30.5	<u>5.08</u>
Pan gong	1.5	1.5	3.5	2.5	3	2	14	2.33

Source: Computed from Table 6 by the authors

Based on the Ranking, at first each region is allotted individual ranks based on different percentages of diseases along with overall ranking for each sector as well and secondly composite

value of all the geographical regions is calculated based on their individual ranks in different nutrition deficiency diseases. The minimum mean rank regarded as the most vulnerable for nutrition deficiency diseases. Pan gong and Drass are ranked as most vulnerable because of geophysical constraints, high crowding, socio-economic backwardness besides freezing temperatures which prevents both the regions from developing modern infrastructure as temperature reaches to -40° Celsius during winters, followed by the increasing order of preference. Bold letters in have highlighted the top two regions of ladakh most vulnerable to nutritional deficiency diseases where as the bottom two regions including Leh and Nobra respectively are least vulnerable because both the districts are economically sound and socio infrastructure is quite developed which are highlighted by bold *Italic underlined* letters.

<b>Region</b>	<b>Diseases Combination</b>	<b>Index</b>
<b>Zanskar</b>	<b>A, N, B, S, P.</b>	<b>Five Disease</b>
<b>Kargil</b>	<b>A, N, B, S, P.</b>	<b>Five Disease</b>
<b>Drass</b>	<b>A, N, B, S, P.</b>	<b>Five Disease</b>
<b>Leh</b>	<b>A, N, B, S, P.</b>	<b>Five Disease</b>
<b>Nobra</b>	<b>A, N, B, S, P.</b>	<b>Five Disease</b>
<b>Pan gong</b>	<b>A, N, B, S.</b>	<b>Four Disease</b>

Where A: Anemia. N: Night blindness, B: Beri Beri. S: Scurvy P: Pellagra

The Diseases combination calculated by weaver’s index reveals that in most of the region’s five diseases combinations is dominant. The calculated value for Zaskar, Kargil Drass Leh are 52.5, 71.31, 17.25, 29.40 respectively, followed by nubra the reason being very less variation in regional contrast. The only region Pan gong shows the four diseases combination, which is attributed to geophysical constraints and socio-economic

backwardness hence more vulnerable region of ladakh. Therefore, all the deficiency was found prevalent and in pan gong region, first four found dominant.

**Relationship between Nutrition and Weight:**

The results derived from regression models representing relationship between nutrition and weight in adults, shows considerable variation among the different regions of ladakh. This can be attributed to the fact of existence of some other factors i.e. Sanitation, exercise, health care facilities, housing etc. which directly or indirectly affects the weight. It can be visualized from the figure 1.2 that the average rate of change in the weight for a unit change in nutrition denoted by slope of the regression line is very large among leh region followed by Kargil. However such values are very low for Drass and zanskar.

**Table 8. Region-wise Regression Models.**

Regions	Coefficient of Correlation (r)	Coefficient of Determination (r <sup>2</sup> )	Regression Equation ( $y=a + bx$ )
Kargil	+0.623	0.385	<u><math>Y=1.641+0.0149x</math></u>
Drass	+0.692	0.479	<u><math>Y= 1.992+0.0053x</math></u>
Zanskar	+0.764	0.583	<u><math>Y= 2.374+0.0036x</math></u>
Leh	+0.593	0.352	<u><math>Y=1.501+0.0230x</math></u>
Nobra	+0.682	0.465	<u><math>Y=1.892+0.0041x</math></u>
Pan gong	+0.792	0.627	<u><math>Y=2.463+0.0021x</math></u>

**Source:** - Based on data obtained from fieldwork (2012).

## **Conclusion and Suggestions:**

The present paper leads to the conclusion that majority of the population of Ladakh is suffering from various degrees of malnutrition due to geophysical constraints and socio-economic backwardness of the region which makes the region as a whole more vulnerable as very scanty agriculture is done that too in patches leading to intra regional variations and lack of balanced diet and poor nutrition awareness among people leading to different deficiency diseases prevalent in the region. Anemia followed by night blindness is taking toll although locals attribute the cause of night blindness to direct and high sun reflectance besides calcium (Scurvy) and in pan gong region, first four found dominant. Lack of proper nutrients in the diet besides. Very good percentage of total reported cases were found suffering from one or the other nutritional deficiency diseases.

The following remedial measures are suggested:

- 1 - Attention must be focused on proper nutrition awareness programmes by health department under NRHMS.
- 2 - Agriculture sector needs attention.
- 3 - Proper supply and stocking of agricultural products like cereals, milk, milk products, vegetables and fruits needs attention.
- 4- Implementation of supplementary nutrition programmes for school children in all the regions of Ladakh needs attention.
- 5- Development of Soil analysis map,

## **Acknowledgement:**

The authors are highly grateful to world renounced medical geographer, Professor Rais Akhtar, (Professor Emeritus) Ex. HOD, Department of Geography and Regional Development, University of Kashmir and S.K Aggarwal former Professor Delhi School of

Economics (Deptt. of Geography) Delhi University for suggestions in conducting this research work.

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