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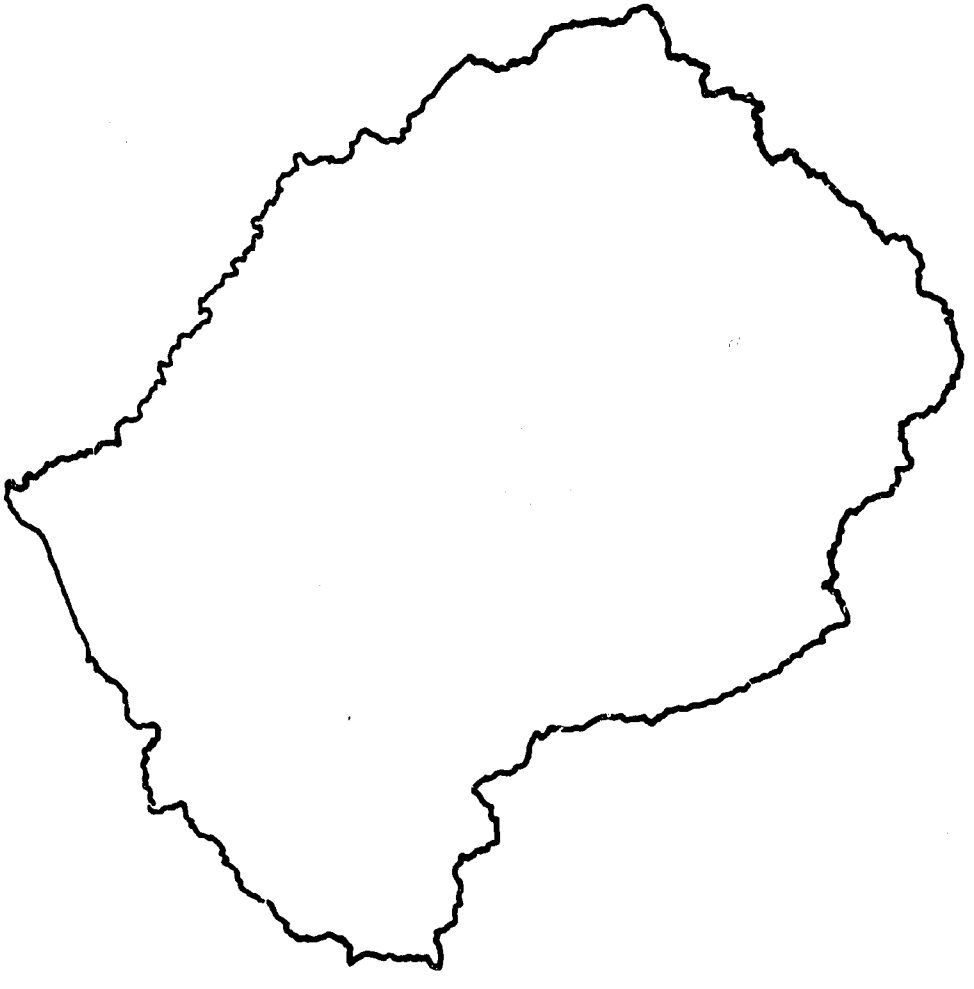

Office of Nutrition
Development Support Bureau
Agency for International Development
Washington, D.C. 20523

THE KINGDOM OF LESOTHO

NATIONAL NUTRITION SURVEY

undertaken by

The Government of Lesotho

REVISED FINAL REPORT - 1977

With the Assistance of the

UCLA Nutrition Assessment Unit

Division of Population, Family and International Health

School of Public Health

University of California

Los Angeles, California, U.S.A.

In Cooperation With

The United States Agency for International Development

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PREFACE

The Government of Lesotho has taken an active interest in nutrition policies and planning. This national concern has resulted in a collaborative effort to coordinate all nutrition-related activities in the country.

At the request of the Government of Lesotho (GOL) to the United States Agency for International Development (USAID), the University of California at Los Angeles (UCLA) Nutrition Assessment Unit assisted in a national nutrition survey from August to November 1976. UCLA Unit members visited Lesotho from April 5-16, 1976 where initial commitments were made by local government and private agencies.

The 1976 National Nutrition Survey was a result of the combined efforts of the Government of Lesotho, private agencies throughout the country, USAID and UCLA.

The Government of Lesotho made notable contributions of personnel, training sites, vehicles, duplication and laboratory facilities as well as administrative support. The diligent efforts of the survey members under difficult circumstances facilitated the survey's smooth implementation.

The U.S. Agency for International Development, Technical Assistance Nutrition (TA/N), Washington provided the funds for the UCLA Unit personnel, survey equipment, planning, data analysis and final report. UCLA subcontracted for logistic assistance with the Catholic Relief Services (CRS) whose support made completion of the survey possible. A complete list of contributions and survey personnel appears in Appendix 5, p. 156.

Acknowledgement is made of all those who were involved in the survey, but most important, appreciation is extended to the people of Lesotho who opened their homes and provided cooperation and hospitality throughout this endeavor.

LESOTHO

LADYBRAND
MASERU
TEYATEYANENG
MOKHOTLONG
GIANT'S CASTLE
THABANANTLENYANA
MORIJA
THABA PUTSOA
3096m
WEPENER
MAFETENG
MOHALES HOEK
QUTHING
Malutsi Mountains
Butha Buthe
Leribe
Maseru Bridge
Thaba Bosiga
Mokhotlong
Mantsonyane
Sehlabathebe
Sani Pass
Le Bihan Falls
(Maletsunyane Falls)
Orange or Senqu
Chiliji
Mazenod
Scale 1:1 267 000
0 10 20 30 40 50 60 70 80
kms
km
Main Roads
Secondary Roads
Tracks
Bridle Paths
International Boundaries
Mountain Passes
Border Control Posts
Capitals
Large Towns
Towns
Villages
Missions
Heights in metres
3482m
LESOTHO IN AFRICA
LESOTHO
SOUTH WEST AFRICA
TRANSVAAL
ORANGE FREE STATE
LESOTHO
NATAL
CAPE PROVINCE

SUMMARY

The purpose of the survey was to provide an estimate of nutritional status of young children and their mothers in Lesotho, to compare nutritional status between selected areas and to provide information about certain associations related to nutritional status such as diet, socio-economic and demographic factors.

Anthropometry (body measurements), clinical signs and hemoglobin assessment provided a description of nutritional status. Interviews with the mother or her substitute were conducted for information on household and family characteristics, child health and diet.

The Lesotho Bureau of Statistics has divided Lesotho into four ecological areas: lowlands (urban and rural), foothills, Orange River Valley and mountains. This survey was based on this stratification but the Orange River Valley was included with the mountain areas because they share many common features. Therefore, this survey describes four ecological areas: urban lowland, rural lowland, foothills and mountains.

All national results were derived from weighting (statistically adjusting) the strata results according to population proportionality. Thus, prevalence estimates for children under five years (excluding neonates) were based on the total number of these children in Lesotho (approximately 0.2 million) in a total population of 1.2 million.

The survey sample for Lesotho was comprised of 1745 children under five years and 988 of their mothers. Mothers often had more than one of their children included in the survey. A multistage, cluster sampling technique was used. Fifty-eight enumeration areas were visited. Two clusters of 15 children and their mothers were measured in their homes in each enumeration area.

A "special group" of 296 children under five years from selected areas of Maseru was measured. Their results were used as a basis of comparison with those of the other children in the main sample. Selection was based on the child's area of residence, good housing and having a parent with a salaried position. It is assumed these children received at least basic health services.

The findings of the survey are briefly summarized as follows:

1. ANTHROPOMETRIC EXAMINATION OF CHILDREN 6-60 MONTHS OF AGE

Chronic Protein-Calorie Malnutrition

Stunted growth (i.e., short height for their age) reflects recurrent episodes or a prolonged period of nutritional deficiency of calories and/or protein available to the body tissues. This nutritional deficiency usually has an onset of at least six months prior to the time of examination. The deficiency is usually the result of poor diet and/or acute infections and diarrheal disease. Also, certain family, social and demographic features which were associated with stunting were revealed in this survey.

In Lesotho, 22.7% of young children had stunted growth and were at high risk for having chronic protein-calorie malnutrition using the criterion of height for age under 90% of an internationally accepted reference value. The prevalence reached a peak at 12 months and remained at that level until 60 months. It was highest in the mountain areas (25.0%) and lower in both the urban sample of the lowlands (17.2%) and in the special urban group (11.3%). Using the same criteria, only about 1% of children of the same age from the middle class in industrialized countries or from elite communities in Africa were shown to be at high risk for having chronic PCM (1,24). The special urban group surveyed in Maseru consisted of children of salaried workers, and were considered to have reasonably adequate nutrition and health care compared with other

Basotho see Appendix 6, p. 163 children of the same age. Using the criterion of a height for age under 90% of the reference median value, the prevalence of stunting in rural children was significantly greater in the following: children aged 6-24 months where the father was absent and not contributing, or dead; children aged 25-60 months where the father was a miner and with a prior birth interval less than 24 months. Also, where the mother could not read Sesotho refer to Appendix 6, p.163 stunting was significantly greater in children 6-60 months.

It should be noted that a statistically significant positive association does not necessarily indicate causality nor does a lack of association exclude a causal relationship.

Acute Protein-Calorie Malnutrition

Body wasting in young children (i.e., a child who is thin for his height) reflects a recent period of nutritional deficiency of protein and/or calories available to the body tissues with a usual onset only a few weeks prior to the time of examination. The prevalence of wasting is expected to be far less than stunting. In a cross-sectional survey, a child is examined at one time only. Thus, the acute episode of wasting might not be present at that time, but evidence of cumulative episodes of wasting will be apparent through stunting. Often children who have acute PCM also have chronic PCM, but the reverse is not usually found.

In Lesotho, 3.4% of young children studied had body wasting, using the criterion of weight for height less than 85% of the internationally accepted reference value. The prevalence of wasting was less in children aged 2-5 months and in the special urban group. However, in no part of the country nor in any yearly age interval was the prevalence much over 5%.

The prevalence of mild body wasting in rural children, using the less stringent criterion of a weight for height under 90% of the reference value, was significantly greater in the following: children aged 6-24 months of male sex; children born fifth or later in the family; children in a household of seven or more; where the number of live births in the family was five or more; where the father was absent and not contributing to the family or was dead; children aged 25-60 months who were cared for by the mother alone and who received market milk.

Underweight for Age

Underweight for age in young children reflects a nutritional deficiency of protein and/or calories available to the body tissues, but the onset and duration is not known. Because the bony skeleton is a large proportion of the weight of a child, the prevalence of underweight is often similar to that of stunting, especially when the prevalence of wasting (low weight for height) is relatively low.

In Lesotho, 22% of young children were underweight based on the criterion of a weight for age under 80% of the internationally accepted reference value. The peak prevalence in children 6-60 months of age was highest in mountain areas (28.1%) and lowest in the special urban group (5.8%).

Obesity and Overweight for Height

In Lesotho, 12.9% of children aged 2-5 months were obese, using the criterion of a triceps fatfold for age over 120% of the internationally accepted reference value. In children of the same age range, 18.8% were overweight based on the criterion of weight for height over 120% of the reference value used. In general, these prevalence rates were much lower in all other children under five years.

2. ANTHROPOMETRIC EXAMINATION OF MOTHERS

The presentation of results of these measures is confined to mothers aged 20-40 years of children aged up to five years who were present at the time these children were examined. In a cross-sectional anthropometric survey, adult nutritional status is more difficult to define than the status of young children. The criteria used for low maternal measures in the Lesotho survey were based on prior experience in other countries throughout the world (3).

Low Stature

In Lesotho, 11% of mothers studied had a low stature (i.e., height of less than five feet or 150 cm). There was a higher prevalence of short mothers in the urban and rural lowland areas than in the rest of the country. The mean height of mothers in Lesotho was 156.8 cm.

Maternal stature is used in considering the genetic component of stunting in children. In Lesotho, 33% of the young children of low stature mothers were stunted and 23% of the normal height mothers' children were stunted. More than 85% of the stunted children in rural areas of Lesotho had mothers of normal height. It should be noted that maternal stature might also reflect nutrition-related environmental factors which influence growth in childhood.

The correlation coefficient between stature of mothers and percentage height for age of their children was 0.2. Although this was significantly different from zero, the value is low enough to suggest that the genetic component of stunting in children was not a dominant factor compared with other factors, such as poor diet and health.

Low Measures of Arm Circumference and Fatfold

In Lesotho, only 3% of mothers had a low arm circumference of less than 23 cm and 5% had a low triceps fatfold of less than 7.5 mm. These

criteria approximate that of the third percentile of American black females (4). In other words, there is little difference in the prevalence rates for black females in Lesotho and the U.S. Undernutrition relating to depletion of fat stores is probably not a problem in the Basotho mothers sampled. Their mean arm circumference was 28.6 cm and fatfold was approximately 15 mm.

There was a higher prevalence of low maternal fatfold in foothill and mountain areas compared with the rest of the country (9% vs. 1%). This might be because of food intake and/or be related to greater physical activity in these areas.

Obesity

In Lesotho, 21% of all mothers were obese as defined by a triceps fatfold of over 25 mm. The prevalence of obesity was higher in urban (42%) and lowland (29%) mothers and lower among those from the foothills and mountains (13%). Reliable fatfold measures are difficult to obtain. The results for obesity were supported by the high prevalence of mothers with a very large arm circumference and by general observations.

3. ANEMIA IN YOUNG CHILDREN

In Lesotho approximately 25% of children aged 6-60 months were anemic as defined by WHO criteria (5). Using these criteria, the prevalence was higher in children aged 25-60 months (31%) with a hemoglobin under 11 gm/100 cc compared with those aged 6-24 months (16%) with a hemoglobin under 10 gm/100 cc.

4. MATERNAL GOITER

Maternal goiter of Grade II or III, by WHO criteria (6) was seen in 5.2% of all mothers. These criteria include goiters seen with the neck extended and excludes those goiters not visualized, but palpable. Goiter was less prevalent in urban areas of the lowlands (0.8%).

5. MATERNAL PELLAGRA

Less than 1% of all mothers had a pellagra-like rash on the neck or arms or other exposed parts of the body. The peak prevalence of pellagra was at a different time of the year (January to April) than when this survey was conducted.

6. DURATION OF BREAST FEEDING

The prevalences of children still being breast fed according to ages were as follows: 90% at 12 months, 70% at 18 months and 50% at 22 months. In urban areas, breast feeding was less prevalent than in the rest of the country; i.e., 75% were still being breast fed at 12 months of age.

7. USUAL PLACES WHERE MILK WAS OBTAINED

In Basotho children aged 6-24 months, 76% were breast fed, 49% usually received milk distributed at the clinic, 25% received milk from the market, 14% received it from their own farm and 12% from another farm. Only 3% did not receive any type of milk. Of those children aged 25-60 months, 5% were breast fed, 55% usually received milk from the clinic, 21% from the market, 21% from their own farm and 19% from another farm. Thirteen percent did not usually receive any milk. In both age groups there was a higher proportion of urban compared with rural children receiving milk from the market or other farms.

In Lesotho, 35% of children aged 6-24 months received milk from only one place and in more than 60% of these, the sole source was the breast. Just over half the children aged 25-60 months received milk from only one place and of these, more than half was from clinics.

8. AGE OF ONSET OF FOOD OTHER THAN MILK

In Lesotho, 70-85% of the children aged 6-9 months and 85-95% aged 9-12 months received food other than milk. In urban areas, these rates were much higher.

9. CLINIC FOOD

Approximately 55% of Basotho young children usually received clinic food. Clinic food was usually corn soya milk (CSM). About 10% of children aged 6-24 months had clinic food but not clinic milk.

10. FEEDING PATTERNS IN YOUNG CHILDREN

These patterns were determined by a 24-hour qualitative recall for staple foods and a 3-day recall for foods of animal origin or legumes. These patterns differed according to age and whether the children lived in urban or rural areas.

Children aged 6-24 months in rural areas ate at least one staple food (usually maize). However, 26% of these children had no protein-rich food (excluding milk) during the past three days. These protein-rich foods included meat, poultry, fish, eggs or legumes (peas or beans). Thirty percent of these children had only one source of protein-rich food of which legumes comprised about one-half. About 20% of these younger children did not receive meat, poultry or legumes when these were consumed by the family. This difference did not occur with eggs or fish.

Children aged 25-60 months in rural areas nearly always ate maize, at times supplemented with wheat, sorghum or both. Although only 14% did not receive a protein-rich food apart from milk, there was still a great reliance on legumes as the only source of protein-rich food.

More children aged 6-60 months from urban compared with rural areas received wheat, meat/poultry, eggs and fish. Even then, 22% of urban children relied on a single source of protein-rich food other than milk. The greatest reliance for this single source was from meat or poultry.

11. ASSOCIATION OF DIET ASSESSMENT WITH ANTHROPOMETRIC DESCRIPTION OF NUTRITIONAL STATUS IN CHILDREN

As the variety of protein foods in the diet of children aged 6-60 months decreased, the prevalence of wasting (low weight for height) and underweight for age increased. Thinner (i.e., more wasted) children tended to have a less varied diet. Because the dietary history was based on recent intake, these associations would be expected for anthropometric indices describing recent wasting.

12. COMPARISONS WITH THE 1956 NATIONAL NUTRITION SURVEY

In children aged 25-60 months, the mean weight was approximately one kilogram heavier and the mean height about two centimeters taller in the 1976 Survey compared with the 1956 WHO survey (15). No consistent change was demonstrated in children aged 6-24 months.

The prevalence of visible goiter in mothers was approximately 5% in the 1976 survey compared with 15% in the previous survey. Rigorous comparison of the two studies is difficult because of differences in sampling methods and times of the year when the surveys were conducted.

13. OVERVIEW

The results would suggest the following:

-Over one-fifth of Basotho children up to five years of age had sufficiently poor growth to indicate a long term lack of calories and/or protein available to the body tissues (chronic protein-calorie malnutrition).

-There appears to be some improvement of nutritional status of children from 2 to 5 years of age since 1956, as determined by growth. This was not found in children from 6-24 months of age.

-Children from 2-5 months of age were generally well nourished and adequately protected by breastfeeding.

-From 6 to 12 months of age, breast feeding continued, but at least 15% of all children in this age range received no other food except milk.

-From 6-24 months of age about 25% and from 25-60 months 14% of all children had milk alone as an animal protein source. More than 50% of all children in the sample reportedly received clinic milk and food.

-About 20% of children aged 6-24 months did not receive meat, poultry or legumes when they were consumed by the family.

-About one-quarter of children under five were anemic.

-Relatively few mothers were undernourished as determined by arm circumference and fatfold. Obesity was present in approximately 40% of urban, 30% of lowland and 13% of foothill/mountain mothers.

-The prevalence of visible goiter in mothers was 5%. It appears that the problem of iodine deficiency was still present when this survey was done, although not as prevalent as in 1956.

Food is a minimum from December to February, and the 1956 WHO-assisted survey reported weight loss during that time of the year. Pellagra, a vitamin deficiency, has a peak prevalence in December. This is earlier than the peak prevalence of kwashiorkor in February. This 1976 survey was conducted from September to November.

1. BACKGROUND INFORMATION

1.1 INTRODUCTION

The Kingdom of Lesotho is an independent country completely surrounded by the Republic of South Africa, bound by three of the Republic's provinces (7). Once known as Basotholand, the country was unified under the leadership of Moshesh (Moshoeshoe I) from 1820-1870. It became a British protectorate in 1868 and gained independence in 1966. The government has a ministerial system in which the King is the Head of State. The country is divided into nine districts (see Appendix 2) headed by district administrators (8).

The area of Lesotho covers 11,716 square miles (30,300 km^2) which is approximately the size of Belgium or the State of Maryland (7,8,9). The country has a population of 1.2 million (10). It is divided into four major regions, the lowlands (including urban areas) along the western plateau, the Orange River Valley, the foothills and the mountains. In this report survey results are described according to urban, (rural) lowlands, foothill and mountain ecological areas. Three-fourths of the country is covered by foothills and mountains of the Drakensberg Range, rising to 11,000 feet above sea level. The remaining one-fourth is lowlands, which are 5,000-6,000 feet above sea level and cover approximately 2,000 square miles (8).

The climate is temperate, varying from 20 to 90 degrees Fahrenheit in the lowlands. In the mountains it can snow at any time of the year, and winter temperatures fall below zero. Rainfall averages about 28 inches (approximately 700 mm) per year in most of the country, with 85% occuring between October and April (7,8,9).

1.2 TRANSPORTATION AND COMMUNICATION

There are approximately 2,000 miles of roads and tracks in the country. The urban and lowland roads are well developed, while horses and donkeys are necessary in the mountain areas. There are approximately 200,000 horses and donkeys in the country. Rail lines link Maseru with the Republic of South Africa. There are 31 airstrips in Lesotho (8, 9, 11).

The telephone system is highly developed in the lowlands, but extends little into the mountains. There are approximately 300 privately owned radios operated by missions, traders and the Flying Doctor Service (8). Lesotho is dependent on South Africa for electricity, international transportation and international communication (9, 11).

Lesotho's unit of currency is the South African Rand (1 U.S. DOLLAR = RAND 0.86). South Africa determines exchange rates and monetary policy and dominates foreign trade and investment in Lesotho (11).

1.3 EMPLOYMENT

The total labor force of Lesotho was estimated in 1973 at 450,000 (290,000 males and 160,000 females) which is 37% of the population. Approximately 60% of the males work in mines, farms and industry in South Africa, while approximately 10% of the females work in South Africa. Less than 5% of the total labor force is employed in government and industry in Lesotho (11).

1.4 EDUCATION

In 1966, there were over 1,000 primary schools and 40 secondary schools with enrollments greater than 165,000 and 3,000 respectively. The government has technical and teacher training institutes in addition to university in Roma, 40 miles from Maseru. At the time of the 1966 census, the literacy rate, which is defined as having completed two years of primary school, was 47.5%. There is a high dropout rate of about 60% after the junior level. The Missions aided in the growth of the educational system (9).

1.5 AGRICULTURE

Lesotho has a relatively large number of livestock, particularly sheep, cattle, goats and chickens which total 3 million (Table 1). The number of livestock per capita is spread fairly evenly in each area of the country. The exception is the mountain area where most sheep graze (Table 2). There is a substantial export of mohair and wool.

Table 1 : Numbers of Livestock 1950, 1960, 1970

(In Thousands)

	1950	1960	1970
Cattle	401	546	551
Sheep	1546	1466	1655
Goats	637	672	974
Horses	103	135	110
Donkeys	59	97	90
Mules	3	7	4
Pigs	36	61	66
Chickens	..	771	841

Source: A World Bank Country Economic Report - Lesotho: A Development Challenge. October 1975.

Maize, sorghum and wheat are the major food crops (Table 4). All crop yields are relatively low and fluctuate from year to year depending on climatic conditions. Lowland areas rely on a winter wheat harvest and in mountain areas on a summer wheat harvest (Table 3). Peas and beans are the major export crops. About 20% of beans are exported (11,12).

Table 2: Livestock in Lesotho According to Area, In Thousands (extracted from 1970 Agricultural Census)

	Lowlands	Foothills	Orange River Valley	Mountains	Lesotho
Cattle	190	166	43	151	550
Sheep	346	217	132	961	1656
Goats	242	238	128	366	974
Poultry	387	242	70	142	841

Animals Per Capita According to Area

	Lowlands	Foothills	Orange River Valley	Mountains	Lesotho
Cattle	0.5	0.6	0.4	0.7	0.5
Sheep	0.8	0.8	1.3	4.6	1.6
Goats	0.5	0.9	1.2	1.8	1.0
Poultry	0.9	0.9	0.7	0.7	0.8

Table 3: Food Production in Lesotho According to Area, In 200 lb x 1000 Units (extracted from 1970 Agricultural Census)

	Lowlands	Foothills	Orange River Valley	Mountains	Lesotho
Maize	343	196	53	146	738
Sorghum	270	240	75	43	628
Wheat (winter)	362	54	3	--	419
Wheat (summer)	-	60	9	148	217
Peas	15	6	1	28	50
Beans	21	16	2	1	40

Food Production Per Capita (lbs. per person per year)

	Lowlands	Foothills	Orange River Valley	Mountains	Lesotho
Maize	170	140	103	140	151
Sorghum	135	170	145	41	130
Wheat	175	80	24	140	130
Peas	7	4	2	27	10
Beans	10	11	4	1	8

Table 4: Crop Statistics, 1950-1972

Crop Production (Metric Tons in Thousands)	1950	1960	1970	1971	1972
Maize	214	121	67	121	64
Sorghum	49	54	57	78	59
Wheat	50	58	58	76	57
Peas	8	12	5	5	4
Beans	1	1	4	4	3

Sources: Agricultural Censuses 1950, 1960 and 1970 and data provided by the Lesotho government.

A World Bank Country Economic Report - Lesotho: A Development Challenge. October, 1975.

Eighty-five percent of the population derives significant income from agriculture. Grain production satisfies about 80% of domestic demand. About 55,000 tons of grain are imported annually, and two-thirds of these are milled maize products (11).

The lowlands, comprising one-fourth the area of the country, are inhabited by 50% of the population who produce most of the agricultural crops. Mixed farming takes place in the foothills, which includes 30% of the Lesotho population. Twenty percent of the population is occupied with herding in the mountain regions.

All land is nationally owned and plots are distributed to households. Over the past 20 years there has been a decrease in the amount of fertile land per household. Severe land erosion, inadequate farming practices and overgrazing have helped to diminish the small proportion of arable land (about 13%) (11).

Although there are a large number of livestock, little cash income is derived from them, particularly in the lowlands where cattle are held for investment purposes (11).

1.6 NUTRITION PROGRAMS

The Government of Lesotho has many well-coordinated nutrition programs. A Permanent Bureau of Nutrition was established in the 1960's to coordinate food and nutrition activities.

The Ministry of Agriculture has a Nutrition Division which is staffed with nutritionists and home economists. These trained professionals conduct demonstrations and hold village-level courses on nutrition. Nutrition education is provided by the Ministry of Health as part of the formal training of health personnel, and by the Ministry of Education in the curriculum of certain schools.

Lesotho receives food aid donated from two major sources, the World Food Program (WFP) and the Catholic Relief Services (CRS), totalling U.S. $8.3 million annually. The United States is the major donor of these foods. The World Food Program operates three major projects totaling $6.1 million annually in donated foods. Of these, $3 million funds a program for 200,000 primary and preschool children. CRS assists in the distribution of food valued at $2.2 million (obtained from USAID and other donors) in programs for 50,000 preschoolers at 70 health facilities. CRS also sponsored a Food for Work program during 1974-75, administered by the Department of Community and Rural Development, reaching 75,000 workers with approximately 300,000 dependents. The Save the Children Fund (SCF) assists the Government in feeding 100,000 children at over 950 schools during each three month quarter. Save the Children Fund is also involved in other school food-related activities such as the building of school kitchens and gardens (9).

In December, 1975, the first Lesotho National Nutrition Conference was held to discuss nutrition policy, planning, implementation and monitoring of nutrition programs. Several ministries and voluntary agencies involved with food production, distribution and consumption were represented (13). At that meeting, it was decided that a comprehensive assessment of the nutritional profile of Lesotho was required to ultimately establish specific objectives and methods of implementation and follow-up for nutrition programs.

The needs were outlined as follows:

1. A national nutrition survey
2. A consumer and household survey
3. An agricultural survey
4. A trader survey and food channel examination from a retailer's perspective
5. An industrial organization study of the food channels from an importer's and wholesaler's perspective.

The Government of Lesotho requested assistance from the UCLA Nutrition Assessment Unit for the national nutrition survey. The National University of Lesotho and Planning Assistance, an international voluntary organization which provides technical support for nutrition planning, were asked to assist in the remaining items. All of these projects were under the direction of the Central Planning Office, Lesotho (13).

1.7. HEALTH PROBLEMS

The Ministry of Health has identified Lesotho's major health problems as tuberculosis, venereal diseases, gastroenteritis and typhoid fever. Malaria and schistosomiasis do not occur in Lesotho. The major causes of infant and child mortality are respiratory and intestinal diseases, often associated with protein-calorie malnutrition. Childhood diseases of measles and whooping cough cause concern (9).

1.8. HEALTH SERVICES

Lesotho has 17 general hospitals, approximately 110 clinics and dispensaries, a mental hospital and a leprosarium (9). The mental health care is considered among the best in Africa. Each district hospital has a mental observation unit with 16-20 beds.

The Private Health Association of Lesotho (PHAL) was formed in 1974, to coordinate various non-government health services within the country. Additionally, the Lesotho Flying Doctor Service which was organized in 1968, visits 11 mountain clinics regularly (19).

"Compared with other developing countries in Africa, Lesotho is relatively well endowed with health facilities. There are, however, serious imbalances between the services available in the urban and rural areas".[1]

[1]Kingdom of Lesotho Second Five Year Development Plan, 1975/6 - 1979/80, Vol. 1, page 193, 1976.

Table 5: Selected Health Data, 1969 and 1974

Item	Number 1969	Number 1974	1974 Item By Population
Hospitals	19	19	1:63,000
Hospital Beds	1700	2106	1:570
Doctors	35	50	1:24,000
Nurses (Employed)	233	333	1:3600
Public Health Nurses		11	1:110,000
Health Inspectors		7	1:170,000

Source: Kingdom of Lesotho, Second Five Year Development Plan, Volume 1, 1975/6-1979/80, Table 13.1, p. 196.

Table 6: Development Expenditures: First Plan Period (in Rand)

	Plan	(%)	Actual	(%)
Hospital Development	695,000	(84)	235,000	(52)
Rural Facilities	90,000	(11)	71,000	(16)
Other	45,000	(5)[1]	147,000	(32)[2]
Total	830,000	(100)	453,000	(100)

Sources: For 1970/71-1972/73, A comparison between planned and actual investments undertaken by Lesotho Government, Central Planning Office, October 19, 1975. For 1973/74 and 1974/75, Ministry of Finance, Revenue and Expenditure Accounts, Part 2, Capital Account.

[1]Central Pharmaceutical laboratory.

[2]All but R 10,000 for the development of a drug stockpile, a program not originally included in the five year plan.

Two Five Year Development Plans were focused on the growth and refinement of health services. The First Five Year Development Plan (1971-75) emphasized the improvement and expansion of medical services (See Table 6).

The Second Five Year Development Plan outlined health facility improvement priorities with emphasis on preventive services in the rural areas. This would be accomplished by establishing maternal-child health, immunization, sanitary and training programs, as well as additional health clinics (Table 7).

Table 7: Projected Development Expenditures: Second Plan Period (In Rand)

Hospital Development	1,200,000	(34%)
Rural Facilities	1,250,000	(35%)
Training Facilities	600,000	(17%)
Drugs and Vaccines	500,000	(14%)
Total	3,500,000	(100%)

Source: A Review of the Health Sector of Lesotho by the American Public Health Association, 1975 from data from Central Planning Office, Maseru.

1.9 PREVIOUS NUTRITIONAL STUDIES

The problem of undernutrition in Lesotho was reported as early as 1948, when Whitworth found that the average Mosotho child was three years behind the average London child in both height and weight (15). A WHO nutrition survey from 1956-1960 was conducted throughout 29 villages in eight of the nine districts of Lesotho (15). Results of that survey were as follows:

1. Over 30% of all children aged 2-20 years were three or more years retarded by height.
2. Over 30% of all children were underweight for age.

These estimates were based on a comparison with Institute of Nutrition, Central America and Panama (INCAP) data(11). The height compares with that of a "normal" child for the same age and the weight estimates for these children under 75% of "normal" expected weight for the same age.

3. The prevalence of obvious goiter was 15-20%, based on WHO classification Grades II and III. This was more prevalent in adolescents and adults than in young children.
4. The prevalence of pellagra was quoted as 15% of the total population during October to February (15).
5. The mean calorie intake for children age 1-15 years was approximately 75% that of "normal" and protein 70% of "normal" (based on INCAP reference). Most of the protein intake came from poor biological sources such as maize. The mean caloric intake of adult males was 75% of normal, whereas that of protein was normal. For adult females, the mean for calories and protein was normal, apart from lactating mothers where the intake was 60% of normal for both calories and protein.
6. The mean hemoglobin value for 50 children aged 1-10 was approximately 14.5 gm % and for 50 aged 11-20 years was 14.2 gm%. The mean iron intake of children and adults was normal.

Recommendations from that survey included a strengthening of agricultural and public health services and nutrition education within Lesotho, as well as a salt iodization program to counter iodine deficiency and goiter. Many of these programs have been implemented.

In 1966, a representative from WHO reported that the main nutritional problem was general undernutrition (16). At that time, concern was raised about the strong dependency on imported foods.

Health clinic data of 1968, showed that almost 20% of all visits during January were related to malnutrition in some form. By August, this rate dropped to 10%. The proportion of all clinic visits for gastrointestinal infection corresponded closely with that of malnutrition (17).

A Pilot Survey on Population and Food Consumption was conducted in May, 1973, by the Bureau of Statistics with UNFPA and FAO assistance. The mean consumption of calories and protein for 150 households appeared normal. A larger scale National Survey is planned before 1980 (18).

A nutrition study in Quthing District reported in 1976 that fewer children aged 1-5 years regularly attending a clinic where food was distributed were undernourished (according to arm circumference criteria), compared with children of the same age from an area where there was no clinic (19).

2. GOALS AND OBJECTIVES

The overall goal of the Lesotho National Nutrition Survey is to provide baseline information about the nutritional status of young children and their mothers which can be used in determining policy and priorities for the planning and administration of applied nutrition activities.

The specific objectives of the survey were to:

1. Provide an estimate of the nutritional status of young children and their mothers throughout Lesotho and from this derive an indication of the general nutritional status of the entire population.
2. Compare the nutritional status in selected areas so that program priorities can be determined.
3. Provide information about important associations between nutritional status and other factors, such as diet, socio-economic status and other demographic information.

This report considers:

1. Prevalence of acute and chronic protein-calorie malnutrition (PCM) in children under five years and their mothers.
2. Prevalence of anemia.
3. Prevalence of pellagra in women.
4. Duration of breast feeding and age weaning foods introduced.
5. Association of nutritional deficiencies with household, family and child characteristics.

3. METHODOLOGY

There are three sub-areas within methodology: logistics and personnel, survey items and data preparation. This section primarily identifies survey items which included interview data, anthropometric measurements, clinical observations and laboratory tests. Survey team members visited homes to conduct the survey interviews, measurements, observations and tests. Appendix 5 contains a description of logistics and a list of personnel.

The assessment of the nutritional status of a defined population includes both direct and indirect methods (20). Direct methods in this survey included anthropometric measurements, hemoglobin estimation and observations of clinical signs of edema, pellagra rash and goiter. These were used to determine the prevalence of malnutrition in children and their mothers. Indirect methods were used to obtain information related to nutritional status. These included interview questions about demographic, dietary and health characteristics of the index child and family. The index child is a child included in the survey.

The survey forms and detailed explanations of measurement techniques and equipment are in Appendix 4, Methodology and Procedures. The following is an explanation of survey items and data preparation.

3.1 SURVEY ITEMS DESCRIBING PREVALENCE OF MALNUTRITION

The survey of households randomly sampled from the entire country included the following items to indicate the prevalence of protein-calorie malnutrition, anemia, pellagra and goiter.

Anthropometry

Weight, height or length (for children unable to stand) and arm circumference were measured on all children under five years of age.

Height and arm circumference of mothers were measured. Triceps fatfold was measured on about half of the children and their mothers.

Hemoglobin Estimation

Capillary blood was obtained, using the finger prick method, and collected in Unopettes. A total of 290 blood samples were collected.

