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DEPARTMENT OF HOME ECONOMICS EDUCATION AND AGRICULTURAL EXTENSION
GABORONE, BOTSWANA

Nutritional Status of Botswana and Characteristics of Nutritional Risk

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1. Introduction

1.1 Background

A delegation representing a number of US organisations and Institutions working on Soybean visited the DHEE on September 4th 2001. The delegation was lead by the Executive Director of the Soybean Program Operating Board (ISPOB) and Illinois Soybean Association and the Deputy Director of the Illinois Department of Agriculture. Other members of the delegation included a Faculty from the University of Illinois, a Nutrition Consultant of the World Initiative for Soy in Human Health (WISHH) and a farm manager. The mission of the Delegation was to explore the possibility of building a partnership with one or more Botswana organisations to establish the potential for using soy protein to improve the nutritional and functional quality of food products manufactured in Botswana and conduct studies to demonstrate benefits of soy protein for people with HIV/AIDS. The DHEE, UB has been identified as a potential collaborator in the project and hence the meeting was arranged. The UB team comprised four staff members with interest and experience in the area of food and nutrition.

The meeting agreed that there is need to conduct a baseline study to evaluate the actual nutritional needs of the Batswana. The study would be sponsored by the WISHH project and coordinated by Cade Fields-Gardner, the Nutrition Consultant for WISHH.

A second meeting between the UB team and the WISHH project consultant was convened on February 11th, 2002 to discuss details of the proposal. A draft proposal under the title “Nutritional Status of Batswana and Characteristics of Nutritional Risk: Needs Assessment” was prepared and submitted to WISHH for financing. The proposal was reviewed and approved by WISHH. A letter of agreement was signed by Mr. J. Hershey (Director, WISHH) and Dr. S. Mahgoub (Principal Investigator, DHEE, UB). According to the agreement, the amount of US\$ 7000.00 has been allocated to conduct the project.

1.2 Statement of the problem

1.2.1 Clear characterization of nutritional status, types of nutritional risk, and factors that may contribute to sub-optimal nutritional status in Batswana has not been accomplished since more recent changes in health issues that affect nutritional status, such as HIV infection.

1.2.2 This project seeks to identify nutrition-related needs of the Batswana through characterization of nutritional status and identification of factors that may be related to varying levels of nutritional well-being. A variety of factors will be explored including food access, economic resources, social issues, education

and awareness of food and nutrition issues, disease, and resources currently available and utilized.

- 1.2.3 Identification and documentation of nutrition-related needs of the Batswana (including food, education, and other resources) are needed to effectively direct efforts toward the improvement of individual and family health and nutrition.

1.3 Objectives of the Study

- 1.3.1 To characterize the nutritional status and nutritional needs of the Batswana.
- 1.3.2 To determine factors related to varying levels of nutritional well-being, including food access, economic and other resources, education, food and nutrition beliefs, disease, and community support.
- 1.3.3 To develop and present a plan for a pilot project of intervention based on findings of the needs assessment.

1.4 Conceptual Framework

- 1.4.1 Adequate dietary intake is linked to nutritional well being, morbidity, and mortality in adults and additional concerns of growth and development in children.
- 1.4.2 Optimal nutritional status can help to support efforts toward activities of daily living and productivity as well as disease resistance in adults and children. In addition, children have added nutritional needs to support growth and physical and mental development.
- 1.4.3 It is felt that by understanding factors that support or diminish optimal nutritional status, effective projects to address specific needs can be developed.

1.5 Limitations

- 1.5.1 The information in this study will characterize the nutrition-related issues of a segment of the population in Botswana. While the conclusions of this study will be informative, but cannot necessarily be extrapolated to a countrywide population of children who may attend day-care or children in other settings.

