NUTRITION SURVEY
OF
NORTHERN AREAS OF PAKISTAN

(JULY - SEPTEMBER 1974)

A REPORT

BY

Dr. S. M. Ali
Principal Scientific Officer,
Food Technology and Nutrition Division,
PCSIR Laboratories, Lahore

and

Dr. M. Akmal Khan,
Chairman
Department of Nutrition
University of Agriculture, Lyallpur

February, 1976

NUTRITION SURVEY

OF

NORTHERN AREAS OF PAKISTAN
(JULY - SEPTEMBER 1974)

A REPORT

BY

Dr. S.M. Ali,
Principal Scientific Officer,
Food Technology and Nutrition Division,
PCSIR Laboratories, Lahore

and

Dr. M. Akmal Khan,
Chairman,
Department of Nutrition,
University of Agriculture, Lyallpur

University of Agriculture Press, Lyallpur

February, 1976

FOREWORD

Since the inception of the People's Government, it has been its prime aim to improve the lot of the people of under-developed parts of the country particularly the Northern Areas of Pakistan. But before any development schemes are launched it is necessary to carry out a comprehensive survey of the area with respect to socio-economic conditions, nutritional status and material resources, etc. With this end in view, the Pakistan Science Foundation in collaboration with the National Development Volunteer Programme sponsored a Science expedition to the Northern Areas of Pakistan in June, 1974. The nutritional survey was carried out jointly by the staff of the Pakistan Council of Scientific and Industrial Research Laboratories, Lahore and University of Agriculture, Lyallpur in July - September 1974 and a preliminary report of the survey was published soon after. I very much appreciate the efforts of Dr. S.M. Ali of PCSIR and Dr. M. Akmal Khan of University of Agriculture who have collected, compiled and analysed the data of the survey which are presented in this report. This brief survey was carried out during summer months and the biochemical part was limited to haemoglobin determination. As such it does not give a complete picture of the nutritional and dietary status of the Area. More extensive surveys particularly including the data for winter months are needed to get complete information about the nutritional status of the population in the area. It should however, be recognised that the survey was conducted under very difficult conditions and the data collected give valuable preliminary informations on the subject. It is my sincere hope that this study will substantially contribute to improve the nutrition and health of the people of Northern Areas of Pakistan.

Dr. Amir Muhammed,
Vice-Chancellor,
University of Agriculture,
Lyallpur

TEAM MEMBERS

1. Dr. S.M. Ali, M.Sc. (Alig), Ph.D.(London),
   Food Technology and Nutrition Division,
   PCSIR Laboratories, Lahore.

2. Dr. M.Akmal Khan,
   M.Sc.(Hons), Ph.D.(London), M.I. Biol;
   F.R.S.H. (London),
   Department of Nutrition,
   University of Agriculture, Lyallpur.

3. Mr. Mohammad Aslam, Research Officer,
   Food Technology and Nutrition Division,
   PCSIR Laboratories, Lahore.

4. Mr. Yousaf Ikram-ul-Haq, Research Officer,
   Food Technology and Nutrition Division,
   PCSIR Laboratories, Lahore.

5. Mr. Mohammad Afzal, Technician,
   Food Technology and Nutrition Division,
   PCSIR Laboratories, Lahore.

6. Miss Firdaus Begum (NDVP).

7. Miss Nasreen (NDVP).

8. Miss Rashida Kamran (NDVP).

ACKNOWLEDGEMENT

The authors are grateful to Dr. Z.A. Hashmi, Chairman, Pakistan Science Foundation and to Mr. Saeed Ahmad Rashid, the then Director General of National Development Volunteer Programme for sponsoring this nutrition survey. They are particularly indebted to Mr. Rashid for his leadership, sagacity and moral support at every stage of the survey. Thanks are also due to Dr. M.B. Sial, Dean, Faculty of Animal Husbandry, University of Agriculture, Lyallpur for his able guidance and planning of the survey and to Dr. Amir Mohammad, Vice-Chancellor, University of Agriculture, Lyallpur, for providing constant encouragement and help during the write-up of this report. Thanks are also due to Dr. Haji Mohammad Chaudhry, Professor of Nutrition, University of Agriculture, Lyallpur for valuable suggestions in preparing this report.

The cooperation of the local administration and of the people of the Northern Areas in general is gratefully acknowledged. Without their collaboration, the survey could not have been possible.

TABLE OF CONTENTS

	Page
Team Members	ii
Acknowledgements	iii
List of Contents	iv
List of Tables	v
List of Figures	vi
Summary	1
Recommendations	4
Introduction	7
Food and Agriculture	8
Methodology	10
Dietary Findings	11
Evaluation of Data in terms of Calories and Nutrients' Intake	15
Clinical Findings	22
References	36
Dietary Survey Form - Appendix A	37
Nutritional Survey Form - Appendix B	38
Special Snacks and Dishes of Northern Areas - Appendix C	39

LIST OF FIGURES

Fig. No.		Page
1	Map of Northern Area.	6
2	Sources and percentage of calories and protein.	19
3	Height and weight of boys, 1-5 years, compared with Iowa standard.	25
4	Height and weight of girls, 1-5 years, compared with Iowa standard.	26
5	Height and weight of boys, 6-18 years, compared with Iowa standard.	27
6	Height and weight of girls, 6-18 years, compared with Iowa standard.	28

LIST OF TABLES

Table No.		Page
1	Food intake per person per day	13
2	Dietary allowances for rural and urban population of Pakistan	17
3	Nutrient intake per person per day	18
4	Average weight and height of male population	23
5	Average weight and height of female population	24
6	Different body measurements of male and female children	30
7	Different body measurements of males	31
8	Different body measurements of females	32
9	Haemoglobin levels in Northern Areas	33
10	Percent prevalence of clinical lesions	35

SUMMARY

The main objective of the Nutrition Survey of the Northern Areas was to identify the nutritional problems of this neglected part of Pakistan. A triphasic approach consisting of dietary, biochemical and clinical assessment of nutritional status was planned. However, due to difficulty of transportation of samples, biochemical part of the survey was only limited to haemoglobin determination. A total number of 26 randomly selected villages consisting of 218 households were appraised.

Dietary intake:

The bulk of the diet of the surveyed population consists of cereals, mainly wheat, followed by barley and maize. The whole cereal flour is made into 'roti' baked on a heated circular iron (tawa), and eaten with meat or vegetables curry. A number of special dishes based on cereal flour and apricot flour are also eaten (Appendix C). Intake of oils and fats is very low and contribute 8.4% of the total calories in the diet. Similarly intake of protein-rich foods, pulses milk and meats, are very low, the average protein intake being 56.8 g out of which only 4.4 g are derived from animal sources.

The main feature of the diet of the Northern Area people is their high consumption of leafy vegetables and fruits. On the average 174 and 186g leafy greens and fruits respectively are consumed per day.

Protein - Calorie deficiency:

The average caloric intake of the people of Northern Areas is 1755, which is 84% of the average intake of the rest of Pakistan. This is also confirmed by lack of subcutaneous fat as indicated by skinfold thickness and arm circumference. Although total protein intake was found to be just adequate but in view of caloric shortage the marginal intake of protein may be further reduced as energy needs have preference over protein

requirement and some of the calories are utilized to meet the energy needs of the body. As a result of sub-optimal protein-caloric intake there is a high child mortality; 19.5% of the infants died within first year of life and 13% between 1-4 years. Although not very many cases of protein deficiency — marasmus or kwashiorkor — were detected, but signs of sub-clinical protein malnutrition, as evidenced by low height and weight of children, were generally noticed in the surveyed population. Both height and weight are sub-normal and are below 3rd percentile of the Iowa standards. It shows that continued food deprivation over ages has forced the people of this area to live on a lower plane of nutrition.

Vitamin deficiency:

Intakes of vitamin A, B_1, B_2, Niacin and C seems to be adequate both from dietary and clinical survey. However, some clinical states of riboflavin deficiency, angular stomatitis, cheilosis and glossitis, particularly in children of Skardu area, show that either vitamin is lost during preparation and cooking of food or is not equally distributed among various family members. Still riboflavin intake of the people of the Northern Areas is higher than those of the rest of Pakistan.

Anaemia:

Anaemia is wide-spread in all sections of the population. The worst sufferers are children between the ages of 5-9 years with an incidence of 91.5%, followed by pregnant women, adult females, older children and adult males with an incidence of 89.7%, 84.7%, 71.0% and 66.7% respectively. Consumption of whole cereal flours, which contain phytates and interfere with assimilation of iron, and wide-spread parasitic infestation, may be the causative factors in high incidence of anaemia.

Goitre:

Goitre is the main nutritional deficiency disease of the area. More than half the population was found to suffer from some degree of goitre. Since it does not give any physical infirmity to the sufferers except in wearing of the clothes, people do not seem to take it very seriously.