The cyanomethemoglobin method was used to determine hemoglobin. Readings were done on a Coulter Counter Hemoglobinometer at the Ministry of Health (WHO assisted) laboratory in Maseru.

Clinical Signs

Every mother was examined for clinical evidence of the following conditions:

1. Pellagra - An obvious rash with well-defined edges on the exposed surfaces of the body such as neck and forearms.
2. Goiter - Swelling of the thyroid using a modification of the WHO classifications (6). See Appendix 4.

Every child was examined for clinical evidence of kwashiorkor. This was determined by testing for the presence of bilateral pedal edema by applying firm thumb pressure on the dorsum of the feet and observing whether pitting occurred.

3.2 OTHER SURVEY ITEMS

The following items were used to provide information relating to nutritional status:

Child Characteristics

Child's Age - determined by one or more of the following: birth record, clinic record, parent record or calendar of events.

Milk Teeth Count - was used to verify ages that were suspected of being grossly incorrect.

Child care - the primary person currently caring for the child.

Clinic attendance - during the past month for any reason.

The following three items applied to children 12-36 months of age at the time of the interview:

Speech - age at which a child spoke his first meaningful word or phrase.

Standing or walking - ability to stand or walk was observed in subsample children.

Grasp - using Bailey Blocks to determine how a child grasped a small block of wood (21).

Household and Family Information

The following information was obtained about the household:

Occupation of household head

Relationship of household head to index child

Number of other household workers in South Africa

Household size - defined as those who regularly eat meals together in the household.

Possession of cattle, sheep and goats in the subsample households only

The following information was obtained about the family:

Occupation and place of work of the father, mother and/or household head

Presence, absence or death of the parents with or without contribution. A contribution is food or money given to the family within the past six months. "Absent" means continuously away for more than six months. For detailed explanation, see Appendix 4.

The following information was obtained about the mother:

Approximate age

Ability to read Sesotho tested by a simple reading passage

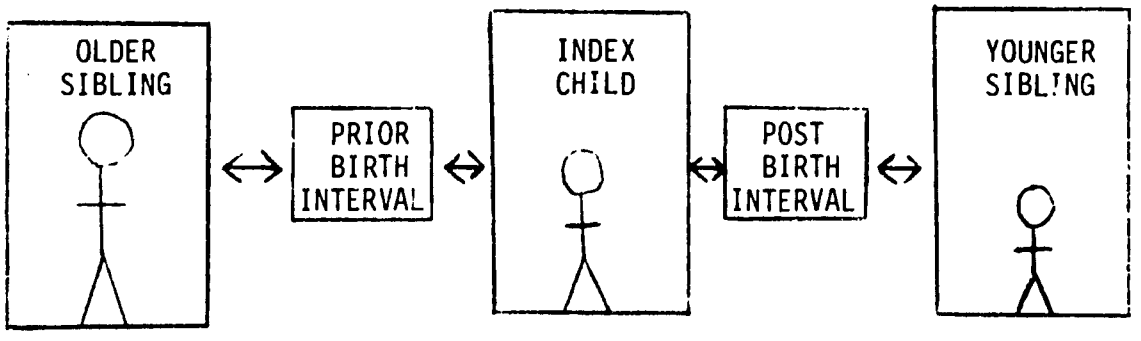
Current pregnancy status

Birth order of children born alive

Total number of live births

Number of children now alive

Birth interval - used by subtracting dates for the end of consecutive pregnancies, one of which is the index child. (See diagram on next page).



Milk Availability

Duration of breastfeeding - all children under three years old.

Sources of milk (breast, own farm, market or shop, clinic and/or none) - all children under five years. More than one source could be recorded.

Food Availability

The age weaning foods were first given - all children under three years of age.

The source of food (home, clinic, school, none or other) - all children under five.

Qualitative Dietary Recall

Food intake information was obtained from interviews. The person questioned was usually the mother of the child. The dietary recall was performed on every fifth child in the sample. A total of 293 families who were interviewed comprised the sample.

The index child's consumption of "basic foods" (i.e. breast milk, other milk, moroho--dark green leafy vegetables, maize, wheat, sorghum) was assessed using a modified 24-hour recall method. The mother (or caretaker) was first asked what the child ate the day before the interview. After checking her responses with the list in Form II (Appendix 4), the interviewer then asked the mother if the child ate each of the Basic Foods (e.g. "Did your child eat moroho?").

"Protein-rich foods" are defined as foods containing a high proportion of protein derived from animals and vegetables, such as poultry/meat, fish, eggs and peas/beans. The index child and family's consumption of "protein-rich foods" assessed using a modified three-day recall questionnaire method. The interviewer first asked the mother if the family had eaten any of the "protein-rich foods". Then the mother was asked if the index child had eaten any of the same foods. This was done to compare those foods reportedly eaten by the family with the child's food. This diet assessment method was easily learned by the interviewer and was rapidly completed in the field.

Although it is a "protein-rich" food, for the purposes of this report, milk has been included in the "basic food" group This should be noted for all discussions regarding protein-rich foods.

3.3 DATA PREPARATION AND ANALYSIS

At the completion of each sample site team members and respective supervisors reviewed survey forms for clarity and completeness. A special team further checked and began coding the forms in Maseru. In Maseru, a graphic method was used to obtain a provisional result for prevalence rates of malnutrition, according to certain areas of the country.

The original forms were taken to UCLA for editing, coding and key-punching prior to analysis on an IBM 360 computer at the Health Sciences Computing Facility. Copies of the survey forms were left with the Government of Lesotho.

The core system of FORTRAN subroutines for anthropometric analysis was obtained from the Center for Disease Control in Atlanta, Georgia, USA and included in the basic program structure at UCLA. These subroutines including reference standards were used for all height for age, weight for age and weight for height indices. The reference values in Appendix 3 were used for the other indices.

4. SURVEY DESIGN

A valid estimate of the prevalence of malnutrition requires:

1. A well defined universe.
2. A sample which is statistically reliable and representative of this universe.
3. An objective, quantifiable definition of malnutrition (see "Indices of Malnutrition.")

4.1 SURVEY UNIVERSE

The universe included the entire population of Lesotho (1.2 million), based on the preliminary results of the 1976 Population Census (Table 9).

The Bureau of Statistics, Maseru, delineates geographic areas within Lesotho as lowlands, foothills, Orange River Valley and mountains. These zones have been used in various Government studies, such as the 1970 Agricultural Census.

This survey followed the same ecological area delineation, with modifications identical to those developed by Planning Assistance for conducting a food and market survey done in mid-1976. Both surveys were designed in consultation with the Bureau of Statistics, Lesotho. These modifications are outlined in Table 8.

Table 8: Areas Delineated Within Lesotho

Study	
1970 Agricultural Census	1976 Food and Market Survey 1976 National Nutrition Survey
Lowlands	Urban Lowlands Rural Lowlands
Foothills	Foothills
Orange River Valley Mountains	Mountains

Table 9: Provisional Population Estimates - Lesotho 1976

Ecological Area

District	Lowlands Urban	Lowlands Rural	Foothills	Mountains	Total
Butha Buthe	2659 (0.2)*	51167 (4.3)	43103 (3.6)	6618 (0.6)	103547 (8.7)
Leribe	9199 (0.8)	91316 (7.7)	54351 (4.6)	24197 (2.0)	179063 (15.0)
Berea	7525 (0.6)	79820 (6.7)	50041 (4.2)	620 (0.05)	138006 (11.6)
Maseru	46121 (3.9)	98064 (8.2)	51487 (4.3)	71424 (6.0)	267096 (22.4)
Mafeteng	4570 (0.4)	96428 (8.1)	47996 (4.0)	-	148994 (12.5)
Mohales Hoek	1948 (0.2)	65667 (5.5)	25625 (2.1)	25387 (2.1)	118627 (10.0)
Quthing				88941 (7.5)	88941 (7.5)
Qacha's Nek				75392 (6.3)	75392 (6.3)
Mokhotlong				72380 (6.1)	72380 (6.1)
Total	72022 (6.0)	482462 (40.5)	272603 (22.9)	364959 (30.6)	1192046 (100.0)

*Parentheses indicate percentage of total country population estimate.

For this survey, the lowlands were divided into two strata, urban and rural. The urban areas consisted primarily of the capital city of Maseru, but included larger towns within districts in the lowlands. Urban areas contain only 6% of the total population of Lesotho and the employment, trade and socio-economic conditions in these towns are different from the rest of the country. The lowlands are uniformly about 5,000 feet above sea level. Economic and other features of the lowlands depend largely on their proximity to Maseru as well as to the Republic of South Africa. About half of the population of Lesotho is in the urban and rural lowlands.

In this report the term "rural children" are all children surveyed in the mountain, foothill and rural lowland areas. The term "rural lowland" or simply "lowland" refers to those children in the rural lowland areas.

The foothills lie between the lowlands and the mountains, and do not include the valleys within the mountain ranges.

The mountains comprise the most remote area of Lesotho, accessible in many parts only by airplane or horse. In this survey the Orange River Valley was included in the mountain group although it has some features similar to the foothills. In general, the geographical differences between the ecological areas could not be clearly defined. For example, some parts of the lowland region have features that resemble the foothills. Moreover, many of the nine political districts of Lesotho include lowland, foothill and mountain areas.

Special Group

A group of 296 children up to five years of age were measured in their homes in Upper and Lower Thamae and Moshoeshoe II areas of Maseru town, to serve as a special group. These areas were not part of the Lesotho universe already described. Most of these were children of government workers and were considered to have a reasonable degree of nutrition and health care. They provided a basis of comparison with the rest of Lesotho. Measurements done on the special group of children included height or length, weight, arm circumference and triceps fatfold.

4.2 SAMPLING

Selection of Sample Sites

The selection of sites was greatly influenced by time and logistic considerations and the Lesotho government's request to coordinate results of this survey with the food and market survey administered by Planning Assistance (PA). These conditions were presented to the Bureau of Statistics who designed the sampling method. It was decided to visit the same areas (but not necessarily the same households) to enable linkage of useful information from both surveys. As a result of advice from the Bureau of Statistics, it was determined that this survey would include all 19 enumeration areas selected in the Food and Market survey. These areas had been selected using a random start and fixed sampling interval within each ecological area.

For this survey, a total of 60 enumeration areas were required. An enumeration area (EA) was a compact geographic area of about 1000 people for rural areas, and 3,500 people in urban areas, as derived from the population census. An EA was the primary sampling unit and the complete list of EAs for Lesotho was the sampling frame.

To increase the number of EAs from the 19 initially selected to the required 60, two steps were taken. First, a smaller sampling interval than that used in the Food and Market Survey was used within each ecological area. For the urban, lowland and foothill areas, the sampling interval for this survey was one-fourth that of the Food and Market Survey and for the mountains one-eighth of the sampling interval (Table 10). In this way a total of 88 EAs were initially selected: the 19 EAs from the Food and Market Survey plus an additional 69 EAs which resulted from decreasing the sampling interval. Second, from the added 69 EAs a total of 41 were selected by simple random sampling within each ecological area. Thus the total of EAs required comprised those 19 automatically selected from the prior survey together with the 41 from the residual 69 primary sampling units.

Table 10: Number of Enumeration Areas According to Description and Ecological Area

Description	Ecological Area: Lowlands Urban	Lowlands Rural	Foothills	Mountains	Lesotho
Total EAs	21	350	254	397	1020
Food and Market Survey (FMS)	3	10	3	3	19
Fraction of Sampling Interval	1/4	1/4	1/4	1/8	
Initial No. of EAs (1)	12	40	12	24	88
No. EAs automatically Selected (2)	3	10	3	3	19
Remainder (3)	9	30	9	21	69
No. Sampled from Remainder (4)	7	11	7	16	41
Total Sampled (5)	10	21	10	19	60
Total Visited	10	21	10	17*	58

(1) Obtained by dividing FMS no. by fraction of sampling interval.
(2) The same as the No. of EAs from FMS.
(3) (1) minus (2).
(4) Simple random sampling
(5) (2) plus (4).

*Three of these mountain sites were visited later. Their results were subsequently included in this report.

The total number of sites selected in each ecological area was determined by having approximately 30 sites from the urban and non-urban lowlands and 30 from the foothills and mountains. Proportionally more sites were selected from the urban areas to make a large enough sample so that a separate urban description was possible.

Simple random sampling was done so that additional EAs could be selected from the remaining 69 primary sample units if time permitted, particularly in those ecological areas where a larger sample size might be required. Due to time constraints and logistic considerations, it was not possible to determine how many sites could be visited prior to the beginning of the survey. The enumeration areas and villages sampled and visited are listed in Appendix 2.

Sampling Within Each Selected EA

In each selected EA, the Bureau of Statistics enumerated (by village and household) all children under five years of age, using recent data from the Population Census of 1976. These children were grouped in clusters of 15 each and two clusters were randomly selected for each EA visited. This grouping of two clusters in an EA was defined as a survey site. This method was considered by the Bureau superior to a single cluster of 30 children and feasible within each EA. The household heads of the residences of the children in the selected clusters were listed.

Teams were instructed to begin at one of the identified households in the cluster and visit as many households on the list as were available. The 15 children for each cluster usually came from households in close proximity to each other. The procedure was repeated in the second cluster for the EA for the next 15 children. Thus the total number selected in each EA was 30 children.

Inferences

For the sample method chosen, it was determined that a minimum of 30 sample sites, each with 30 children for a total sample size of 900 is required (see Appendix 2). This sample is sufficient to provide precision estimates (estimates of variation between sample sites) for each ecological area or combination of areas, as shown in Appendix 1.

A list of areas to be described, with the number of sites of 30 children or two clusters of 15 is as follows:

Urban	10 sites
Lowlands	21 sites
Foothills	10 sites
Mountains	14 sites
Lowlands, foothills and mountains	45 sites
Foothills and Mountains	24 sites

5. INDICES OF MALNUTRITION

5.1. ANTHROPOMETRIC INDICES FOR PROTEIN-CALORIE MALNUTRITION IN CHILDREN

The focus of this survey was to quantify malnutrition in young Basotho children via use of anthropometry. The nutritional condition resulting from a deficiency in protein and/or calories utilized by the body, is called protein-calorie malnutrition (PCM)(23). Children with PCM have a low weight or height for their age (20) and thus, anthropometric measurements can be used to indicate the presence and severity of PCM. Throughout the report, anthropometric measurements indicate that a child might have PCM, but do not necessarily diagnose PCM.

Reference Values

An "optimal" weight or height is represented by the median values in a population where there is little or no PCM. Such a well-nourished population, also called a reference or elite group, can consist of children from industrialized areas of the world or from the best nourished groups of African children (24). Unlike adults, young children with different ethnic origins but similar socio-economic backgrounds have similar body measures (1).

Internationally available reference median values for body measures are used in this survey to represent a level where the likelihood or risk of the presence of PCM is extremely small (2). The further the body measure (such as weight or height) is below this reference median level, the greater is the risk of PCM.

Reference data for height and weight for this survey were derived from large, representative studies recently completed in the U.S.A. This was recommended by the National Academy of Sciences (NAS) Committee on Nutrition Advisory to the Center for Disease Control, U.S.A. in 1974. The reference populations included children up to 24 months from middle to upper socio-economic status families and those aged 2-6 years from a nation-wide study in the U.S.A. (48, 49).

Index Level of High Risk for PCM

A certain percentage of the reference value is selected as a point below which the risk of the child having PCM is high. The basis of this selection is discussed later in this section. For example, for a child below 90% of the reference median height for age, the likelihood of PCM is high for that age.

As a hypothetical example, if one thousand children of the same age with reasonable health were measured, the height of the median (five-hundredth ranked) child would be used as a "median reference." Then a certain percentage of his measurments would be used as cut-off reference point values. For example, 90% of his height for age would be used as a cut-off. Children measured in this survey with height for age lower than 90% of the reference child's height for age would be considered at high risk for chronic PCM.

Duration of PCM

In this survey, when body measurements are done at only one point in time, it is still possible for certain measures to indicate the presence of acute or chronic PCM. For example, the weight for height index can be used to identify acute PCM and the height for age index that of chronic PCM.

Acute PCM (also termed "acute undernutrition" or "recent body wasting") is a nutritional deficiency of recent onset of usually a few weeks to a few months. The highest prevalence occurs in times of famine (25).

Chronic PCM (also termed "chronic undernutrition" or "stunting") is a deficiency with a prior onset of at least six months. The highest prevalence occurs with a long-term deficit of food (calories and/or protein), often combined with persistent or recurrent ill health (20).

5.2 SPECIFIC ANTHROPOMETRIC INDICES AND THEIR INTERPRETATION FOR CHILDREN

The median values for height and weight of the reference population are described and tabulated in Appendix 3, pp.140-146 . These values are the median values. In this report, 90% of the median values are used to indicate high risk for PCM.

Weight for Height

The weight of a child is the sum total of all body tissues, whereas height measures only the body skeleton. During an acute period of nutritional deficiency, there is a reduction of muscle and fat, but not bone. This results in a reduction of weight, but height is not affected. The relationship between weight and height alters so that the weight for height ratio is reduced. After a recovery period when weight is restored, the weight for height returns to "normal" (26,27).

In this survey weight for height is used to gain knowledge about acute PCM (recent body wasting), based on the principle that a child of a certain height has an expected "normal" weight (26,27). This index is independent of precise age, thus it is particularly useful when exact ages are difficult to determine (28).

Height for Age

As a result of frequent episodes or a prolonged period of undernutrition, the height or length of a child will fail to increase in the normal way. Short stature can be the end result, which may be considered an indication of chronic PCM (stunting). Thus, the proportion of short children in a population gives an estimate of the prevalence of chronic PCM.

In this survey the height for age index compares the height of the child with that expected for a normal or reference child of the same age. This index, unlike weight for height, requires a precise estimate of age, particularly for very young children.

Weight for Age

The weight of an individual measured repeatedly over a period of time, will indicate the onset and duration of protein calorie malnutrition (29). In a single prevalence weight measurement of a population however the weight for age index does not distinguish between the acute protein calorie malnutrition (recent body wasting) and the chronic form (stunting).

For example, using the weight for age index alone, it is not possible to determine whether a child with low weight for age is tall with body wasting or short and well-proportioned. Combinations of weight for height and height for age overcome this problem.

Weight for Height and Height for Age

The weight for height index estimates acute PCM (wasting) and height for age estimates chronic PCM (stunting). Because these two indices represent different durations of the child's nutritional history, the presence of absence of wasting or stunting may be linked for each individual child (26, 27). One of four possible categories can be described: normal, wasting, stunting, wasting and stunting (Table 11). For example, a child with normal weight for height and a low height for age would be at risk for stunting only.

Table 11: Combined Weight for Height and Height for Age Indices

Nutritional Status	Nutritional Index	
	Weight for Height*	Height for Age**
Normal	Normal	Normal
Wasting	Low	Normal
Stunting only	Normal	Low
Both Wasting and Stunting	Low	Low

*Weight for Height

Normal: 80% or more than reference median weight for height.

Low (wasting): Less than 80% of reference median weight for height.

**Height for Age

Normal: 90% or more than reference median height for age.

Low (stunting): Less than 90% of reference median height for age.

Indices Derived From Arm Measurements

These include measurements of arm circumference and triceps fatfold. Both are performed on the upper arm which consists mainly of muscle and fat. The interpretation of results from these measures is different than that for weight and height, which includes all body tissues. There are three arm measurements: arm circumference for age, arm circumference for height, and triceps fatfold for age.

A key clinical sign for undernutrition is thin limbs (20). Arm circumference quantifies arm bulk, and hence more definitively describes muscle and fat on a single site of the body than weight measurement alone. The weight for height index may not always detect changes in soft tissue bulk, resulting from chronic PCM. The expected or normal relationship of weight to height may be restored after an acute episode, when food intake increases. This increase does not have to reach a normal level. This is because a child might not grow in height as rapidly, and then if he does not gain much weight (muscle and fat) it will not be easily detected in a weight for height measurement (25).

The arm circumference for age measurement is useful because in young children there is a good correlation between the mid-upper arm circumference and weight for age measurements (30). Arm circumference in well nourished children increases rapidly during the first year of life. It does not change significantly between 1-5 years of age; and therefore precise age is not essential to evaluate arm bulk in this age range (28). Hence it is a useful screening measurement for protein-calorie malnutrition when precise age is not known. Arm circumference for age was used on this survey because ages were carefully determined for other measures and children under one year were included.

Arm circumference for height, like weight for height, is independent of precise age. Results have a similar interpretation as arm circumference for age.

The triceps fatfold for age measurement is important in conjunction with the arm circumference to indicate the proportionate amount of fat in the arm circumference and thereby estimate total body caloric storage. Subcutaneous fatfold measures correlate well with overall body fat (31). Fatfold is difficult to measure reliably; therefore results should be interpreted cautiously.

Interpretation of Children's Indices

Indices are based on internationally available reference median values. A list of these sources and the actual values are presented in Appendix 3. These reference values do not constitute a specific "standard" of ideal nutrition; but simply compare the results from populations with reasonable health and nutrition backgrounds (2). No reference information is available for Lesotho, thus outside sources are required.

For each index value, a single value was predetermined below which there was a high risk of the child having PCM. This value or cut-off point is based on a percentage of the reference median according to age (or height). In general, this cut-off point corresponds to the first to third percentile level of the reference distribution. This means that any result below the cut-off point is equivalent to the lowest 1-3% of the reference population.

Experience in Africa indicates that the cut-off points selected for this survey are suitable for estimating the presence of PCM in young children. Such studies include weight for age (32), weight for height (25), height for age (33), arm circumference for height (34) and fatfold for age (35). The cut-off points according to the percentage of medians and percentiles, with their interpretations are listed in Table 12.

Table 12: Anthropometric Indices in Young Children

INDEX	CUT-OFF POINT REFERENCE VALUE % MEDIAN	PERCENTILE*	INTERPRETATION**
Height for Age	90%	1st	Chronic Protein-Calorie malnutrition (PCM)
Weight for Height	80%	3-5th	Acute PCM - mod/severe
	85%	5th-10th	Acute PCM - mild/moderate
Weight for Age	80%	3rd	Combination Acute/Chronic PCM
Arm-Circum. for Age	82.5%	3rd	Arm Soft Tissue Wasting
Fatfold for Age	60%	3rd	Fat Wasting-Low Calorie Reserve

*In the reference population this is the approximate percentile, due to some variation according to age.
**Interpretation of a value below the cut-off point percent median of reference; for example, a child with under 90% of the reference median for Height for Age is very likely to have chronic PCM.

Throughout the report percentage prevalence rates for PCM are presented. A prevalence rate for a particular index is the proportion of children who fall below the cut-off point compared with the total number of children, expressed as a percentage.

The selection of a single cut-off point for a description of PCM allows comparisons between areas of the country and selected groups. It also permits investigation of associated factors, such as occupation of household head associated with PCM in children.

The values above the cut-off point are interpreted as "normal" in the sense that the risk of undernutrition is less than for the values below. Obviously, those above the cut-off point represent a broad spectrum from borderline high risk of undernutrition to normal to overnutrition.

It should be noted that distributions of index values according to percentage ranges of the reference median are also included in this report This is particularly useful to estimate "borderline" values. For example, the 90-92.5% of median reference height for age quantifies those children who are very close to a high at-risk level for chronic PCM. This estimates the number who may fall below the cut-off point of 90% if unfavorable environmental changes occur which commonly result in a worsening of nutritional status.

Overnutrition resulting in overweight and obesity also needs to be considered. Overweight was predetermined in this survey as over 120% weight for age (95th percentile of reference population) or over 120% weight for height (97th percentile) (36). Obesity was defined as over 120% triceps fatfold for age (90th percentile).

5.3 MATERNAL ANTHROPOMETRIC MEASURES

For the purposes of this survey, maternal age was categorized according to three groups: under 20 years, 20-40 years and over 40 years. This took into account the variation of expected anthropometric results of adolescent and older women according to age. Since most mothers were twenty to forty years, results are presented for those mothers only, unless otherwise indicated.

Indices include, with cut off points:

Table 13: Anthropometric Measures for Mothers

	Cut-Off Point	Significance
Height	less than 150 cm (or 5 ft.)	Short
Arm Circumference	less than 23 cm	Undernutrition
Fatfold (triceps)	less than 7.5 mm	Low calorie reserve

Obesity in mothers was defined as having an arm circumference of greater than 35 cm. or triceps fatfold larger than 25 mm (4). Gross obesity was defined as a fatfold of more than 35 mm.

Height

A maternal stature of less than five feet may be considered sufficiently short to be associated, at least to some degree, with short stature in the woman's child. Maternal height alone is less useful than that of both parents, but is acceptable when only the mother is available. Correlation between the height of mother and child could suggest important genetic factors and/or the affect of the environment on growth (37). The nutritional significance of short stature in women is not nearly as clear as for young children, although it may reflect her nutritional status as a child. The choice of the cut-off point for maternal height of five feet, a level used in parts of Africa, has an added value in obstetric interpretations, in that a shorter woman is decidedly at risk for obstructed labor due to small pelvis (38).

Arm Circumference

An arm circumference of 23 cm corresponds to 80% of the reference value for adult women and has been used to provide an estimate of undernutrition in other countries (3).

Triceps Fatfold Thickness

The triceps fatfold cut-off point of 7.5 mm is the value for the third to fifth percentile value for adult black women in the U.S.A. (4). This value is approximately 40% of the reference median triceps fatfold. A value below this does not necessarily mean undernutrition, but does suggest a lack of caloric reserve and low fat stores in the body.

Survey results for adult fatfold should be interpreted with the utmost caution, as this measurement was the most difficult to standardize.

5.4 CLINICAL SIGNS

Children

Kwashiorkor was diagnosed by the presence of bilateral pedal edema. Edema was determined by the occurence of pitting as a result of thumb pressure on the dorsum of the feet. Kwashiorkor is a much more severe form of acute PCM than the levels described by anthropometry in this report.

Mothers

Pellagra was diagnosed by the presence of a well defined rash on exposed skin surfaces such as the neck and the back of the hands (20).

Goiter was determined by a visible neck swelling in accordance with a modification of the WHO classification (6).

5.5 HEMOGLOBIN

The presence of anemia was determined according to the WHO reference for hemoglobin levels below which a young child was considered anemic: 10.0 gm/100 ml for children aged 6-24 months and 11.0 gm/100 ml for those aged 2-5 years. Allowances were made for high altitudes. For each survey result, 0.2 gm/100 ml was deducted for each increment of 2,500 feet above sea level (5).

6. SURVEY RESULTS AND ANALYSIS

6.1 INTRODUCTION

Format of Survey Results

Survey results are generally presented in the form of a description and table, followed by a discussion within each major section. Tables usually indicate the percentage result for each variable followed by the sample size (n).

Weighting

When ecological areas are combined all results are weighted according to the population proportion in each area, unless otherwise stated. The percentage estimates for the whole of Lesotho are calculated by the following formula:

$$\bar{P}\ (\text{Lesotho}) = \bar{P}\ (\text{Urban}) \times 0.060 + \bar{P}\ (\text{Lowland}) \times 0.405 + \bar{P}\ (\text{Foothill}) \times 0.220 + \bar{P}\ (\text{Mountain}) \times 0.306$$

where $\bar{P}$ is the percentage result and each weight is the ratio of the area population to that of Lesotho; e.g. urban area ratio is 0.060.

Comparison of Results

As well as presenting results for the whole Lesotho sample, comparisons of results have been made between ecological areas of the country as well as between certain groups (subsets) within the sample. These subsets include age and sex.

The following are outlines of such comparisons:

- Subsets within the national estimate; e.g. nutritional status of Lesotho by sex.

- Subsets between individual or combined ecological areas; e.g. urban vs. rural Lesotho, urban and lowland vs. foothill and mountain, urban vs. mountain areas.
- Subsets within or between ecological areas; e.g. nutritional status by age according to areas (comparing results of 6-24 with 25-60 month age group in foothill/mountain area or comparing 6-24 month in urban vs. 6-24 month old in the rural areas.

In addition to a national description, it is useful to study prevalence and association data for areas and groups within the country.

Criteria for Comparing Prevalence Estimates

These criteria depend on the extent of the percentage difference and the sample size of each area or group described. The extent is based on a relative as well as an absolute scale such that a result of 10% vs. 20% shows a more meaningful difference than 40% vs. 50%. In general a difference of at least 5% is required to merit attention. A difference of 5% might still be statistically non-significant, because of inadequate sample size.

The smaller the sample size, the less the precision (the greater the variation within the area or group described), so that an estimate of the prevalence has a greater variability around the "true" prevalence.

6.2 AGE AND SEX DISTRIBUTION OF SAMPLE

Age of Child

The age distribution was similar throughout all areas of the country as well as the special group in Maseru. In Lesotho, the weighted estimate for children 12-23 months old was 25.3% and for children 48-60 months old was 14.6%.

Table 14: Age of Child

	Urban	Lowlands	Foothill	Mountain	Lesotho	Special
<2 months	0.7	1.3	0.0	0.4	0.7	1.0
2-5	6.3	6.5	7.0	6.1	6.5	5.1
6-11	12.9	13.7	13.5	11.7	13.0	13.3
12-23	25.9	24.3	23.2	28.2	25.3	24.1
24-35	21.7	19.3	17.5	24.3	20.6	22.4
36-47	18.9	19.7	20.9	17.8	19.3	20.8
48-60	13.6	15.2	17.9	11.5	14.6	13.3
Total	100%	100%	100%	100%	100%	100%
n	286	618	297	511	1712	294

Sex of Child

With the exception of the urban areas, there were more females than males in the sample. The weighted mean for all areas was 54% female and 46% male.

Table 15: Child's Sex

	Urban	Lowlands	Foothill	Mountain	Lesotho	Special
Male	52.4	46.0	45.8	43.8	45.7	44.9
Female	47.6	54.0	54.2	56.2	54.3	55.1
Total	100%	100%	100%	100%	100%	100%
n	286	618	297	511	1712	294

Age of Mother

Of all mothers measured, based on weighted totals, 5.6% were under twenty years of age, 87.0% were between twenty and forty years of age and 7.4% were over forty. The proportion of pregnant women in the total sample was approximately 10%.

Determination of Child Age

Clinic records which included the date of birth of the child were available for about half of the children. Another frequent method for finding age was via a statement by the person interviewed, usually the mother. Only about 5% had a birth record available. A local calendar of events was used about 20% of the time, particularly in the rural areas. (This calendar is in Appendix 4). More than one method was used for each child, hence the total percentage exceeds 100%.

Table 16: Percentage Distribution of Methods for Determining Age

	Urban	Lowlands	Foothill	Mountain	Lesotho	Special
Birth Record	7.0	5.3	4.7	4.3	5.0	10.5
Clinic Record	52.5	41.4	53.2	43.2	45.3	46.6
Calendar	0.4	11.3	22.2	32.5	19.6	0.0
Parent's Record	15.4	5.7	1.0	12.5	7.3	0.0
Stated	38.8	71.2	51.9	55.4	60.0	44.9
n	286	618	297	511	1712	294

Discussion

The age group 0-1 month is not represented by this survey because very few neonates were presented at the interview. Thus, this group is excluded from the results. In the 1966 census, the proportion of infants (under 12 months of age) to children 1-5 years was about 20%. The findings in this survey are similar.

The apparent greater proportion of children selected in the 12-23 month age group compared with those in later age groups might be explained by the following:

1. Selective presentation or availability of these children to the interviewer
2. Actual demographic pattern
3. Error in age determination

No data on age distribution by year are available for children under five years of age in Lesotho.

Only those mothers in the 20-40 year old age group are included in the results for body measurement. The results for younger and older mothers are much more difficult to interpret.

All of the above methods of age determination were considered reliable. The age stated by a parent may be the most questionable source, however, it was accepted in most instances. Basotho parents have a relatively high literacy rate and often take particular care to remember birth dates of their children. Where there was no birth record, clinic or parents record, stated age was verified by using a local calendar of events, and/or by counting milk teeth or by other means, such as comparison with another child who had a documented date of birth.

The importance of determining the correct date of birth was stressed throughout the survey. Most of the children's anthropometric indices require precise age to estimate the presence of protein-calorie malnutrition.

During the final editing of completed forms, 30 (2% of the total) were excluded from the results because the age of the child was questionable. Criteria for exclusion were based on extreme measurement results which relied on age, (such as height and weight for age) in addition to a gross discrepancy between teeth count and stated age. An example was a child with a stated age of six months and 20 teeth present.

6.3 HOUSEHOLD CHARACTERISTICS

A total of 1285 households were visited during the survey. Three-fourths of these households had one index child, the remainder had two or more children under five years measured in the survey.

Information elicited during the interview concerned the household head, occupation of father, mother and other household members, household size, status of father and mother, person caring for the child and ability of the mother to read Sesotho.

Person Interviewed

About four-fifths of the people interviewed were mothers of the index child. When the mother was absent, usually the grandparent was interviewed.

Table 17: Person Interviewed By Relationship to Index Child

	Urban	Lowlands	Foothill	Mountain	Lesotho
Mother	64.9	76.1	79.5	81.0	77.7
Father	1.1	1.0	0.7	1.2	1.0
Grandparent	24.3	18.2	15.2	13.9	16.5
Aunt/Uncle	5.2	3.4	4.4	3.1	3.7
Other	4.5	1.3	0.2	0.8	1.1
Total	100%	100%	100%	100%	100%
n	268	614	297	511	1690

Household Size

The mean household size was 6.0 for urban areas and 5.6 for rural areas. Urban areas had the highest proportion of households consisting of ten or more people (12%) compared with other areas (5.5-6.0%).

Sex of Household Head

In the urban sample, 20% of all household heads were female; in each other area approximately 15% were female.

Table 18: Sex of Household Head

	Urban	Lowlands	Foothill	Mountain	Lesotho
Male	79.9	85.9	86.9	84.1	85.2
Female	20.1	14.1	13.1	15.9	14.8
Total	100%	100%	100%	100%	100%
n	204	448	214	397	1263

Relation of Household Head to Index Child

For the rural areas, the father was the household head in approximately 65-70% of the households while the mother was the household head in 5% of the households. A grandparent (usually the grandfather) was the household head in approximately 25% of all households surveyed.

Father's Occupation

In rural areas over 63% of the fathers were miners. The number of fathers who were farmers in the lowlands (9%), and the foothills (13%) was noticeably less than in the mountains (22%). In urban areas, fathers' occupations included civil servants (27%), professionals (12%) and sales and production (26%).

Table 19: Father's Occupation

	Urban	Lowlands	Foothill	Mountain	Lesotho
Farmer	5.5	9.3	12.6	22.3	13.8
Miner	28.8	68.9	75.3	67.1	67.4
Other	65.7	21.8	12.1	10.6	18.8
Total	100%	100%	100%	100%	100%
n	146	386	182	350	1062

Father's Place of Work

About three-fourths of the fathers in rural areas and one-third in urban areas worked in the Republic of South Africa (RSA). In the mountain areas one-fourth of the fathers worked in their own villages which was more than in the other areas.

Table 20: Father's Place of Work

	Urban	Lowlands	Foothill	Mountain	Lesotho
Own Village	7.1	11.5	12.9	23.6	15.3
RSA	34.4	75.0	78.7	71.8	72.4
Other	58.5	13.5	8.4	4.6	12.3
Total	100%	100%	100%	100%	100%
n	154	392	178	351	1075

Mother's Occupation

Over 90% of mothers in rural areas were housewives and in urban areas, 73% of mothers were housewives. Of the 27% in urban areas who were not housewives, the occupation of the mother included that of civil servant (6% of total), domestic help (5%), professional (6%) and salesperson (6%).

Mother's Place of Work

Almost all of the mothers (approximately 90%) surveyed in the rural areas worked in their own villages whereas only half of the mothers in the urban areas worked in the same locale. The other half of urban mothers worked elsewhere, usually in the district or national capital. Very few mothers worked in the Republic of South Africa.