2 Methodology

2.1 Study type

- 2.1.1 This study was a national, cross-sectional descriptive one, which was conducted in eight sites that represented towns, urban villages, rural villages, and small villages in Botswana.
- 2.1.2 Being a national study, selection of study sites and sample population reflected the national picture. However, in fixing the sample size consideration was given to financial and time constraint. A multistage cluster sampling with probability proportional to size with a combination of stratified sampling technique was employed for two reasons (1) to cover a population from relatively small area rather than the same number of people randomly selected from the whole country, (2) to ensure heterogeneity of the different settlement levels of study sites. The sampling method allowed for large clusters (villages or towns) to have relatively larger number of households in the sample and small clusters to constitute a relatively smaller number. The sample size was fixed at 400 households that was translated into individuals.

Table 1 presents the distribution of the population, households and required number of households per stratum.

Table 2 indicates the proportionate number of households required in the selected clusters

Table 1: Proportion distribution of the population, households and required number of households per stratum

Stratum	Population	Percent	Households	Percent	Household required
Towns	371,932	23.3	97, 877	28.2	112
Urban Villages	395,011	24.8	80,614	23.4	94
Rural Villages >= 1,000	265,334	16.6	53,067	15.4	62
Small Villages 500 – 999	563,401	35.3	112,680	32.8	132
Total	1,595,678	100.0	344,238	100.0	400

Towns	7
Urban Villages	17
Rural Villages	150
Small Villages	201

Table 2: The proportionate number of households required in the selected clusters

Cluster	1995 No. of Households	Percent	No. of required Households
Towns			
Gaborone	51,261	69.5	78
Francistown	22,492	30.5	34
Total	73,753	100.0	112
Urban Villages			
Kanye	6 226	80.6	76
Bobonong	1 497	19.4	18
Total	7 724	100.0	94
Rural Villages			
Werda (Kgalagadi)	244	59.0	37
Goshwe (Tutume)	169	41.0	25
Total	413	100.0	62
Small Villages			
Ngarange (Ngamiland)	108	44.0	58
Maokwe (Serowe/Palapye)	139	56.0	74
Total	247	100.0	132

2.2 Procedures

- 2.2.1 A survey instrument that captures basic information on current nutritional status of family members, food intake, demographics, resources available and utilized, and perceived needs, was designed.
- 2.2.2 Appropriate research personnel were trained to take anthropometric and dietary intake measures.
- 2.2.3 Surveys were pretested on 16 households in a village near Gaborone under the principle investigator's supervision.
- 2.2.4 Anthropometric measures included height, weight, head circumference, midarm circumference, and triceps fatfold. Survey interviews included dietary intake of family members and methods of food storage, handling, and preparation. Demographics data included age, sex, any illness or symptoms that may affect food intake and assimilation, and information on social and economic factors that may affect food availability, access, and utilization.

2.3 Data Analysis

- 2.3.1 Data were coded and analyzed for frequencies and to determine any relationships between variables of nutritional status, dietary intake, demographics, and economic or social factors.
- 2.3.2 Data were evaluated to determine current nutritional status and means, and medians that characterize the nutritional status and practices of the population.

3 Findings

3.1 Demographic characteristics of study population

This section presents results on the demographic characteristics of the study population. The information was available from 388 households covering eight research sites. The eight sites were further reduced to three settlement strata during the analysis, namely towns, large villages, and small villages.

Table 3: Distribution of demographic characteristics of households

Demographics	Frequency	Percent
Locality		
Towns	114	29.4
Large villages	96	24.7
Small villages	178	45.9
Gender of household head		
Male	178	44.9
Female	211	54.4
Age of Head		
Less than 15 years	2	0.5
15-64	288	75.6
65 and above	91	23.9
Marital status		
Married	116	30.4
Living together	61	16.0
Separated	3	0.8
Divorced	10	2.6
Widowed	59	15.4
Never married	133	34.8

According to Table 3, the majority of households (45.9 percent) in this sample were drawn from small villages. Overall small villages constitute the biggest proportion of the population of Botswana. In this study, sample selection was done to proportionally represent the size of the population of the three main strata.