RECOMMENDATIONS

1. More area should be brought under cultivation to increase food production of cereals and legumes.
2. Small food preservation units should be installed in various locations to increase the availability of foods all the year round.
3. Efficient methods of extraction of oil from apricot stones and walnuts should be introduced to get the maximum yield of oil from the above sources. This will increase the calorie intake of the people.
4. Fish ponds should be provided by utilizing water from natural streams to increase fish production.
5. Better storage techniques should be introduced to minimise food losses.
6. Since there is plenty of fruits available in the Northern areas, it is recommended that methods for domestic food preservation such as pickling, jams and jelly making should be taught to the people through well organized food and nutrition education programme.
7. Fortification of common salt or tea with iodine should be done at commercial scale to eradicate goitre.
8. In areas e.g. Skardu, where vitamins B-complex deficiency was noticed, fortification of 'atta' with thiamine, riboflavin and niacine should also be carried out.
9. Mothers should be taught to prepare home-made weaning foods containing cereals, legumes and fruit flour. These should be given to infants after about 6 months of age.

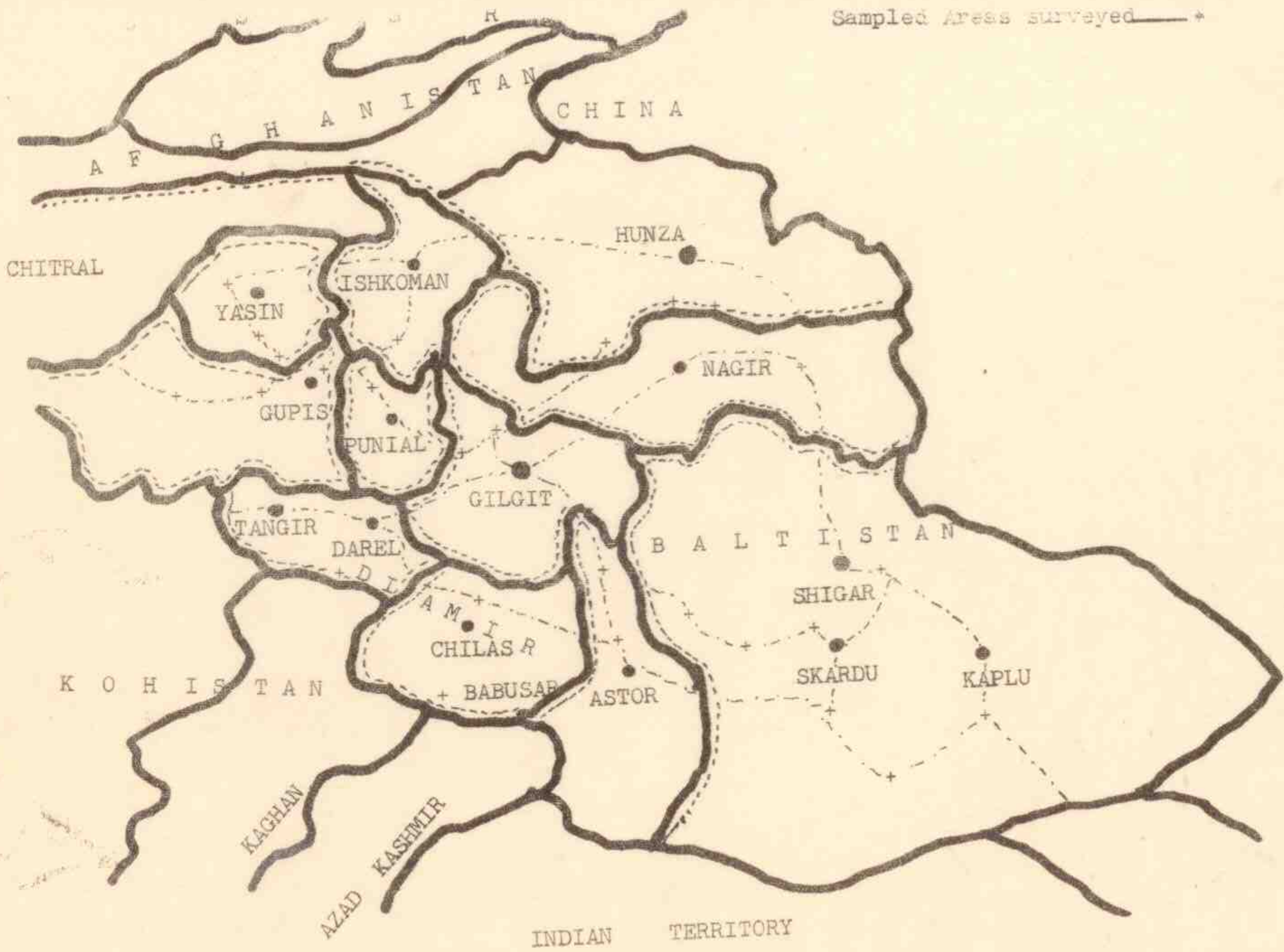
10. Steps should be taken to increase meat and milk of the local breeds of cattle and sheep, by introducing artificial insemination technique, by improving reproductive efficiency, reducing dry period, ensuring early maturity and other better animal husbandry practices.

11. There are good prospects for poultry and bee keeping which should be developed to provide more animal proteins and calories as well as to eradicate poverty in the area.

12. Applied nutrition programmes should be introduced to educate the people about the nutritive value of foods, supplementary feeding of mother and children. Public health measures should be improved to prevent and to control the infections, so that available food is better utilized by the community.

13. Steps should be taken to improve the socio-economic conditions of the people such as introducing cottage industries, opening of more schools and health centres, harnessing local sources of energy from running water of streams.

14. Since the survey was carried out during summer months, it is recommended that another nutrition survey may also be conducted during winter so that a complete picture of the dietary intake is obtained.


Sampled Areas surveyed ——+
AFGHANISTAN
CHINA
CHITRAL
YASIN
ISHKOMAN
HUNZA
GUPIS
PUNIAL
NAGIR
GILGIT
TANGIR
DAREL
DIAMIR
CHILAS
BABUSAR
ASTOR
BALTISTAN
SHIGAR
SKARDU
KAPLU
KOHISTAN
KAGHAN
AZAD KASHMIR
INDIAN TERRITORY

INTRODUCTION

Background:

In Pakistan, the first nation-vide nutrition survey was carried out in 1965-66[1]. The report excluded areas which comprise the Northern parts of Pakistan. However, Ali[2] made a survey of the people of Hunza, but it was limited to food intake of the inhabitants of Karimabad and anthro-pometric study of the school children. Thus, there was a need for a nutrition survey of the Northern Areas. The present Government is very keen to develop these areas, but before any scheme for improving the nutritional status of these people is planned, it is necessary to identify the nutritional problems of this neglected part of Pakistan. The present study was sponsored by Pakistan Science Foundation/National Development Volunteer Programme(NDVP) as a part of overall Scientific Expedition to the Northern Areas conducted during the months of July - September 1974. The aim of the survey was to determine the nutritional status of the people and to find out any dietary deficiency disease prevalent in the areas as the result of imbalance in their dietary.

Geography:

The Northern areas comprise the three districts of Gilgit, Baltistan and Diamir, cover an area of 27, 118 sq. miles and are situated in the Karakurram range of Himaliyas. The region is located at an altitude ranging from 3,000 to 28,250 feet above sea-level. The well known second highest peak in the world K-2 and other peaks such as Nangaparbat and Rakaposhi also lie in this area. The boundary of the areas runs with Kashmir, China, U.S.S.R. and Afghanistan. The climate is extremely cold in winter and temperate in summer. The Northern areas have unknown reserves of mineral wealth such as rubies found in Hunza, other important minerals

include copper, miça, lead pyrite, marble, alum and some radio-active materials.

Population:

According to 1972 census, the population of these areas is 4.15 lakh. The density of population is 15 persons per sq. mile. The villages are widely scattered and can be approached only by pony tracks while the existing roads are inadequate to serve the whole pop-ulation. Most of the areas become inaccessible during the winter season. About 5 per cent of the population is literate. The main occupation of the people is agriculture and manual labour. Some of the population migrate to various parts of Pakistan for odd jobs in winter and return back in summer. The people are very poor and the per capita income in Northern areas was Rs. 175/- compared to Rs. 423/- in Pakistan during 1969-70. The main languages spoken in these areas are Urdu, Shina, Balti, Persian, Chitrali, Tibeti and Brushaski.

FOOD AND AGRICULTURE

Cultivated Area and Production:

About 6 per cent of the total area is under cultivation, while the remaining is covered by the thinly scattered forest which yields about 3.0 lakh cft of timber per year and supports over one million heads of livestock. About 80 per cent of the cultivated area is under food grains and other arable crops, producing 11.0 lakh maunds of food (Wheat and pulses etc.) per annum while the remaining 20 per cent is under fruits which is yielding 6.5 lakh maunds of fruits every year. The food production is insufficient to meet the food requirements of the population and the deficit is met by the imports of food grains from the plains. Since the rainfall is scanty, crops are irrigated from water of the melting snow. The following food crops are grown:

Cereals and legumes:

These include wheat, barley, buck wheat, millet and maize.