Table 21: Mother's Place of Work

	Urban	Lowlands	Foothill	Mountain	Lesotho
Own Village/ Own Urban Locale	49.0	87.8	93.4	94.8	88.9
RSA	4.0	3.2	3.3	0.9	2.6
Other	47.0	9.0	3.3	4.3	8.5
Total	100%	100%	100%	100%	100%
n	194	442	213	394	1243

Number of Households With Members Working in RSA

Half of the urban households and 71-85% of rural households had at least one member working in the Republic of South Africa. For the country, one-fifth of all households had at least two members working in RSA.

Table 22: Total Number of Workers From Household in RSA

	Urban	Lowlands	Foothill	Mountain	Lesotho
None	50.0	20.9	15.4	25.9	22.9
At least 1	50.0	79.1	84.6	74.1	77.1
At least 2	15.2	20.0	23.8	19.5	20.4
n	204	450	214	401	1269

Status of Father and Mother

The status of the parent was defined as their presence or absence in the household. Overall, 81% of fathers were present or "absent with contribution"; this was less (71%) for urban households. Contribution means giving income to the household within the last six months. Of all fathers absent from rural households almost 75% contributed, whereas this proportion was less than 50% for urban households.

For Lesotho, 93% of all mothers were present in the household, 4% were absent with contribution, 2% absent and under 1% dead (table not included). A complete explanation of "status" appears in Appendix 4, "Form Clarification."

Table 23: Father's Status

	Urban	Lowlands	Foothill	Mountain	Lesotho
Present	59.2	59.6	59.0	53.9	57.5
Absent, Contributing	11.7	23.1	19.6	29.6	23.9
Absent	13.4	10.6	8.7	9.8	10.1
Dead	4.5	4.6	8.3	5.0	5.5
Mother Unmarried	11.2	2.1	4.4	1.7	3.0
Total	100%	100%	100%	100%	100%
n	223	480	229	399	1331

Person Caring for Index Child

In rural areas, 90% of the mothers took care of the index child. In urban areas, 80% of the mothers took care of the index child. Grandparents, principally the grandmother, took care of the children in the rest of the households.

Table 24: Relative Caring for Child

	Urban	Lowlands	Foothill	Mountain	Lesotho
Mother	80.9	87.6	89.9	90.8	88.8
Grandparent	15.2	10.7	9.1	8.6	9.9
Other	3.9	1.7	1.0	0.6	1.3
Total	100%	100%	100%	100%	100%
n	282	615	297	511	1705

Mothers' Ability to Read Sesotho

More than 90% of mothers were able to read Sesotho. A smaller percentage of mothers in the mountain areas read Sesotho.

Table 25: Mother Reads Sesotho

	Urban	Lowlands	Foothill	Mountain	Lesotho
Yes	90.9	95.3	94.4	84.8	91.6
No	9.1	4.7	5.6	15.2	8.4
Total	100%	100%	100%	100%	100%
n	132	361	178	322	993

Discussion

The quality of information obtained from interviews was assumed to be generally correct for the following reasons: four out of five persons interviewed were mothers and the others usually grandmothers of the index child; the interview was conducted in Sesotho, which was spoken and understood throughout the country; and, most of the interviewers were women.

The social structure of the household appeared somewhat different in the urban and rural areas. In the urban areas, one out of five household heads were women; which is more than in the rural areas. Furthermore, 13.6% of all urban mothers were unmarried, compared with 5.5% in the other areas. When the mother was unmarried, the father was not usually present.

It should be noted that only households which had at least one child under five years of age present at the time of the visit were included in the survey. It is not known whether the demographic characteristics of these households differ from households without young children.

Approximately 70% of fathers from rural areas worked in the Republic of South Africa (almost all as miners) and 3% of mothers worked in RSA. This compares with a prior report of 60% of the male and 10% of the female labor force working in RSA (9).

Three-fourths of all households in Lesotho had at least one worker in RSA and one-fifth at least two in RSA. About two-thirds of the absent fathers were contributing to their family's household in Lesotho.

The mountain area has special demographic features which must be considered when planning programs for that area. One-sixth of the mothers cannot read Sesotho, so programs should not be fully contingent on that ability. In the mountain area, one-fourth of the fathers are farmers, a much greater proportion than in other areas. Mountain dwellers often have less access to goods and services, which is partially reflected in their child mortality rate which is nearly double that of other areas. (See page 80 for a more complete description.)

Demographic characteristics of the urban areas also stand out. Especially important results include: a higher proportion of unmarried mothers; more mothers working outside their own village; a greater proportion of mothers not taking care of their young child; a high proportion of both fathers (66%) and mothers (27%) earning income within Lesotho; and more fathers absent without contribution than in other areas. It should be noted that 60% of the urban sample was within greater Maseru town.

6.4 NUTRITIONAL STATUS OF CHILDREN

Prevalence of Protein-Calorie Malnutrition in Lesotho

Table 26 lists the prevalence rates for various types of PCM in Lesotho compared with the special group in Maseru, for children under five years of age. Methods for deriving these rates are fully discussed in the section,"Indices of Malnutrition."

Table 26: Prevalence of High Risk for PCM in Lesotho

Type of PCM	Lesotho (W)*	Special Group
Chronic PCM	22.7%	11.3%
Acute PCM		
Moderate to Severe	1.1%	0.0%
Mild to Severe	3.4%	1.0%
Arm Wasting	4.2%	1.0%
Underweight	22.0%	5.8%
	n 1621	293

(W)* By weighted average

Discussion

A prevalence rate of 22.7% for chronic PCM (height for age less than 90% of reference median) suggests that more than one in five young children in Lesotho were at high risk for having chronic undernutrition and below their full growth potential.

A rate of 3.4% for acute mild to severe PCM (weight for height less than 85%) implies that recent onset of PCM affected relatively few children. A similar rate, 4.2% for arm wasting (arm circumference for age less than 82.5%) supports the conclusion for acute PCM.

The rate for underweight children (weight for age less than 80%) was similar to that for chronic PCM. Children were smaller than expected but well proportioned by total body size.

Comparison of results for Lesotho with those of the special group shows dramatic differences in rates of chronic PCM and underweight for age. This implies that given a more favorable environment similar to that of the special group, the nutritional status of the Basotho young child population might greatly improve over time, approaching that of the special group.

The low rates for acute PCM and arm wasting could be explained by the fact that the survey was conducted during October and November, a time of the year when there was still a relative food sufficiency and the annual "hungry season" from January to April had not yet begun. The prevalence of acute PCM might be much higher during that season than as shown in the results obtained by this survey.

The growth of children up to five years of age might also be considered in terms of mean values for age ranges (Figures 1 and 2). The growth rate is not as great after 10 months of age for Basotho children.

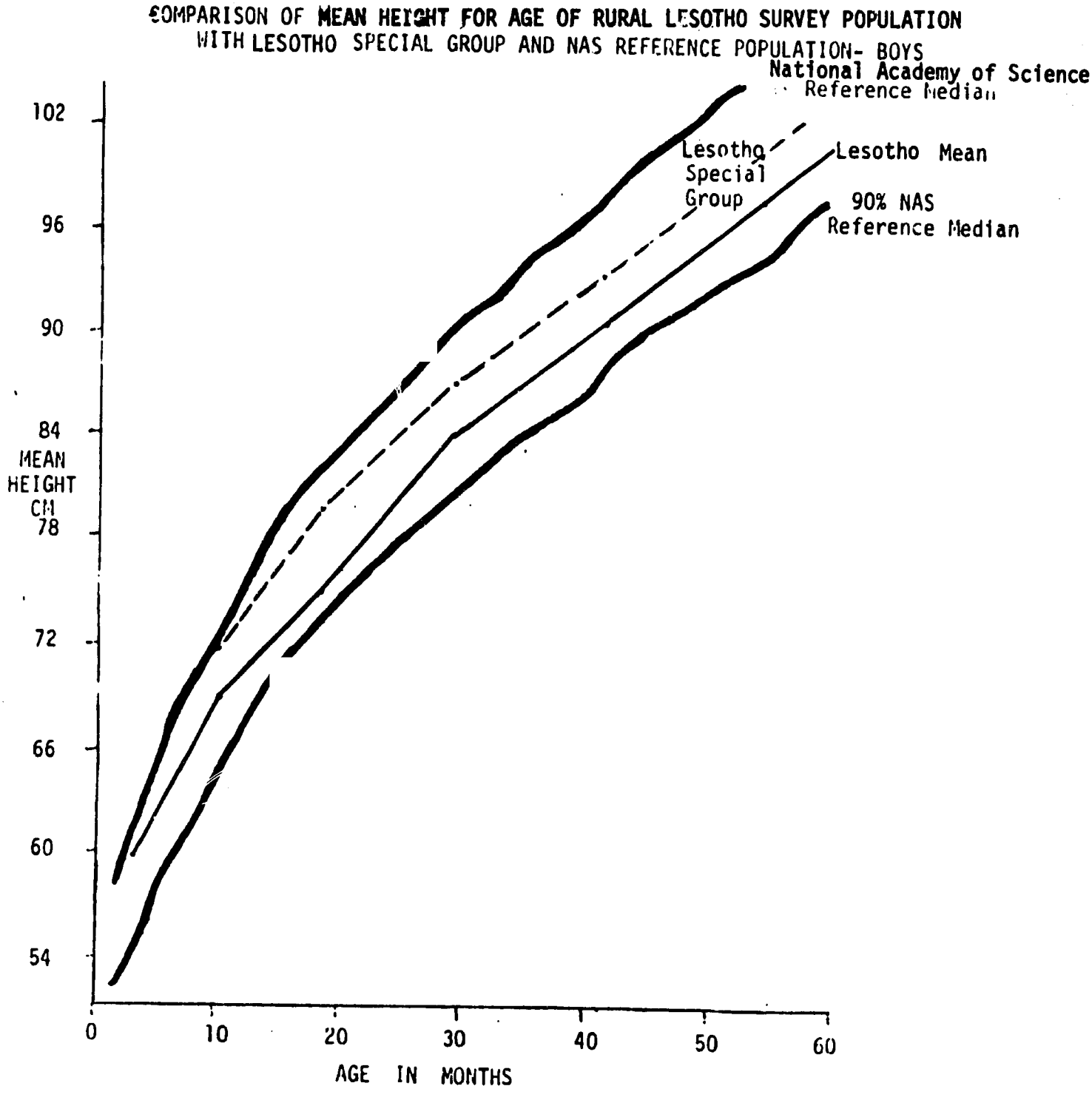


Figure 2

For National Academy of Science, see Appendix 3, pp. 143-146.
For Lesotho Special Group explanation, see p. 34.

COMPARISON OF MEAN HEIGHT FOR AGE OF RURAL LESOTHO SURVEY POPULATION
WITH LESOTHO SPECIAL GROUP AND NAS REFERENCE POPULATION- GIRLS

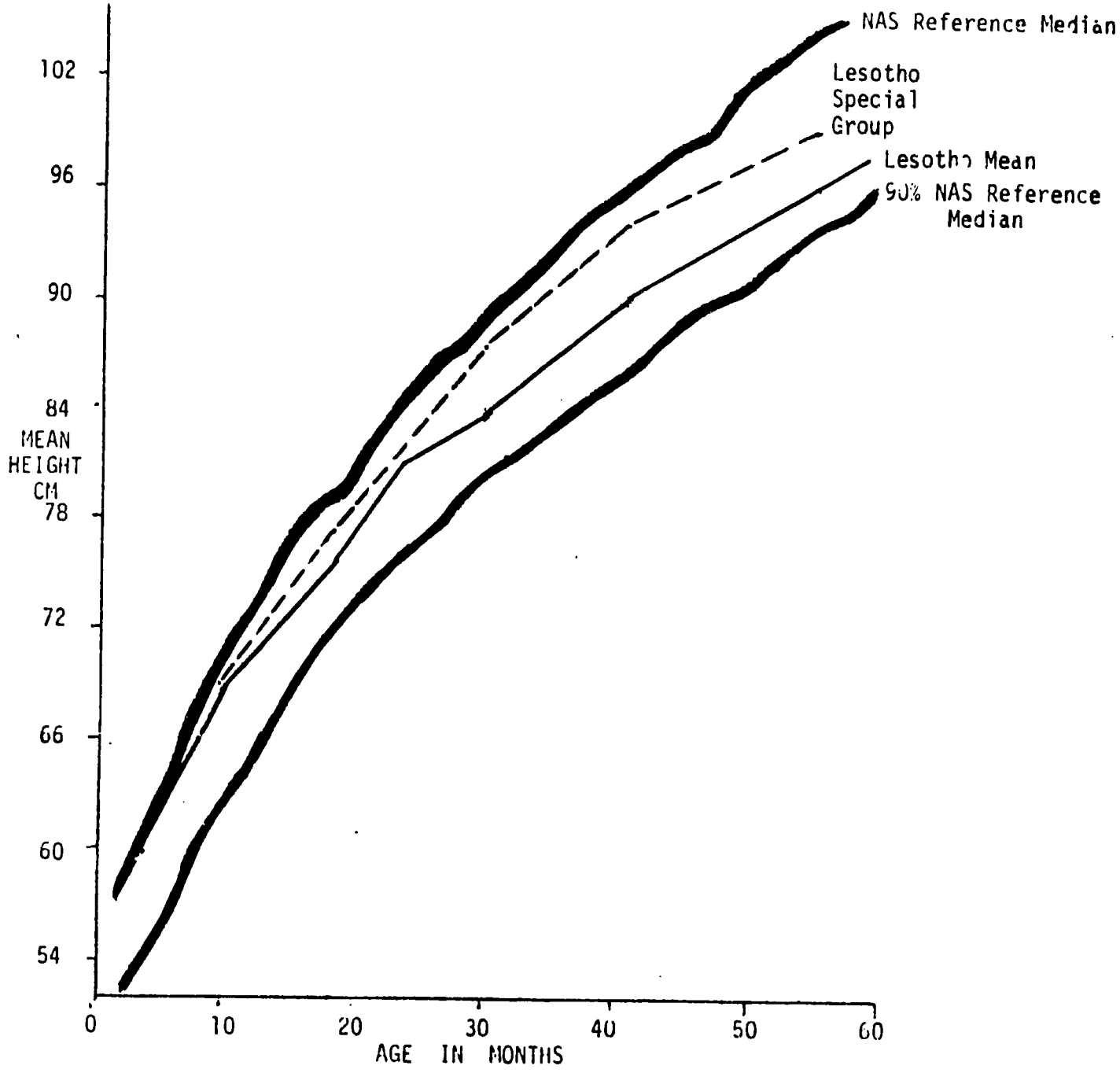


Figure 2

6.5 ANTHROPOMETRIC INDICES ACCORDING TO PERCENTAGE DISTRIBUTIONS

It is important to examine the frequency distribution of reference anthropometric indices for a more complete profile of nutritional status of young children in Lesotho. Figures 3, 4, and 5 illustrate such distributions for indices including height, weight and age for the Lesotho sample of young children aged 6-60 months according to sex.

The height for age histogram (p.63) shows a peak in the distribution for males at 90-92.5% and for females at 92.5 -95% of the reference median value. It should be noted that about 50% of all male and 40% of all female children had a height for age less than 92.5% reference. Few children are over the reference level of 100%.

The weight for height histogram (p.64) shows a broad peak for both sexes from 90-105% reference median value. Regarding weight for age, the peak for both sexes ranges from 80-95% of reference median value.

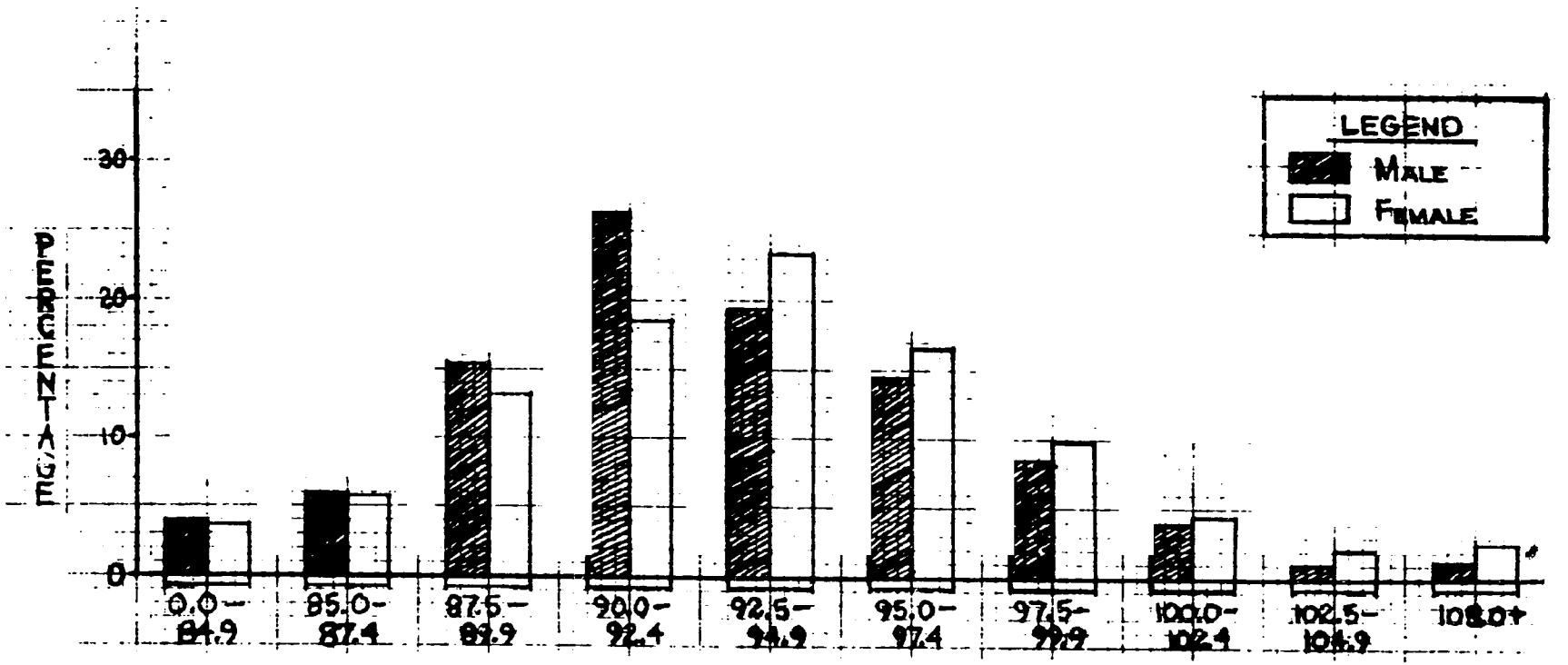
Discussion

Males,as a group, were shorter in stature than females in the sample within the 6-24 month age range.

Table 27: Percentage Frequency of Height for Age Under 90% Reference Median by Age and Sex

Age	Sex		
	Male	Female	n
6-24 months	23.1	16.5	655
25-60 months	27.0	27.3	847
6-60 months	25.3	22.6	1502

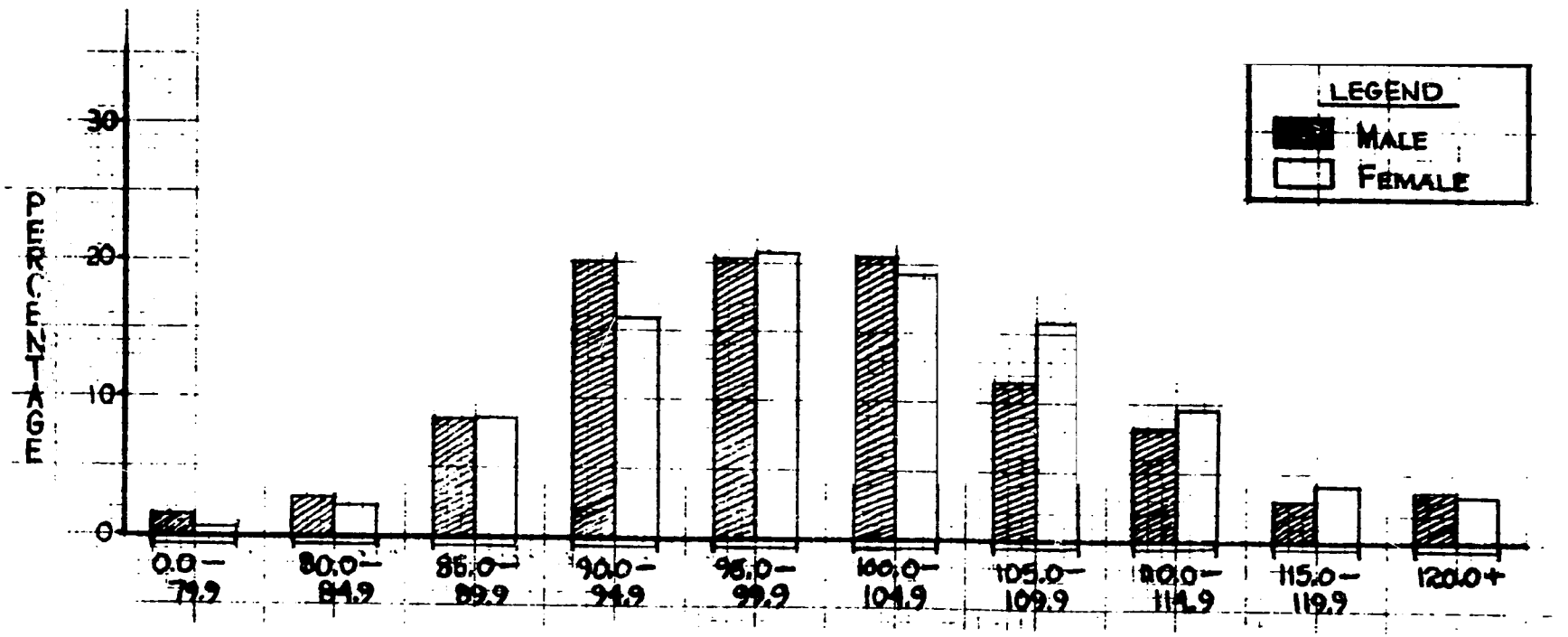
The relatively high proportion of children in the height for age histogram from 90-92.5% reference, should be considered as a borderline group very close to the defined cut-off point of high risk for chronic PCM. It is likely that the factors in the environment influencing the development of chronic PCM are only marginally better for this group than those at high risk (under 90%). The same consideration may apply to children underweight for age and underweight for height.



Ht./Age in Percentages of Reference Median Value

FREQUENCY DISTRIBUTION OF HEIGHT FOR AGE BY SEX - LESOTHO

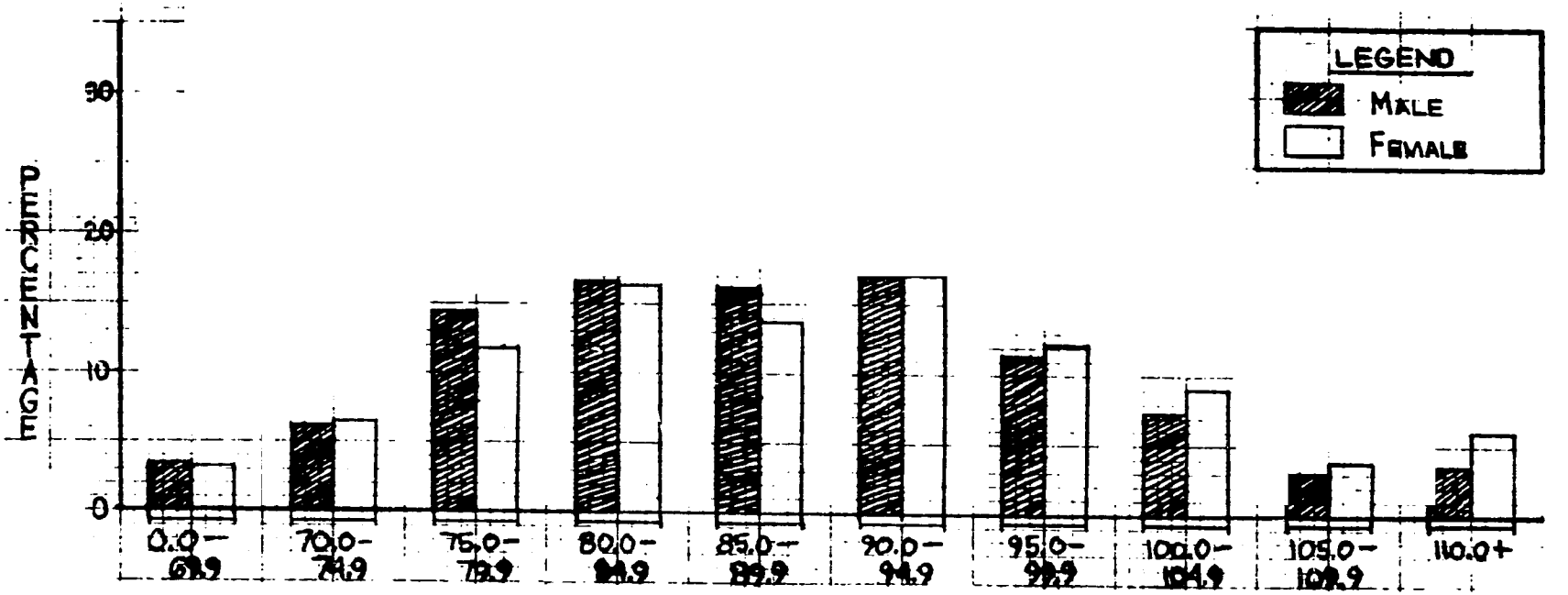
Figure 3



Wt/Ht in Percentages of Reference Median Value

FREQUENCY DISTRIBUTION OF WEIGHT FOR HEIGHT BY SEX - LESOTHO

Figure 4



Wt./Age in Percentages of Reference Median Value

FREQUENCY DISTRIBUTION OF WEIGHT FOR AGE BY SEX - LESOTHO

Figure 5

Table 28: Percentage Frequency Distributions According to Reference Values

Lesotho ages 6-60 months

Percentage ranges of reference median Height for Age

Sex	0-89.4	85-87.4	87.5-89.9	90-92.4	92.5-94.9	95-97.4	97.5-99.9	100-102.4	102.5-104.9	105+	Total	n
Male	3.9	5.0	15.4	26.2	19.3	14.6	8.5	3.9	1.0	1.2	100.0	690
Female	3.7	5.8	13.1	18.5	23.3	16.7	9.9	4.3	2.1	2.6	100.0	812
Group												
Special	1.1	4.0	5.8	12.0	18.5	18.5	18.9	11.3	4.4	5.5	100.0	275
Urban	4.1	2.3	11.7	17.3	24.2	18.5	9.1	7.2	3.0	2.6	100.0	265
Rest	3.8	6.1	14.3	22.3	21.4	15.6	9.2	3.9	1.5	1.9	100.0	1237

Percentage ranges of reference median Weight for Height

Sex	0-79.9	80-84.9	85-89.9	90-94.9	95-99.9	100-104.9	105-109.9	110-114.9	115-119.9	120+	Total	n
Male	1.5	2.8	8.5	20.0	20.4	20.6	11.3	8.2	3.0	3.7	100.0	681
Female	0.5	2.2	8.6	15.9	20.8	19.3	15.8	9.5	4.1	3.3	100.0	804
Group												
Special	0.0	1.1	4.4	8.8	15.8	19.9	26.5	14.3	5.9	3.3	100.0	272
Urban	1.9	2.7	6.9	16.8	16.0	20.3	16.0	9.5	4.6	5.3	100.0	262
Rest	0.9	2.4	8.7	17.8	20.9	19.9	13.7	8.8	3.5	3.4	100.0	1223

Percentage ranges of reference median Weight for Age

Sex	0-69.9	70-74.9	75-79.9	80.0-84.9	85-89.9	90-94.9	95-99.9	100-104.9	105-109.9	110+	Total	n
Male	3.6	6.2	14.5	16.7	16.2	17.3	11.4	7.4	3.1	3.6	100.0	683
Female	3.3	6.5	11.8	16.4	13.8	17.2	12.2	9.0	3.8	6.0	100.0	805
Group												
Special	0.8	2.2	2.9	9.2	13.2	16.1	13.9	15.0	12.8	13.9	100.0	273
Urban	3.4	2.7	11.0	13.3	14.8	19.4	8.8	12.5	4.2	9.9	100.0	263
Rest	3.4	6.6	13.2	16.7	14.9	17.2	12.0	8.0	3.4	4.6	100.0	1225

6.6 NUTRITIONAL STATUS OF BASOTHO CHILDREN BY AGE

Results for anthropometric indices are presented by age for the whole country. This is done to indicate whether the prevalence of PCM is related to age groups within the total range of children up to five years old.

Height for Age

Few children under one year were less than 90% of reference height for age. There was a sharp increase at 12-23 months to a prevalence rate of 25%. From 24-59 months this rate tended to remain the same.

Table 29: Percentage with Low Height for Age

	Age in Months						
	2-5	6-11	12-23	24-35	36-47	48-59	Total
H/A (<90%)	5.0	11.6	24.1	28.6	26.5	27.3	22.7
n	101	210	413	333	314	232	1603

Weight for Height

Very few children under 2-5 months were underweight for height, although there was a relatively high percentage overweight at that age (18.8%). The percentages for all other age groups were low, and there was a decreasing trend for both under and overweight as the children approached five years.

Table 30: Percentage Under and Over Normal Weight for Height

	Age in Months						
Weight for Height	2-5	6-11	12-23	24-35	36-47	48-59	Total
Underweight (<85%)	0.3	5.3	3.4	4.1	2.7	1.5	3.4
Overweight (>120%)	18.8	5.3	4.7	3.3	2.1	1.6	4.3
n	99	207	406	332	311	229	1584

Weight for Age

Of children six months or older 20-26% were less than 80% reference weight for age. Children from 2-5 months had the highest prevalence of overweight (7.5%) and the lowest prevalence (4%) of underweight.

Table 31: Percentage Under and Over Normal Weight for Age

	Age in Months						
Weight for Age	2-5	6-11	12-23	24-35	36-47	48-59	Total
Underweight (<80%)	4.0	25.6	25.1	20.2	22.2	23.2	22.0
Overweight (>120%)	7.5	0.2	1.5	0.5	0.1	0.3	1.1
n	102	208	408	332	311	229	1590

Weight for Height and Height for Age Combined

The results for these combined indices showed a relatively high proportion of stunted children compared with wasted children. The percentage of normal children (neither stunted nor wasted) decreased with age. Only 70% were normal in the 24-59 month age range.

Table 32: Percentage Wasting and Stunting by Age

	Index		Age in Months			
Description	Weight for Height	Height for Age	2-5	6-11	12-23	24-59
Wasting and Stunting	< 85%	< 90%	0.0	1.2	0.5	0.8
Wasting	< 85%	> 90%	0.3	4.1	2.7	2.2
Stunting	> 85%	< 90%	5.1	10.4	22.8	26.3
Normal	> 85%	> 90%	94.6	84.3	74.0	70.7
		n	99	207	438	840

Arm Circumference for Age

Few children had a small arm circumference, particularly those 2-5 months of age.

Table 33: Percentage with Low Arm Circumference for Age

	Age in Months						
	2-5	6-11	12-23	24-35	36-47	48-59	Total
AC/A (<82.5%)	1.4	7.0	3.7	4.0	3.5	4.4	4.2
n	104	208	414	330	312	227	1595

Triceps Fatfold for Age

As they become older, more children had a fatfold which was less than 60% reference. There was no consistent pattern in the results for children with obesity as defined by a fatfold over 120% reference. Thirteen percent of children 2-5 months had a high fatfold for age.

Table 34: Percentage with Low and High Fatfold for Age

	Age in Months						
Fatfold for Age	2-5	6-11	12-23	24-35	36-47	48-59	Total
Low (<60%)	3.9	3.8	9.6	6.1	10.0	16.0	9.0
High (>120%)	12.9	2.7	4.9	11.7	7.5	3.8	6.8
n	60	135	265	207	204	147	1018

Discussion

Children aged 2-5 months had the least prevalence of all types of undernutrition. This relates to the protective influence of breast feeding, and the consequent high resistance to infection from maternal antibodies which contributes to an adequate nutritional status. Some of these children were overweight and perhaps obese. The significance of this finding is not clear. It should be noted that there was a small sample for this age group.

From 6-11 months there was an increase in the proportion of children who were stunted and underweight, but not wasted (Tables 29 and 30). The numbers of children with stunting started to reach a peak from 12-23 months of age. It should be noted that these figures reflect the cumulative results of the child's past growth and to a large extent, nutritional history. Both weight and height are affected by episodes of acute infection and underfeeding throughout a child's life. Weight reduction is greater and can be restored more quickly than height deficits. With the cumulation of repeated episodes, the child's height and weight (for age) may become progressively reduced even between such episodes. Weight for height will be relatively normal however, during the interims.

The process which manifests in chronic PCM (or stunting) probably begins around six months of age, increases to a plateau in the second year of life and continues at least until five years of age. Throughout each 12 month interval from 12-23 to 48-59 months, about one-quarter of the children were stunted. It is likely that many children who were already stunted by 12-23 months might have failed to improve in later years. The diminishing prevalence in low weight for height (wasting) over the years suggests that acute episodes of PCM were less common as the child approached five years of age. More children nearing five years had a low fatfold, however, which might reflect increased activity.

6.7 NUTRITIONAL STATUS OF CHILDREN BY ECOLOGICAL AREA AND AGE

Results for the four ecological areas studied are presented by combining urban with rural lowland and foothill with mountain to ensure a reasonable sample size for each group. Results for individual ecological areas are given where considered important.

For all combinations, results were weighted by area according to population proportionality. The results for the combination group of urban and lowland were similar to lowland alone, because of the much higher proportion of population in the lowland area compared with urban, 405,000 vs. 60,000 respectively.

The special group from Maseru is shown separately in each table for purposes of comparison only.

All tables describe the percentage prevalence of the anthropometric index according to the cut-off point listed.

Height for Age

The proportion of children aged 6-24 months with low height for age (stunting) was greater in the foothill and mountain areas than in the rest of the country (22% vs. 17%).

Table 35: Height for Age

Combined Areas	Age Ranges 6-24 Months <90%	n	25-60 Months <90%	n	0-60 Months <90%	n
Urban/Lowland	17.0	361	26.8	472	21.6	898
Foothill/Mountain	22.2	331	27.9	423	23.7	808
Lesotho	19.7	692	27.2	895	22.7	1706
Special	10.5	114	11.2	161	11.3	293

When compared with the other areas the urban areas had the least prevalence of stunting for both age groups. Prevalence of stunting in urban areas still far exceeded that of the special group.

Table 36: Height for Age

Single Areas	Age Ranges 6-24 Months <90%	n	25-60 Months <90%	n	0-60 Months <90%	n
Urban	13.9	115	21.3	150	17.2	285
Lowlands	17.5	246	27.6	322	22.2	613
Foothill	25.2	115	22.4	161	21.9	297
Mountain	19.9	216	32.1	262	24.5	511
Lesotho	19.7	692	27.2	895	22.7	1706
Special	10.5	114	11.2	161	11.3	293

In the age group 2-11 months, differences within Lesotho were more striking. Whereas only 5.4% were stunted in the urban and lowland areas, 13.9% were stunted in foothill and mountain areas.

Table 37: Height for Age

Combined Areas	Age Ranges 2-11 Months <90%	n	12-60 Months <90%	n
Urban/Lowland	5.4	186	24.6	712
Foothill/Mountain	13.9	137	26.0	580
Lesotho	10.2	323	25.8	1292

Weight for Height

The prevalences of low weight for height (acute PCM), and high weight for height (overweight) were low and uniform throughout the country. Results were similar for individual ecological areas also.