In terms of sex distribution the findings showed that 54.4 percent of the households were female headed (FHH). Although the difference may not be statistically significant it is higher than the national prevalence of FHHs showing that an estimated 47 percent of households are female headed (CSO, 2002). The reason for this difference is unclear. It could be a difference in sampling errors. When it comes to the age distribution, 23.9 percent of the households were headed by the elderly people while children less than 15 years of age head two of the 388 households. This could pose a problem for quality child care and own food production. Heads of households who never married constitute the largest proportion (34.8 percent) of the study population. A significant number of people in the study are single parents. This could pose a socio-economic problem since the sub-population group constitute a significant proportion of the poorest of the poor.

3.2 Socio-economic characteristics of study population

Households were asked about their cash income and main employment. Results are presented in Table 4.

Table 4: Distribution of socio-economic characteristics of households

Socio-economics *	Towns	Large Villages	Small villages
Cash income (pula)/month			
Less than 400	6(5.3)	40(42.1)	76(43.2)
400-599	11(9.6)	1(1.1)	3(1.7)
600-799	7(6.1)	0(0.0)	6(3.4)
800-999	12(10.5)	7(7.4)	7(4.0)
1000 or more	64(56.1)	16(16.8)	14(8.0)
Don't know	14(12.3)	29(30.5)	70(39.8)
Main employment *			
None	13(11.5)	40(41.7)	104(60.1)
Formal	73(64.6)	12(12.5)	18(10.4)
Informal	17(15.0)	9(9.4)	9(5.2)
Self-employed	9(8.0)	3(3.1)	4(2.3)
Farming	0(0.0)	31(32.3)	22(12.7)
Student	1(0.9)	0(0.0)	0(0.0)

(p=0.000)*

Numbers in brackets are percentages

Results that are not presented here show that the largest proportion (31.7 percent) of households falls in the less than P400 cash income category while 24 percent were within the P1000 or more income group. Formal employment constitutes the main form of employment with 27 percent engaged in such employment while 41 percent said they were not employed. When the three settlement clusters are compared a clearer picture emerges. It shows that the largest proportion of rural households i.e. those large and small villages are in the P400 cash income group while 56 percent of urban households are within the P1000 or more income category (Table 4). According to Table 4, 64.6 percent of the study population in towns were engaged in formal employment. As expected rural areas have a significantly smaller percentage of people engaged in formal employment. The difference in the proportion of people in formal employment between the different strata is statistically significant (p=0.000). The reason for this is that in Botswana as in many developing countries there are better formal employment opportunities in towns compared to rural places. Drought conditions are crippling the rural areas. Rural areas also experience limited formal employment, little farming; no wonder the frequency of meals and nutritious food is less in the rural areas.

3.3 Dietary patterns

This section presents findings from the food frequency questionnaire on eating patterns of our study population. The different clusters are also compared to determine whether there are differences between them. Results are presented in Table 5 and Table 6.

Table 5: Eating patterns of the study population

Meal frequency	Frequency	Percentage
Once a day	79	20.4
Twice a day	145	37.6
Three or more a day	162	42.0

Although a food frequency questionnaire gives quantitative information on the nutrition of households it is useful in giving an early warning sign of inadequate dietary intake. When people were asked about the number of meals consumed in a day, 20.5 percent said they have one meal a day while 42 percent have three or more meals a day (Table 5).

Table 6: Eating patterns of the study population according to food group

Food group	Daily	3-6 a week	1-2 a week	2-3 a month	Seldom	Never
Meat and products	87(22.5)	54(14.0)	91(23.5)	27(7.0)	122(31.5)	6(1.6)
Pulses	5(1.3)	32(8.3)	118(30.6)	48(12.4)	139(36.0)	44(11.4)
Fruits	64(16.6)	40(10.4)	44(11.4)	35(9.1)	141(36.5)	62(16.1)
Green vegetables	108(28.0)	92(23.8)	88(22.8)	13(3.4)	73(18.8)	12(3.1)
Cereals	347(89.9)	25(6.5)	10(2.6)	1(0.3)	2(0.5)	1(0.3)
Rice	27(7.1)	81(21.2)	119(31.2)	19(5.0)	94(24.6)	42(11.0)
Alcohol beverages	25(6.5)	17(4.4)	46(11.9)	13(3.4)	49(12.7)	235(61.0)
Milk and products	212(54.8)	51(13.2)	30(7.8)	10(2.6)	72(18.6)	12(3.1)
Fats and oils	274(72.1)	28(7.4)	28(7.4)	4(1.1)	41(10.8)	5(1.3)
Hot beverages	303(78.5)	18(4.7)	8(2.1)	9(2.3)	35(9.1)	13(3.4)
Caterpillar	1(0.3)	6(1.6)	6(1.6)	13(3.4)	172(44.8)	186(48.4)