Among legumes, peas, beans and common pulses are grown. No rain crops are grown. In Hunza wheat is grown in one half of the field and barley in other. Rice is not cultivated. Water mills although only a few are used to grind wheat into flour.

Vegetables:

The following vegetables are commonly grown during summer months. Cabbage, Cauliflower, green peas, black beans, spinach, potatoes, tomatoes, carrots and turnips. Tomatoes, chillies, bringils and gourd are dried in summer and stocked for use in winter. In summer fresh vegetables are eaten while in winter potatoes, turnips and dried vegetables or dried fruit is available.

Fruits:

All the northern area is rich in fruits. Almonds, apples, apricots, grapes, peaches, plums, mulbury and walnuts are to be found in plenty, particularly in Hunza valley. Apricots and mulbury are dried and stored for consumption during winter. Grapes are mostly used for making grape wine popularly called as 'Hunza Pani'.

Nuts:

These are restricted to walnuts and almonds only and are eaten raw or in combination with certain foodstuffs.

Poultry and eggs:

Most of the households keep poultry, but they rear to sell them to the rich. In some areas chickens are not kept, since they eat away seeds and crops.

Meat:

Mutton, beef and meat of wild sheep is eaten but it is in short supply and is available in some quantity during winter months.

Oils and Fats:

The major source of oil and fats is the oil obtained

from apricots kernels which is used for culinary purpose. Some milk is also converted into butter.

METHODOLOGY

The Northern Areas comprise of three districts i.e. (1) Gilgit (2) Baltistan and (3) Diamir. Twenty six villages, were selected randomly for study.

Nutrition survey consists of:(1) Dietary,(2)Biochemical, and (3) Clinical examination. For dietary survey a twenty four hour recall and weighing method was adopted. Data of dietary intake were obtained by personnel trained in food weighing and interviewing by visiting the selected households in the villages. Information regarding monthly income and the number of persons taking the food were also recorded on special form prepared for the survey (Appendix 'A').

Due to difficulties of communication and transportation in these areas and the absence of a base laboratory, the biochemical part of the survey was limited to haemoglobin estimation. Clinical examination provided no such difficulty and each member of the household was clinically examined and entries were recorded on a modified proforma (Appendix 'B') based on ICNND Manual[3] and Jelliffe's report[4].

A pilot survey of Jutial, a village near Gilgit, was done to test the methodology and the number of households to be examined in order to give a statistically valid sample. Some idea about the nature of population and magnitude of variance was obtained from the pilot survey and this information coupled with consideration of cost in terms of labour, time and materials involved was used to determine the size of the sample and the sampling design. It was decided to use the technique of systematic sampling with a sampling fraction as 1/24 as it was expected to give a fairly representative sample.

DIETARY FINDINGS

Since majority of the population is poor having income less than Rs. 1500/- per annum per household or Rs. 300 per capita, if an average family comprises of 5 members, no attempt was made to further breakdown the surveyed population into various income groups.

Meal Pattern:

Three meals are taken per pay i.e. morning meal, mid-day meal and evening meal. The morning meal consists of cereal flour (wheat, maize or barley) made into roti. Since fat is used sparingly, 'paratha'(roti fried in fat) is not usually made, but some people having higher income such as shop keepers and contractors cook 'paratha'. Roti is usually taken with tea containing small amount of milk produced from cows or goats reared in the house. Often previous day's left over roti is taken in breakfast. Mid-day meal is the principal meal of the day and consists of roti with vegetables (spinach, cauliflower, turnips etc) or meat. Most of the families surveyed did not consume meat at all which they do in winter. In very poor families even mid-day meal is taken with tea.

Evening meal does not differ much with the mid-day meal and consists of roti with vegetables or tea.

Breast feeding is the common practice of feeding the babies for about two years.

Tea Drinking:

The survey indicated that tea is very popular in the Northern areas. People think that it keeps them warm and makes them active. In poor families it serves as a dish to be taken with roties. Since sugar is in short supply it is usually taken with salt. In some areas e.g. Skardu, ghee is mixed with tea in place of milk. Advantage may be taken of this habit for using tea as a vehicle for fortification with nutrients, deficient in their diets.

INTAKE OF FOOD BY FOOD GROUP

Food consumption of different kind of foods is shown in Table 1.

Cereals:

The bulk of an average Northern Area diet constitutes of cereals (wheat, barley and maize). The per capita intake in Gilgit, Diamir and Baltistan districts respectively is 459, 404 and 412 g , the mean intake is 425 g , which in terms of calories, constitute 84.7 per cent of the total caloric intake. Consumption of wheat is almost twice that of other cereals and does not meet their requirements and hence extra supply is obtained from the plains. Poor section of the population mainly subsists on cheap cereals. Wheat flour is often mixed with other cereals, apricot flour and oilseed flour. These are described in Appendix 'C'.

Starchy Roots:

The per capita intake of starchy root is 26 g in Gilgit. Diamir district did not show any consumption of starchy roots at the time of survey while in Baltistan district the average intake was 11.4 g .

Sugar:

Consumption of sugar was very low in the whole of Northern areas. Average intake was 4.3 g which was only 0.94 per cent of the total caloric intake.

Pulses:

Pulses are not consumed to a great extent in Northern Areas. Average intake was 3.6 g per day which was only 0.75 per cent of the total caloric intake.

Vegetables:

Consumption of leafy vegetables was quite high. Per caput intake was found to be 173.5 g per day as compared with 28 g per day of non leafy vegetables. Average intake of vegetables was 202 g which comes to 3.5 per cent of the total caloric intake.

Table 1

Food Intake Per Person Per Day

	Gilgit	Diamir	Baltistan	Mean of Three distts.
No. of villages	13	6	7	
No. of households	88	60	70	
	(g)	(g)	(g)	
1. Cereals				
Wheat	294.4	191.9	336.5	
Maize	78.1	77.2	-	
Barley	86.3	132.9	75.5	
Rice	-	1.5	-	
Total:	458.8	403.7	412.0	424.8
2. Starchy Roots	26.0	-	11.4	12.5
3. Sugar	0.3	9.2	3.5	4.3
4. Pulses	3.5	5.2	2.1	3.6
5. Vegetables				
Leafy	241.3	156.1	123.0	173.5
Non-leafy	41.4	16.6	26.3	28.1
6. Meat	0.3	4.3	3.0	2.5
7. Fish	-	-	-	-
8. Eggs	-	0.7	-	0.3
9. Milk	113.5	127.6	64.8	101.9
10. Oils and Fats	11.6	13.1	13.9	12.8
11. Fruits	203.2	136.0	219.0	186.0

Animal Protein Foods:

Consumption of foods of animal origin was found to be very low in Northern Areas. Intake of eggs is negligible while fish is not consumed at all. Per capita meat consumption in Gilgit, Diamir and Baltistan is 0.3, 4.3 and 3.0 g per day respectively. This may also be due to the fact that the people of these areas consume flesh of sheep, goats or cows during winter when it is difficult to grow anything. Thus the true intake of animal food can only be found when a dietary survey is made during winter as well.

Per caput consumption of milk is 102 g per day which comes to 3.45 per cent of the total caloric intake. Most of it is consumed in tea and very little is given to the children.

Oils and Fats:

Intake of cooking fats and oils per caput per day is less than half an ounce being 11.6, 13.1, 13.9 g in Gilgit, Diamir and Baltistan respectively (average 12.8 g). Most of the fat is derived from apricot stones but in Gilgit hydrogenated fat is consumed in sizeable quantity. Calories derived both from visible and invisible fat are 8.4 per cent of the total caloric intake.

Fruits:

Consumption of fruits is quite high in the whole of Northern Areas as this commodity is freely available to all. Every household has a couple of fruits trees. Per caput fruit intake in Gilgit, Diamir and Baltistan was 203, 136 and 219 g respectively. Average intake is 186 g per day which comes to 3.7 per cent of the total caloric intake.

EVALUATION OF DATA IN TERMS OF CALORIES AND NUTRIENTS' INTAKE

Energy and protein requirements of an individual are dependent upon climate, age, body size, sex and level of activity. In turn intake of other nutrients is related to the intake of particular food group e.g. requirements of vitamins, thiamine and niacin, are dependent upon the consumption of carbohydrate and protein (for tryptophan) respectively.

Requirements for various nutrients have not been determined for the people of the Northern Areas. In the absence of these standards we give a comparison of our results with the dietary allowances recommended for Pakistan by National Health Laboratories, Islamabad (Table 2).

Table 3 shows calories and nutrients' intake. These were calculated from Food Composition Tables. It may be noted that the intakes pertain to the period when the survey was made.

Calories

Per caput intake of calories in Gilgit, Diamir and Baltistan districts was 1781, 1743 and 1739 respectively — the mean intake for the Northern Areas being 1755. There is no appreciable difference between the various intakes. The caloric requirement for Pakistani rural and urban population are 2067 and 2088 calories per person per day. However, it may be stated that these may be under-estimates, since the mean temperature is much lower as compared with the plains, and the people of the areas have to be more active than those living in the plains. These factors increase caloric needs. Even then the people of Northern Areas are taking 84 per cent of their required caloric intake. As will be shown later, this is also confirmed by low weights and tricep skinfold thickness, particularly of the male population.