Table 38: Weight for Height

Combined Areas	Age Ranges 6-24 Months <85%	>120%	n	25-60 Months <85%	>120%	n	0-60 Months <85%	>120%	n
Urban/Lowland	2.3	5.9	354	3.4	3.9	465	3.0	5.6	883
Foothill/Mountain	6.0	3.5	328	3.4	1.3	423	4.3	3.3	803
Lesotho	3.9	4.6	682	3.0	2.5	888	3.4	4.3	1686
Special	2.7	6.2	113	0.0	1.3	159	1.0	4.8	293

Weight for Age

More children were underweight for age in the foothills and mountains than in other areas. These differences were greater in the 25-60 month age group (Tables 39 and 40).

Table 39: Weight for Age

Combined Areas	Age Ranges 6-24 Months <80%	n	25-60 Months <80%	n	0-60 Months <80%	n
Urban/Lowland	22.9	357	16.3	465	18.7	890
Foothill/Mountain	26.1	328	28.0	423	24.9	803
Lesotho	24.6	685	21.7	888	22.5	1693

The prevalence of low weight for age was lowest in the urban and highest in the mountain areas.

Table 40: Weight for Age

Single Areas	Age Ranges 6-24 Months		25-60 Months		0-60 Months	
	<80%	n	<80%	n	<80%	n
Urban	21.9	114	13.4	149	17.3	283
Lowlands	23.0	243	16.8	316	18.9	607
Foothill	22.8	114	21.7	161	20.7	295
Mountain	28.5	214	32.8	262	29.6	508
Lesotho	24.6	685	22.7	888	22.5	1693
Special	7.0	114	5.0	159	5.8	291

Arm Circumference for Age

The rates for low arm circumference for age were low throughout the country. More children in the urban and lowland areas had a result equal to or greater than the reference value (100%). This was apparent in both age ranges.

Table 41: Arm Circumference for Age

Combined Areas	Age Ranges 6-24 Months			25-60 Months			0-60 Months		
	<82.5%	>100%	n	<82.5%	>100%	n	<82.5%	>100%	n
Urban/Lowland	4.0	32.9	360	2.3	28.5	465	3.0	32.7	893
Foothill/Mountain	5.1	25.3	331	5.5	17.4	420	5.0	23.3	805
Lesotho	4.6	29.0	691	4.1	23.2	885	4.2	27.6	1698
Special	0.9	53.9	115	0.7	50.9	161	1.0	53.1	294

Discussion

There was evidence that nutritional status of children under five years, determined by body measures, was better in the urban areas than in the rural areas. In the urban areas, there was a lower prevalence of child stunting and of underweight for age.

There was also evidence for a lower proportion of children underweight for age in urban and lowland areas than in foothill and mountain areas. For this measure, mountain children had the highest prevalence rate (29.6%). No conclusive differences for stunting prevalence rates between lowland, foothill and mountain areas were found for children under five years of age.

The prevalence for wasting was low in each area.

Stunting and wasting were far less prevalent in the special group in Maseru than in urban and other groups. On the other hand, 14% of the children in the special group were obese (fatfold for age greater than 120% of the reference median) compared with 7% in the urban sample.

6.8 FREQUENCY DISTRIBUTIONS OF ANTHROPOMETRIC INDICES ACCORDING TO ECOLOGICAL AREAS

Figures 6-8 compare nutritional indices by area or group. The special group in Maseru consists of children whose families provide a reasonable degree of health and dietary care. The urban group included Maseru and larger towns in the lowlands which were combined for presentation. The remaining children were from rural lowlands, foothills and mountains.

Height for Age

The children from the special group had the greatest percentage frequency at the 92.5%-100% level of reference height for age, urban children at the 90-97.4% level and rural at the 87.5-97.4% level.

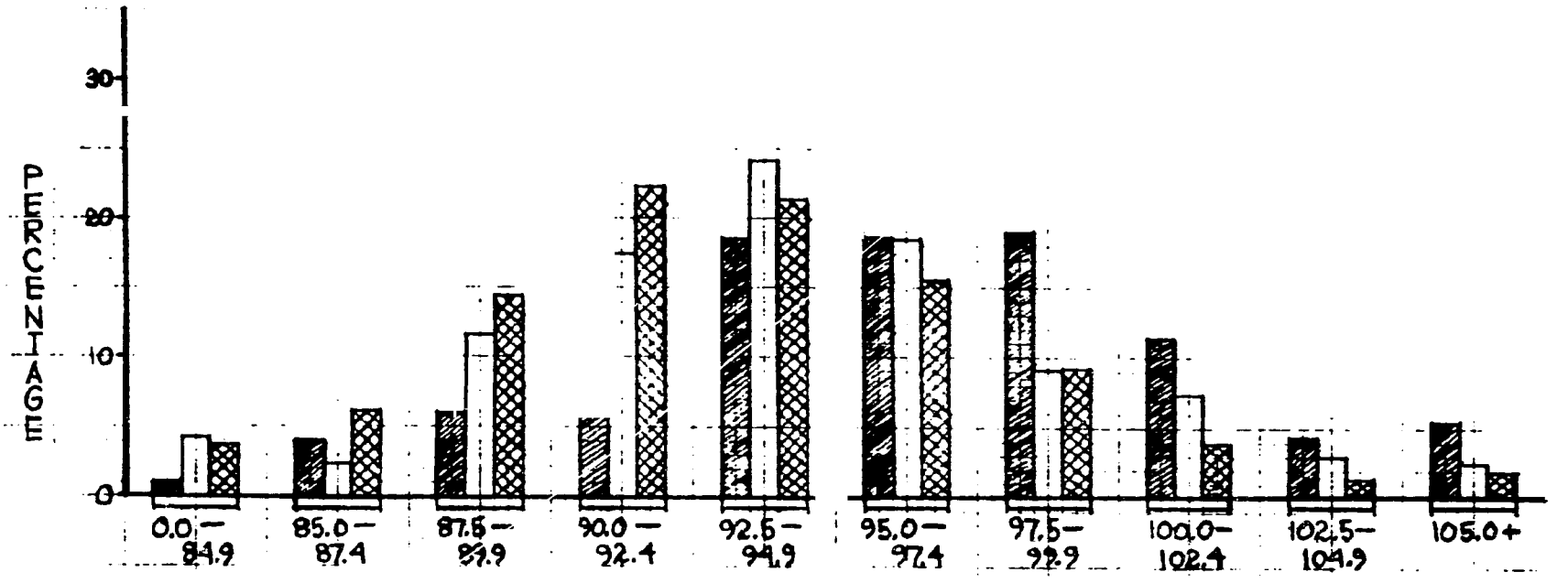
Weight for Height

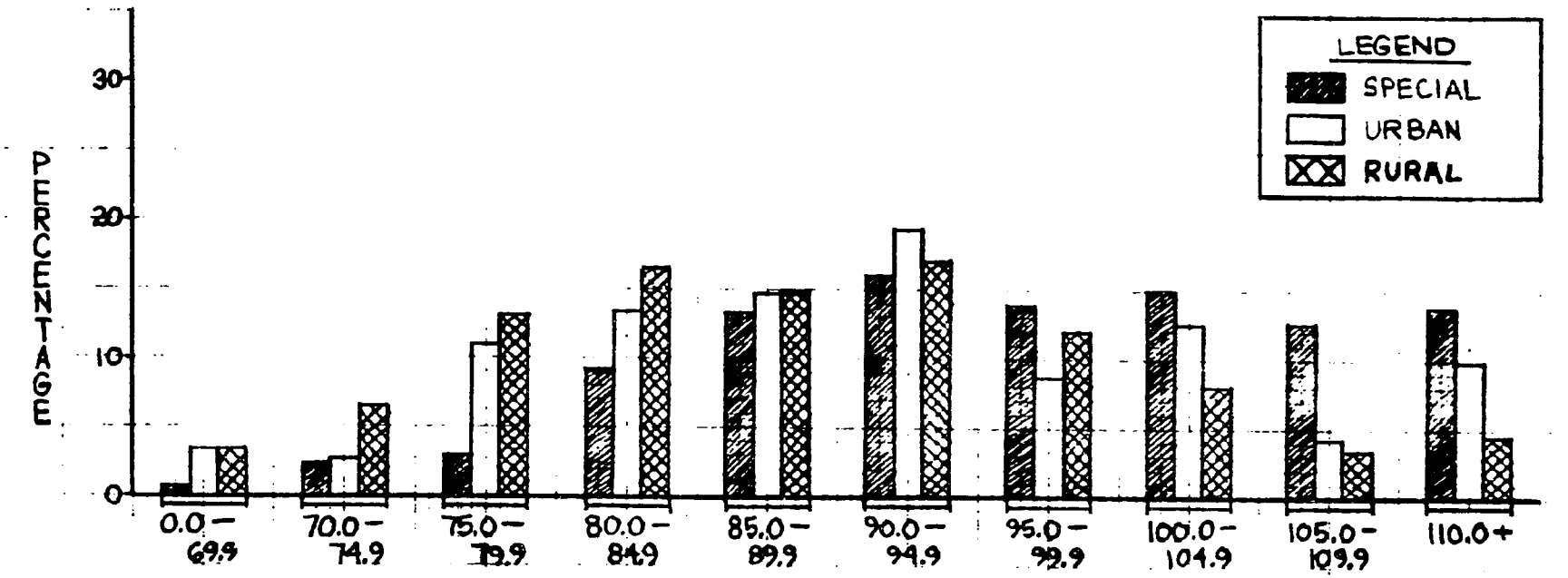
The peak frequency for children from the special group was at the 105.0-109.9% level of reference weight for height, whereas the greatest frequency for children in the other groups was at a lower level.

Weight for Age

There was a continuing high peak frequency above 100% reference weight for age for children in the special group and to a lesser degree the urban children.

Borderline areas for percentage intervals are those just above the criteria used for indicating high risk for having PCM. The frequency of rural children in these borderline areas were as follows: 22% with height for age 90.0-92.4% of reference median, 8% with weight for height 85.0-89.9% of reference median, and 15% with weight for age 80.0-84.9% of reference median value. These children may be considered at a potentially high risk for PCM.

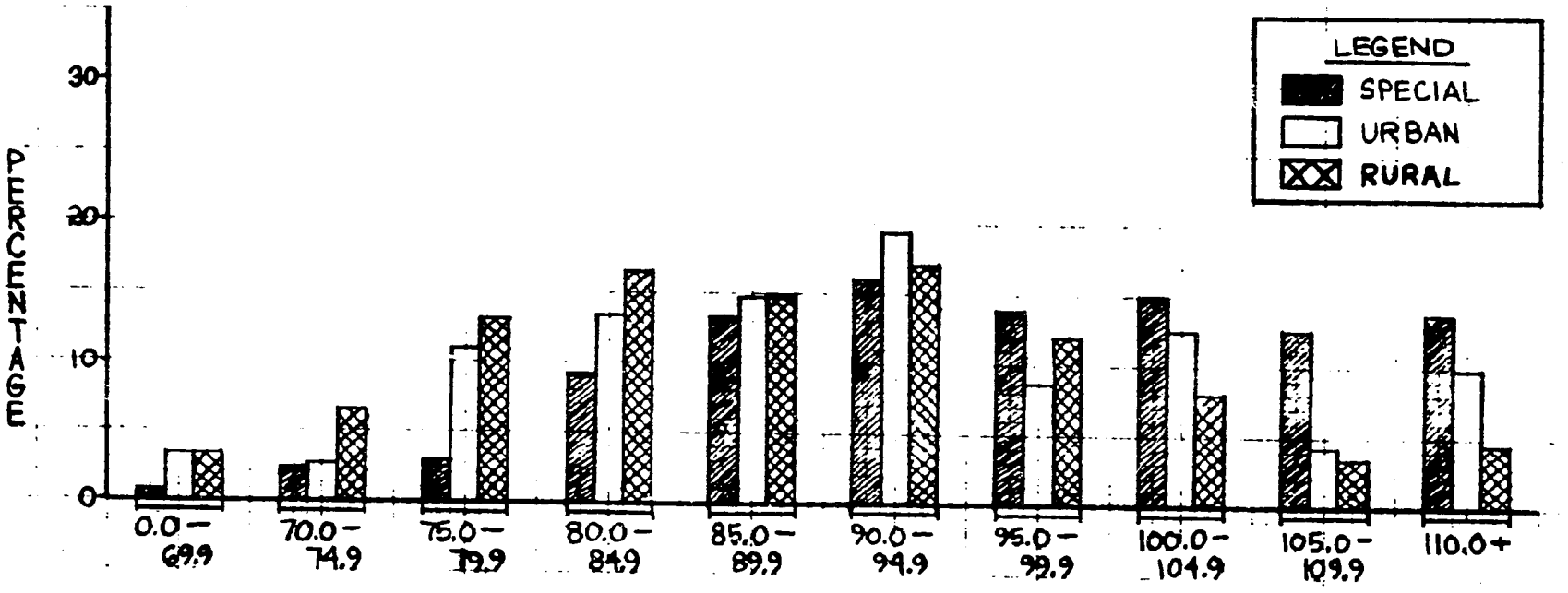

PERCENTAGE
30
20
10
0
0.0 — 84.9
85.0 — 87.4
87.5 — 89.9
90.0 — 92.4
92.5 — 94.9
95.0 — 97.4
97.5 — 99.9
100.0 — 102.4
102.5 — 104.9
105.0+



Wt./Age in Percentages of Reference Median Value

FREQUENCY DISTRIBUTION OF WEIGHT FOR AGE BY GROUP

Figure 8



Wt./Age in Percentages of Reference Median Value

FREQUENCY DISTRIBUTION OF WEIGHT FOR AGE BY GROUP

Figure 8

6.9 EDEMA

Only four children (0.3%) in the total sample had the presence of bilateral pitting edema of the lower legs, a clinical sign of kwashiorkor. It is possible that in a few cases this sign may have been overlooked. Even if this were taken into account, the prevalence would still be very low.

Discussion

The low prevalence of edema is consistent with the results of low weight for height (i.e. acute PCM) estimate throughout the country. It must be noted that this sign is very insensitive in detecting prevalence of malnutrition and identifies only a certain severe type of PCM, florid kwashiorkor.

6.10 ANEMIA

The proportion of children aged 6-24 months with anemia (defined by WHO as under 10 gm/100 cm) was 16% and of children 25-60 months (under 11 gm/100 cc) it was 31%. There was little difference in the distribution of hemoglobin levels between urban and all other areas. The mean level for each area was approximately 11.0 gm/100 cc.

The percentage of children with severe anemia (under 8 gm/100 cc) was only 2%.

Table 42: Percentage Distribution of Hemoglobin Levels According to Area (All Ages)

	Hemoglobin Level gm/100 cc to Nearest Unit								
Area	<8.0	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-12.9	13.0+	Total	n
Urban	2	7	7	24	33	20	7	100%	98
All Other Areas	2	5	8	20	28	20	18	100%	192
Lesotho (Weighted)	2%	5%	8%	20%	28%	20%	17%	100%	290

Table 43: Percentage Distribution of Hemoglobin Levels by Age Range

Age Range	<8.0	8.0-8.9	9.0-9.9	10.0-10.9	11.0-11.9	12.0-12.9	13.0+	Total	n
6-24 Months	2	6	8	29	28	14	13	100%	104
25-60 Months	2	6	7	16	31	23	15	100%	181

Discussion

Anemia might be considered a problem in Lesotho, based on the above results. The 1956-60 National Nutrition Survey sampled too few children under five years of age to estimate anemia prevalence in this age range. For the present survey, it was not clear why the prevalence was higher in the 25-60 month group compared with those 6-24 months.

It should be noted that the hemoglobin results were based on two samples: one from the subsample in the mountain and foothill areas, the other from a representative non-random sample from urban and lowland homes. This was done because Unopettes were available in limited supply in the beginning of the survey.

6.11 CHARACTERISTICS RELATED TO CHILD HEALTH

Health Clinic Attendance

Approximately 60% of the children attended a health clinic within the month prior to the interview date.

Table 44: Child Attends Clinic

	Urban	Lowlands	Foothill	Mountain
Yes	-	65.3	67.2	50.3
No	-	34.7	32.8	49.7
Total	-	100%	100%	100%
n	-	150	119	505

Onset of Speech

Some of the responses elicited for "onset of speech" were not considered valid, therefore, the results have not been included in this presentation.

Child Mortality

There were almost twice as many child deaths in mountain families (18%) compared with other areas (10-12.5%), expressed as a percentage of live births. The proportion of live births per family was similar throughout all areas in Lesotho. It was determined by taking the total number of child deaths divided by the total number of live births per family interviewed. It is not an age specific mortality rate.

Table 45: Mortality Rate of Children in Families

	Urban	Lowlands	Foothill	Mountain
No. Live Births/Family	3.39	3.48	3.70	3.64
No. Child Deaths/Family	0.34	0.37	0.46	0.66
Mortality Rate	10.14	10.70	12.50	18.22

Discussion

Mothers and children attend clinics for medical care as well as to receive milk and food distributed by government and voluntary agencies. In this report, clinic attendance and milk or food source at clinic correlated very closely (see pages 93-94).

Care should be exercised in the interpretation of mortality rates. Direct questioning of the teams after they had visited the sites suggested that one or two teams may have underestimated the number of child deaths within the family. It was not clear how much this problem contributed to the higher child mortality rate in the mountain area. These higher rates might otherwise be explained by the relative remoteness and lack of services in the mountains.

Maternal Birth Information

This section concerns the number of index children per family and the birth order of the index child and birth interval between the index child and his older and younger siblings.

Number of Index Children per Family

Approximately 80% of all families had only one index child; 20% had two children. Less than 1% of the families had more than two index children.

Table 46: Number of Index Children per Family

	Urban	Lowlands	Foothill	Mountain	Lesotho
One	80.6	78.6	77.4	82.2	79.4
Two	18.7	20.3	21.6	17.6	19.8
Three or more	0.7	1.1	1.0	0.2	0.8
Total	100%	100%	100%	100%	100%
n	283	616	297	510	1706

Birth Order of Index Child

More than 45% of the children under five years of age were either first or second born.

Table 47: Birth Order

	Urban	Lowlands	Foothill	Mountain	Lesotho
1st or 2nd	46.1	46.4	47.6	47.1	46.9
3rd or 4th	30.5	27.0	21.3	25.9	25.6
5th or Higher	23.4	26.6	31.1	27.0	27.5
Total	100%	100%	100%	100%	100%
n	256	588	296	507	1647

Birth Interval

The prior birth interval was defined as the duration between the birth of the index child and the end of the pregnancy prior to this birth. The post birth interval is the duration between the birth of the index child and the end of the next pregnancy of the mother. The mean birth interval was the average of the prior and post birth intervals.

Approximately 20% of prior, 20% of post and 10% of mean birth intervals in Lesotho were less than 24 months duration. The mean birth interval for 90% of the index children was greater than 24 months.

Table 48: Prior Birth Interval Index Child

	Urban	Lowlands	Foothill	Mountain	Lesotho
<24 Month Interval	18.9	16.0	16.9	19.2	17.4
24-36 Months	43.4	37.7	39.9	33.5	37.2
>36 Months	37.7	46.3	43.2	47.3	45.4
Total	100%	100%	100%	100%	100%
n	159	374	183	343	1059

Table 49: Post Birth Interval Index Child

	Urban	Lowlands	Foothill	Mountain	Lesotho
<24 Month Interval	29.0	22.1	19.0	18.4	20.7
24-36 Months	58.0	53.6	53.2	61.0	56.0
>36 Months	13.0	24.3	27.8	20.6	23.3
Total	100%	100%	100%	100%	100%
n	69	140	79	141	429

Table 50: Mean Birth Interval Index Child

	Urban	Lowlands	Foothill	Mountain	Lesotho
<24 Month Interval	26.1	7.6	22.0	2.2	10.4
24-36 Months	50.0	51.9	46.0	65.2	54.5
>36 Months	23.9	40.5	32.0	32.6	35.1
Total	100%	100%	100%	100%	100%
n	46	79	50	89	264

Discussion

The mean birth interval for 90% of the index children was greater than 24 months. A favorable birth interval is between two and three years (29).

Some potential at-risk factors for protein-calorie malnutrition (PCM) might include a high number of children under five years in the family, a high birth order and a short birth interval (39). From the results for birth information, it appears that up to 20% might be at-risk for PCM. On the other hand, 90-95% of the children were breast fed until at least one year of age.

6.12 MATERNAL NUTRITIONAL STATUS

Anthropometry

There were 1745 children from 1285 households surveyed. Because some mothers were not present at the time of the survey, 988 were measured and interviewed. Because so few mothers were under 20 or over 40 years of age (see p. 51), results of measurements are reported only for 848 mothers, aged 20-40 years.

Table 51 shows that approximately 10% of all mothers in the Lesotho sample had low stature (< 150 cm), 3% had low arm circumference (<23 cm) and 5% had low triceps fatfold (<7.5 mm). When comparing urban and lowland with foothill and mountain areas, there was a greater proportion of mothers in the urban and lowland areas with low stature (14% vs. 8%) and a lesser proportion with low arm circumference (1% vs. 4%) and fatfold (1% vs. 9%) than in foothill and mountain areas.

Table 51: Percentage Distribution Low Maternal Measures According to Area

Area	HEIGHT <150 cm	n	ARM CIRC. <23 cm	n	FATFOLD <7.5 mm	n
Urban	12	112	1	117	0	69
Lowland	14	291	1	291	1	184
Foothill	8	161	5	161	12	91
Mountain	8	278	4	279	6	174
Urban/Lowland	14	403	1	408	1	253
Foothill/Mountain	8	439	4	440	9	265
Lesotho	11%	842	3%	848	5%	518

Six percent of all Lesotho mothers (weighted) had an arm circumference over 35 cm and 21% a fatfold over 25 mm. The largest proportions for these measures were from urban and lowland areas.

Table 52: Percentage Distribution High Maternal Measures According to Area

Area	HEIGHT >16[illegible] cm	ARM CIRC. >35 cm	FATFOLD >25 mm	>35 mm
Urban	6%	16	42	20
Lowland	5	8	29	7
Foothill	6	2	9	1
Mountain	9	3	16	1
Urban/Lowland	5	10	31	9
Foothill/Mountain	8	3	13	1
Lesotho	7%	6%	21%	4

The mean and median values are of particular interest (Table 53). The median is required for fatfold and fatfold-derived measures due to the skewed nature of the distributions. The values for fatfold and arm fat area were much higher in urban and lowland mothers compared with the rest of Lesotho, whereas values for other measures were similar throughout each area. Particular note should be made of the uniform arm muscle mass throughout the country.

Table 53: Average Values of Maternal Measures by Area

	Maternal Measure				
	Mean			Median	
Area	HEIGHT (cm)	ARM CIRCUM (cm)	FATFOLD (mm)	ARM MUSCLE (cm^2)	ARM FAT (cm^2)
Urban	156.0	30.2	22.2	42.4	27.8
Lowland	155.6	29.4	18.2	42.1	22.8
Foothill	156.0	28.0	12.0	42.9	15.6
Mountain	157.6	27.8	13.4	41.1	16.7
Urban/Lowland	155.6	29.5			
Foothill/Mountain	156.9	27.9			
Lesotho	156.8	28.6			

Distribution Tables are included for completeness of the description.

Table 54: Percentage Distribution of Maternal Height According to Areas

Area	Height in cms.						
	< 150	150-153	154-157	158-161	162-165	166+	n
Urban	12	26	18	24	13	6	112
Lowland	14	25	26	19	10	5	291
Foothill	8	26	28	19	13	6	161
Mountain	8	20	20	26	16	9	278
Urban/Lowland	14	25	25	20	10	5	403
Foothill/Mountain	8	23	23	23	15	8	439
Lesotho	11%	24%	24%	21%	13%	7%	842

Table 55: Percentage Distribution of Maternal Arm Circumference According to Areas

Area	Arm Circumference in cms.						
	< 23	23-25.9	26.0-28.9	29.0-31.9	32-34.9	35+	n
Urban	1	15	26	24	17	16	117
Lowland	1	18	30	28	15	8	291
Foothill	5	24	39	18	12	2	161
Mountain	4	22	45	18	8	3	279
Urban/Lowland	1	18	29	27	15	10	408
Foothill/Mountain	4	22	43	18	10	3	440
Lesotho	3%	20%	37%	22%	12%	6%	848

Table 56: Percentage Distribution of Maternal Triceps Fatfold According to Areas

Area	< 7.5	7.5-9.9	10.0-14.9	15.0-19.9	20.0-24.9	25.0-29.9	30.0-34.9	35+	n
	Fatfold in mms.								
Urban	0	1	20	20	16	10	12	20	69
Lowland	1	8	29	18	15	13	9	7	184
Foothill	12	20	32	18	9	7	1	1	91
Mountain	6	16	36	14	12	8	7	1	174
Urban/Lowland	1	7	28	18	15	13	9	9	253
Foothill/Mountain	9	18	34	16	11	8	4	1	265
Lesotho	5%	13%	32%	17%	13%	10%	7%	4%	518

Clinical Signs

The two clinical signs used in this survey for mothers were goiter and a pellagra-like rash. A goiter was seen in 4.4% of mothers in the Lesotho sample. Goiter was very rare in urban areas.

Table 57: Maternal Goiter

	Urban	Lowlands	Foothill	Mountain	Lesotho
Obvious or Seen	0.8	5.9	3.9	6.2	5.2
Not Seen	99.2	94.1	96.1	93.8	94.8
Total	100%	100%	100%	100%	100%
n	132	357	180	323	992

Only eight mothers in the total sample (less than 1%) had a pellagra-like rash on the neck or arms or other exposed parts of the body.

Table 58: Maternal Rash On Exposed Surface

	Urban	Lowlands	Foothill	Mountain	Lesotho
Rash	2.3	0.3	1.2	0.9	0.9
No Rash	97.7	99.7	98.8	99.1	99.1
Total	100%	100%	100%	100%	100%
n	133	359	179	321	996

Discussion

Nutritional status in adults is more difficult to define using anthropometric measures than in young children. Useful reference information is scanty and the significance of differences not always clear. The cut-off points for low maternal measures (see page 45) used in this survey are based on prior studies in different parts of the world (3, 4, 38).

Arm wasting, as shown by a low arm circumference, was used as an index of recent maternal undernutrition. The results for arm wasting suggest that few mothers had recent undernutrition. The addition of weight as an index was considered, but there was no suitable instrument that could be used in the field.

Fat wasting, as shown by a low triceps fatfold, may be related to a low caloric reserve as well as other factors such as activity. Although the proportion of mothers with fat wasting was higher in the foothill and mountain areas compared with the rest of the country, the results in all the combined areas of Lesotho do not indicate that fat wasting was a problem in terms of numbers affected. Results for fatfold should be viewed with caution due to the difficulty in obtaining reliable measurements and the relatively small sample sizes.

Obesity was indicated by a fatfold more than 25 mm and gross obesity by a fatfold more than 35 mm. There was a high prevalence of obesity (31%) and gross obesity (9%) among urban and lowland mothers which was further confirmed by a corresponding high rate for very large arm circumference and observation. It appears that obesity is not associated with an increase in arm muscle area (see Table 53), i.e., a larger arm circumference indicates more fat, without more muscle. This would suggest greater availability

of calories to the body tissues than availability of protein which may be related to the high intake of papa, a maize food. The significance of these findings for obesity requiresfurther investigation. Studies in other countries show that cardiovascular disease, hypertension and diabetes may be related to obesity in women (40). Consistent evidence for obesity of children in the survey was limited to the special group in Maseru under five years and those 2-5 months from urban and lowland areas.

The results for maternal height suggest that approximately 10% of mothers in the sample may have been undernourished during childhood, resulting in small stature. If such women deliver babies that are relatively larger than the mother's pelvic bone capacity, disproportion and prolonged labor can result, with disability or death of the mother or infant (38).

Throughout Lesotho, there were only small differences in maternal height between ecological areas. The Basotho have a homogeneous tribal origin which contributes to this expected result. This was in contrast to height measures in children, where urban children were generally taller than those in the rest of the country. The greatest proportion of short children was in the mountain areas. This is further evidence for the important influence of environment on child growth and nutritional background. The relationships between maternal and child height are presented in more detail in Section 6.19.

The prevalence of goiter, indicating iodine deficiency in Basotho mothers was far less in this survey compared with results obtained in the 1956-1960 nutrition survey (4% vs. 15-20%), using similar WHO criteria for diagnosis (see page 120). Since the previous survey, a salt iodization program has been implemented by the Government of Lesotho. It should be noted that the 4% prevalence rate pertains only to those with a neck swelling that could be seen. The proportion of palpable, but not visible, thyroid swelling would be greater, but certainly less than that reported some 20 years ago.

Pellagra was rarely found in mothers, in contrast to the common finding in prior studies (up to 15%). This difference was expected because

the present survey was conducted at a time of the year when pellagra is far less common.

6.13 MILK AVAILABILITY AND CONSUMPTION

Duration of Breast Feeding

A very high percentage of rural children was still being breastfed at 12 months of age. Even by 24 months one-quarter of all children were breastfed. The percentages were slightly, but consistently less for urban children. The age at which 50% of the children were breastfed was 19 months (urban) and 22 months (rural).

Table 59: Percentage Still Breast Fed (from Figures 9 and 10)

	Age in Months							
Area	3	6	9	12	18	24	30	n
Rural	99	98	95	90	72	35	10	1007
Urban	90	87	82	75	55	25	4	222

Place Where Milk Obtained

Figures 9 and 10 indicate the "usual place where milk was obtained" for the index child. The term "milk" refers to any animal or human milk, fresh or preserved. The milk was not necessarily seen by the interviewers and therefore the dilution and actual consumption were not confirmed. Frequency of breastfeeding and/or bottlefeeding or other supplementation was not assessed. Milk was often obtained from more than one place for each child. "Other farm" was any farm not belonging to the household head. Milk which originated from the Republic of South Africa was considered "market milk".

Sources of Milk for Rural Children (Figure 9)

Breast milk is the predominant form of milk received by children up to about 22 months of age. Milk was frequently obtained in markets for infants and children between 4-5 years of age, but less frequently for children between 1-4 years. From one to five years, milk was obtained from a clinic for more than half the rural children. However, interviewers were not required to assess the quantity and dilution nor confirm the consumption of clinic milk.

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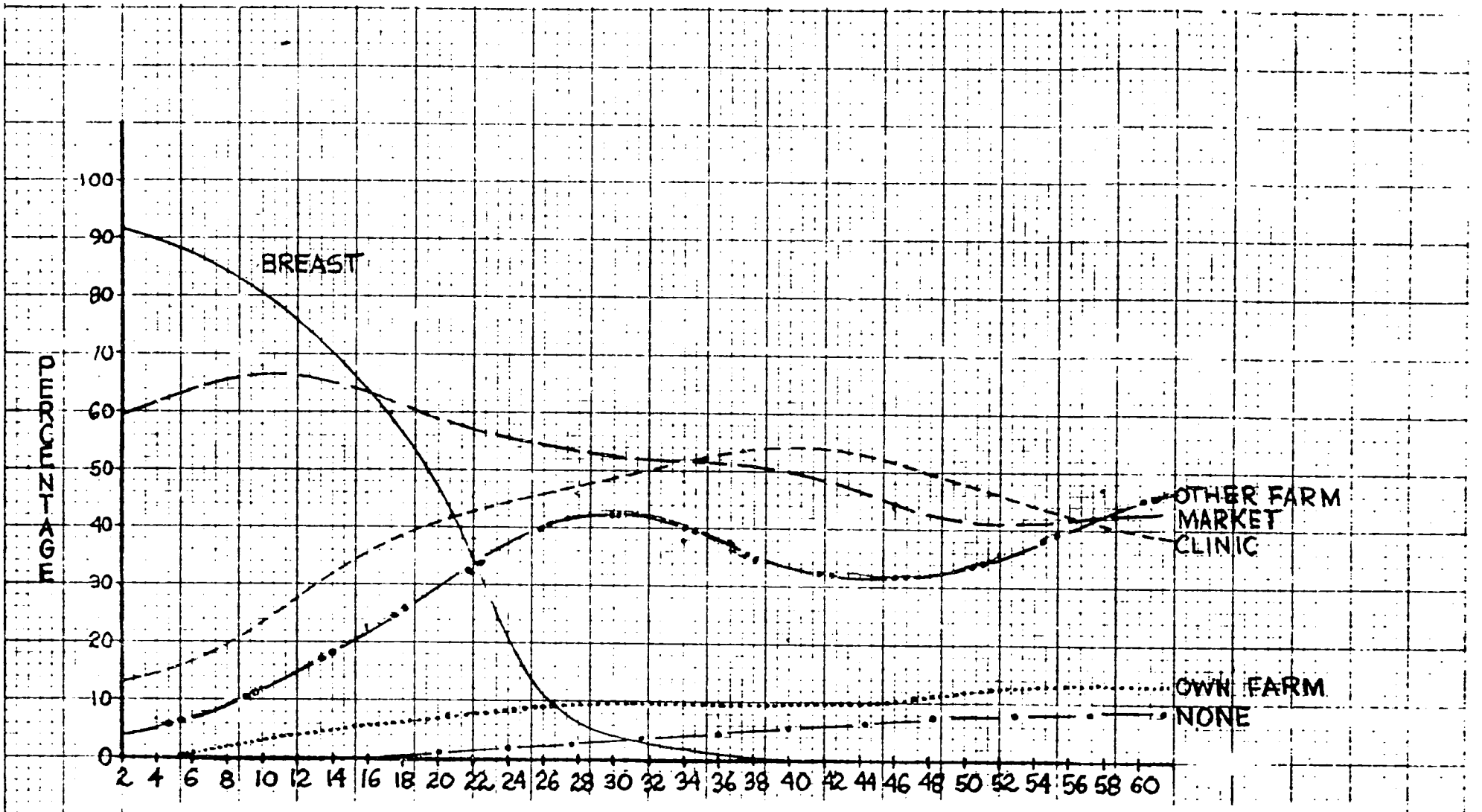


Percentage Frequency Distribution by Age for
PLACES WHERE MILK WAS OBTAINED - URBAN LESOTHO
Figure 9

The "none" category in Figure 9 indicates that some type of milk was obtained for nearly all rural children less than 18 months old, and for 85-90% of rural children aged 2-5 years.

Sources of Milk for Urban Children

Breast milk is the predominant source of milk received by children up to 15 months of age, after which market or clinic milk are most frequently received. From 2-5 years of age, clinic milk was obtained for about half the urban children. After two years of age milk was primarily obtained from places outside the family.

The "none" category in Figure 10 indicates that milk was given to nearly all children under two years of age and to 85-90% of 2-5 year old children.

Comparison of Milk Sources by Area Within Lesotho

In urban and lowland areas market milk was purchased for more children 6-24 months than for children in the corresponding age group in the mountain and foothill areas (Table 60). Breastfeeding and clinic milk were less predominant for urban children than for those in each of the other areas, respectively. Clinic milk was predominant for rural children, 2-5 years.

Mountain children, 2-5 years, relied more on breast milk and milk from their own farms. Market milk was purchased for relatively few and no milk was obtained for approximately 18% of these children.

Table 60: Percentage Frequency Milk Sources by Area

Children Aged 6-24 Months

	Area				
	Urban	Lowland	Foothill	Mountain	Lesotho
Breast Milk	60	78	70	82	76
Own Farm	8	11	16	16	14
Other Farm	22	14	6	12	12
Market Milk	53	33	16	11	24
Clinic Milk	32	49	47	54	49
No Milk	3	2	5	2	3
n	116	248	115	179	658
Clinic Food	43	54	58	55	55

Children Aged 25-60 Months

	Area				
	Urban	Lowland	Foothill	Mountain	Lesotho
Breast Milk	1	5	4	8	5
Own Farm	9	16	18	31	21
Other Farm	39	20	13	18	19
Market Milk	47	31	20	5	21
Clinic Milk	44	52	68	51	55
No Milk	7	11	11	18	13
n	150	322	161	214	847
Clinic Food	44	52	68	51	55

Milk Obtained From Only One Place

The highest percentages for milk obtained from a single place were for breast milk in rural children aged 6-24 months (23%) and clinic milk in rural children aged 25-60 months (28%).