Protein:

The recommended protein allowance for a person living in rural area in Pakistan is 58.5 g per person. In view of recent FAO/WHO report[5] this may be on the higher side. The reference protein requirement for an adult weighing 60 kg will be 34.2 g . Since the diet is predominently cereal based, the Net Protein Utilization(NPU) of the diet is expected to be about 60. Thus the requirement is 57 g ($34.2 \times \frac{100}{60} = 57$), which is slightly lower than what is recommended for Pakistan (Table 2). The per capita protein intakes of Gilgit, Diamir and Baltistan are 57.2, 57.5 and 55.7 g respectively (average 56.8 g) which more or less equals to their average protein requirement. There is no significant difference between the intakes of the three districts but animal protein consumption is significantly more in Diamir district. However, such borderline protein intakes may not meet the protein needs of weaned infants who depend mostly on their mothers' milk and young children who may not get equitable share of the family diet. Expectant and nursing mothers are other groups who under the influence of traditions and food taboos may voluntary restrict their protein intake. The protein intake of an average Pakistani is 62 g which is comparatively much higher than that of the people of Northern areas.

Fats:

Fat provides energy to the body and as long as other sources of energy are supplied in adequate amounts in the diet, it is hardly needed. However, for absorption of fat soluble vitamins and for adequate supply of essential fatty acids, it is generally recommended that fat should contribute at least 20 per cent of the total calories. Fat calories constitute 8.4 per cent of the total caloric intake of the people of the Northern Areas which is even lower than what is consumed in the whole of Pakistan. But inspite of such low intake no frank case of vitamin A and D deficiency was noted in the surveyed population.

Table 2

Dietary Allowances for Rural and Urban Population of Pakistan

Nutrients	Recommended allowance for Rural Areas	Recommended allowance for Urban Areas
Calories	2,067.0	2,088.0
Protein (g)	58.5	59.5
Calcium (mg)	464.0	465.6
Iron (mg)	10.6	11.9
Vitamin A (µg)	913.0	895.0
Thiamine (mg)	0.83	0.83
Riboflavin (mg)	0.83	0.83
Niacin (mg)	13.7	13.7
Vitamin C (mg)	28.5	28.2

Source : Guide Notes on Nutrition, National Health Laboratories, Islamabad, 1973.

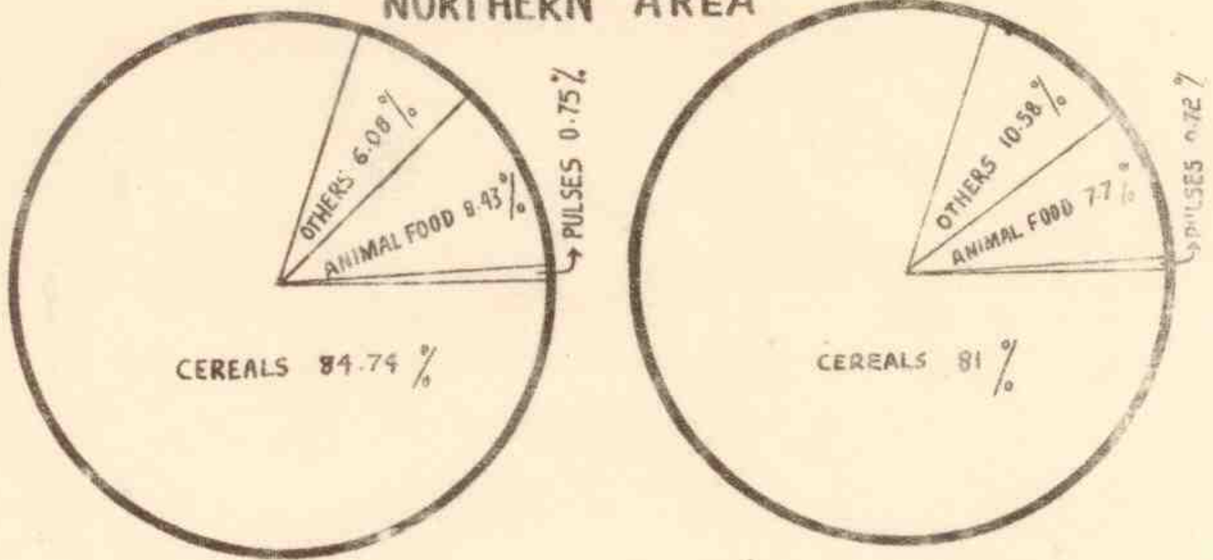
Table 3

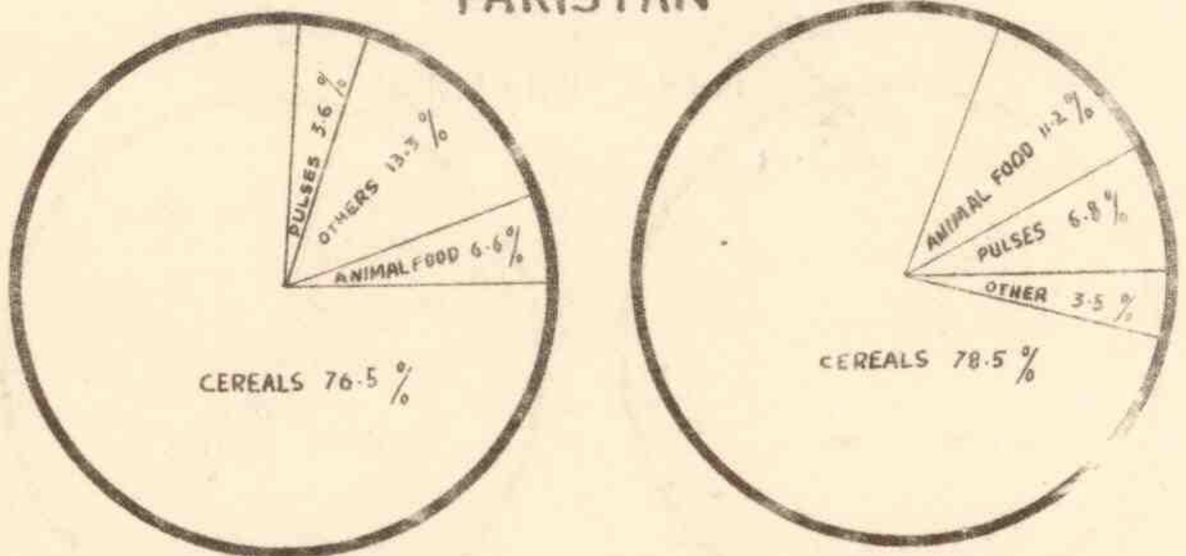
Nutrient Intake per Person per Day

	GILGIT	DIAMIR	BALTISTAN	MEAN
Calories*	1761.0	1743.0	1739.0	1755.0
Total protein(g)	57.2	57.5	55.7	56.8
Animal Protein(g)	3.1	5.9	4.1	4.4
Fat (g)	15.6	17.5	16.5	16.5
Vitamin A (µg)	1827.9	1126.6	887.6	1280.8
Thiamine (mg)	2.5	2.4	2.5	2.5
Riboflavin (mg)	1.3	1.1	1.0	1.2
Niacin (mg)	22.8	18.3	20.0	20.4
Vitamin C	72.9	38.5	35.8	49.0
Calcium (mg)	456.8	406.0	380.3	414.4
Iron (mg)	19.3	15.8	16.1	17.1
%calories from carbohydrates	80.0	76.9	78.0	78.3
%calories from protein	12.8	13.0	12.7	12.8
%calories from fat	7.9	9.0	8.3	8.4

*It has been proposed that more fundamental unit of energy (1 kilo calorie = 4.186 kilo joules) be used, but we have preferred to use calorie because of its popular usage.

FIG.2. SOURCES AND PERCENTAGE OF CALORIES & PROTEIN





Carbohydrates:

Carbohydrates form the bulk of Northern Areas diet derived mostly from cereals and tubers and constitute about 80 per cent of the total calories. 3.7 per cent of the calories are contributed from fruits alone. Fruits contain mostly glucose and fructose which are easily assimilable and produce a ready source of energy to the body. This may partly explain the capacity to do more work by the people of Northern areas.

Calcium:

Per caput daily intake of calcium was 414 g per day. When compared with the recommended allowances both of FAO and of Pakistan it appears to be slightly less. However, there are evidence that human body can adapt itself to low calcium intake and without suffering any deleterious effect[6].

Iron;

Per caput iron intakes in Gilgit, Diamir and Baltistan are 19.3, 15.8 and 16.1 mg respectively. Average intake is 17.1 mg which is well over recommended allowances of 11.9 mg, but inspite of adequate supply of iron widespread occurrence of anaemia was noticed in the surveyed population. It appears that there are other causes of causation of anaemia which need investigation.