Table 61: Percentage Frequency of Only One Source of Milk

	6-24 Months		25-60 Months	
	Urban	Rural	Urban	Rural
Breast	12	23	0	1
Own Farm	3	1	5	10
Other Farm	5	3	20	6
Market	12	3	15	9
Clinic	3	5	6	28
Total	35	35	46	54
n	115	540	150	697

Discussion

There is a high prevalence of breastfeeding, particularly in the rural areas. This appears to be a major factor in protecting the child from undernutrition up to the age of six months, where the prevalence of underweight for age was 4%, but not from 6-11 months when underweight prevalence was 25.6% (see page 68, Table 31).

Although there is a large number of cattle in the country, a relatively small proportion of milk came from "own" or "other" farms (30% in rural areas). This supports the statement that cattle are often held for investment purposes.

Figures 9 and 10 show that market milk, which was purchased for 40-60% of urban and rural children under six months, probably supplemented breastmilk which was reportedly consumed by nearly all children. Clinic milk was obtained for about one-half urban and rural children, 1-5 years. Table 62 shows where additional milk other than clinic milk was obtained for these children.

Almost 30% of all rural children aged 25-60 months usually received milk only from the clinic. In addition, one-quarter of the children 6-24 months obtained only breast or clinic milk.

Table 62: Percentage Frequency of Clinic and Other Milk Sources

Source	Age in Months 6-24 mths Urban	6-24 mths Rural	25-60 mths Urban	25-60 mths Rural
Clinic only	3	5	6	28
Clinic & Breast only	7	24	0	2
Clinic & Own Farm only	3	3	3	8
Clinic & Other Farm only	1	1	10	8
Clinic & Market only	5	2	22	7
Clinic & one other source	16	30	35	25
Clinic & more than one other source	13	15	3	2
No clinic milk	68	50	56	45
	100%	100%	100%	100%

6.14 AGE OF ONSET OF FOOD OTHER THAN MILK

Approximately 90% of urban and 70% of rural children aged six months were receiving some food other than milk. At nine months almost all urban children received food other than milk, whereas most rural children were receiving food at 12 months.

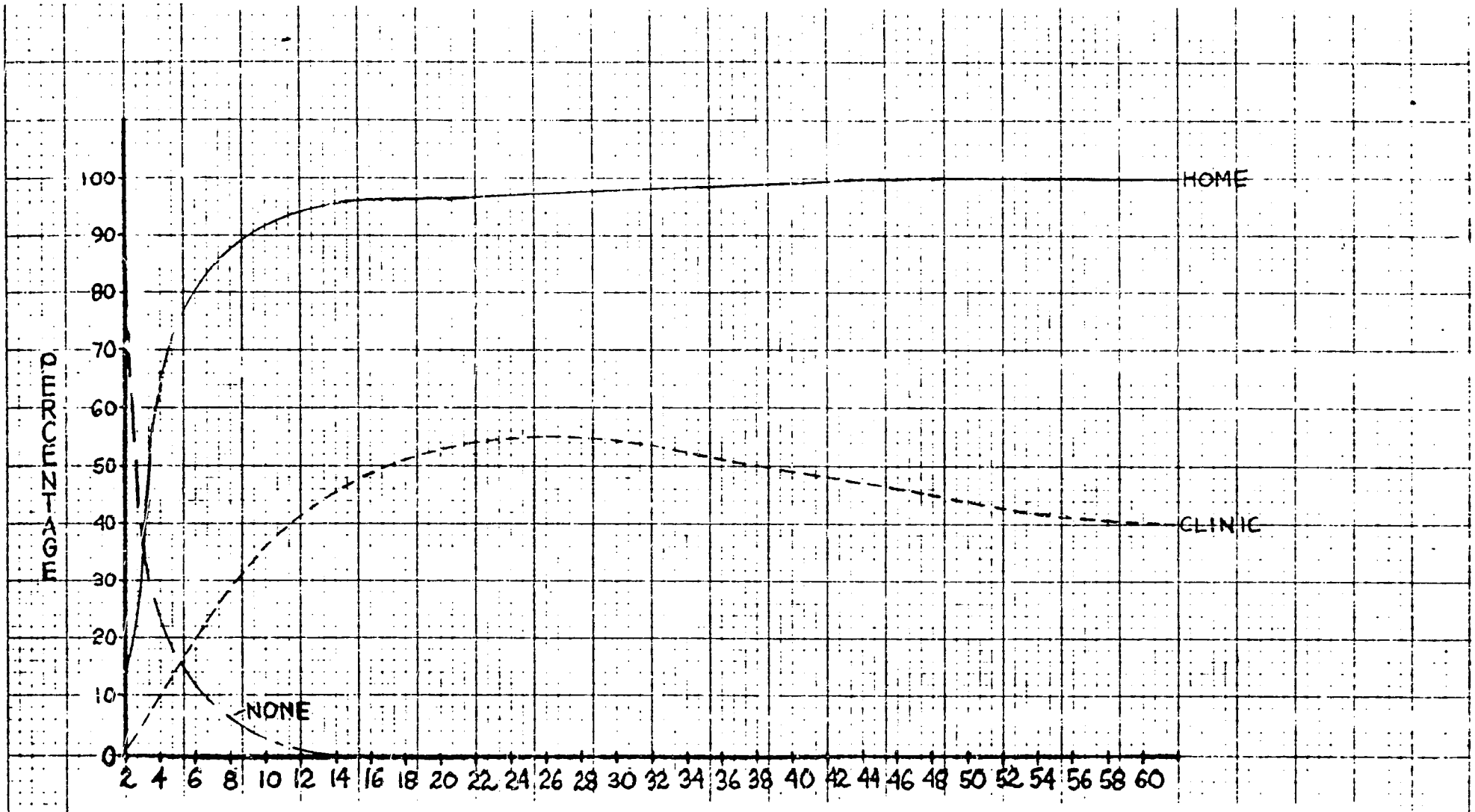
Table 63: Percentage Receiving Weaning Food By Age (from Figures 11 and 12)

Area	Age in Months 3	6	9	12	18
Urban	65	90	95	99	100
Rural	20	70	85	95	100

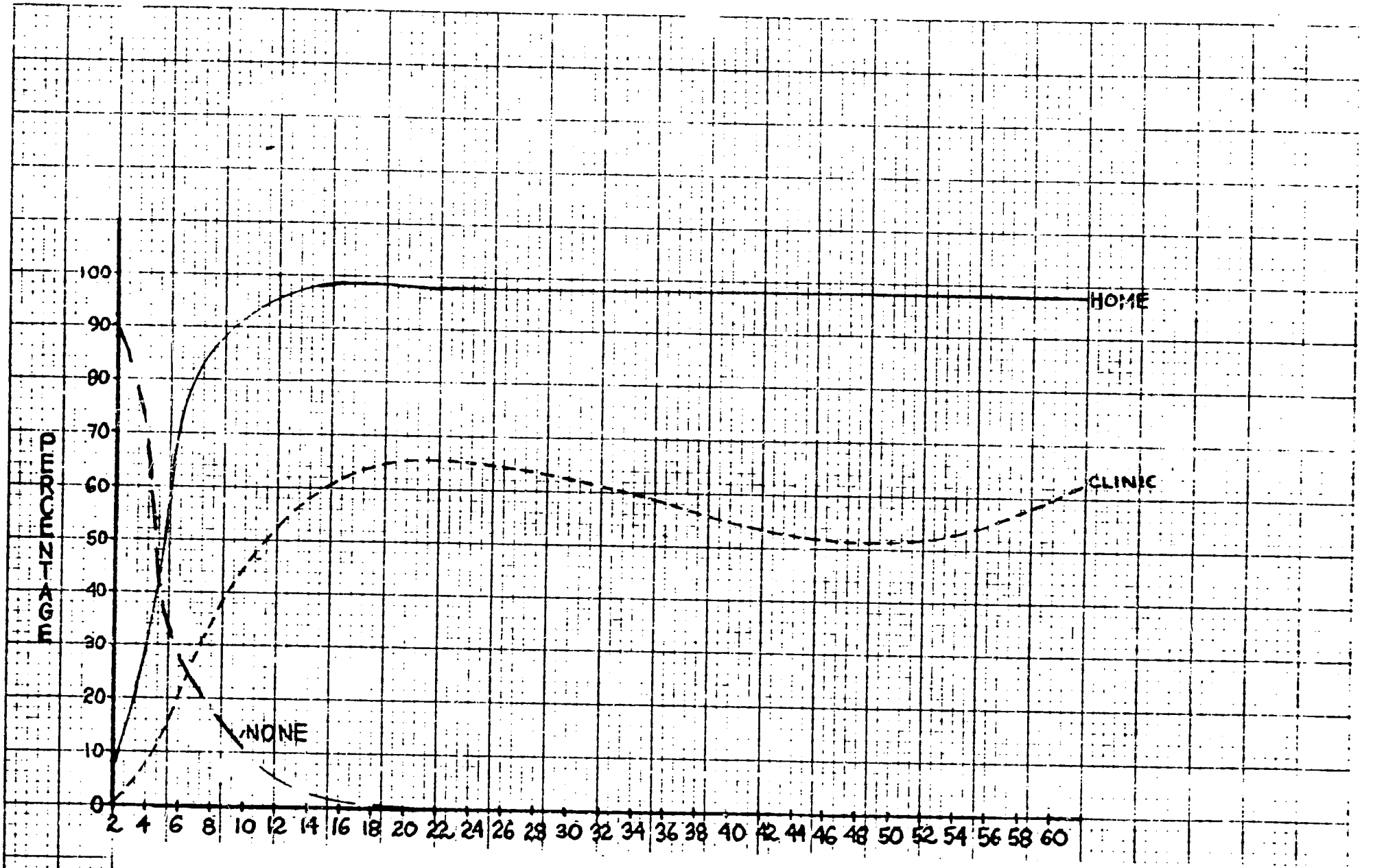
Clinic food included Corn Soya Milk (CSM). Food was obtained at a clinic for 40-65% of urban and rural children 1-5 years of age.

Discussion

Milk alone is insufficient for adequate nutrition of children after six months of age. Food should be introduced into the child's diet by this age. Table 63 shows that 15% of rural children aged nine months and 5% of rural children aged twelve months did not receive any food other than milk.



Percentage Frequency Distribution by Age for
PLACES WHERE FOOD WAS OBTAINED - URBAN LESOTHO
Figure 11



Percentage Frequency Distribution by Age for
PLACES WHERE FOOD WAS OBTAINED - RURAL LESOTHO
Figure 12

These findings together with the higher prevalence of protein-calorie malnutrition after six months of age compared with children 2-5 months of age, described earlier in this report, suggest a highly important association between diet and nutritional status in this age range for all of Lesotho. There were too few children in this category to test this association in individual ecological areas.

More rural than urban children aged 6-60 months received clinic food. Approximately half of all children received this food.

6.15 QUALITATIVE FOOD CONSUMPTION

Within the subsample, the index child's consumption of "basic foods" was assessed, using a modified 24-hour recall method. A three-day recall questionnaire was used to assess the consumption of "protein-rich" foods by index children and their families included in the subsample. For specific techniques used, see "Methodology," p. 30.

Information was not collected about the method of preparation, frequency or quantity of intake. It was not known if the foods reportedly eaten were consumed together or separately, nor were any time intervals assessed between consumption of foods.

Types of Basic Foods Consumed by Child

Breast milk and maize were the most common foods consumed by children in the 6-24 month age group. Almost all children in the older group reportedly received maize within the past 24 hours. Moroho, wheat or sorghum were eaten by 35-68% of the children. Almost all children received some form of grain.

Table 64: Percentage Proportion of Types of Basic Foods Consumed by Child - Lesotho

Type of Food	Age Ranges 6-24 Months	25-60 Months	6-60 Months
Breast Milk	80	4	36
Other Milk	35	44	40
Moroho	47	68	59
Maize	76	96	87
Wheat	36	57	48
Sorghum	53	35	43
Any Grain	99	100	100
n	122	171	293

The results were weighted according to population proportion, so that they represented the rural areas of the sample. There were only 55 urban children in the subsample, thus it was difficult to make comparisons between diets of urban and rural children. However, it was apparent that a higher percentage of urban children were not breast fed but more received other milk and wheat compared with rural children.

Types of Protein-Rich Foods Consumed by Child and Family

Protein-rich foods were consumed at least once in the past three days by approximately 90% of the families visited. Peas and beans were the most common type of other food reportedly consumed by both child and family in at least 50% of the cases; meat or poultry in 40-50% of the cases, and eggs and fish each in about 25-35% (see Table 65).

Table 65: Percentage of Types of Protein-Rich Foods Consumed by Child and Family

Lesotho

Protein Food	6-24 Months			
	Child	Family	Family Not Child	
Meats/Poultry	37	49	12/49	24%
Eggs	25	23	-2/23	-9%
Fish	28	31	3/31	10%
Peas/Beans	52	64	12/64	19%
Any Protein Food	78	90		
n	122	122		

	25-60 Months		6-60 Months		
	Child	Family	Child	Family	Urban Families
Meats/Poultry	44	44	41	46	(75)
Eggs	29	27	28	26	(45)
Fish	34	36	31	32	(62)
Peas/Beans	61	62	57	63	(62)
Any Protein Food	88	89	84	89	(100)
n	171	171	293	293	(55)

Table 65 shows that younger children did not consume the same kinds of foods as the family, particularly meat/poultry and peas/beans. Twenty-two percent of these children did not receive any of the foods listed as protein-rich foods compared with 10-12% of children aged 25-60 months. In the older children aged 25-60 months, greater similarity of kinds of foods consumed between child and family was reported.

Table 65 includes the percentages for urban families. Although there was a small sample of urban families, it is of interest that with the exception of peas/beans, a higher percentage of urban families consumed the protein-rich foods compared to rural families.

Child's Consumption of Only One Protein-rich Food, Excluding Milk

Table 66 shows the percent of children who consumed only that food listed. Thirty-two percent of all rural children consumed only one of the protein-rich foods listed. Half of all rural children reportedly consumed more than one of the protein-rich foods listed. The remaining 16% of rural children consumed none of those.

Almost all of the urban children 6-60 months of age had consumed at least one of the other foods listed. Meat/poultry was the most common single source of protein-rich food. Three-fourths of the urban children consumed more than one of these protein-rich foods.

Table 66: Percentage of Only One Source of Protein-Rich Food Consumed by Child

	Rural children			Urban Children
	Age Range			
Protein-Rich Food	6-24 Months	25-60 Months	6-60 Months	6-60 Months
Meat/Poultry	7	8	8	13
Eggs	4	3	3	2
Fish	5	2	3	2
Peas/Beans	14	21	18	5
Subtotal	30	34	32	22
No Protein-Rich Food	26	14	16	4
More than one type of protein-rich food	44	52	48	74
	100	100	100	100
n	99	139	238	55

Intake of Groups of Foods

The usual diet in Lesotho apart from milk, is based on a staple cereal to which additions of vegetable or animal proteins are made (41). A method was devised to examine the variety of foods consumed by the child. The groups listed in Table 67 indicate an increasing scale of qualitative food variety. It should be noted that the quantity of each food eaten was not known and these food groups are not mixes as classified by Jelliffe (42).

Table 67: Variety Groups of Foods

Group 1(M)	Milk
Group 1(G)	Grain Grain + Moroho
Group 2	Grain + Milk Grain + Moroho + Milk Grain + (Legume or Protein)*
Group 3	Grain + (Legume or Protein) + Milk Grain + (2 of Legume, Protein, Moroho)
Group 4	Grain + (2 of Legume, Protein, Moroho) + Milk Grain + Legume + Protein + Moroho Grain + Legume + Protein + Moroho + Milk

*Animal protein.

Table 68 describes the distribution of the food groups throughout the country. For children aged 6-60 months, the proportion of urban children having both Group 1 and 2 foods was less than those in other areas (6% vs. 17-27%); and the proportion of urban children having Group 4 foods was greater (72% vs. 45-62%). The part of the table for children aged 6-24 and 25-60 months suggests these differences were not greatly influenced by the age ranges of the children.

Table 68: Percentage of Food Group Consumed According to Age Range and Area

Age 6-60 Months

Group	Urban	Lowland	Foothill	Mountain	Rural
1(M)	2	5	2	2	3
1(G)	0	7	4	2	5
2	4	15	11	20	16
3	22	27	21	30	27
4	72	47	62	45	49
	100%	100%	100%	100%	100%
n	54	107	47	80	234

Age 6-24 Months

Group	Urban	Lowland	Foothill + Mountain	Rural
1(M)	(5)*	12	6	8
1(G)	(0)	5	0	2
2	(0)	21	17	19
3	(18)	14	20	18
4	(77)	48	57	53
	100%	100%	100%	100%
n	22	42	54	96

*Numbers in ( ) have a very low sample size.

(Table 68, continued)

Age 25-60 Months

Group	Urban	Lowland	Foothill + Mountain	Rural
1(M)	(0)*	0	0	0
1(G)	(0)	9	5	7
2	(6)	11	16	14
3	(25)	35	32	33
4	(68)	45	47	45
	100%	100%	100%	100%
n	32	66	73	139

*Numbers in ( ) have a very low sample size.

Association of Food Groups with Anthropometric Indices in Children

The relevance of anthropometric indices to nutritional status has been discussed fully in "Indices of Malnutrition," p.38 . Diet is one important variable associated with nutritional status. It is of interest to determine the association of diet with anthropometric results.

Food groups were used to indicate variability of diet. The cut-off points for low anthropometric indices were the same as described for prevalence rate descriptions in the report, with the exceptions of weight for height, arm circumference for age and fatfold for age. The cut-off points for these indices were slightly higher to increase the sensitivity of any differences according to diet.

All the results refer to rural children in Lesotho. Urban children were not included because of their relatively very low population representation; moreover, their sample size was too small for separate analysis. Results should be interpretated with caution because of the low sample sizes, particularly when broken down into 6-24 and 25-60 month age ranges.

As the food groups increased in variety there was (in children aged 6-60 months), a reduction of the prevalence of low anthropometric indices. The prevalence of weight for height and weight for age (Table 69) were most reduced. The weight for height index showed this reduction in both age groups, whereas weight for age showed it only in children aged 6-24 months.

There was a reversal of trend regarding height for age. In children aged 6-24 months, the proportion with low height for age was greater when they had Group 4 foods; in the older children, it was less when they had Group 4 foods compared with Group 1-3 foods.

Table 69: Percentage Distribution of Low Anthropometric Indices According to Food Group and Age of Child

Age 6-60 Months	Food Group			
INDEX	Under 3	3	4	Total
Wt/Ht < 90%	21	16	7	11
Ht/Age < 90%	24	26	15	22
AC/Age < 85%	14	12	7	11
Wt/Age < 80%	35	20	16	24
n	79	96	61	236
FF/Age < 70%	32	19	21	24
n	53	57	42	152

Age 6-24 Months	Food Group		
INDEX	Under 4	4	Total
Wt/Ht/ < 90%	21	4	12
Ht/Age < 90%	14	24	19
AC/Age < 85%	11	8	9
Wt/Age < 80%	34	16	24
	44	51	95
FF/Age < 70%	20	19	20
n	30	31	61

(Table 69, continued)

Age 25-60 Months	Food Group		
INDEX	Under 4	4	Total
Wt/Ht <90%	14	8	11
Ht/Age< 90%	31	17	25
AC/Age< 85%	13	13	13
Wt/Age< 80%	26	23	25
	74	64	138
FF/Age 70%	33	20	27
n	45	44	89

Discussion

Feeding patterns in young children differ with age and with urban or rural residence. There are three groups to consider: rural children 6-24 months and 25-60 months and urban children 6-60 months. There were 238 rural and 55 urban children in the subsample.

Topics studied included: the types of "basic foods" (milk and grains) consumed by the child, and protein-rich foods (meat, fish, eggs, legumes) in the diet of the child and his family.

Rural children 6-24 months consumed at least one basic food (most often maize) during the preceeding day. Most of these children (80%) were given breast milk, and 35% drank other milk (Table 64). However, 26% of these young children did not consume any other protein-rich foods such as meat, poultry, fish, eggs or legumes over the past three days, but most consumed milk. Thirty percent consumed only one of the other foods of which 14% were legumes (Table 66). This suggests that there is a great reliance on milk as a source of animal protein for these children. Much of this is clinic milk (Table 60).

Children aged 25-60 months in rural areas invariably ate maize, at times supplemented with wheat, sorghum or both (Table 64). A lesser proportion did not receive protein-rich food compared with younger children (14% vs. 26%). However, there was still a great reliance on peas or beans as the only source of protein-rich food (Table 66). It is not known whether the partially complete proteins in legumes and grains complemented each other in a child's diet since it is not known whether these foods

were consumed together.

More children aged 6-60 months from urban areas compared with rural areas received other milk, wheat (p.100), meat/poultry, eggs, and fish (Table 65). Even then, 22% of urban children relied on a single source of protein-rich food apart from milk. The greatest reliance for a single source was from meat/poultry, whereas in the rural children this was from legumes (Table 66).

There were clear differences in diet patterns between urban and rural children, based on variety of foods consumed.

There was a clear relationship between diet variation and anthropometry in young children aged 6-60 months. As the diet decreased in complexity, the prevalence of low weight for height (wasting) and under weight for age increased (Table 73). This suggests that thinner or lighter children tended to have a less varied diet. This is to be expected as the dietary history was based on recent intake and the anthropometric indices, particularly weight for height describes recent undernutrition or wasting. This would explain the opposite trends of diet with stunting (low height for age) regarding 6-24 months and 25-60 months. It is possible, however, that children aged 25-60 months have a more uniform diet for several months preceeding. This could explain the lower prevalence of stunting in these children have quadruple food mixes, which is reflected for the several months previously.

The association between food variety and anthropometry tends to some extent to validate the methodologies used. Post survey checks on the methods of questioning indicated that the twenty-four hour dietary recall procedure was in general correctly followed. With regards to the three day protein-rich food recall, some interviewers assumed that the family received the same food as the child and marked this off accordingly, once they had known the child had received that food.

6.16 ASSOCIATIONS OF CHILDREN'S ANTHROPOMETRY WITH RELEVANT HOUSEHOLD OR INDIVIDUAL CHARACTERISTICS

In this section, relevant associations between household or individual characteristics (i.e. father's occupation or sex of the child) and the percentages of sampled rural children that fall into categories of low anthropometric measurements are presented. Only rural children were included because they represent 94% of the population and have different characteristics from urban children.

The most important indices are heignt for age and weight for height. Percentages and P - values are presented for children aged 6-24 or 25-60 months if statistically significant difference (P value equal to or less than 0.05) is found for either of these indices under 90% of reference median value. Arm circumference for age those 85% of reference value is included if it shows a difference as well. In addition, clinic attendance and clinic milk are included because of their particular interest.

Probability valu s (P) show the significance of differences derived from the chi-square test by considering the proportions above and below the selected anthropometric indicator cut-off point. Only the lower level of each anthropometric distribution is included in the tables (i.e. less than 90% height for age). Percentage comparisons will indicate the magnitude of the differences of low anthropometric measures for each characteristic tabulated.

In accordance with the descriptions given in "Indices of Malnutrition" (p. 38), the cut-off points for low measures are as follows:

Height for Age (H/A) <90% reference median is termed stunting.

Weight for Height (W/H) <90% reference median is termed body wasting. This cut-off point represents body wasting of a milder degree than the 80% or 85% reference median value.

Arm Circumference for Age (AC/A)< 85% reference median is termed arm wasting.

It should be noted the cut-off point for the weight for height index is set at 90% of reference median value instead of 85% or 80% used previously in this report and that for arm circumference for age at 85% instead of 82.5%. This new classification increases the total proportion of children within this newly defined anthropometric index. By raising the cut-off point for "low" anthropometric index, a sample size large enough for statistical comparisons is provided. These newly defined low anthropometric indices should be interpreted cautiously.

To illustrate, Table 70 shows the percentage of low anthropometric measures according to child's sex, for children 6-24 months old. Of the male children, 16.5% were less than 90% of the reference median value for weight for height (i.e. wasted) compared with 10.7% of the female children. This shows that approximately 6% more male than female children were stunted. The P value of 0.04 indicates the difference is statistically significant at the 0.05 level. The 'n' column shows there were 264 males and 313 females included in this sample.

It must be noted that an important or significant association of any variable with nutritional status does not necessarily indicate a causal relationship. On the other hand, an association could exist, but might not be found with this particular sample.

Sex of Child

In this sample of children aged 6-24 months, the prevalence of wasting (low weight for height) in males was significantly greater than in females. In the older age group, there was no such difference between sexes.

Table 70: Percentage of Low Anthropometric Measure According to Sex of Child

Age 6-24 Months SEX OF CHILD	H/A <90%	W/H <90%	n
Male	22.7	16.5	264
Female	17.5	10.7	313
Total	19.9	13.4	577
p	0.12	0.04	

Household Size

In children aged 6-24 months from larger households, the prevalence of body and arm wasting (low arm circumference) but not stunting (chronic PCM) was significantly greater than for children from smaller households (Table 71). There was no difference in anthropometric measures according to household size for children aged 25-60 months.

Table 71: Percentage of Low Anthropometric Measure According to Household Size

Age 6-24 Months	H/A <90%	W/H <90%	n
HOUSEHOLD SIZE			
1-3	21.8	8.0	101
4-6	20.7	11.8	275
7+	17.9	18.2	201
Total	19.9	13.4	577
P	0.66	0.03	

Number of Live Births

The greater the number of live births in a family, the more likely the index child from 6-24 months had body and arm wasting. This relationship was not apparent for children aged 25-60 months.

Table 72: Percentage of Low Anthropometric Measure According to Number of Live Births

Age 6-24 Months	H/A	W/H	AC/A	n
NO. LIVE BIRTHS	<90%	<90%	<85%	
1-2	17.3	9.7	6.6	260
3-4	20.3	14.7	10.5	153
5+	23.1	18.5	13.7	160
Total	19.7	13.5	9.6	573
P	0.34	0.03	0.05	

Birth Order of the Index Child

The later the birth order in his family, the more likely the child from 6-24 months had body and arm wasting.

Table 73: Percentage of Low Anthropometric Measure According to Birth Order

Age 6-24 Months	H/A <90%	W/H <90%	AC/A <85%	n
BIRTH ORDER				
1-2	17.1	9.4	6.0	267
3-4	19.5	15.8	11.5	146
5+	24.2	18.0	14.3	150
Total	19.6	13.3	9.7	563
P	0.21	0.03	0.01	

Prior Birth Interval

In children aged 25-60 months, the prevalence of stunting appears to have been greater in those with a prior birth interval of less than 24 months compared with greater than 36 months.

Table 74: Percentage of Low Anthropometric Measure According to Prior Birth Interval

Age 25-60 Months	H/A <90%	W/H <90%	n
PRIOR BIRTH INTERVAL			
< 24 mths	35.4	8.5	82
24-35 mths	30.7	15.0	140
36+ mths	24.0	13.0	217
Total	28.3	12.8	439
P	0.11	0.38	
< 24 vs. > 36 mths	0.05	0.31	

Father's Occupation

In families where the father was a miner, children 6-60 months were more often stunted compared with farmers and other occupations of the father. When comparing the children of these farmers, miners, and others, the differences in anthropometry were most apparent in children 25-60 months.

Table 75: Percentage of Low Anthropometric Measure According to Father's Occupation

Age 25-60 Months	H/A <90%	W/H <90%	n
FATHER'S OCCUPATION			
Other	24.5	13.1	239
Miner	31.4	12.6	417
Farmer	21.0	4.9	81
Total	28.1	12.5	737
P	0.05	0.24	

Total Number of Household Workers In Republic of South Africa (RSA)

In children aged 6-24 months, the prevalence of body wasting was greater in households where there were two or more members working in RSA, compared with one or no members working in RSA (19.8% vs. 12.1%; P=0.04).

Father's Status

Children of fathers who were absent or dead had a higher prevalence of stunting and arm wasting. This was particularly evident for children aged 6-24 months.

Table 76: Percentage of Low Anthropometric Measure According to Father's Status

Age 6-24 Months	H/A <90%	W/H <90%	AC/A <85%	n
FATHER'S STATUS				
Present	17.4	13.9	10.5	356
Abs Cont.	20.6	9.8	4.8	146
Abs/Dead	30.7	17.8	16.0	75
Total	20.0	13.4	9.7	577
P	0.03	0.23	0.02	

Current Child Care

In children aged 25-60 months, the prevalence of body and arm wasting but not stunting was significantly greater when they were cared for by the mother. The sample size of 6-24 month age children cared for by someone other than the mother was too small for analysis.

Table 77: Percentage of Low Anthropometric Measure According to Current Child Care

Age 25-60 Months	H/A <90%	W/H <90%	AC/A <85%	n
CURRENT CHILD CARE				
Mother	28.2	13.6	12.2	601
Other	27.3	4.4	4.4	138
Total	28.1	11.9	10.7	739
P	0.84	<0.01	0.01	

Mother's Ability to Read Sesotho

Only about 8% of the rural mothers could not read Sesotho. Children of these mothers had a higher prevalence of stunting. The age ranges 6-24 and 25-60 months were not presented separately for children because so few mothers were unable to read Sesotho.

Table 78: Percentage of Low Anthropometric Measure According to Mother's Ability to Read Sesotho

Age 6-60 Months	H/A <90%	W/H <90%	n
MOTHER READS SESOTHO			
Yes	22.7	13.2	938
No	36.9	20.5	84
Total	23.9	13.8	1022
P	<0.01	0.07	

Clinic Attendance

The percentage comparisons suggest greater prevalence of stunting and arm wasting in children aged 6-24 months who had not attended a clinic for the past month. However, statistical testing showed no significant difference.

Table 79: Percentage of Low Anthropometric Measure According to Clinic Attendance

Age 6-24 Months	H/A <90%	W/H <90%	AC/A <85%	n
ATTENDS CLINIC				
Yes	18.5	12.3	8.5	189
No	24.8	13.2	13.2	121
Total	21.0	12.7	10.3	310
P	0.19	0.81	0.18	

Child Receives Clinic Milk

Percentage comparisons show a greater prevalence of stunting and wasting in children 6-24 months who did not receive clinic milk, compared with those who did. However, statistical testing showed no significant difference.

Table 80: Percentage of Low Anthropometric Measure According to Child Receives Clinic Milk

Age 6-24 Months	H/A <90%	W/H <90%	AC/A <85%	n
CLINIC MILK				
Yes	17.7	10.8	8.1	271
No	21.9	15.6	11.2	306
Total	19.9	13.4	9.7	577
P	0.21	0.09	0.30	

Child Receives Market Milk

Children aged 25-60 months who did not receive market milk were more likely to have stunting and body wasting than those receiving market milk.

Table 81: Percentage of Low Anthropometric Measure According to Child Receives Market Milk

Age 25-60 Months	H/A <90%	W/H <90%	n
MARKET MILK			
Yes	21.9	6.3	146
No	29.6	13.3	599
Total	28.1	11.9	745
	0.07	0.02	

Discussion

Characteristics that tend to be associated with low anthropometric measures of young children can be regarded as "at risk factors" for stunting or wasting (body or arm) according to the age range.

As previously explained in "Indices of Malnutrition," stunting or low height for age can be regarded as an index for chronic protein-calorie malnutrition, reflecting a nutritional deficiency that began at least several months ago. Body or arm wasting, as shown by low weight for height or small arm circumference for age, could be regarded as an index of acute protein-calorie malnutrition with a more recent onset. It should be noted that these cut-off points have been altered to provide a sample size sufficiently large for statistical comparison. For convenience in this discussion, body or arm wasting is termed "wasting."

The characteristics associated with low anthropometric measurements of children in this survey are grouped as follows:

Family Size and Child Spacing

1. Children aged 6-24 months in a household with seven or more members were associated with wasting.
2. Children aged 6-24 months whose mothers have had five or more live births (wasting).

3. Children aged 6-24 months born fifth or later in a family (wasting).
4. Children aged 25-60 months with a prior birth interval of less than two years compared with more than three years (stunting).

Socio-Economic

1. Fathers employed as miners whose children were aged 25-60 months (stunting).
2. Two or more household workers employed in the Republic of South Africa, whose children were 6-24 months of age (wasting).
3. Children 6-24 months whose fathers were absent without contributions or dead (stunting).
4. Mothers unable to read Sesotho whose children were aged 6-60 months (stunting).
5. Children aged 25-60 months who did not receive milk purchased from the market (wasting).

These associations are "at risk" factors for health and nutritional status (39). The results reiterate the relationship between nutritional status of the child and family size and child spacing, economic status, stable social situations and access to health care facilities. In most cases, these characteristics appeared more important for children 6-24 months than for those aged 25-60 months. This underscores the necessity for concern with the younger child of these two age groups.

The positive relationship between young male children and low anthropometric measures cannot be readily explained, although similar results were obtained in survey of Liberia using the same methodology (33).

Associations are sometimes incorrectly thought of as causal relationships. An example of a case where this misconception could occur is the association between a person other than the mother caring for the child aged 6-60 months with this child less likely to be wasted. This does not mean that it is better for a child of this age to be cared for by someone other than the mother, with regards to his nutritional status. It could mean there were other more important variables associated with this situation. For example, in Section 6.17 it is shown that in families where someone other than the mother cares for the child, the father was not likely to be a farmer nor miner and the children were more often aged 25-60 months. This information would influence the interpretation greatly.

Associations tested but not found to be statistically significant in the 6-24 month or 25-60 month age range for children included the sex of the household head and the relationship of the household head to the child, clinic attendance and child receiving clinic milk. When associations were presented for a particular age group only (such as 6-24 months) it means no association was found in the other age group, unless otherwise stated. In several instances, associations were found for the 6-24 month old children but not for the older group.

The lack of an association in this report does not necessarily mean that a relationship does not exist. Moreover, several items that are known to be related to protein-calorie malnutrition in young children, such as acute infection and diarrheal disease, were not included in the survey. Dietary associations have already been considered in this report (page 105).

6.17 ASSOCIATIONS BETWEEN VARIABLES NOT DESCRIBING NUTRITIONAL STATUS

To clarify important variables already associated in relation to nutritional status in Section 6.16, the interrelationships of these variables with each other were investigated. These variables included:

Father's occupation: miner, farmer or other
Current care of the child: mother or other
Mother's ability to read Sesotho
Father's status: present, absent with contribution or absent/dead
Child attends clinic or receives clinic milk/food
Household size: 1-3, 4-6, 7+
Sex of household head
Sex of child
Age of child: 6-24 months or 25-60 months
Birth order of child: 1-2, 3-4, 5+
Prior birth interval: under 24, 24-35 or 36+ months
Number of live births: 1-2, 3-4, 5+

The results for the first five variables are described for children aged 6-60 months and their families in rural areas. The relationship of several variables with each area of Lesotho has been presented more fully elsewhere in this report (page 52). The criteria for presenting an association between variables are the same as for Section 6.16.

Associations between Father's Occupation and Other Variables

Miners' families were associated with a smaller household size. These fathers were more likely to be absent and contributing and their children were more likely to have a low birth order.

Farmers' families were more common in mountain areas. Fewer of their wives read Sesotho and fewer of their children attended a clinic or received market milk. Children under five years in these families to have longer prior birth intervals. Child deaths were more common in farmer's families.