Vitamin A:

Vitamin A intakes in Gilgit, Diamir and Baltistan are quite variable being 1623, 1127 and 888 µg (Average 1281 µg) per caput per day, but are well within the recommended intake for Pakistan. This is mainly due to high consumption of leafy vegetables and fruits particularly apricot which is good source of vitamin A.

Thiamine:

The average intake of thiamine is 2.5 mg per caput per day as compared with recommended allowances of 0.83 mg.

Thiamine requirement is related to carbohydrate intake. Since the average Northern Area diet derives its energy from carbohydrates the above recommended allowance may be underestimated. But even then thiamine intake is over twice that of recommended allowance. Since the cereals are consumed as whole meal flour in the form of 'chappaties', it is probable that most of the thiamine is available to the Northern Area's people.

Riboflavin:

Per caput riboflavin intake is 1.2 mg per day and recommended intake is 0.83 mg. Cases of riboflavin deficiency, particularly in children in Skardu area, show that either vitamin is lost during preparation and cooking of food or is not equally distributed among various family members. However, it may be noted that riboflaving intake of the people of Northern Area is higher than those of the rest of Pakistan.

Niacin:

Per caput niacin intake in Gilgit, Diamir and Baltistan is 22.8, 18.3 and 20 mg (Average 20.4 mg per day) respectively. This is well within the recommended allowance of 13.7 mg per caput.

Vitamin C:

Per caput vitamin C intake in Gilgit, Diamir and Baltistan is 73, 39 and 36 mg respectively (Average 49 mg). Vitamin C intake in Gilgit areas is appreciably higher than that in Diamir and Baltistan, while there is no significant difference between the intakes in Diamir and Baltistan area. Recommended allowance for Pakistan is 28.5 mg, hence vitamin C intake of Northern Area diet is much higher than that of the rest of Pakistan.

CLINICAL FINDINGS

All household members, who were present at the time of survey, were given a clinical examination. Due to paucity of time and unfavourable conditions prevailing in the mountaineous areas the clinical examination was limited to anthropometric measurements and those clinical symptoms which could be diagnosed by visual examination. As explained earlier no biochemical measurements in blood and urine were possible except determination of haemoglobin by means of spencer haemoglobin meter. Child mortality figures were also collected by interviewing the women folk.

Mortality:

Child mortality is very high, 19.5 per cent of the children died within first year of life; 13 per cent between 1-4 years as compared with West Pakistan Nutrition Survey figures of 13 per cent and 12.1 per cent in the age groups 0-1 years and 1-4 years respectively.

Height and Weight Measurements:

Since height-weight measurements for age provide the simplest index for nutritional status, these measurements constituted the major part of the physical examination. Average weight and height measurements of males and females of all age groups have been presented in Tables 4 and 5. Since no local standards were available, the height and weight of males and females 1-5 years and 6-18 years were plotted separately and compared with the 3rd, 50th and 97th percentile of Iowa standard (Fig. 3-6). It is evident that both height and weight progress of the population of the Northern Area of Pakistan, are sub-normal and are below the 3rd percentile of Iowa standard.

Skinfold Thickness:

Subcutaneous fat is a measure for the caloric intake of the body. There are several ways of determining body fat amongst which measuring of skinfold thickness with Lange skin fold caliper is said to be quite satisfactory in nutrition

Table 4

Average Weight and Height of Male Population

Age (Yrs)	No. examined	Weight (kg)	± S.E.	Height (cm)	± S.E.
1	18	6.31	0.35	66.44	1.17
2	12	7.84	0.31	76.33	0.91
3	15	9.75	0.35	81.00	1.55
4	12	12.80	0.57	92.00	2.29
5	23	14.86	0.51	96.21	1.49
6	24	16.3	0.41	102.00	1.79
7	31	18.83	0.68	108.05	1.89
8	24	21.00	1.00	114.20	1.24
9	19	21.60	1.16	120.15	1.39
10	32	22.86	0.59	122.53	1.36
11	20	26.18	0.82	128.70	1.23
12	37	26.09	0.69	128.37	1.19
13	21	30.21	1.14	133.70	2.04
14	15	34.18	1.69	140.13	2.65
15	11	36.00	3.08	142.00	4.52
16	9	41.56	3.16	155.00	3.34
17	3	45.45	2.14	164.70	6.49
18	8	49.60	2.56	165.30	2.41
19	2	58.63	-	166.50	-
20-49 (Adult)	94	54.00	0.63	164.00	0.70
50 and above	44	53.00	1.08	162.00	1.00

Table 5

Average Weight and Height of Female Population

Age (Yrs)	No. examined	Weight (kg)	± S.E.	Height (cm)	± S.E.
1	21	6.00	0.22	64.00	1.00
2	11	8.30	0.52	73.10	1.13
3	15	10.94	0.48	81.00	1.73
4	10	11.36	0.43	90.00	2.27
5	18	14.06	0.43	95.12	1.80
6	15	15.11	0.58	98.50	2.23
7	23	17.92	0.63	110.70	1.72
8	14	19.67	0.77	116.38	2.59
9	15	20.60	0.87	117.66	2.51
10	8	23.23	0.95	129.20	1.23
11	11	24.21	1.10	123.27	2.37
12	12	27.53	1.65	126.00	2.82
13	5	29.88	1.81	132.60	3.59
14	8	34.60	3.44	137.37	3.82
15	9	38.00	0.89	145.00	2.29
16	4	41.36	3.26	148.00	2.08
17	10	43.00	0.90	150.70	0.64
18	4	45.79	3.06	153.00	3.08
19	1	45.90	-	153.00	-
20-49 (adult)	153	45.00	0.47	153.00	0.60
50 and above	29	44.23	1.35	148.00	1.34

Fig.3. Weight and Height of Boys, 1-5 Years, Compared with Iowa Standard.

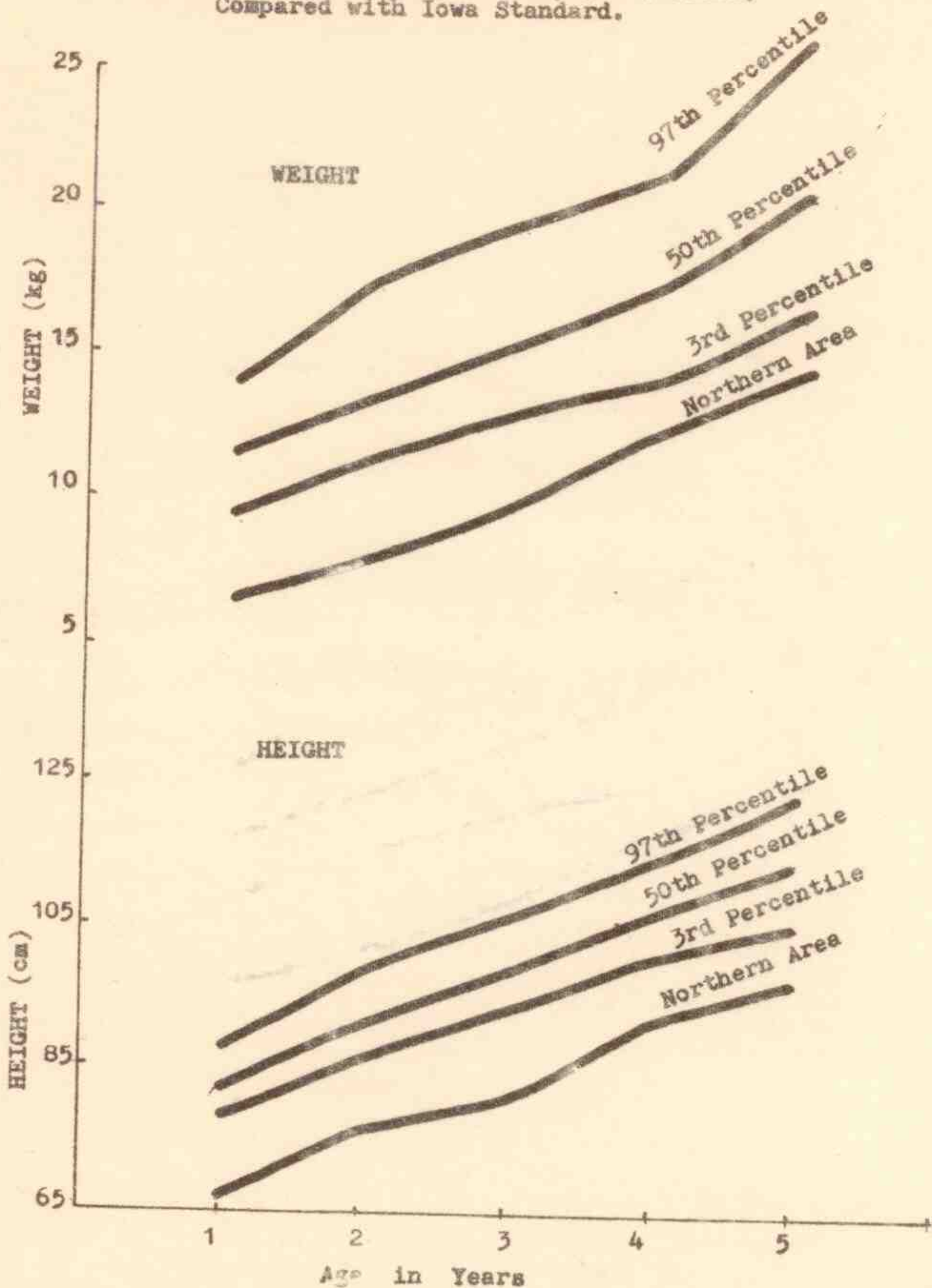


Fig. 4. Weight and Height of Girls, 1-5 Years, Compared with Iowa Standard.