Families where the father was neither a miner nor farmer, more often had a female as household head and someone other than the mother caring for the young child. These young children were more likely to be two to five years old. More of these families had five or more live births.

Associations Between Current Care of the Child and Other Variables

Children under five years who were cared for by someone other than the mother tended to have a low birth order, had fathers who were absent or dead, and were more likely to be 25-60 months instead of 6-24 months of age. Their fathers were less likely to be a farmer or miner. The heads of their households were more often females, compared with children cared for by the mother.

Associations Between Mothers' Inability to Read Sesotho and Other Variables

Mothers who could not read Sesotho were likely to have husbands as farmers and were most common in mountain areas. They were more often over forty years of age. In addition, mothers who could not read Sesotho tended to have more live births. Their children under five years of age had a higher birth order and were less likely to receive market or clinic milk or clinic food.

Associations Between Father's Status and Other Variables

Families with an absent or dead father were more likely to have females as household heads and persons other than the mother caring for the young child. The father was unlikely to be a farmer or miner. Their household size was more likely to be large, usually of seven or more.

Their children under five yearswere more often 25-60 months than 6-24 months old.

Associations Between Clinic Attendance or Receiving Clinic Milk or Food and Other Variables

Children were less likely to attend a clinic or receive clinic milk or food when the household head was male, the father was a farmer or the mother could not read Sesotho. A child receiving market milk was less likely to receive clinic milk or food.

6.18 COMPARISONS OF ANTHROPOMETRIC RESULTS BETWEEN THE WHO 1956 AND PRESENT SURVEYS

Certain differences in data presentation make comparisons between the 1956 WHO survey and this survey difficult. The prior survey described anthropometric results in terms of age lag. Children were reported as one to two years retarded by height. Thus an average Basotho child aged five years had the same stature of a "normal" child aged three to four years according to Institute of Central America and Panama (INCAP) reference values. These reference values are similar to those used in this report but not identical, so that a comparison of prevalence estimates for children underweight for age might be misleading. Also, certain information regarding the methodology of the 1956 survey is lacking, such as validity of age determination, sampling adequacy, measurement checks and precision of the estimates. It is not known what time of the year the measurements were taken and the seasonal factor may be a highly important consideration.

With these limitations in mind, data from the 1956 survey was abstracted according to mean anthropometric values of height and weight for certain age ranges (Table 82). To compare the 1956 and 1976 surveys, the 1956 results for male and females were combined due to the low sample size of each sex.*

From these results, it appears that for children up to 24 months of age there was little if any difference in means of height or weight between the two surveys. The 57 cm value for 1956 in children aged 1-6 months should be considered cautiously because of the low sample size (52 children). In children considered by intervals of one year from 24 to 60 months, there

*The 1956 survey was begun in that year and the report presented in 1962.

appears to be a consistently greater increase in height by roughly 2-3 cm (1 inch) and weight by 1 kg (2.2 lbs) in the present study compared with the 1956 study. This suggests that the prevalence of low height and low weight for age may have decreased over this time in children 24-60 months, but the extent of reduction is not known.

Statistical testing for differences was not likely to give meaningful results because the standard deviation (SD) of each mean value was relatively high. When measures over a wide age range, such as 12-24 months, are included the normal variation of values over this range will result in a large standard deviation.

Table 82: Comparison of 1956 and 1976 Survey Results: Means for Males and Females Combined

	Height (cm)		Weight (kg)		Sample Size	
Age	1956	1976	1956	1976	1956	1976
1-6 mths	57.0	59.5	6.7	6.0	52	140
7-12 mths	69.5	68.5	8.4	8.1	113	213
13-23 mths	74.0	75.0	9.0	9.6	81	377
24-35 mths	81.8	83.9	10.8	11.6	121	333
36-47 mths	87.6	90.7	12.3	13.2	140	313
48-60 mths	95.3	97.3	13.9	14.7	132	231

6.19 CORRELATIONS BETWEEN ANTHROPOMETRIC MEASUREMENTS

Using the data from the Lesotho survey, relationships between anthropometric measurements were determined according to:

1. Measurements of children in two age ranges: 6-24 months and 25-60 months.
2. Comparisons between measurements of the child and mother in each family.

Table 83 shows a matrix of simple correlation coefficients ("r" values) between the measures and indices. Strong correlations for children are arbitrarily defined as equal or greater than r = 0.70. This indicates that at least 50% of the variation in one measure can be accounted for by its regression on the other (coefficient of determination).

Table 83: Correlation Coefficients For Anthropometric Measures and Indices

Children 6-24 months - Lesotho

	(Rural)						(Urban)					
	Wt.	Ht.	AC	FF	AF	AM	Wt.	Ht.	AC	FF	AF	AM
Weight	-						-					
Height	0.85*	-					0.81*	-				
Arm Circum.	0.65	0.36	-				0.66	0.36	-			
Fatfold	0.23	-0.04	0.55	-			0.23	0.01	0.68	-		
Arm Fat Area	0.40	0.09	0.77*	0.95*	-		0.39	0.13	0.83*	0.97*	-	
Arm Muscle Area	0.65	0.45	0.86*	0.05	0.35	-	0.72*	0.49	0.87*	0.24	0.47	-
	W/H	H/A	AC/A	FF/A	AF/A	AM/A	W/H	H/A	AC/A	FF/A	AF/A	AM/A
Weight/Ht	-						-					
Height/Age	-0.02	-					0.14	-				
AC/Age	0.64	0.37	-				0.64	0.47	-			
Fatfold/Age	0.51	0.03	0.58	-			0.37	0.22	0.72*	-		
Arm Fat/Age	0.63	0.15	0.79*	0.95*	-		0.49	0.29	0.86*	0.97*	-	
Arm Muscle/Age	0.53	0.42	0.86*	0.09	0.37	-	0.61	0.44	0.88*	0.31	0.52	-
Weight/Age	0.66	0.70*	0.74*	0.38	0.55	0.68	0.82*	0.66	0.79*	0.45	0.59	0.74*
n = 540							n = 116					

Correlation Coefficients For Anthropometric Measures and Indices

Children 6-24 months and their Mothers - Lesotho

	(Rural) Maternal					(Urban) Maternal				
Child	Ht.	AC	FF	AF	AM	Ht.	AC	FF	AF	AM
Weight/Ht.	-0.08	0.06	0.05	0.04	-0.05	0.15	0.26	0.15	0.25	0.32
Height/Age	0.22	0.11	0.03	0.04	0.01	-0.00	0.28	-0.01	0.10	0.31
Arm Circ./Age	0.00	0.12	0.05	0.06	0.03	0.05	0.20	-0.04	0.05	0.29
Fatfold/Age	0.04	-0.01	-0.02	-0.01	0.06	-0.02	0.03	-0.02	-0.12	0.20
Arm Fat/Age	0.04	0.03	0.01	0.02	0.01	-0.03	0.09	-0.16	-0.07	0.24
Arm Muscle/Age	0.01	0.10	0.06	0.08	0.04	-0.01	0.26	0.08	0.16	0.29
Weight/Age	0.12	0.12	0.06	0.06	0.03	0.09	0.34	0.11	0.24	0.40
n = 470						n = 82				

* r value equal or more than 0.70.

For child and mother comparisons a high correlation is more difficult to define as the measures are more independent than for children. For example, in children one would expect one measure to vary in the same direction with the other. Thus as a child's age increases, height, weight and other measures usually increase.

"R" values will generally be higher in the urban area because of the lower sample size. An "r" value of 0.1 or more for urban and 0.2 or more for the rural mothers and their children indicates that the correlation is significantly different from zero at the $P \leq 0.01$ level for the number of measures selected. It should be noted that the "r" values and the coefficients of determination are low.

Children 6-24 Months and 25-60 Months

Children 6-24 months and 25-60 months were analyzed separately, and results were similar in both groups.

One of the strongest correlations is that between weight and height ($r = 0.81 - 0.85$). This is expected because the bony skeleton contributes greatly to the weight of a child. Both arm circumference ($r = 0.66$) and arm muscle ($r = 0.65 - 0.72$) show lower correlations with weight. The "r" value is high between arm circumference and arm muscle area (0.86) because arm muscle is a function of arm circumference.

The correlation between arm circumference for age and weight for height (0.64) suggests that AC/A or a similar arm circumference index might be used to assess the more acute types of PCM when weighing scales are not available. The relationship between arm circumference and arm muscle area for age is high (0.86 - 0.88).

Maternal and Child Correlations

The correlation between maternal height and child percentage of height for age was 0.22 for the rural areas. This value was significantly different from zero, however the coefficient of determination is only 4%, suggesting that only a very small variation in height for age of the child can be related to maternal height variations. This may indicate that the genetic factors determining stunting in young children are far less important than environmental factors such as nutrition and health.

Cross Tabulations for Maternal Height and Child Height for Age Percentile Categories

This is another method to determine the association between maternal height and child height for age. This considers the rural children aged 6-60 months and their mothers. Thirty-three percent of children with short mothers (under 150 cm) were stunted (height for age under 90% of reference value) whereas 23% of children with mothers of normal height were stunted (Table 84). On the other hand, the frequency results show more than 85% of all stunted children had mothers who were not short. Thus genetic factors do exist but do not appear to be a major component compared with environmental factors (Table 84).

Table 84: Cross Tabulations for Maternal Height and Child Height for Age Categories - Rural Areas

Frequency
Maternal Height (cm)

Child Ht./age	<150	151-157	158-164	164+	n
< 90%	31	101	65	8	205
90-94.9%	48	159	136	35	378
95-99.9%	12	69	83	27	191
≥ 100%	4	16	34	12	66
n	95	345	318	82	840

Percentages
Maternal Height (cm)

Child Ht./age	<150	151-157	158-164	164+	n
<90%	33	29	20	10	205
90-94.9%	50	46	43	43	378
95-99.9%	13	20	26	33	191
≥100%	4	5	11	14	66
Total	100%	100%	100%	100%	840

APPENDIX 1. SURVEY RESULTS AND ANALYSIS

Estimates of Mean Prevalence Rates With Confidence Intervals

Prevalence rates from this sample survey are estimates of true prevalence rates. The estimated prevalence rate plus or minus twice its standard error defines an interval that has a probability of about 95 percent of containing the true prevalence rate. Thus, once the standard error of an estimate is available, the reliability of the estimate can be determined.

An important feature of probability samples is that standard errors can, in most cases, be estimated directly from the results of the survey. In this survey, the standard errors of those estimates that are based on all 30 sample children within each of the sample sites can be estimated as follows for a stratum or ecological area:

$$\text{Standard Error (S.E.)} = \sqrt{\frac{s_h^2}{m_h}}$$

Where:

$$s_h^2 = \sum_{1}^{m_h} \frac{(x_{h_i} - x_h)^2}{m_h - 1}$$

is the variance of the estimate in the hth stratum and:

(1) m_h is the number of sample enumeration areas (sites) in the hth stratum

(2) X_{h_i} is the prevalence rate determined from the thirty children within the ith sample site of the hth stratum

(3) $\bar{x}_h$ is the mean prevalence rate for all the sample sites in the hth stratum

Stratum variances can then be combined to obtain total variance as below:

$$s_{\bar{x}}^2 = \frac{1}{N^2} \sum_{1}^{L} \frac{N_h^2 \; s_h^2}{m_h}$$

Where: L is the number of strata

and: (1) N_h is the population of the hth stratum

(2) $N = \sum_{1}^{L} N_h$ is the total population of the L strata

(3) s_h^2 is the variance of the prevalence rates of the hth stratum

The use of standard errors to determine reliability of estimates is illustrated in Table 85 below: To read Table 85, the numbers in the left column show that for all children surveyed in Lesotho, 22.9 + 2.2% (20.7 - 25.1%) were less than 90% of the reference population median height for age. This means that one can be 95% confident that the true prevalence rates for this measurement are between 20.7 and 25.1%. Likewise, one can be 95% confident that between 6.8% - 10.8% of Lesotho children are taller than the median for the reference population.

Estimates of mean prevalence rates with confidence limits for all children and mothers measured in Lesotho are shown in the following tables.

Table 85: Estimate of Mean Prevalence Rates With Confidence Intervals for Basotho Children

	Height for Age	Weight for Height	Weight for Age	Arm Circ. for Age	Fatfold for Age
<60%					8.8 ± 3.1
<70%					25.4 ± 5.9
<75%			9.9 ± 1.6		
<80%		1.1 ± 0.6	22.4 ± 2.4		
<82.5%				7.0 ± 1.1	
<85%		3.6 ± 1.0		9.3 ± 1.1	
<90%	22.9 ± 2.2	11.8 ± 1.6			
>100%	8.8 ± 2.0			24.8 ± 2.4	23.8 ± 4.5
>110%		17.3 ± 3.1	5.6 ± 1.6		
>120%		4.4 ± 1.8	1.1 ± 0.5		6.7 ± 2.3

Table 86: Estimates of Mean Prevalence Rates With Confidence Intervals For Basotho Mothers, 20-40 Years Old

HEIGHT		ARM CIRCUMFERENCE		FATFOLD	
< 150 cm.	12.1 ± 2.6	< 23 cm.	2.9 ± 1.2	< 7.5 mm.	5.8 ± 2.8
		< 26 cm.	23.3 ± 3.8		
> 164 cm.	12.6 ± 2.1	> 29 cm.	40.3 ± 4.2	> 25 mm.	18.0 ± 7.0
		> 33.5 cm.	11.6 ± 2.5	> 35 mm.	4.3 ± 3.0

Comparisons of Prevalence Estimates Between Ecological Areas

Statistically significant differences of prevalence estimates of nutritional status comparing certain parts of Lesotho are examined in this section. The formula for determining a statistically significant difference between two geographic regions is:

$$\ell_1 = (\bar{x}_a - \bar{x}_b) - 2\sqrt{SE_a^2 + SE_b^2} \quad \text{and}$$

$$\ell_2 = (\bar{x}_a - \bar{x}_b) + 2\sqrt{SE_a^2 + SE_b^2} \quad \text{where:}$$

x_a = the mean prevalence rate for area "a"

x_b = the mean prevalence rate for area "b"

SE_a = the standard error of mean prevalence estimate for "a"

SE_b = the standard error of mean prevalence estimate for "b"

If the range from ℓ_1 to ℓ_2 does not include zero, then the difference between the mean prevalence rates ($\bar{x}_a$ and $\bar{x}_b$) is statistically different from zero at the 0.05 level.

In Tables 87 and 88, comparisons of prevalence estimates between ecological areas for children and mothers are shown. The two numbers shown in each column do not represent ℓ_1 and ℓ_2, although the ℓ_1 and ℓ_2 can be computed from the information given. What is presented are the range of prevalence estimates. For example, in the height for age <90% column, urban vs. mountain row, there is a range of -8.5 ±

7.5. This shows that the difference of the prevalence estimates for low height for age was -8.5 when comparing urban and mountain areas. In other words, there was a greater prevalence in mountain areas. The range of this difference was -1.0 (derived from -8.5 + 7.5) to -16.0 (derived from -8.5 - 7.5). Therefore, the 95% confidence interval for the true prevalence difference might have been as low as 1% or as great as 16%. Because this is a large range, this suggests that the precision for the estimate of -8.5 was low.

The prevalence estimates weight for age <80%, comparing urban and mountain areas have better precision than low height for age estimates. The estimates shown are -12.2 $\pm$ 6.2. Therefore, the 95% confidence interval for the true difference is -6.0 to 18.4.

Need for Caution

The formulas in this appendix apply in the case where the estimated prevalence rate is based on all 30 sample children (or an equal number of children) from each site. When the estimated prevalence rate is for a sub-group of the children where the number of children varies by site (e.g. for those in a particular age class), the estimate is for a ratio and the variance formula would be more complicated than those in this appendix. In addition, as noted in the previous paragraphs some emphasis has been placed on comparing prevalence rates or estimating the difference between two prevalence rates. The formulas for estimating the standard error of a difference between two ratios can be very complicated. The reader is referred to pages 195-202 of Survey Sampling by Dr. Leslie Kish for a comprehensive discussion of the computation of estimates of variances for such complex statistics. However, variances computed by the formulas in this section are often used as approximate measures of variances for prevalence rates based on subgroups of children.

Table 87: Differences Between Prevalence Estimates For Children By Ecological Areas Anthropometric Indices

Low Cut-Off Point

	Wt/Ht <90%	Ht/Age <90%	Wt/Age <80%	AC/Age <85%
Urban vs. Rural	---	---	-5.5 ± 5.1	-5.5 ± 2.9
Urban vs. Lowland	---	---	---	-4.0 ± 3.6
Urban vs. Foothill	---	---	---	-5.0 ± 4.4
Urban vs. Mountain	---	-8.5 ± 7.5	-12.2 ± 6.2	-8.0 ± 3.6
Urban & Foothill & Lowland vs. Mountain	-3.7 ± 3.2	---	-7.0 ± 5.0	---
Lowland vs. Foothill	---	---	---	---
Lowland vs. Mountain	-5.1 ± 4.0	---	-10.6 ± 6.3	---
Foothill vs. Mountain	---	---	-8.9 ± 5.7	---
Mean Prevalence Estimate for Lesotho	11.8 ± 1.6	22.9 ± 2.2	22.4 ± 2.4	9.3 ± 1.7

High Cut-Off Point

	Wt/Ht >110%	Ht/Age >100%	Wt/Age >100%	AC/Age >100%
Urban vs. Rural	---	4.9 ± 4.5	5.8 ± 5.2	---
Urban vs. Lowland	---	---	---	---
Urban vs. Foothill	---	---	7.2 ± 5.6	9.5 ± 8.9
Urban vs. Mountain	8.9 ± 7.5	5.8 ± 5.2	7.1 ± 5.4	10.2 ± 7.8
Urban & Foothill & Lowland vs. Mountain	7.8 ± 6.4	---	3.8 ± 3.3	8.4 ± 4.8
Lowland vs. Foothill	---	---	---	7.8 ± 6.9
Lowland vs. Mountain	9.8 ± 7.0	---	---	8.5 ± 5.4
Foothill vs. Mountain	---	---	---	---
Mean Prevalence Estimate for Lesotho	17.3 ± 3.1	8.8 ± 2.0	5.6 ± 1.6	24.8 ± 2.4

NOTE: --- Indicates the difference was not statistically significant from zero at the P = 0.05 level.

Table 88: Comparisons of Prevalence Estimates Between Ecological Areas For Mothers

Mother's Nutritional Status

Low Cut-Off Point

	Ht. <150 cm.	Fatfold <7.5 mm.
Urban vs. Rural	---	6.1 ± 3.0
Urban vs. Lowland	---	---
Urban vs. Foothill	---	-10.6 ± 8.4
Urban vs. Mountain	---	-6.0 ± 3.7
Urban & Lowland vs. Foothill andMountain	5.7 ± 5.2	---
Lowland vs. Foothill	---	---
Lowland vs. Mountain	6.0 ± 5.7	---
Foothill vs. Mountain	---	---
Mean Prevalence Estimate for Lesotho	12.1 ± 2.6	5.8 ± 2.8

High Cut-Off Point

	AC >29 cm.	AC >33.5 cm	AC >164 cm.	Fatfold >25 mm.
Urban vs. Rural	17.5 ± 14.1	11.0 ± 10.7		**
Urban vs. Lowland	---	---	---	---
Urban vs. Foothill	21.3 ± 16.3	13.3 ± 11.7	---	**
Urban vs. Mountain	26.9 ± 15.6	15.5 ± 10.9	---	**
Urban & Lowland vs. Foothill andMountain	17.4 ± 8.4	9.0 ± 5.1	5.4 ± 4.2	16.0 ± 14.2
Lowland vs. Foothill	13.1 ± 11.3	---	---	15.0 ± 12.7
Lowland vs. Mountain	18.7 ± 10.2	9.1 ± 5.5	7.7 ± 5.1	---
Foothill vs. Mountain	---	---	---	---
Mean Prevalence Estimate for Lesotho	40.3 ± 4.2	11.6 ± 2.5	12.6 ± 2.1	18.0 ± 7.0

NOTE: ** Indicates the difference was greater than 20% but not statistically significant from zero at the P = 0.05 level.

--- Indicates the difference was not statistically significant from zero at the P = 0.05 level.

APPENDIX 2. SURVEY DESIGN

Survey Sample Size

The method of determining sample size presented here very closely follows the method used by the Center for Disease Control, Atlanta, Georgia.

Some of the key factors which determine sample size include:

1. Available financial, personnel and physical resources.
2. Constraints such as time and logistical problems affecting the survey in the field, particularly transport.
3. Nature of the sample distribution assumed applicable.
4. The extent and depth of information desired.
5. Precision desired for statistical estimates and the confidence level to be associated with them.

Considering the effect of these factors on the survey, 30 sampling units would allow an estimation of the portion of the population in an area having a characteristic provided the characteristic is not rare (less than 5%) or very sporadic in its distribution.

To determine the appropriate survey sample size for a geographic area, the following equation can be used if the sampling distribution of the estimated prevalence is approximately Gaussian (43).

$$n = \frac{K Z^2}{D^2} (p) \quad (1 - p)$$

Z = normal deviate for confidence level desired (1.96 for 95% confidence and 1.64 for 90% confidence).

p = proportion of population having the attribute measured. This is determined by educated guess.

D = deviation from "p" due to sampling with confidence level chosen. The confidence limits for "p" would be $p \pm D$.

K = adjustment for "clustering effect."

Past experience with the Liberia National Nutrition Survey data regarding the proportion of children up to five years of age under the 90% reference median height for age has shown that K = 2 should allow for the clustering effect. The "Z" score is generally chosen for 95% confidence (Z = 1.96).

While the value of D can be predetermined, it depends on the value of p and may or may not be acceptable; for example, 50% ± 5% might be considered acceptable, but 10% ± 5% might not.

The value of p yielding the largest n is .5, so if a number of different attributes are to be measured for the universe, it is usually safest to assume p = .5. After fixing K, Z and p; n and D are the only values not determined.

By determining maximum deviation tolerable (D) equal to 4.6%, n can be solved for as follows:

$$K = 2 \text{ (cluster effect)}$$
$$Z = 1.96 \text{ (95\% confidence)}$$
$$p = .5 \text{ (50\%)}$$
$$D = .046 \text{ (4.6\%)}$$
$$n = \frac{2\ (1.96)^2}{(.046)^2}\ (.5)\ (.5)$$
$$n = 900$$

Thirty children were drawn using a random start technique within each selected unit. A total sample of 900 children (30 sample units x 30 children) with proportions having a characteristic varying as follows would have the following approximate precisions:

% Having Characteristics	95% Confidence Limits
50.0%	± 4.6%
20.0% (80.0%)	± 3.7%
10.0% (90.0%)	± 2.8%

Predetermination of sample size does not predetermine precision of survey estimation. Some variables will have greater precision than predicted and others will have less. The precision estimates are in Appendix I, p. 125.

Figure 13

SURVEY SITES

SURVEY SITES

URBAN - Sites 1-10
LOWLAND - Sites 11-31
FOOTHILL - Sites 32-41
MOUNTAIN - Sites 42,43,44,46,51-55, 57-59
*ORANGE RIVER VALLEY - Sites 45,47-50
Sites 56+60 were included in the sample design, but not surveyed.
*Included as part of the Mountain Sites

LESOTHO DISTRICT BOUNDARIES

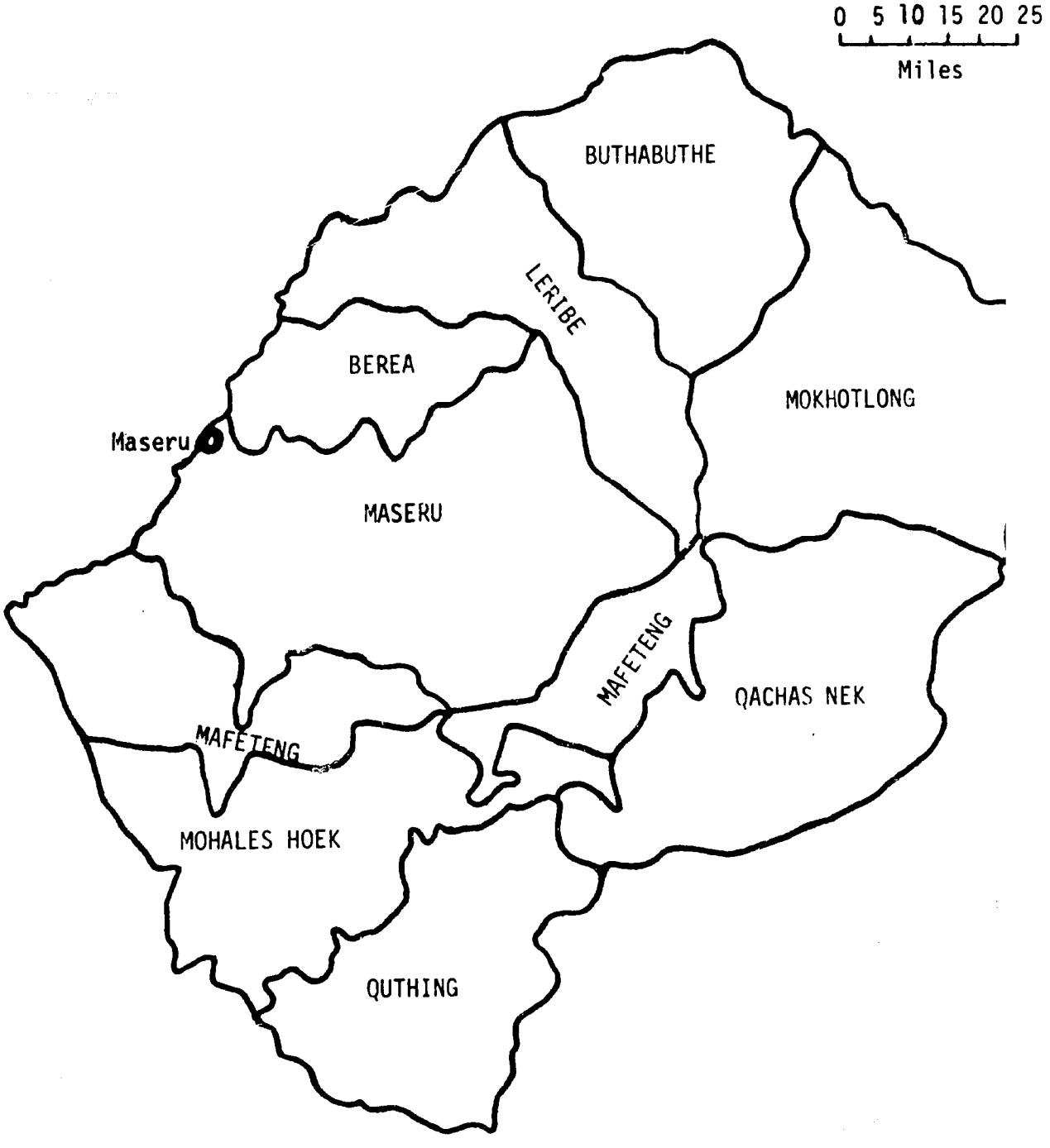


Figure 14

Table 89: Survey Sites

URBAN AREAS

DISTRICT	SITE No.	E.A. No.	VILLAGE NAME	VILL. No.	No. Sampled	COMMENTS
Leribe	1*	1116	Lisemeng	1	30	
	2	1214	Hleoheng	2	30	
Berea	3	1408	Ramonaheng	3	30	
Maseru	4*	3204	Besele	4	30	
	5	3205	Thamae	5	30	
	6	3205	Thamae	5	15	
		3205	Lithabaneng	6	15	
	7	3206	Motimposo	7	30	
	8	3209	Stadium Area	8	30	
	9*	3209	Hoohlo	9	30	
Mafeteng	10	3703	Liteneng	10	30	

LOWLAND AREAS

Butha Buthe	11	0213	Qalo	11	30	
	12*	0403	Likhutlong	12	30	
Leribe	13	1006	Likhakeng	13	15	
			Ha Kotsana	14	15	
	14	1014	Ha Ntholi	15	30	
	15*	1102	Matukeng	16	30	
	16	1112	Ha Qacha	17	30	
	17	1204	Maputsoe	18	30	

*Sites included in Planning Assistance Survey

Table 89 (continued)

DISTRICT	SITE No.	E.A. No.	VILLAGE NAME	VILL. No.	No. Sampled	COMMENTS
Leribe	18*	1306	Tokoto	19	15	
			Makhaketsa	20	15	
Berea	19*	2014	Senyotong	21	15	
			Thokolosi-Ha Sekaleli	22	15	
Maseru	20	2905	Ha Tsilo	23	30	
	21*	2914	Ha Pela	24	15	
			Malimong	25	15	
	22	2915	Mahlanyeng	26	6	Non-urban lowland site (was sampled from urban universe)
			Mafikeng	27	24	
	23	3005	Sekhutloaneng	28	15	
			Lihaseng	29	15	
	24	3010	Hekeng	30	15	
			Khoabane	31	15	
	25	3108	Ha Ramokotjo	32	15	
			Ha Loka-Takalimane	33	15	
	26*	3113	Matebesi	34	15	
			Setho	35	15	
	27	4014	Tsoeneng Ha Letsie	36	15	
			Joala Bohold	37	15	
Mafeteng	28	3702	Khubetsoana	38	30	
	29*	3710	Ha Mahosi	39	30	
	30*	4003	Ha Joel	40	15	Ha Mohale surveyed instead of Ha Joel
			Ha Nkhabu	41	15	
Mohale's Hoek	31*	4514	Ha Lesala	42	15	Mootsinyane surveyed instead of Ha Selemo
			Ha Selemo	43	15	

*Sites included in Planning Assistance Survey

Table 89 (continued)

FOOTHILL AREAS

DISTRICT	SITE No.	E.A. No.	VILLAGE NAME	VILL. No.	No. Sampled	COMMENTS
Butha Buthe	32	0205	Ha Lebesa	44	15	
			Ha Mphoroane	45	15	
	33*	0315	Mokebe	46	15	
			Mokone	47	15	
Leribe	34	0714	Malefane	48	15	All 30 children
			Lenka	49	15	from Malefane
	35	0902	Lekhalong	50	30	
Berea	36	1508	Tsatsa-Le-Moea	51	15	All 30 children
			Ha Nthoba	52	15	from Ha Nthoba
	37*	1804	Mokhameleli	53	15	All 30 children
			Ha George	54	15	from Mokhameleli
Maseru	38	2414	Ha-Motanyane-Thusong	55	30	Outlying part of Ramabanta surveyed instead
	39	2618	Likolobeng	56	15	
			Monyane	57	15	
Mafeteng	40*	3408	Makhakhe	58	30	
	41	3611	Phillip, Ranahoe	59	30	Most from Ranahoe

MOUNTAIN AREAS

Maseru	42	2106	Khojane	60	15	Tumaote surveyed
			Malimong	61	15	instead of Malimong
	43	2123	Thebe Ea Khale	62	15	
			Ha Toka-Linokong	63	15	
	44	2308	Ha Nthibane	64	15	Koebung instead of
			Monyane	65	15	Ha Nthibane. Makhalong instead of Monyane
Mohale's Hoek	45	4315	Putsoame, Ha Makara	66	15	
			Tsepong	67	15	

ites included in Planning Assistance Survey

Table 89 (continued)

DISTRICT	SITE No.	E.A. No.	VILLAGE NAME	VILL. No.	No. Sampled	COMMENTS
Quthing	46	4816	Seqalaba	68	30	
	47	4911	Ha Ntjoli	70	15	
			Pulane	69	15	
	48	5016	Makorong	71	15	
			Tlokoeng, Phokeng	72	15	
	49	5110	Seqhobong Ha Koloi	73	15	Alternate villages surveyed.
			Mphasane	74	15	Vill 73 - Ha Mopheti EA5017
						Vill 74 - Ha Koali EA5018
	50	5219	Ha Khakhau	75	15	
			Mabitseng	76	15	
Qacha's Nek	51	5501	Matebelleng	77	15	
			Makauteng, Ha Thaha	78	15	
	52	5601	Motorong	80	15	
			Liphakoeng	79	15	
	53	5617	Ha Pheello	81	21	
			Ha Sebata	82	9	
Mokhotlong	54	5810	Salang	83	15	
			Mokhotlong	84	15	
	55	5904	Mabothong	85	15	Alternate villages surveyed.
			R.C.S.	86	15	Vill 85 - Tseko EA5911
						86 - Rafolatsane EA5912
	56	5711	Ha Toeba	95	30	Only 15 children surveyed from substitute village, Koeneho EA5911 (results not included)

Sites included in Planning Assistance Survey

Table 89 (continued)

DISTRICT	SITE No.	E.A. No.	VILLAGE NAME	VILL. No.	No. Sampled	COMMENTS
Leribe	57	0608	Mpakatheng	87	15	Completion of sites 57, 58, 59 were delayed several weeks due to logistic difficulties.
			Ha Mpeli	88	15	
Mohale's Hoek	58*	4221	Ha Kou	89	15	
			Ha Ferete	90	15	
Qacha's Nek	59*	5313	Ha Seeiso-Boliammele	91	15	
			Khoshaneng	92	15	
Leribe	60	0515	Mankoeng	93	15	Not surveyed; persistently inaccessible. No substitute selected.
			Ha Mashapha	94	15	

*Sites included in Planning Assistance Survey

APPENDIX 3. ANTHROPOMETRIC REFERENCE DATA

Anthropometric Standards for Reference Populations

Data from reference populations are used throughout the world to indicate whether a subject, usually a child, has normal anthropometric measurements such as weight or height. The reference median value is a basis of comparison between the child studied and that of the reference population.

The result is usually presented in the form of percentages (20). For example, a child's weight has a value that is a percentage of the median weight for children of the same age from the reference population. This result is expressed a "percentage weight for age." In the same way, percentages of other measures can be expressed such as "percentage height for age." The percentage weight for height is the ratio of the weight of the child with that of the median weight of reference children who are the sam height.

Requirements for reference data include (2):

1. A large and valid sample, representative of a well defined group.
2. Relatively recent reference data.
3. Adequate measuring techniques.

If the reference population is from an industrialized country and is characterized by reasonably adequate health and nutrition care, then it might indicate a median level of a measure near which the risk of morbidity and mortality related to undernutrition is relatively low. This is one basis for the "Road to Health" weight charts used throughout the world, where a continuing upper level of the "safe" weight range is based on a reference median.

Such a level is neither ideal nor is it necessarily a "standard" that a population would be expected to achieve with improved health and nutrition status. Within the country itself, there is usually an upper socio-economic group which can indicate to some extent the potential growth and tissue bulk of the rest of the country. This assumes similar racial groups are compared. A perspective may thus be achieved by comparing the reference median such as from the USA, a Basotho optimum and the rest of the Basotho population.

No reference data are available from Lesotho. However, studies in West Africa, such as in Ibadan (24) show that young children of families attending the University have similar measurements of weight and height to American children. Habicht presents evidence from studies in less developed countries that the difference in growth of preschool children associated with social class and environment are many times related to ethnic factors alone (1). Recent results of the International Biological Program indicate that genotype differences in growth perhaps do not exist between Africans and Europeans (44), strengthening the evidence that environmental factors such as health and nutrition, are all important in growth.

Reference data for height and weight for this survey were derived from large, representative studies recently completed in the USA. This was recommended by the National Academy of Sciences (NAS) Committee on Nutrition Advisory to the Center for Disease Control, USA in 1974. The reference populations included children up to 24 months from middle to upper socio-economic status families and those aged 2-6 years from a nation-wide study in the USA (48, 49).

These data are similar but not identical to that recommended by WHO using the "Boston" reference population compiled 30 years ago (20). Comparisons of results for this survey with others using the Boston references should take into account the differences.

There are no suitable data from the USA for arm circumference and fatfold measures. In this survey arm circumference median values were based on modified data from Polish children (44). Arm circumference for height reference was derived by combining these values with the NAS median height data. The source for fatfold data was a survey of London children, reported in 1962 by Tanner (44).

Using the reference data, on what basis can an index for undernutrition be derived? For practical purposes, it should indicate a level below which an individual or population is at serious risk of ill health. Delayed mental development and reduced potential for learning also have been implicated as factors related to this low nutritional status (47).

Reference Data Values

The data listed are the median or 100% values from the reference populations according to age or height. The sources of these reference data values were varied. Weight for age, height for age and weight for height values were from the Center for Disease Control, USA from data of two major USA surveys (48, 49).

Arm circumference for age reference values came from:

Burgess, H.J. and Burgess, A.P., A Modified Standard for Mid-Upper Arm Circumference in Young Children, J. Trop. Pediat., 15: 189, 1969, using data collected by N. Wolanski for Polish children.

Triceps fatfold for age reference population data was taken from:

Tanner, J.M. and Whitehouse, R.H., Standards for Subcutaneous Fat in British Children, Brit. Med. J., 1: 446, 1962.

Table 90: Anthropometric Reference Data According to Age and Sex for Weight, Height, Arm Circumference and Triceps Fatfold

AGE IN MONTHS	WEIGHT (kg)		HEIGHT (cms)		ARM CIRCUMFERENCE (cms)		TRICEPS FATFOLD (mm)	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
0	3.5	3.2	50.2	49.6	10.5	10.2	6.0	6.5
1	4.4	4.0	54.6	53.8	11.5	11.1	7.0	7.5
2	5.3	4.8	58.3	57.1	12.5	12.0	8.0	8.5
3	6.1	5.5	61.3	59.8	13.5	13.0	9.0	9.0
4	6.7	6.1	63.8	62.0	14.1	13.7	9.5	9.5
5	7.4	6.7	65.8	63.9	14.5	14.2	10.0	10.0
6	7.9	7.2	67.6	65.6	14.9	14.5	10.0	10.0
7	8.4	7.7	69.3	67.3	15.2	14.8	10.0	10.0
8	8.8	8.2	70.8	68.9	15.4	15.0	10.2	10.2
9	9.2	8.6	72.3	70.3	15.6	15.2	10.2	10.2
10	9.6	8.9	73.6	71.8	15.7	15.4	10.2	10.2
11	9.9	9.2	74.9	73.1	15.8	15.5	10.5	10.5
12	10.2	9.5	76.2	74.6	15.9	15.6	10.5	10.5
13	10.4	9.7	77.4	75.6	16.0	15.6	10.5	10.5
14	10.6	9.9	78.5	76.8	16.0	15.6	10.5	10.5
15	10.8	10.1	79.5	77.9	16.0	15.8	10.5	10.5
16	11.0	10.3	80.5	78.9	16.2	15.8	10.5	10.5
17	11.2	10.5	81.5	79.9	16.2	15.8	10.5	10.5
18	11.4	10.7	82.4	80.9	16.2	15.8	10.2	10.2
19	11.6	10.9	83.2	81.8	16.2	15.8	10.2	10.2
20	11.8	11.0	84.0	82.7	16.2	16.0	10.2	10.2
21	12.0	11.2	84.8	83.5	16.2	16.0	10.2	10.2
22	12.2	11.4	85.6	84.4	16.2	16.0	10.2	10.2
23	12.3	11.6	86.4	85.1	16.2	16.0	10.0	10.0
24	12.5	11.8	87.1	85.9	16.4	16.0	10.0	10.0
25	12.7	12.0	87.8	86.6	16.4	16.0	10.0	10.0
26	12.8	12.1	83.5	87.3	16.4	16.2	10.0	10.0
27	13.0	12.3	89.2	88.0	16.4	16.2	10.0	10.0
28	13.1	12.5	39.9	88.7	16.4	16.2	10.0	10.0
29	13.3	12.7	90.6	89.4	16.4	16.2	9.6	9.8
30	13.4	12.8	91.3	90.1	16.4	16.2	9.6	9.8
31	13.6	13.0	92.0	90.8	16.4	16.2	9.6	9.8
32	13.7	13.2	92.7	91.4	16.4	16.2	9.6	9.8
33	13.9	13.4	93.3	92.1	16.4	16.2	9.6	9.8
34	14.0	13.5	94.0	92.7	16.4	16.4	9.6	9.8
35	14.2	13.7	94.6	93.4	16.4	16.4	9.3	9.6

Table 90 (cont'd.)

AGE IN MONTHS	WEIGHT (kg) MALES	WEIGHT (kg) FEMALES	HEIGHT (cms) MALES	HEIGHT (cms) FEMALES	ARM CIRCUMFERENCE (cms) MALES	ARM CIRCUMFERENCE (cms) FEMALES	TRICEPS FATFOLD (mm) MALES	TRICEPS FATFOLD (mm) FEMALES
36	14.3	13.9	95.3	94.0	16.4	16.4	9.3	9.6
37	14.5	14.0	95.9	94.6	16.4	16.4	9.3	9.6
38	14.6	14.2	96.6	95.3	16.6	16.4	9.3	9.6
39	14.8	14.4	97.2	95.9	16.6	16.4	9.3	9.6
40	14.9	14.5	97.8	96.5	16.6	16.4	9.3	9.6
41	15.1	14.7	98.5	97.1	16.6	16.4	9.0	9.4
42	15.2	14.9	99.1	97.7	16.6	16.4	9.0	9.4
43	15.4	15.0	99.7	98.3	16.6	16.4	9.0	9.4
44	15.5	15.2	100.3	99.0	16.6	16.4	9.0	9.4
45	15.7	15.3	100.9	99.6	16.6	16.4	9.0	9.4
46	15.9	15.5	101.5	100.1	16.6	16.6	9.0	9.4
47	16.0	15.7	102.1	100.7	16.6	16.6	8.8	9.3
48	16.2	15.8	102.7	101.3	16.6	16.6	8.8	9.3
49	16.4	16.0	103.3	101.9	16.6	16.6	8.8	9.3
50	16.5	16.2	103.8	102.5	16.6	16.6	8.8	9.3
51	16.7	16.3	104.4	103.1	16.8	16.8	8.6	9.3
52	16.9	16.5	105.0	103.6	16.8	16.8	8.6	9.3
53	17.0	16.7	105.5	104.2	16.8	16.8	8.6	9.2
54	17.2	16.8	106.1	104.8	16.8	16.8	8.4	9.2
55	17.4	17.0	106.6	105.3	17.0	16.8	8.4	9.2
56	17.6	17.1	107.2	105.9	17.0	16.8	8.4	9.2
57	17.7	17.3	107.7	106.4	17.0	16.8	8.2	9.2
58	17.9	17.5	108.3	107.0	17.0	16.8	8.2	9.2
59	18.1	17.6	108.8	107.5	17.0	17.0	8.2	9.2
60	18.3	17.8	109.4	108.1	17.0	17.0	8.2	9.2

Table 91: Anthropometric Reference Data According to Sex for Weight for Height and Arm Circumference for Height

HEIGHT/LENGTH (Cm)	WEIGHT (Kg) MALES	WEIGHT (Kg) FEMALES	ARM CIRCUM. (Cm) SEXES COMBINED	HEIGHT/LENGTH (Cm)	WEIGHT (Kg) MALES	WEIGHT (Kg) FEMALES	ARM CIRCUMF. (Cm) SEXES COMBINED
				67.5	7.9	7.7	14.8
48.0	3.1	3.1	10.0	68.0	8.0	7.8	14.9
48.5	3.1	3.1	10.1	68.5	8.2	7.9	15.0
49.0	3.2	3.2	10.2	69.0	8.3	8.1	15.1
49.5	3.2	3.3	10.3	69.5	8.4	8.2	15.2
50.0	3.3	3.3	10.4	70.0	8.6	8.3	15.3
50.5	3.4	3.4	10.5	70.5	8.7	8.4	15.3
51.0	3.5	3.5	10.6	71.0	8.8	8.6	15.4
51.5	3.6	3.6	10.7	71.5	9.0	8.7	15.4
52.0	3.7	3.7	10.8	72.0	9.1	8.8	15.5
52.5	3.8	3.8	10.9	72.5	9.2	8.9	15.5
53.0	3.9	3.9	11.0	73.0	9.3	9.0	15.6
53.5	4.0	4.0	11.1	73.5	9.5	9.2	15.6
54.0	4.1	4.1	11.2	74.0	9.6	9.3	15.7
54.5	4.2	4.2	11.3	74.5	9.7	9.4	15.7
55.0	4.3	4.3	11.4	75.0	9.8	9.5	15.7
55.5	4.4	4.4	11.6	75.5	9.9	9.6	15.7
56.0	4.6	4.5	11.8	76.0	10.1	9.7	15.8
56.5	4.7	4.7	12.0	76.5	10.2	9.8	15.8
57.0	4.8	4.8	12.2	77.0	10.3	10.0	15.8
57.5	5.0	4.9	12.4	77.5	10.4	10.1	15.8
58.0	5.1	5.0	12.6	78.0	10.5	10.2	15.9
58.5	5.2	5.2	12.7	78.5	10.6	10.3	15.9
59.0	5.4	5.3	12.8	79.0	10.8	10.4	15.9
59.5	5.5	5.4	13.0	79.5	10.9	10.5	15.9
60.0	5.7	5.6	13.1	80.0	11.0	10.6	16.0
60.5	5.8	5.7	13.3	80.5	11.1	10.7	16.0
61.0	6.0	5.9	13.4	81.0	11.2	10.8	16.0
61.5	6.1	6.0	13.5	81.5	11.3	10.9	16.0
62.0	6.3	6.1	13.7	82.0	11.4	11.1	16.0
62.5	6.4	6.3	13.8	82.5	11.5	11.2	16.1
63.0	6.5	6.4	13.9	83.0	11.6	11.3	16.1
63.5	6.7	6.6	14.0	83.5	11.8	11.4	16.1
64.0	6.8	6.7	14.1	84.0	11.9	11.5	16.1
64.5	7.0	6.8	14.2	84.5	12.0	11.6	16.1
65.0	7.1	7.0	14.4	85.0	12.1	11.7	16.1
65.5	7.3	7.1	14.4	85.5	12.2	11.8	16.2
66.0	7.4	7.3	14.5	86.0	12.3	11.9	16.2
66.5	7.6	7.4	14.6	86.5	12.4	12.0	16.2
67.0	7.7	7.5	14.7	87.0	12.5	12.1	16.2

Table 91 (cont'd)

HEIGHT/LENGTH (cm)	WEIGHT (Kg) MALES	WEIGHT (Kg) FEMALES	ARM CIRCUMF. (Cm) SEXES COMBINED	HEIGHT/LENGTH (cm)	WEIGHT (Kg) MALES	WEIGHT (Kg) FEMALES	ARM CIRCUMF. (cm) SEXES COMBINED
87.5	12.6	12.2	16.2	107.5	17.7	17.4	16.9
88.0	12.7	12.3	16.3	108.0	17.9	17.6	16.9
88.5	12.8	12.5	16.3	108.5	18.0	17.8	16.9
89.0	13.0	12.6	16.3	109.0	18.2	17.9	16.9
89.5	13.1	12.7	16.3	109.5	18.4	18.1	17.0
90.0	13.2	12.8	16.3	110.0	18.5	18.3	17.0
90.5	13.3	12.9	16.3	110.5	18.7	18.4	17.0
91.0	13.4	13.0	16.4	111.0	18.9	18.6	17.1
91.5	13.5	13.1	16.4	111.5	19.0	18.8	17.1
92.0	13.6	13.2	16.4	112.0	19.2	19.0	17.1
92.5	13.7	13.4	16.4	112.5	19.4	19.1	17.2
93.0	13.9	13.5	16.4	113.0	19.6	19.3	17.2
93.5	14.0	13.6	16.4	113.5	19.8	19.5	17.2
94.0	14.1	13.7	16.4	114.0	19.9	19.7	17.3
94.5	14.2	13.8	16.4	114.5	20.1	19.9	17.3
95.0	14.3	14.0	16.4	115.0	20.3	20.0	17.4
95.5	14.4	14.1	16.4	115.5	20.5	20.2	17.4
96.0	14.6	14.2	16.5	116.0	20.7	20.4	17.4
96.5	14.7	14.3	16.5	116.5	20.9	20.6	17.5
97.0	14.8	14.5	16.5	117.0	21.1	20.8	17.5
97.5	14.9	14.6	16.5	117.5	21.3	21.0	17.6
98.0	15.0	14.7	16.5	118.0	21.5	21.2	17.6
98.5	15.2	14.8	16.5	118.5	21.7	21.4	17.6
99.0	15.3	15.0	16.5	119.0	21.9	21.6	17.7
99.5	15.4	15.1	16.6	119.5	22.1	21.8	17.7
100.0	15.6	15.2	16.6	120.0	22.3	22.0	17.8
100.5	15.7	15.4	16.6	120.5	22.5	22.2	17.8
101.0	15.8	15.5	16.6				
101.5	16.0	15.6	16.6				
102.0	16.1	15.8	16.7				
102.5	16.2	15.9	16.7				
103.0	16.4	16.1	16.7				
103.5	16.5	16.2	16.7				
104.0	16.7	16.4	16.7				
104.5	16.8	16.5	16.8				
105.0	16.9	16.7	16.8				
105.5	17.1	16.8	16.8				
106.0	17.2	17.0	16.8				
106.5	17.4	17.1	16.8				
107.0	17.6	17.3	16.9				

APPENDIX 4. METHODOLOGY AND PROCEDURES

Interview Form I, used for all households surveyed (p. 148)

Interview Form II, used for every fifth child surveyed to make up the subsample (p. 149)

Form clarification of some questionnaire items (p. 150)

Age Assessment (p. 151)

Calendar of Events (p. 153)

Anthropometric Equipment (p. 154)

Steps for Taking Blood for Hemoglobin (p. 155)

FORM I

KINGDOM OF LESOTHO — NATIONAL NUTRITION SURVEY — FORM I 0-59 MONTHS

DISTRICT	ECOLOG	SITE NO.	TEAM	CHILD ID	VILLAGE	H'HOLD	FIRST
(1-2)	(3-4)	(5-8)	(9-10)	(11-12)	(13-14)	(15-16)	1 Yes 2 No (17)

HH HEAD _____ 1 M 2 F (18)
Relat _____ (19)
OCCUP _____
Fr _____ (20)
Mr _____ (21)
HH _____ (22)
PLACE WORK
Fr _____ (23)
Mr _____ (24)

OTHER HH WORKER IN S.A.: 1 Yes 2 No 3 Unknown (25)

PERSON INTERVIEWED: 1 Mother 2 Father 3 G'Mother 4 Other _____ (26)

CHILD CARE — USUAL: 1 2 3 4 — CURRENT: 1 Mother 2 Father 3 G'Mother 4 Other (27-28)

H'HOLD SIZE (29-30)

	MTH	YEAR	
End Last Preg			(31-34)
End Next Preg			(35-38)
No. Live Births			(39-40)
Children Alive Today			(41-42)
Birth Order			(43-44)

Attends Clinic: Yes ☐ No ☐ (46)

NAME CHILD _____

SEX 1 M 2 F (45)

INTERVIEW DATE	DAY	MTH	YEAR	(47-52)
BIRTH DATE				(53-58)

AGE — TOTAL MTHS (59-60)

SOURCE BIRTH DATE: 1 Birth Record 2 Clinic Record 3 Calendar 4 Teeth 5 Parent record 6 Other _____ (61-65)

CHILD 0-36 MONTHS — MILK TEETH COUNT (66-67)

SOCIAL

MOTHER

READS SESOTHO: 1 Yes 2 No (68)

AGE: 1 Under 20 2 20-40 3 Over 40 (69-70)

PREGNANT: 1 Obvious 2 Stated 3 No 4 Unknown (71)

STATUS — FATHER: 1 2 3 4 (72) — MOTHER: 1 Present 2 Abs. Contr. 3 Absent 4 Dead (73)

DIET DATA CHILD

EACH CHILD

MILK SOURCE: 1 Breast 2 Own Farm 3 Other Farm 4 Market/Shop 5 Clinic 6 School 7 None (18-24)

FOOD SOURCE: 1 Home 2 Clinic 3 School 4 None 5 Other (25-29)

CHILD 0-36 MONTHS

AGE BREAST STOPPED: 1 Not Yet 2 0-1 MTHS 3 2-5 4 6-12 5 12+ 6 Unknown (30)

AGE FOOD FIRST GIVEN: 1 Not Yet 2 0-5 MTHS 3 6-12 4 12+ 5 Unknown (31)

MEASURES

CHILD: WEIGHT ___.___ kg — LENGTH/HEIGHT ___.___ cm (32-38)
A/C ___.___ cm — FATFOLD ___.___ mm (39-44)

MR: A/C ___.___ cm (45-53) — FATFOLD ___.___ mm — HEIGHT ___ cm

CLINICAL

EACH CHILD — BILAT PEDAL EDEMA: 1 Yes 2 No 3 Uncertain (54)

SPEECH 12-36 MTHS: 1 Says 1 Word only 2 Says phrase 3 None 4 Uncertain (55) — AGE ONSET (Mths) (56-57)

MOTHERS — GOITER: 1 Obvious 2 Seen Close 3 No 4 Uncertain (58) — RASH: 1 Neck 2 Forearm/hand 3 Legs 4 No 5 Uncertain (59-63)

SUBSAMPLE SELECTED: 1 Yes 2 No (64)

FORM CHECKED BY: 1 Team _____ 2 Super _____ 3 Other _____

COMMENTS: _____

FORM II (Subsample)

KINGDOM OF LESOTHO — NATIONAL NUTRITION SURVEY — FORM II SUBSAMPLE 0-59 MTHS

SITE NO.	CHILD ID.	CHILD AGE (MTHS)	CHILD NAME
(36–39)	(40–41)	(42–43)	

FAMILY POSSESSIONS

SES

Cattle
1 ☐ 0
2 ☐ 1-5
3 ☐ 6-9
4 ☐ 10+
5 ☐ UNK
(44)

Sheep/Goats
1 ☐ 0
2 ☐ 1-10
3 ☐ 11-20
4 ☐ 21-50
5 ☐ 50+
6 ☐ Unk
(45)

COMMENTS (46–48) ___ ___ ___

FOOD INTAKE

DIET

ALL CHILDREN PAST 24 HOURS
1 ☐ Breast Milk
2 ☐ Other Milk
3 ☐ Moroho*
4 ☐ Maize
5 ☐ Wheat
6 ☐ Sorghum
7 ☐ None
(49–54)

CHILD/FAMILY PAST 3 DAYS
Child Family
1 ☐ ☐ Poultry/MEAT
2 ☐ ☐ Fish
3 ☐ ☐ Eggs
4 ☐ ☐ Peas/Beans
5 ☐ ☐ None
(55–58)

COMMENTS (59–61) ___ ___ ___

DEVELOPMENT

CLIN 12-36 MTHS

STAND/WALK
1 ☐ Stand
2 ☐ Walk
3 ☐ Neither
4 ☐ No Test
(62)

GRASP
1 ☐ Pinch
2 ☐ Hand
3 ☐ Either
4 ☐ Unable
5 ☐ No Attempt
6 ☐ No Test
(63)

COMMENTS (64–66) ___ ___ ___

LAB — BLOOD TAKEN 1 ☐ Yes 2 ☐ No (67) — Hb ☐☐.☐ gm % (68–70)

COMMENTS

*Moroho: Dark Green Leafy Vegetables

Form Clarification

The following are explanations of some questionnaire items on Form I:

First: "Yes" was marked if this was the first time the person was being interviewed on this survey.
"No" was marked if the person interviewed was interviewed before for this survey.

Birth Order: If twins were surveyed the same birth order number was entered for both children.

Status: #1 The mother/father was marked PRESENT if he/she was physically present with the index child anytime within 6 months from the interview date. The parent did not have to be present at the interview.

#2 The parent was marked ABS. CONTR. (absent with contribution) if the parent was physically away from the child for greater than 6 months from the interview date, but contributed food or money to the child within that six month period.

#3 The parent was marked ABSENT if he/she was physically away from the child for more than 6 months before the interview date, and had not contributed food or money to the child within that six month period.

#4 The parent was marked DEAD if he had been dead for greater than 6 months from the interview date. If he/she had been dead for less than 6 months since the interview date, he is either in category 1, 2, or 3 depending on his former physical whereabouts and contribution to the index child during and/or greater than the last six months from the interview date.

Goiter in Mothers: If the mother was not available at the time of the interview, this question was omitted. The following is the text that appeared in the training manual:
Goiter - A goiter is a swelling in the neck involving part or all of the thyroid gland.

a. Look at the mother's neck from about 5 feet away. If you see a large swelling with her head in normal position, mark in the blocks "Obvious."
b. If at 5 feet swelling is not seen, stand next to the mother and look at her neck. If you see a swelling with her head in normal position, mark in the blocks "Seen Close."
c. If no swelling is seen, have the mother throw her head back and fully extend her neck. (Swallowing will also help in identifying swelling.) If swelling is seen, mark in the blocks "Seen Close."

d. If no swelling is seen at all mark in the blocks "No."

e. If uncertain whether there is any swelling at all, mark "Uncertain."

The following are explanations of some questionnaire items on the subsample form, Form II, taken from the training manual.

Food Intake for Each Child Yesterday

Ask the child and/or mother what the child ate yesterday. Mark in the blocks the kind of foods eaten by the child yesterday. With older children, ask the mother and the child. As the child and/or mother recall the child's food intake, mark the appropriate boxes. After this is done, as a double check, ask the mother and/or the child if the child has eaten any of the listed foods yesterday. There may be more than one answer to this question.

Child/Family Past 3 Days

Mark in the blocks the kinds of foods eaten by the child and his family. First ask the child and/or the mother of the child if the child has eaten any of the listed foods in the past three days. Then ask the mother and/or the family members the same question from the same list of foods. There may be more than one answer to this question.

Clinical Development

Stand/Walk - (There may be more than one answer to these questions.)

1. Instruct the caretaker to have the child stand (with no help). If the child stands, mark in the appropriate box.
2. Instruct the caretaker to have the child walk (with no help). If the child walks, mark in the appropriate box.
3. If the child cannot stand or walk, mark in the box "Neither."
4. Mark "No Test" if this test is not done.

Age Assessment

Date of birth is the most important piece of background information on the form. Be certain to take great care in assessing the child's age. Survey data which will be compared to anthropometric standards require highly accurate age information.

Question the caretaker and/or other relative several times about different birth records which may be available. Cross check answers given by requestioning using other methods (e.g. calendar).

Methods of Age Assessment - The most valid birthdate information is obtained from records such as:

1. Birth Record - This is an official document recorded at the time of birth (e.g. birth certificate, baptismal certificate) and is the most reliable type of record.

2. Clinic Record - This is a verifiable record from a clinic which contains the age of the child.

If no such records are available, estimates of birth must be made by using the following:

3. Calendar - This is a calendar of events. Age can be determined if a child is born at the time of a particular event. Local events such as floods, elections, harvests etc. are recorded in the appropriate boxes as follows:

a. In the first column marked ANNUAL, mark in the box events next to the appropriate month which occur every year (e.g. planting season, harvest, rains, winter).

Example:

	ANNUAL
May	rains
June	
July	
Aug.	
Sept.	
Oct.	harvest

b. In the remaining columns record in the appropriate box when a special event took place.

Example:

	1967	1968	1969
Aug.			Village Chief Died

4. Milk Teeth Count - The number of milk teeth plus 6 = child's age in months. Count the number of milk teeth if the child is approximately 36 months of age or less. This may be done by glancing in the child's mouth when the opportunity arises during the interview session. DO NOT FORCE THE CHILD'S MOUTH OPEN.

5. Verifiable record - This includes a broader, more general category such as a written record kept by the parents and is the least valid type of record.

6. Stated - the parent or caretaker states the birthdate (or age) of the child.

7. Sibling Age - This is a comparison of ages between the child and a brother or a sister.

Figure 15

LOCAL EVENTS CALENDAR 0-59 MONTHS

DISTRICT	SITE NO.	VILLAGE NO.	TEAM
01	02C5	44	09

	ANNUAL	1971	1972	1973	1974	1975	1976
JAN.	NEW YEAR SCHOOLS OPEN						
FEB.	PEACH PRESERVATION						
MAR.	MOSHOESHOE'S DAY BEAN HARVEST						
APR.	EASTER END OF PRESERVATION						POPULATION CENSUS
MAY	SORGHUM HARVEST ASCENSION DAY KING'S BIRTHDAY			INSTALLATION OF A NEW CHIEF		LOBOLA CELEBRATION	
JUNE	MID WINTER				CONSTRUCTION OF SELF HELP ROAD		
JULY	RE OPENING OF SCHOOLS						
AUG.	FROSTS DUSTS						
SEPT.	PLOUGHING PERIOD	CHIEF DIED					
OCT.	PLOUGHING INDEPENDENCE						10TH ANNIVERSARY OF INDEPENDENCE
NOV.	HOEING BEGINS						
DEC.	SCHOOLS CLOSE CHRISTMAS						

Anthropometric Equipment

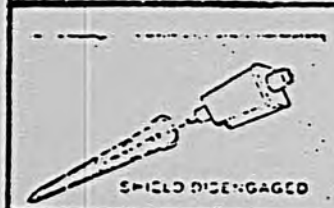
Height or length of children was measured in centimeters with a custom-made portable wooden board produced from a prototype made at UCLA. Height of mothers was measured to the nearest centimeter using an extension piece of this board. Weight of children was measured using a Salter hanging scale (25 kg. capacity). Larger pants were made locally because some children 0-5 years could not fit into the ready-made Salter pants. Arm circumference was measured with a Zerfas Insertion Tape. Triceps fatfold of children and mothers was measured with a Holtain-Tanner-Whitehouse caliper at the mid-posterior point of the left upper arm.

Figure 16

STEPS FOR TAKING BLOOD FOR HEMOGLOBIN USING UNOPETTES

1. Take one unopette reservoir from the sealed plastic bag which has been premarked with the village ID code.

2. Grasping the reservoir in one hand, holding the pipette assembly with the other, apply firm even pressure and push the tip of the pipette shield through the diaphragm in the neck of the reservoir. Remove the pipette with shield.



3. Disengage shield from the pipette with a twist action and leave the pipette loose in the shield (as shown) until ready to use. Place reservoir and pipette aside until ready to use.

4. Clean thumb of subject's hand by rubbing with alcohol swab. Allow area to dry.

5. Hold the subject's thumb in your hand. Make a quick, but firm jab with the lance to the fleshy part of the thumb. (Be prepared for a sudden, instinctive withdrawal movement by the subject).
Using a dry gauze swab, wipe away the first two drops of blood.

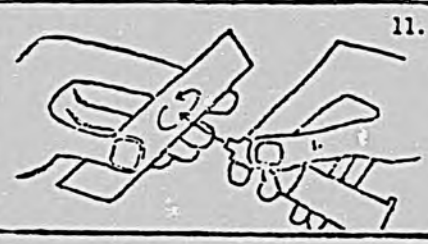
6. Allow a drop of blood to form on the thumb. Holding the pipette horizontally, touch the pipette to, but not into this drop, and allow the pipette to fill by capillary action. Wipe away excess blood from outside of the pipette, being careful not to touch the tip which would draw blood out.

7. Loosely insert pipette into the opening of reservoir bottle.

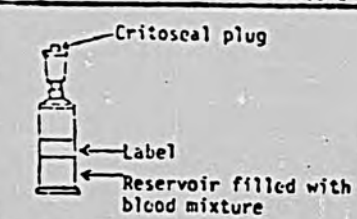
8. Gently squeeze the bottle with one hand.
With the other hand cover upper opening of pipette with your index finger. Seat pipette into reservoir.

9. Release pressure on reservoir. Release finger from pipette. (Blood will then be drawn into reservoir bottle).
Squeeze the container several times. Be careful not to let reservoir liquid overflow.

10. Place your index finger over the opening of reservoir and pipette unit and invert a few times to mix.



11. Hold Critoseal upside down in one hand.
With thumb and index finger of other hand, hold reservoir and pipette unit by grasping pipette top.
Place pipette opening into Critoseal. Use twisting action to plug pipette. Remove.



12. Make sure subject's hand is wiped off and if desired, apply bandaid.
Write ID# of subject on unopette lable. Return unopette to premarked plastic bag. Place bag in pack.

APPENDIX 5. LOGISTICS AND PERSONNEL

Survey Schedule

March 23	USAID/Washington requested UCLA to discuss possibility of nutrition survey with USAID and Government of Lesotho.
April 5-16	Initial UCLA Nutrition Assessment Unit visit to Lesotho.
April 27	USAID/Maseru received formal request from Government of Lesotho for assistance in National Nutrition Survey.
August 16-29	Survey Preparation in Lesotho
August 25-27	Initial Supervisor Training
August 30-Sept. 17	Trainee Training
Sept. 20-Nov. 26	Field Phase
Oct. 11-15	Teams convened in Maseru for standardization testing, equipment reorganization and final field phase planning.

Survey Preparation in Lesotho (August 16-29)

Two weeks of preparation were required for the following:

1. Inform Government Ministries of survey commencement.
2. Finalize government and other agencies committments for personnel and other contributions (e.g. transport, petrol, etc.).
3. Arrange a training center.
4. Send advance notification to village heads by mail, direct personal communication and/or use of local radio.
5. Coordinate UCLA activities with Government of Lesotho, USAID and Planning Assistance representatives.
6. Import UCLA equipment.

Field Phase (September 20-November 26)

The total time for the field phase was 9 weeks. During the first half of field phase, the teams were based in Maseru, where urban, lowland and a few foothill sites were surveyed. The teams surveyed the remaining foothill and mountain sites during the last half of the field phase. Survey work was suspended for a few days during the Lesotho 10th Anniversary Celebration.

Training

Training of the supervisors took place at the Office of Central Planning three days before the formal training period, and continued on for three weeks with afternoon sessions. The UCLA co-director instructed supervisors regarding technical aspects of the survey. Additionally, extensive discussions

were held on survey content, planning, preparation and logistical problems. Training of the supervisors and Basotho co-director enabled these host country nationals to serve as leaders and reference sources in the formal training of survey members and the field phase.

Survey members were trained at the National Teachers Training College (NTTC). The co-directors and supervisors led the training which lasted from August 30 to September 17. The usual schedule consisted of one-half a day training, five days per week, while the rest of the day was used for either independent reading of the training manual or special afternoon training sessions. Clinical sessions for all participants were led by public health nurses, a health educator and the acting WHO director.

There were approximately 2-3 hours of explanation for each anthropometric measurement followed by demonstration and practice sessions which were held at the Domiciliary Clinic, a maternal and child health clinic. Standardization tests for each measurement were administered during training. A one-day field trial was held during the third week of training in a nearby village, where the teams conducted interviews and practiced measurements under close supervision of the supervisors and co-directors. Measuring techniques were reviewed midway through the field phase of the survey in October.

There were ten teams consisting of two trainees per team and a supervisor for every two teams. Teams were selected during the end of the first week of training. Supervisors were assigned to specific teams for the duration of the survey. Three team members worked in the Maseru office copying and editing forms during the last half of the survey which reduced the teams to eight.

Logistics

There were eight vehicles (five Government and three rental) used throughout the survey. The vehicles provided by the GOL were in excellent condition and needed only minor repair. Although there was a shortage of drivers in the country, the three government pool four-wheel-drive vehicles and the Ministry of Agriculture, Nutrition vehicle were provided with drivers.

Early rains and rough mountainous terrain caused travel delays. Three remote mountain sites could not be surveyed until after mid-November because flights were repeatedly postponed due to inclement weather conditions. A few other villages were inaccessible because of overflowing rivers. (See Appendix 2 for list of sites surveyed.)

Teams were transported to an ecological area before branching out to villages. At times, teams were spread throughout different ecological areas. In some mountain sites, horses were hired when available to reach villages. Team members slept in villages when more than one day was required to complete a site. Trainees frequently brought their own cooking facilities, food and bedding to sites. Telephones were often used when available. In mountain areas private agency, police, mission, and the Flying Doctor Service radios were also used to communicate with personnel in the nutrition office in the Central Planning Office in Maseru.

Participating Organizations

The Ministry of Central Planning and Statistics was the center of activity for the nutrition survey where office space was provided. Statistical personnel provided advice on the sampling procedure using data from the 1976 Population Census prior to its publication. The Ministry also donated a large van and arranged for three additional government pool four-wheel drive vehicles with drivers. The GOL supplied petrol from government garages.

The Ministry of Agriculture, Nutrition, provided 15 trainees, two senior supervisors and a short wheel base four-wheel drive vehicle.

The Ministry of Health provided five trainees, two senior supervisors and the use of duplicating facilities where initial survey forms were produced.

The National Teachers Training College (NTTC) provided a room for training and storage facilities. In addition, the College's audio-visual equipment was made available for use during the training.

Catholic Relief Services/Lesotho provided logistic support and handled in-country funds throughout the entire survey.

Peace Corps provided some personnel through government ministries.

USAID/Lesotho provided necessary assistance and backup support.

UCLA was responsible for survey administration, training of survey personnel, establishing a survey methodology (anthropometric, clinical, laboratory and developmental), and analyzing results. UCLA also provided anthropometric equipment (See Appendix 4), a survey co-director from the UCLA Nutrition Assessment Unit who was in Lesotho for three months and the UCLA Unit Director who was in Lesotho for five weeks.

Personnel

Personnel participating in the Kingdom of Lesotho National Nutrition Survey or in its preparation and analysis are listed below. Unless otherwise indicated, personnel are officials of the Government of Lesotho.

Mr. Benjamin Browdy	Statistical Consultant, UCLA School of Public Health
Dr. Potter Chang	Statistical Consultant, UCLA School of Public Health
Mr. D. Corvada	Ministry of Education, (Peace Corps)
Mr. Lee Dahringer	College of Business and Administration, University of Colorado, Boulder, Colorado and Planning Assistance, New York
Mr. Oleg DeBode	Statistical Preparation, UCLA Nutrition Assessment Unit, UCLA School of Public Health
Mr. Alan Dower	Logistics Officer, Min. of Education, (Peace Corps)
Mr. John Figueira	USAID/Lesotho
Mr. Sonny Fong	Ministry of Health
Mrs. Maforere Forere	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mr. Joseph Gerstle	Director, Catholic Relief Services/Lesotho
Mr. R. Giri	Min. of Central Planning & Statistics (FAO)
Mrs. Patricia Goodale	Ministry of Health
Mrs. Elizabeth Gordon	Survey Consultant, Lesotho
Dr. Derrick B. Jelliffe	Principal Investigator, UCLA Nutrition Assessment Unit, UCLA School of Public Health
Mr. Harry Johnson	USAID/Lesotho
Miss Boopane Khanyetsi	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mr. Litsiba Khoaile	Survey Trainee; Health Assistant, Min. of Health
Mrs. Fumane Koali	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Dr. Joseph Lema	Acting Director, World Health Organization/ Lesotho
Mr. G. Lemphane	Survey Trainee; Health Assistant, Min. of Health
Miss Agnes Lesoli	Survey Trainee; Home Economist, Min. of Agric., Nutrition

Mr. Herman Makhooane	Survey Trainee; Health Assistant, Min. of Health
Mrs. Phofong Makosholo	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. 'Masikeme Malelu	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. Eunice Mapape	Survey Supervisor; Public Health Nurse, Min. of Health
Mrs. Mateboho Mathule	Survey Supervisor; Home Economics Officer, Min. of Agric.
Mr. John A.M. Metsing	Survey Trainee; Health Assistant, Min. of of Health
Mrs. Thato Mokhachane	Survey Supervisor; Home Economics Officer, Min. of Agric.
Mrs. Kuena Molapo	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. 'Mathabo Molupe	Survey Trainee; Home Economist, Min. of Agric.
Mr. A.M. Monyake	Permanent Secretary, Min. of Central Planning & Statistics
Mrs. Aa Mopeli	Survey Trainee; Home Economist, Min. of Health
Mr. Leshoboro Nkunyane	Survey Trainee; Health Assistant, Min. of Health
Mrs. Celestina Phafane	Survey Co-Director; Min. of Education
Mrs. Anna Phamotse	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. Ernestina Phatsoane	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. Sandra Pitorak	Survey Supervisor; Dietitian/Nutrition Ed., Peace Corps
Miss Rosaliah Seitiheko	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mr. Irwin J. Shorr	Survey Co-Director; Assistant Director, UCLA Nutrition Assessment Unit, UCLA School of Public Health
Mrs. 'Makatleho Tebesi	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. Masejeng Thatho	Survey Trainee; Home Economist, Min. of Agric., Nutrition
Mrs. Mamzwati Thobothobo	Survey Trainee; Home Economist, Min. of Agric., Nutrition

Mr. Thomas Tuoane	Min. of Central Planning & Statistics
Mrs. Mathilda Van der Wiel	Nutritionist, Lesotho
Ms. Ramona Wassenberg	Research Associate, UCLA Nutrition Assessment Unit, UCLA School of Public Health
Mr. Carl Wallemark	Statistical Consultant, National University of Lesotho, Roma
Ms. Camilla Weber	Survey Supervisor; Dental Hygienist/ Health Ed., Min. of Education
Mrs. Pauline A. Wright	Survey Supervisor; Public Health Nurse, Min. of Health
Dr. Alfred J. Zerfas	Director, UCLA Nutrition Assessment Unit, UCLA School of Public Health

APPENDIX 6. GLOSSARY

"A citizen of Lesotho is a 'Masotho,' plural 'Basotho.' 'Basotho' is commonly used in English both as a noun and as an adjective, as in 'Basotho hat.' The national language is 'Sesotho' and the word 'Sesotho' may also be used as an adjective referring to anything characteristic of the Basotho.