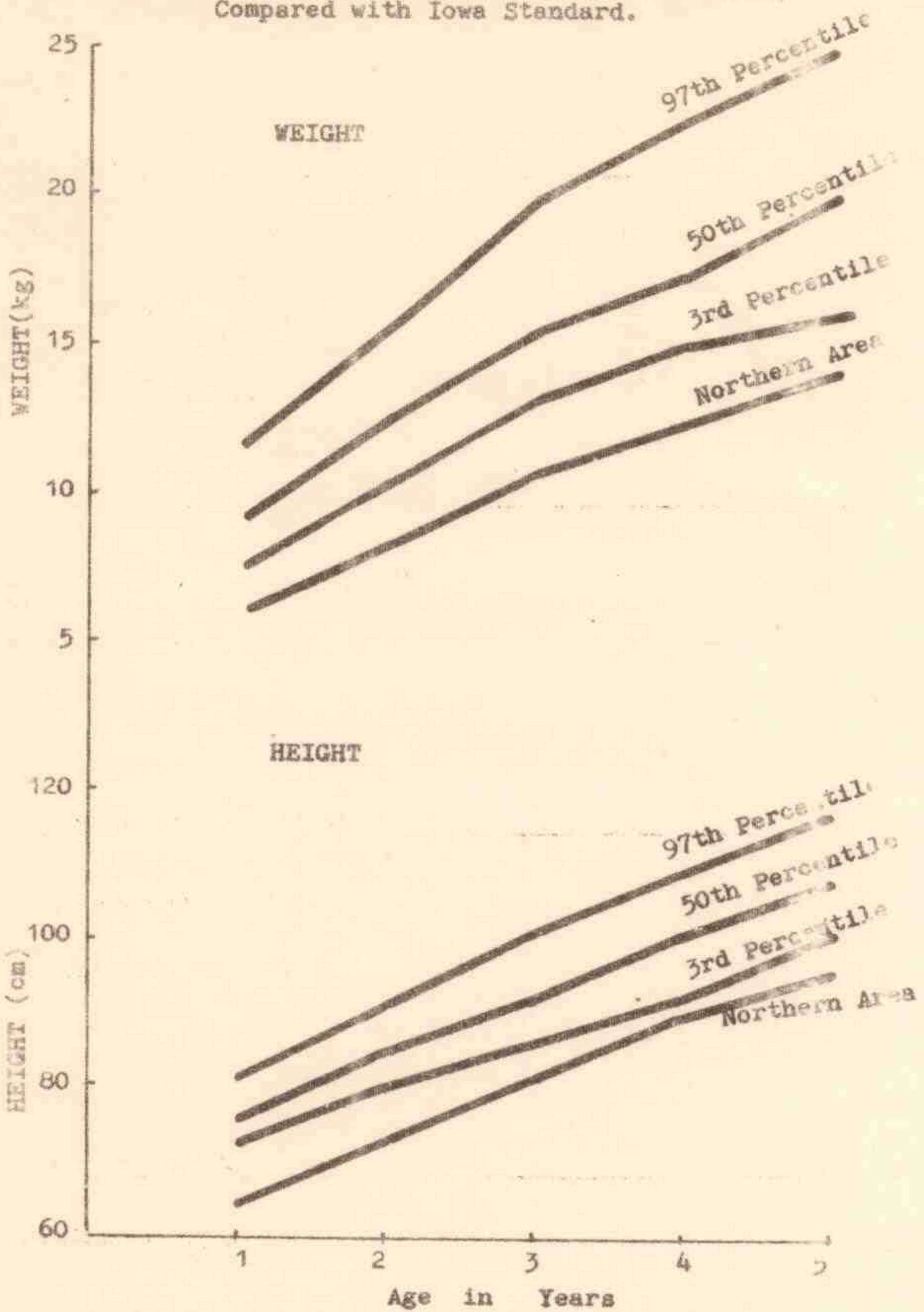


Fig.5. Weight and Height of Boys, 6-18 Years, Compared with Iowa Standard.

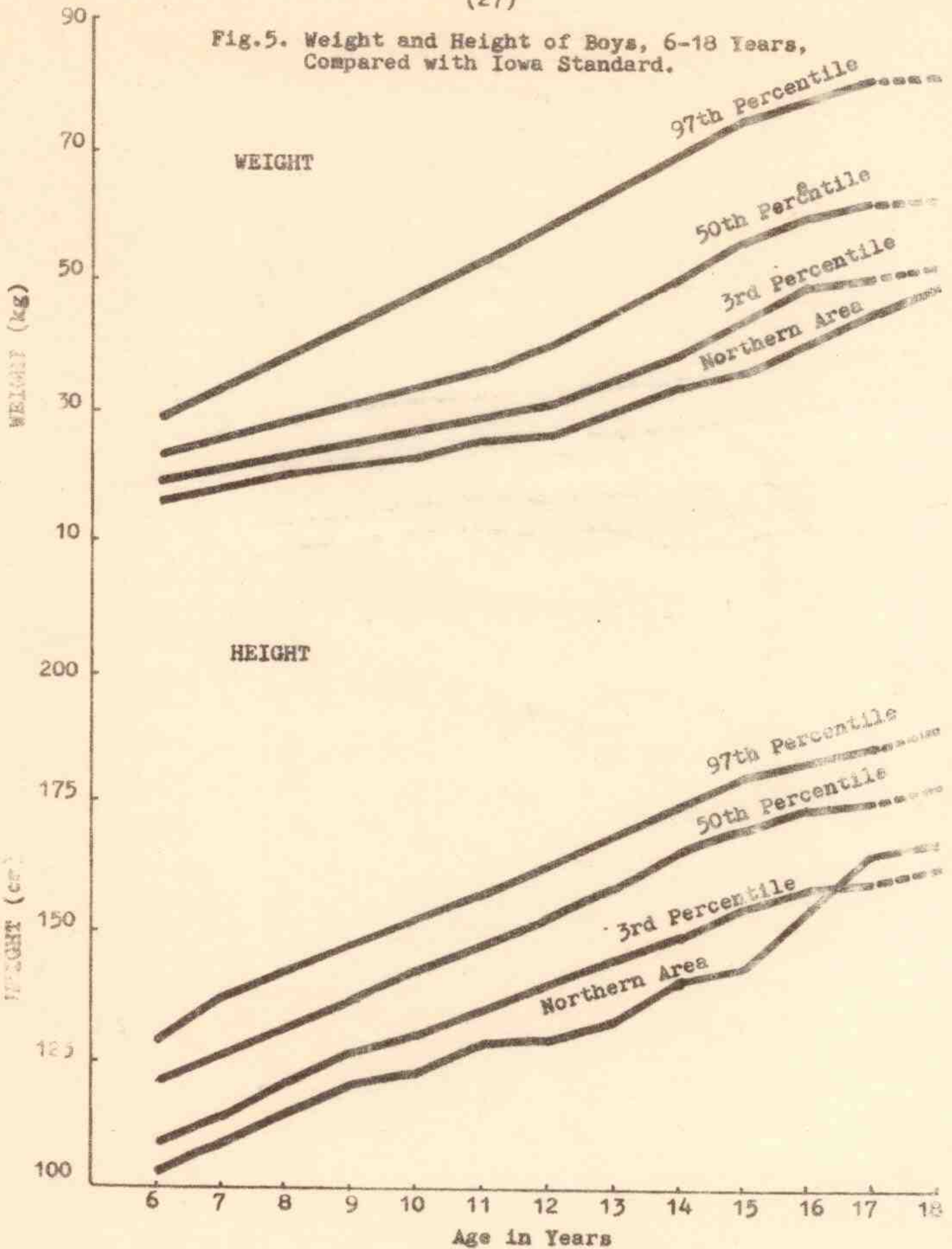
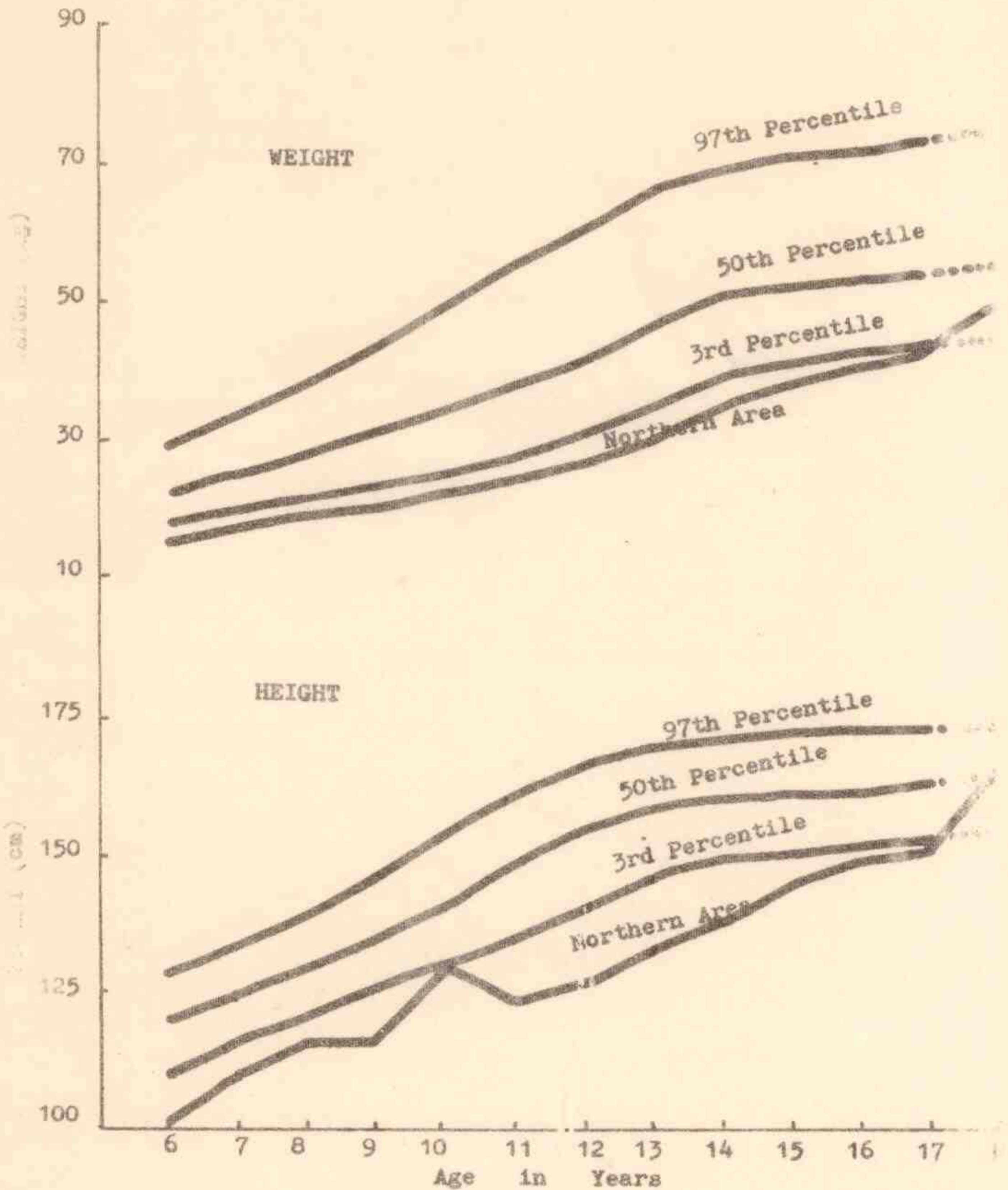


Fig.6. Weight and Height of Girls, 6-18 Years, Compared with Iowa Standard.



surveys. Among the sites chosen for measuring skinfold over triceps is the most commonly used and is quite accurate in measuring subcutaneous fat. Data for skinfold thickness of various age groups are shown in Tables 6-8. Females of all age groups generally had more subcutaneous fat than males. The population surveyed were mostly lean and thin which indicated that their caloric intake was marginal for their needs. This conclusion is further supported by the fact that the average caloric intake of the people of the Northern Areas was even lower than that of an average Pakistani. The West Pakistan Survey Report (1970) showed 46 per cent of the families had sub-optimal intake of calories.

Head and Chest Circumference:

The average head and chest circumference of males and females of different age groups have been given in Tables 6-8. The ratio of chest circumference over head circumference can be used as another indicator of malnutrition. In a well-nourished child the chest circumference starts to exceed the head circumference during the second six months of life and after one year it should be greater. The average chest-head ratio in the children, 1-6 years of Northern Area of Pakistan is shown in Table 6.

Arm Circumference:

Mid-upper arm circumference is another useful indicator. It is affected by bone diameter, muscle thickness and skinfold thickness. Normally the arm circumference increases rapidly from birth to one year by a little more than 5 cm i.e. from about 11 to 16 cm; but during the period from 1-3 years of age the average arm circumference remains about 16 cm. In the present study the arm-circumference of the children 1-3 years was 26 per cent below the standard.

Table 6

Different Body Measurement of Male and Female children 1-6 years

Age (yrs)	No. examined	Average skinfold thickness (mm)	± S.E.	Average Arm Circumference (cm)	± S.E.	Average Chest Circumference (cm)	±S.E.	Average Head Circumference (cm)	± S.E.	Chest-head ratio
1	49	6.70	0.31	10.74	1.10	40.05	0.54	41.60	0.51	Less than one
2	25	7.20	0.34	11.76	0.48	45.70	0.61	46.40	0.36	
3	31	8.10	0.38	12.92	0.59	48.06	0.58	47.30	0.41	Greater than one
4	22	8.00	0.58	13.36	0.47	48.58	1.24	46.86	0.74	
5	42	6.76	0.34	13.60	0.52	51.60	0.41	48.71	0.29	
6	35	6.1	0.25	13.95	0.43	53.71	0.45	49.55	0.30	

Table 7

Different Body Measurements of Males

Age (Yrs)	No. examined	Average skinfold thickness (mm)	± S.E.	Average Arm Circumference (cm)	± S.E.	Average Chest Circumference (cm)	± S.E.	Average Head Circumference (cm)	± S.E.
7	31	5.24	0.22	14.20	0.70	57.00	0.73	50.40	0.34
8	24	5.00	0.28	14.21	0.82	56.80	0.58	50.72	0.31
9	19	5.20	0.47	14.70	0.56	56.20	0.81	49.80	0.72
10	32	4.70	0.23	14.84	0.24	57.12	0.78	51.26	0.31
11	20	4.85	0.26	15.00	0.28	60.40	0.73	51.20	0.30
12	37	5.91	0.27	16.10	0.20	62.70	0.70	52.64	0.38
13	21	5.00	0.41	16.00	0.37	64.50	0.86	51.51	0.31
14	15	4.90	0.49	16.60	0.46	67.50	0.93	52.70	0.32
15	11	5.60	0.58	18.70	0.96	66.80	2.16	53.00	0.84
16	9	5.00	0.62	18.80	0.80	-	-	-	-
17	3	-	-	-	-	-	-	-	-
18	8	4.50	0.44	18.12	1.24	-	-	-	-
19	2	-	-	-	-	-	-	-	-
20-49 (Adults)	94	4.95	0.18	22.10	0.19	-	-	-	-
50 and above	44	4.80	0.33	21.84	0.29	-	-	-	-

Table 8

Different Body Measurements of Females

Age (Yrs)	Nos. examined	Average skinfold tricep. (mm)	± S.E.	Average Arms Circumference (cm)	± S.E.	Average Chest Circumference (cm)	± S.E.	Average Head Circumference (cm)	± S.E.
7	23	6.00	0.36	13.86	0.23	54.34	0.42	50.00	0.37
8	14	5.50	0.40	12.30	0.96	55.00	0.80	50.40	0.39
9	15	5.76	0.41	14.60	0.39	56.80	0.96	50.80	0.60
10	8	5.12	0.39	-	-	59.37	0.88	50.93	0.79
11	11	6.13	0.45	15.54	0.51	59.50	1.59	52.63	0.36
12	12	5.50	0.36	15.83	0.34	-	1.05	52.54	0.56
13	5	5.60	1.13	18.00	1.18	-	2.41	52.60	0.38
14	8	7.12	0.90	17.6	0.74	-	-	-	-
15	9	7.40	0.56	18.94	0.45	-	-	-	-
16	4	8.00	1.97	20.00	0.81	-	-	-	-
17	10	8.80	1.09	19.75	0.63	-	-	-	-
18	4	9.50	1.19	20.30	0.96	-	-	-	-
19	1	-	-	-	-	-	-	-	-
Adults (20-49)	153	8.20	0.21	20.30	0.15	-	-	-	-
50 and above	29	8.00	0.60	19.80	0.42	-	-	-	-

Blood Haemoglobin:

Haemoglobin values show widespread occurrence of iron deficiency anaemia in all sections of populations (Table 9). The worst suffers were children between the ages of 5-9 years with an incidence of 91.5 per cent. Pregnant women, adult females, older children and adult males with an incidence of 89.7 per cent, 84.7 per cent, 71 per cent and 66.7 per cent respectively. It is interesting to find that dietary surveys did not show any deficiency of iron. Hence there may be other factors, e.g. parasitic infestation, phytates, which may be responsible for incidence of anaemia in Northern areas.