The correct pronunciation of the name of the country, the language, its people and its founder are as follows:

Lesotho . . . . . lǐ - sŏo′ - tŏo
Sesotho . . . . . sǐ - sŏo′ - tŏo
Mosotho . . . . . moo - sŏo′ - tŏo
Basotho . . . . . bă - sŏo - tŏo
Moshoeshoe . . . . . moo - shwĕ′ - shwĕ

(ă as in răck, ĕ as in nĕck, ĭ as in rĭch, ŏo as in rŏok)"

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RECOMMENDATIONS

BROAD TENTATIVE RECOMMENDATIONS

1. The survey indicated that general undernutrition exists in Lesotho particularly in children from one to five years of age. Approximately 40,000 children under five years (22% of 200,000) in Lesotho require improvement in nutritional status according to the criteria for impaired growth used on the survey based on the height of the child. The proportion of children with evidence of long-standing poor nutritional background was greater in the rural areas of Lesotho compared with the urban lowland areas. There was some, but not conclusive evidence that the children in the mountain areas had a higher prevalence of poor growth than in the other rural areas of the country. However, because the population of each area of the country was not ecologically homogeneous, it is difficult to make conclusive descriptions about individual ecological areas.
   For children under five years in the special urban group, the prevalence of impaired growth was 11.3%. This compares with a 6% prevalence of impaired growth of children in the U.S. with low socio-economic status. Therefore, either of these prevalence rates would be a reasonable goal to attain when assessing the progress of children up to five years of age in future anthropometric surveys in Lesotho.

2. Undernutrition is a persistent situation and can be attacked with intermediate and long range nutrition-related programs in the health, agriculture, education and other sectors.

3. Food is at a minimum from December to February, and the 1956 WHO-assisted survey reported weight loss during that time of the year. Pellagra, a vitamin-deficiency, has a peak prevalence in December. This is earlier than the peak of kwashiorkor in February. The 1976 survey was conducted from September to November. This would explain the low prevalence of acute protein-calorie malnutrition (undernutrition of recent onset). It is recommended that an effort be made to inspect seasonal dietary and anthropometric patterns in both mothers and children. Trained personnel are available for this procedure and some basic anthropometric equipment was left in the country for this purpose.

4. The protective effect of breastfeeding against undernutrition for children under 6 months of age was shown in the low prevalence of undernutrition compared with children 6-59 months of age.
   The prevalence of breastfeeding is very high in children up to one year of age, particularly in the rural areas. Milk and food distribution at the health centers probably has not been detrimental to breastfeeding. However, there are no previous data on breastfeeding in Lesotho from which to make comparisons. In addition, it is not known from the survey how frequently the children were breastfed and what quantity of breast milk they received. The proportion of children usually receiving clinic milk and clinic food under six months was relatively low compared with the older children; however, there was a high prevalence of market milk purchased for these children, particularly in urban areas.

5. Adequate feeding of the young child is essential particularly during the transition phase from the breast to adult food. There was evidence in the survey that many children from 6-12 months might not receive any food apart from milk. It is essential that all mothers be encouraged to feed the child at least maize, wheat or sorghum to complement milk over this period.

6. There was evidence that many children (particularly 6-24 months) had no meat, poultry, fish, eggs or legumes during the three days previous to the interview. There are two associated problems: local availability and preferential feeding. First, eggs and fish are available to about one-quarter of the rural families and meat or poultry to about one-half. Legumes were available to approximately two-thirds of the families. This could be alleviated by improving food availability through agricultural, marketing and economic programs.
   The second problem related to food available to the family, but not given to the child. Meat, poultry and legumes were often consumed by the family, but not given to the 6-24 month old child. Nutrition education and demonstration could improve this dietary pattern. Mothers should be encouraged to supplement their children's diets with high protein foods (particularly legumes, the most readily available) by six months of age. Nutrition education programs should be geared towards practical demonstrations, especially in consideration of those mothers who are unable to read. In this survey, nearly one-sixth of mothers in the mountain region could not read Sesotho. Illiteracy rates were much lower in other areas of the country.

7. The interpretation of the results of anemia should take into consideration the following:
   (a) the lack of iron-rich foods (especially for children aged 6-12 months).
   (b) the infestation of hookworm and other parasites, infections and poor absorption. These factors were not investigated in this survey.
   (c) comparing the prevalence rate (25%) with other countries in Africa, such as Liberia (60%), it would appear that anemia is not as great a problem.

8. From this survey alone, the prevalence of overweight and perhaps obese children should not be considered a problem in the country. High prevalence rates were found only in children under six moths of age.

9. The soft tissue measurements of arm circumference and triceps fatfold suggest that undernutrition is not a problem in Basotho mothers surveyed, but that overnutrition might be a problem. Based on these measurements, the high prevalence of obesity in mothers, especially in the lowland and urban areas, should be investigated more thoroughly and the health implications seriously considered. These results do not preclude the possibility that in a more unfavorable time of the year or during a more unfavorable year the prevalence of maternal overnutrition would deminish or even a substantial prevalence of undernutrition might occur. In addition, a longitudinal study is necessary to assess the nutritional status of pregnant women.

10. The comparisons between the 1956 WHO assisted surveys and the present survey should be considered cautiously because of the differing methodology of the two surveys. The lack of improvement in children aged 6-24 months compared with the 25-60 months cannot be explained by this survey. However, it appears that the prevalence of goiter has decreased since 1956. Further investigation would be required to determine the impact of the salt iodization project.

11. The base line data results from this survey can be used for future reference for the purposes of evaluation and monitoring of nutritional status and its associated factors. The prevalence of stunting in rural children was significantly greater where the mother could not read Sesotho; in children 25-60 months where the father was a miner, or with a prior birth interval less than two years. Also young children 6-24 months were more likely to be stunted

where the father was dead or absent and not contributing. These associated factors should be considered in targeting nutrition projects.

12. It is essential that the National Nutrition Planning and Policy Body be informed as much as possible of the results of the survey and their implications, so that such results will be of optimal value to Lesotho.

9. Consultant's Analysis of the Survey

Analysis

of the

National Nutrition Survey

of

Lesotho

Prepared by

David P. McNelis

Submitted under AID PO # AFR-147-89

Dated September 20, 1979

Purpose of this report

This report has been prepared at the request of the U.S. Agency for International Development. Its purpose is to make a review of the 1976 National Nutrition Survey of Lesotho and the data resulting therefrom through analysis of the Revised Final Draft Report, interviews with AID and contract personnel, and review of the survey documentation in the AID(W) files which included analyses conducted earlier by the host government. The review also covers the accomplishments and deficiencies of the survey, as those became apparent during the study, and the overall achievements in relation to the project's established goals. In preparing this report the writer has been guided generally by the spirit of AID's Project Evaluation Summary (PES) and appropriate portions of AID Handbook No. 3. Aside from major issues which are considered in this report a rather large and far ranging number of other issues emerged during the course of studying the materials of the survey. Rather than adhere solely to the outline of the PES it seemed the better course to let the analysis follow its own internal logic.

First of all, the major objective of the report is to recommend to the Government of Lesotho and to USAID and other parties to the survey whether or not to accept the survey as the National Nutritional Survey of Lesotho and whether or not the data resulting from the survey can be used in planning Lesotho's national nutrition policy and program.

Secondly, and intimately related to the first point, questions have been raised about methodology and findings. These relate to sample design, field work, and analytical approach. It is hoped that detached consideration of these matters can contribute to an informed decision on point No. 1 above.

Thirdly, while a large number of questions have been raised about the survey -- not all of which are of equal importance -- other issues or observations have surfaced as a result of this review. These, too, are not of equal importance; but recognition of them is important to understanding the context within which the writer makes his recommendation.

This report is based upon a study of written materials in the files of USAID(W). The principal materials included in these files were the "Revised Final Draft Report" prepared by the Contractor, numerous letters and memoranda asking questions or answering them, and a variety of cables, conference resumes, and similar materials. By no means was this file complete; but it contained enough to enable the writer to identify and to gain some appreciation of the principal issues of concern to GOL, AID, and other parties to the survey.

The writer also had an opportunity to discuss the survey with staff members of AID(W), PAI, and UCLA. Contacts were also

made with the U.S. National Academy of Sciences and the U.S. National Center for Health Statistics relative to the existence (or non-existence, as it turns out) of anthropometric reference standards based on measurement of children in African nations.

Apparent history of the project

This survey was one of several contracted to UCLA in 1976 in the customary AID-Host Country manner, with jointly shared interest in the survey to be carried out. The Contractor was expected to carry out 2 such surveys per year and one, Liberia, was in fact in progress when Lesotho, after some initial hesitation, was determined to be the next country to mount a Nutrition Survey. The decision to proceed in Lesotho came at about the time the contractor's work in Liberia was coming to a close and it reflected in part AID's desire to take advantage of the Contractor's presence in Africa. The Contractor moved quickly to Lesotho and established working relationships with FNCO, a relatively new organization, which was designated as the locus of survey responsibility within GOL. The Statistical Office of GOL participated with the contractor in designing and selecting a multi-stage cluster sample of persons, using the most recent Population Census as a sample frame. An organization of approximately 50 individuals, some full time, some part-time, was formed from a variety of sources and given training and data were collected in the field. All these things were accomplished in about 3-1/2 months. The timetable for the ensuing analysis, which was done by the contractor at his site in the U.S.A., was shortened to accommodate planning in Lesotho

for a National Nutrition Conference initially scheduled for June 1977. It was desired that data from the survey be available for consideration by participants in the Conference. The Contractor, attempting to be responsive, prepared a rough draft report (referred to as the "April Draft") and sent it to Lesotho for review. Before any response was made from Lesotho word was received in AID(W) that the June Conference was postponed until a later date. The contractor was advised to finalize the report and to move on to Cameroon and Sierra Leone to initiate surveys there. Thus, the contractor could not return to Lesotho to participate jointly with GOL in the analysis of survey data and the joint formulation of recommendations based thereon. The "April Draft," which this writer has not had an opportunity to read, became the object of controversy and a long list of questions and criticisms was prepared in Lesotho and forwarded to the contractor via AID(W). It appears these questions were formulated sometime in July 1977, about 8 months after the close-out of field work and 3 months after the April Draft. Point by point responses were written by the contractor and sent to Lesotho. During this period the "finalized" version of the April Draft appeared. It incorporated some of the changes, clarifications and deletions from the earlier list of questions where, in the contractor's judgement, they seemed well founded. But the initial list of questions could not be so easily related to the "finalized" draft report, because it had undergone some change.

During the period there seems to have developed substantial

confusion in communication. Materials seem to have crossed in the mails. Closer person-to-person contact might well have improved the situation; but the contractor;s duties elsewhere prevented him from having closer contact with personnel in Lesotho. The period seems to have been one of non-communication or mis-communication.

As of September, 1979, three years after the intiation of this survey and, perhaps, 2-1/2 years after the analytical findings might have been expected, this survey remains unconsummated and the data remain unaccepted, unpublished, and, presumably, unused.

This paper addresses itself to the question: "What should GOL-USAID do about this survey? Accept it without reservation? Accept it with some cautions and reservations? Or abandon it altogether and conduct a new survey?"

This writer recommends that the middle course above be followed and will attempt to provide reasons for doing so below.

The major issues which have been called into question about this survey are:

1. the representativeness of the sample as designed;
2. the faithful execution of the sample design in the field data collection phase of the survey, and;
3. the quality and soundness of the analytical approach used by the Contractor.

The framing of the above issues is this writer's. Many more questions were raised by GOL in its letter of 21 June 1979. That letter presents -- or re-presents -- the questions posed earlier. The contractor, UCLA, made diligent effort to respond to the many questions raised but, apparently, not to the full satisfaction of personnel in Lesotho.

The Major Issues:

Q. Is the sample, as designed, a representative sample of the population of Lesotho?

A. Yes.

Q. Was the sample, as designed, faithfully executed in the field?

A. No. And for this reason the survey has coverage problems.

Q. Is the analytical approach sound?

A. Yes - but a qualified yes. There are many ways to approach the analysis and interpretation of sample survey data. This contractor has chosen to depend heavily on Chi-square analysis of the data. The sample data were obtained through cluster sampling. The Chi-square as it was used assumes the sample was a simple random sample. Also, the survey, like all surveys, offers many opportunities for biases to enter into the estimates. The use of Chi-square under these circumstances would be an approximate procedure. A more exact procedure would be to base the analysis on estimates for

variables and sampling errors which take the complexities of the sample design into account. Since most of the data are presented as rates or proportions, which are not affected as greatly by clustering as are other types of estimates, the Chi-square may be a very useful approximate measure to use.

Q. Can the survey data be used for national planning purposes?

A. Yes - but with the understanding that analysis and interpretation of survey data should be tempered by caution, reservation, and a thorough knowledge of Lesotho.

Q. Should the GOL accept this survey as its official Nutritional Survey?

A. Yes - with the same caveats presented immediately above.

Discussion:

This writer has taken several positions and in the following discussion he hopes to present the basis for these positions, to persuade readers of the soundness of those positions, and to present, finally, a recommendation for action.

The survey should not be abandoned. To do so would be

to write off the time, effort, and money already spent. The GOL would have to forego the planning opportunity presently before it. If a new survey were to be designed and fielded, at least another year would be required and unless it were so designed as to avoid some of the administrative and technical problems that arose in this effort there is no guarantee that similar problems would not be re-encountered in a new survey or that they could be surmounted in any more satisfactory manner. Some of these problems are inherent in a survey of this particular type; others flow out of the way in which the 1976 survey was handled by all parties to the survey

To accept the 1976 survey and its data without reservation would be imprudent, not only because the sample design was not faithfully executed in the field but also for other reasons which may be of equal or even greater importance than the problems related to sampling. In this regard, the writer suspects there may be a large response error in the data which would remain even if the sample had been carried out in the field as it was supposed to have been.

Had the field work been carried out as designed the resulting estimates would still have contained both sampling error and response error as well as any other error introduced through data processing. GOL would have been able to have had somewhat greater assurance than it now has about the sampling error component and its effect on the accuracy of estimates. But due to the absence of any kind of an internally designed checking device, such as a reinterview program, GOL would still know little or nothing about response error or other types of error that might have been introduced in data processing.

The sample design is an application of multi-stage cluster sampling, probability of selection proportional to size (PPS). The methodology is presented in every basic text on sampling and is especially well-explained in Hansen, Hurwitz, and Madow.* The inclusion of special self-representing segments (in this case 19 segments from another survey) is not an unusual requirement of a sample design. Neither is the over-sampling of a relatively small (urban) area with an intention of producing sufficient sample observations to support estimates for that small area. The division of the country into statistical regions (lowlands, moun-

Footnote:

*The reader will find value in consulting the first 3 chapters of Sample Survey Methods and Theory, Hansen, M.; Hurwitz, W.; and Madow, W.; Vol. I; Ch. 1-3; J. Wiley & Sons, Inc., 1953. This reference is widely regarded by statisticians as the definitive work in the field of sample surveys.

tains, Orange River valley, etc.) is also not unusual. This is a kind of requirement that is frequently stated, a priori, by the planner to the sampler and is based on the planners' (not the samplers') objectives in having a survey in the first place. In the 1976 Survey these subdivisions were based on previous practices of the Statistical Office of GOL and were apparently related to the need to have these nutrition data parallel other statistics for those areas. Finally, the inclusion of a "Special Group" is not an unusual thing to do in order to supply an ad hoc reference standard, directly applicable to Lesotho, because of the non-existence of any more general reference standards applicable to children of African countries.* This was an innovative step and the study's designers are to be commended for their foresight in including it.

Nonetheless, there are some uncertainties about the second-stage of the sample, where the index children to be included in the survey were actually identified in the field and, if they were present when the enumerator called at the dwelling unit, selected and measured. The presentation of this uncertainty

Footnote:

*This point was checked out with the U.S. National Academy of Sciences and the U.S. National Center for Health Statistics, USDHEW. Staff members there knew of no such standards. NCHS advised that a limited study of Tunisian children will be published about a year from now (9/80) on data collected in 1976.

is a bit complicated. First of all, the focus of the survey is on the 0-5 age group; but the sample is of the general population, all ages. It is reasonable to suppose a fairly high positive correlation between the two and, given the problems that are inherent in the survey with respect to obtaining or estimating ages of children, use of general population weights instead of those that might have resulted had the 0-5 population served directly as the sampling frame is probably acceptable and justified. In fact, the estimates, presented as proportions (prevalence rates), are probably less affected by field-related problems (such as these 2nd stage doubts) as would be estimates of totals or aggregates. As a practical matter at the field execution of the sample at the second stage, one is led to wonder if some very young children might not have been missed because they were accompanying mothers who were not at home when the enumerator called. Under the field procedure, as the writer understands it, the enumerator would then have proceeded to other dwelling units to obtain the required 15 (in some cases 30) index children to satisfy the assignment in a field segment. It is conceivable that series of children who would have fallen in sample were not surveyed because they were not home and the enumerator moved on to a new dwelling unit in search of an index child. To the degree this happened the randomness of the second-stage procedure may have been affected. It is hard to say how much, there is nothing in the written record on which to base a judgment on this matter--except to say some nagging doubts are raised in the writer's mind about the randomness

of the second stage in the field.

In general, however, the basic sampling methodology was in accordance with accepted statistical practice and the representativeness of the sample, as designed, should not be a matter of serious concern to GOL or other parties to the survey.

The sample design, however, was not carried out in the field, principally in one part of the country. For reasons of climate, geography, and access the field staff found it impossible to visit certain sites. They substituted some sites, not picked in the sample, for other sites that were picked to be in the sample. In one or two cases alternate sites were surveyed instead of primary sites. In still other cases primary sites were not surveyed nor were alternates surveyed and neither were substitutions made. Succinctly, we have

A. Selected but not surveyed, no alternate surveyed, no substitution made.

B. Selected but not surveyed, alternate surveyed instead.

C. Selected but not surveyed, nearby site substituted instead (no "alternate" site surveyed).

In survey work, especially in countries where physical access to remote areas is difficult or impossible, as seems to be true in Lesotho, one can expect physical problems of climate, geography, and access to cause practical problems in completing field work according to plan. This survey is no different from many others in this respect. Aside from any response problems

that may be involved, the above conditions create uncertainties which are difficult to deal with. For example, estimates can be made, but accurate measures of their reliability cannot be made. Conservative thinking would be that the confidence limits attached to any given level of estimates must have been widened beyond what they would have been had the survey been carried out correctly in the field. Here we are dealing with a difference in confidence limits. Done correctly GOL could have known that a given estimate was within, say, 5 or 10% of its probable true value. Done as it was, the GOL can only speculate that the estimates are within some limits greater than the 5-10% above. The estimates are probably less accurate than they might have been. How much error? How much broader the limits? We can only speculate. What has happened practically in the field work makes impossible the calculation of one of the two necessary points from which to make such a judgment.

The places where the field work encountered problems of weather, impassable rivers, lack of access roads and consequent isolation made it desirable either to substitute a non-selected place or necessary to omit surveying a selected site altogether.

It is a little difficult to reconstruct what actually happened in the field. Of the initial 60 sites selected 10 were in the urban area, 21 in the lowlands, 10 in the foothills, and 19 in the mountain area. In one of the contractors' responses to questions he reports that 58 sites were visited as follows:

urban 10, lowlands 21, foothills 10, and mountains 17. His same treatment of this subject identifies 4 selected sites in the mountain area (5904, 5711, 6018 and 5918) which were not visited and two substitute sites (5911 and 5812) which were visited instead with apparently complete results from only one of the latter two. 4 alternate sites were visited in the non-mountain areas and 1 foothill site (0515) appears to have been non-respondent. The substitution/non-response problem then seems concentrated in the mountain area.

There is no completely satisfactory way of compensating for these omissions and substitutions. This writer suggests 4 possibilities, all of which will offend either statistical purists or practical men or both.

(1) Redefine the country for the purpose of this survey to exclude the problem areas. This amounts to throwing away about 25-30% of the collected data (the Mountain area), recalculating weights for the remaining areas, re-doing all the estimates and re-writing the Final Report--a big job. The writer is not sure whether this procedure is even technically pure, whether it would satisfy those who require scientific regularity, or whether it would result in estimates any better from a practical planning point of view than those presented in the Revised Final Draft. The likely answer to all 3 uncertainties is negative.

As a practical man, the writer sees no particular advantage in this procedure. In a sense it amounts to working backwards--trying to invent a sampling rationale for whatever happened

in the field. This is not a good idea and certainly is not consistent with sample survey theory and practice. Further, the writer finds it unconscionable to eliminate 25-30% of the data --a large part of the country. He feels it is better to know something--rather than an assumed nothing--about the mountain area. This procedure would involve a lot of work to achieve an increase in the accuracy of the estimates that would be questionable. Furthermore to adopt this procedure would preclude the making of any nationwide estimates, since 25-30% of the country's data would be excluded from such estimates because it was redefined as "out-of-scope".

This procedure has no practical appeal to the writer and he recommends against it.

(2) It might be possible to treat the omitted and substituted sites as non-respondents and to impute values for them. Procedure (1) above ignores these sites and, by definition, excludes them from the survey. An alternative procedure, however, might be to assign initial values of zero to all omitted or substituted sites and then to replace the zeroes possibly with a value derived from the data from other responding segments in the country. There are several ways it could be done. One way would be to impute to these problem areas the nationwide average data for all responding segments. This is not a very satisfactory procedure. A true national average, of course, does not exist and the concentration of omitted/substituted segments is in the mountain areas which,

initially, were identified as "different" enough to warrant recognition as a separately identified statistical area. A "bland" national average of all other responding units would probably not very well describe the situation in the omitted/substituted areas.

This procedure would also, like (1) above, require a complete re-compilation of all the data and a re-analysis and re-writing of the entire report. There is no way to tell what increase would be achieved in the accuracy of the estimates.

Like procedure (1) this approach requires a lot of work and has a questionable end. This writer recommends against it, once again on practical grounds.

(3) A third course of action with respect to the omitted/substituted segments would be to <u>impute for them based on a random selection of other selected and responding units in the same geographic area</u>. This is sometimes done. Like any statistical palliative, (which includes <u>all</u> these suggestions) one would wish that the non-responses for which imputations are made were relatively smaller than they appear to be in this case.

To follow this course would mean a lot of work--re-calculating estimates and re-writing the report. The <u>gain</u> in accuracy of the estimates is questionable. On practical grounds this writer does not favor this approach above the fourth course, which follows.

(4) A fourth course of action with respect to the "problem" segments would be to <u>impute for the omitted segments from the</u>

nearest surveyed segment in the same area, to accept alternate site data, and for non-selected sites substituted for selected sites, accept the data collected in the field.

Survey sites 56, 57, and 60, all in the mountain area, were in sample but only 57 was surveyed. They all apparently share qualities of isolation, altitude, demographic characteristics, and presumably other features. Physical access to 56 and 60 was impossible during the survey. It is suggested that the data for 57 might be used as a proxy for 56 and 60.

The writer believes this would be a better procedure than (1) above, which would exclude all 3 areas (and others) from the survey altogether. He also believes it would be superior to (2) above which would attribute values from areas presumably different from those in question. Procedure (3) is better statistically than (4) but it would require substantial recalculation and rewriting of the report and its conclusions and the use of imputed data in place of actual field-collected data. The improvement in estimating accuracy of (3) over (4) is speculative.

The writer recommends that the data from the "substituted" sites be accepted and used in lieu of those which might have been obtained had the enumerators been able to reach the truly selected sites. This recommendation is not pure statistically, but the writer feels that since these subsitutions are first of all geographically close to the sites that could not be visited, they are more likely to be "like" the sites that could not be visited, and, therefore, they probably represent as good

or better values than any that could be imputed from other parts of the country. Best of all, they are truly field-collected data (as opposed to imputed or modelled data) and while they do not fit in a pure statistical sense with the other data from the survey they do have the virtue of being data reported by people in that time and in these places--they are field-collected data. One might even say, though it is incorrect to do so in the present circumstances..."...but for the random start these units might actually have been selected..." This general line of argument does not give statistical respectability to inclusion of these substituted units, it merely says that the easiest, least expensive, and most practical course to follow is to use their data--with the sure knowledge they are substituted units.

With all its imperfections the writer recommends the adoption of this fourth course, which is what the Contractor has done in preparing his Revised Final Report. In interpreting the data and in using it for nutritional planning purposes the planners of GOL ought to keep in mind that there are flaws in it and uncertainties about it that must be tempered by the planners' first-hand knowledge of and familiarity with life as it is actually lived in the several parts of Lesotho. Statistical sample survey data, when used with maturity by planners who are intimately familiar with a country's needs on other-than-statistical bases, function only to increase the planner's chances of being right in his program formulations. Survey data can never replace a planner's judgment, can never point to the exact directions a country should take

and can never over-ride the social, economic, and political realities of countries.

In the present case, GOL has data which in spite of the above kinds of problems is mostly well-collected and, from a practical point of view, represents real field experience at a given point in time. With respect to the estimates made, the Contractor's preference for working with proportions--prevalence rates--is a saving feature of this study for they are not affected as greatly as other types of estimates might be by the kinds of problems noted in this report.

As is obvious from the above, there is no entirely satisfactory way to compensate for the omission and substitution problems and their effect on estimates. Almost all surveys in developed and developing countries have the same kinds of problems to contend with, though they tend to be more numerous in countries where more severe circumstances are met in field data collection. This is where the really hard survey problems arise and Lesotho's experience is not very different from most other countries. One ends up, usually, with a less-then-perfect survey and data which have some troubles. As a conclusion to this part of the discussion it is the writer's recommendation that the GOL accept the survey and act upon it--with prudence. It is, in a practical sense, probably as good a survey effort as could have been achieved, all things considered. This recommendation is tempered by the writer's observations, below, about this project. These observations, which are the writer's own, are numerous but not uniformly important.

They deal with circumstances evident from the file of survey materials. On one hand some of these circumstances might have been avoided; but, on the other hand, some were either unavoidable or at least unpredictable, given the nature of this project and how it was handled.

Sample surveys are complicated and this one is particularly so on a number of counts. Many things can cause problems --or even "go wrong"--technically or administratively. Both types of problems are taken up below. Once again the writer recommends that the reader consult Chapters 1-3 of Hansen, Hurwitz and Madow for background, particularly on the kinds of error (sampling, response, processing) that can arise in surveys.

Project design and management

There were no fewer than 8 entities involved in one way or another in this survey: FNCO, MOH, the Statistical Office, PAI(NY), PAI(L), AID(L), AID(W), and UCLA. There does not emerge from the written record a clear, clean picture of the division of labor, authority, and responsibility--who was in charge of what. In such circumstances it is easy to conjecture how controversy or mishaps might occur. For example, the file contains one plaintive letter dealing with an hiatus in budgetary support which caused one participant to have to contribute personal funds to the project in order to keep it going. In a loosely structured management situation, as this one appears to have been, it is to be expected that illness, staff turnover, and financing delays, all of which happened, would cause difficulties great and small. In the writer's

judgment the "management mix" was too complex, especially for a project that by many standards is not a very large one.

The leadership role, technical and managerial, clearly should have been GOL's It is the writer's experience that survey projects like this one do not succeed very well unless "ownership" rests firmly with the host government and not with outside experts or financiers. The roles that outsiders can play are limited by and subordinate to this "ownership". Projects do not generally prosper when close collegial relationships fail to develop within this context between host country and advisory personnel. That seems to be the case here if one can judge from the tone and content of some of the written exchanges.

In spite of the fact that the project was not a huge one, the time allotted for planning and start-up and for field collection of data was insufficient. Three and one-half months is not enough time in which to get this kind of survey underway. And the selection of a bad weather time of the year for the field work should have been tempered by a practical knowledge of Lesotho's climate, geography, river and road systems, etc. This might have indicated a choice of some other time of the year, especially since this was to be a one-time survey which should have been undertaken when the physical access problems were at a minimum. To have chosen a different time might well have avoided some of the coverage problems noted elsewhere in this report.

The sample design, omissions, and subsitutions have been dealt with earlier and will not be repeated here. However,

the writer observes that it is a good idea that all sample selection be done in the headquarters office by qualified samplers and that no part of the sample selection be done in the field by enumerators or field supervisors, as was done in this survey design. This is probably partly a function of the absence of recent, accurate maps of the ultimate segments of the sample, and partly reflects a too-short planning and "get-ready" period. While the field staff may have carried out the sampler's intentions (but we know, in fact, that in two types of situations they did not and could not), permitting field selection of sample units is never a good idea. It always creates doubts, as it does in this case, about whether or not this aspect of the survey was done correctly.

In reviewing the survey documentation the writer had an opportunity to examine computer print-outs labelled "Cluster Level Condescriptive Regional Summary" which displays, for each prevalence estimate, the mean, standard error, standard deviation, variance, and other measures. These should be made available to GOL along with the above, accompanied by an explanation and perhaps a concise summary table which puts them together in ready reference form.

All the prevalence estimates should be compared by GOL with the most recent and trustworthy data available in the administrative records of GOL. The writer has no doubt that this would happen anyway as GOL works with the survey data. He is merely suggesting a concentrated effort of spot checking a few of the estimates. A few hours of compilation effort may yield a "feel" for the correctness of the survey's estimates.

With respect to the report that is to emerge from this survey, this writer would have preferred to see a 3-part final report composed of (1) a straight-forward, factual, tabular presentation of estimates without interpretation but accompanied by a description of sources and limitations of the data; (2) a separate analytical and interpretative treatment of the data, and; (3) a third section containing an executive summary of findings and recommendations. As it is, it appears only (2) and (3) are planned. This approach was also followed later in the Sierra Leone Nutrition Survey.

A straight-forward presentation of raw data might have permitted users to try a variety of analytical methods. Analysts differ in their preferences. Some like to work with proportions, as is the case with the Contractor; others like to use, perhaps, correlation and regression techniques or merely inspection of magnitudes and differences in raw data, averages, dispersions, etc. In reviewing the final report it becomes obvious that the Contractor never lost sight of his objective--he leaped directly into subject-matter analysis--but without bothering to present basic survey data in their "unvarnished" form. There is nothing wrong with this except that it limits the opportunities for analysis that others might have preferred to see built into the plan for the project.

To be sure, such factual tables could probably be reconstructed from many of the presentations made in the Revised Final Draft Report; but it would be a lot of work. It would have been

better to have planned them into the report in the first place.

The analysis has relied heavily on the presentation of proportions (prevalence rates) and use of the Chi-square statistic. Both are legitimate statistical tools and appear to have been used soundly; but the writer does recall his earlier comments on the Chi-square. It does require considerable concentration, however, to follow discussions of proportions, which vary within a range of vales, related to a reference standard which, itself, is the median value of a distribution of values. Notwithstanding the difficulty of such an analytical presentation, the Contractor is to be commended for what appears to be an ability to get deeply "inside" the data and to maintain the required concentration. On balance, this writer would have preferred simpler presentations. The use of Chi-square in the manner it has been used--which is to derive conclusions of a rather lasting nature--is a little unusual. The writer has always regarded Chi-square more or less as a researcher's tool, whose greatest value is as a first step in determining whether to pursue particular lines of inquiry and whether or not to pursue others. Other methods of testing the significance of <u>observed differences</u>, as opposed to <u>observed versus expected</u> differences (Chi-square) are frequently used and are more powerful tools.

<u>The Revised Final Report seems to have been prepared in great haste</u>. There are some typographical errors, duplicate pages, what appear to be incomplete sentences, and some language that is a little hard to understand. These matters can be repaired, and

this is not a major criticism of the report. Some of the subjects (e.g., "statistical difference from zero" on page 127) are a little arcane to all but practising statisticians and are hard to explain to anybody without some murkiness. It seems to this writer that this problem, where it occurred, is probably reflective of the earlier observations that too little time was allowed for survey planning, conduct, and analysis.

The Survey Recommendations

One of the questions raised about the Survey Report was "Where are the recommendations?" It is the writer's understanding that the initial plan was that the survey results were to have been analyzed jointly by the Contractor and GOL with whatever input might have been desirable from other parties to the survey. A collegial effort was anticipated in which all interested parties would have played contributing roles. This idea, which is the only proper one, was apparently interrupted by changes in timing of events (the Nutrition Conference), demands on the Contractor's time and location and, consequently, his inability to be present for the necessary consultations, illness, mis-communication, and a variety of other circumstances. The interruption should be corrected as soon as possible. This writer has reviewed a number of tentative "recommendations" prepared by the Contractor based on his analysis of the data. These are actually tentative conclusions, resulting from analysis, that might well form an agenda for a meeting of all parties to the survey, which GOL should host.

Its purpose would be to get the collegial analytical effort back on track. This writer recommends that such a meeting be held in Lesotho as soon as possible and with all parties in attendance. The Contractor's recommendations/conclusions appear to be responsibly formulated. They are very broad in character and indicate only general directions in which the GOL's policy planning might go rather than specific activities which might be undertaken. The Contractor's paper on this subject is an excellent agenda for discussion, from which there may emerge lasting recommendations to the GOL which have the concurrence of all parties to this survey. In this connection, the ultimate authority and responsibility for the development, evaluation, and selection of recommendations, strategies, or plans rests with the GOL and not with the Contractor or AID. Further, translation of such strategies and plans into action programs can only be done by Lesothans. The point is belabored here only to emphasize that over-dependence on outside experts should be avoided.

This writer recommends that the Contractor submit his draft "Recommendations" to GOL as a possible conditional agenda for a meeting whose purpose would be to consider the survey's results and to develop formal recommendations to GOL.

It is recommended that the GOL accept the Revised Final Draft Report officially as a National Nutritional Survey of Lesotho with full awareness that the Survey has some imperfections but that in a practical sense it is probably as good an effort as can be achieved without undue additional expenditure of effort, time and money.