Table 9

Haemoglobin Levels in Northern Areas

Age group (yrs)	No. examined	Sex	Per cent Prevalence		
			Normal	Above normal	Below normal
5 - 9	142	-	3.5	5.0	91.5
10-14	114	-	22.0	7.0	71.0
20-49 (Adult)	144	Male	12.5	20.8	66.7
	164	Female	7.3	8.0	84.7
	39	Pregnant	10.3	-	89.7

Standard Haemoglobin values below which anaemia is considered to exist:

5-9 years	11.5 g/100 ml
10-14 years	12.5 g/100 ml
Adults(M)	14.0 g/100 ml
(F)	12.0 g/100 ml
Pregnant	10.0 g/100 ml

(Health aspects of Food and Nutrition, Manila 1969).

Clinical Lesions:

Table 10 shows per cent prevalence of clinical lesions on physical examination of the surveyed population of the Northern Area. It should be appreciated that clinical lesions are non-specific and represent only the late stage of a deficiency state. Usually multiple deficiencies co-exist and many lesions also result from non-nutritional factors.

Other factor which can cause serious differences in diagnosis is examination by several persons at different times. This was obviated by assigning physical examination to one person. The following observations were made:

Angular stomatitis was present in 13.5 per cent of adult population (male and females showing equally). In the age group 5-9 years, male had almost twice the number of female suffering from angular stomatitis, while in the age group 10-14 years, 22.8 per cent of the girls had angular stomatitis as compared to only 4.7 per cent of the boys. Incidence of cheilosis was higher in girls aged 10-14 years. Similarly glossitis was present in 5.7 per cent of the adolescents girls as compared to 3.1 -4.3 per cent of other groups of the population.

Angular stomatitis, cheilosis and glossitis indicate deficiency of B-vitamins particularly riboflavin. Food consumption data do not show deficiency of B-vitamins. It appears that some B-vitamins are lost during cooking or processing of food.

Goitre was found wide-spread in all age groups. More than half the population was found to suffer from some degree of goitre. Relatively, incidence of goitre was less in younger age groups but increased with advancing age. It is evident from the Table 10 that 66 per cent of the adults had goitre.

Table 10

Per cent Prevalence of Clinical Lesions

Age (years)	5 - 9		10 - 14		Adults	
Sex	M	F	M	F	M	F
No. examined	115	86	128	35	171	209
1) Angular stomatitis	12.2	7.0	4.7	22.8	13.5	13.4
2) Cheilosis	2.6	2.3	0.8	2.8	1.8	2.4
3) Glossitis	4.3	3.5	3.1	5.7	4.1	2.9
4) Goitre	51 3	38.4	64.0	57.1	66.35	64.59

REFERENCES

1. Ministry of Health "Nutrition Survey of Pakistan" Directorate of Nutrition Survey Research Government of Pakistan, Islamabad (1970).

2. S.M. Ali "A Nutritional Survey of Hunza". Pak. J.Med.Res., 5.141 (1969).

3. Inter-department committee for National Defence. Manual for Nutrition Survey (Second Edition), Washington (1963).

4. D.B. Jelliffe "The Assessment of Nutritional Status" of Community WHO, Geneva (1968).

5. F.A.O. "Energy and Protein Requirement". Report of a Joint FAO/WHO Adhoc Expert Committee. Food and Agriculture Organization of the United Nations, Rome (1973).

6. Council on Foods and Nutrition "Symposium on Human Calcium Requirements". J.A.M.A. 185: 588 (1963).

APPENDIX 'A'

DIETARY SURVEY

Code No. — Cluster — Name of the head of family — Occupation

Cluster Element — Adults: M. FM — Children: M FM — Income

No. of family members.

Food groups	Break-fast	Lunch	Dinner	Total	Cals	Protein		CHO	Ca	Fe	Vitamins					Remarks
						Veg.	Ani.				A	B_1	B_2	Niacin	C	
1. Cereals Wheat																
Maize																
Rice																
2. Starchy Roots																
3. Pulses & Nuts.																
4. Sugar &Sweets																
5. Vegetables. Non-leafy.																
Leafy																
6. Fruits. Fresh																
Dried																
7. Meats																
8. Eggs																
9. Fish																
10. Milk/curd/lassi																
11. Fats & oil																
12. Miscellaneous																

Per capita income

Date:

Investigator.

APPENDIX 'B'

NUTRITIONAL SURVEY

Height	Cluster
Code Number	Date
Name	Date of birth or age
Father's name	Sex Male Female
	Pregnancy/Lactation

Weight	Height
Skinfold Triceps	Arm Circumference
Chest circumference	Head Circumference

Breast feeding	Bottle feeding
Other feeds	

Hair___________	Throid Glands___________
Depigmentation	Goitre
Easy Pluckability	Skin
Thin Sparse/Straight	Oedema
Face	Follicular Hyperkeratosis
Moon-face	Pellagrous Dermatosis
Eyes	Diffuse Depigmentation
Bitot's spots	Liver
Pale Conjunctiva	Hepatomegaly
Conjunctival Xerosis	Skeleton
Mouth	Epiphyseal Enlargement
Angular Stomatitis	Rickety Rosary
Cheilosis	Harrison's Sulcus
Glossitis	Bossing of Skull
Swollen Bleeding Gums	Knock-Knees Bowlegs. Signs
Clinical Impression Haemoglobin.	Marasmus /Pre-kwashiorkor/ Kwashiorkor.

APPENDIX 'C'

SPECIAL SNACKS AND DISHES OF NORTHERN AREAS

I. Beverages:

1. 'Khanda'

Dried mulbury fruit is cooked in excess of water for 30-60 minutes. The water extract of the fruit is called 'Khanda'.

2. 'Sattoo'

Dried apple flour and sprouted wheat flour are mixed in the ratio of 3:1 and stored. About ten times of water is added to the mixture and served as a refreshing drink.

3. 'Chamus'

Water is added to dried apricot and taken as a drink.

4. 'Daodo'

Dried apricot flour and sprouted wheat flour are mixed in the ratio of 1:1 and stored. The water is added to the flour when required and taken as a drink.

II. Bread(Roti):

5. 'Diramspik'

Sprouted and unsprouted wheat flours are mixed in the ratio of 1 to 4. Roties are made from the above mentioned mixture and are fried in butter oil, walnut oil, apricot nut oil.

6. 'Berrykuz'

Stuffed roties are prepared by mixing dough with spiced apricot-nut flour and are fried in the seed oil.

7. Humun

Roties are prepared from the dextrinised, powdered and sieved linseed flour. These are generally eaten after soaking in milk for some time.

8. Khas Chappati

The chappaties are prepared from browne. wheat flour.

9. 'Minna'

This is a kind of roti prepared from apricot nut cake.

III. Puddings

10. 'Namkeen Halwa'

Wheat flour	2 lb
Butter oil	½ lb
Water	2 litres
Salt	To taste

Wheat flour is fried in butter oil till it is brown. Salt and water are added later. The thick soup is taken hot.

11. 'Mull' (Sweet halwa)

Wheat flour	4 lb
Ghee or apricot Nut oil	1 lb
Milk or 'Khanda'	2 lb

Halwa is cooked from the above ingredients.

12. 'Kigaling' (Sweet Halwa)

Wheat flour	3 lb
Butter oil	½ lb
Milk or 'Khanda'	1 lb

A kind of 'Halwa' is prepared from the above ingredients.

13. 'Hawaloo-Garmamuch'

Bread crumbs	1 lb
Spinach beans	3 lb
Apricot-nut powder	½ lb
Onion	¼ lb
Red chillies & salt	To taste

Spinach is cooked with onions, red chillies and apricot nut powder. Bread crumbs and salt are added to the cooked spinach beans and the food is eaten as such.

14. Maleeda

Bread crumbs are fried in butter oil or apricot nut oil

and mixed with whey, salt and spices and cooked till it becomes thick.

15. 'Dachirum'

Linseed	1 Lb
Walnut	1 Lb

Linseed is roasted in apricot-nut oil and mixed with walnut and 'Kigaling' till a thick paste is obtained.

16. 'Hareesha'

Meat	2 lb
Wheat grains	4-5 lb

Meat and wheat grains are cooked after the addition of water, till a thick paste is formed. The paste is mixed with spices and salt and eaten with chappaties.

17. 'Gour'

This is a soup prepared from dextrinised wheat flour and minced meat.

18. 'Jookush' (Small)

A lamb is killed, skinned and cleaned. A thick paste of buck wheat flour containing spices, salt and onion is applied to the inner side of the dressed lamb and the whole is cooked in water in big iron frying pan. This preparation is made during winter, seasoned for one month and eaten in small lots.

19. 'Enrich or Soopin'

These are a kind of sausages. Lambs' intestines are stuffed with a mixture of minced meat, onions and black pepper and salt. The sausages are seasoned and eaten after frying.

20. 'Saapinder'

Butter oil is stored in storeware for 10 to 40 years and served on special occasion.