Numbers in brackets are percentages

The frequently consumed (daily) food items are cereals (89.9 percent), followed by hot beverages (78.5 percent), fats and oils (72.1 percent) and milk and milk products (54.8 percent). When protein sources are examined 31.5 percent said they seldom consume meat, 36 percent and 44 percent responded that they seldom consume pulses and caterpillar respectively. Although meat is preferred, it is an expensive source of protein. Hence a significant number of households seldom consume meat (Table 6).

Recent reports on causes of death in Botswana have pointed to both road accidents, mainly caused by alcohol, and AIDS as the main killers in this country, yet this study indicates that the majority of people here seldom take alcoholic beverages. This could indicate that alcohol is abused by few but could be affecting a lot of other people, who may not habitually indulge in it.

3.3.1 Meal patterns by clusters

One of the objectives of this study was to determine the number of meals consumed in a day by comparing the towns, large villages and small villages. The results are presented in Table 7.

Table 7: Meal patterns by different places

Meals	Town	Large village	Small village
Once a day	10(8.8)	9(9.4)	60(34.1)
Twice a day	38(33.3)	49(51.0)	58(33.0)
Three or more a day	66(57.9)	38(39.6)	58(33.0)
Total	114(100)	96(100)	176(100)

Numbers in brackets are percentages

According to Table 7 the frequency of meals a day increases with an increase in size and level of development of an area. The results show that about 58 percent households in towns have three or more meals in a day while in small villages 33 percent households have three or more meals a day. The difference in the number of meals between the three areas is statistically significant ($p=0.000$).

3.3.2 Consumption pattern of meats and pulses by clusters

This sub-section presents data from cross-tabulations comparing the differences between the three clusters of towns, large villages and small villages. Results are presented in Table 8.

Table 8: Eating patterns of meat/meat products, and pulses by the different clusters

Food frequency	Towns	Large villages	Small villages
Meat and meat products			
Daily	63(55.3)	8(8.3)	16(9.0)
3-6 a week	21(18.4)	18(18.8)	15(8.5)
1-2 a week	17(14.9)	47(49.0)	27(15.3)
2-3 a month	6(5.3)	10(10.4)	11(6.2)
Seldom	5(4.4)	13(13.5)	104(58.8)
Never	2(1.8)	0(0.0)	4(2.3)
Pulses			
Daily	3(2.4)	0(0.0)	2(1.1)
3-6 a week	12(10.5)	12(12.5)	8(4.5)
1-2 a week	44(38.6)	49(51.0)	25(14.2)
2-3 a month	20(17.5)	11(11.5)	17(9.7)
Seldom	24(21.1)	15(15.6)	100(56.8)
Never	11(9.6)	9(9.4)	24(13.6)

Numbers in brackets are percentages

When the different clusters are compared, results show that there are significant differences in the consumption pattern of meat and meat products. According to Table 8 55.3 percent of households in towns consume meat and meat products daily while less than 10 percent of households from rural areas consumed meat daily. As many as 58.8 percent households from small villages indicated that they seldom consume meat compared to 4.4 percent in urban centres. The consumption pattern of pulses indicates that about 57 percent households in small villages seldom consume pulses compared to 21.1 percent in towns and about 16 percent in large villages. Although meat is expensive it is the preferred source of protein. Hence it is likely to be consumed more frequently in urban areas compared to rural places. Data not presented here indicate that caterpillar which is a delicacy in the northern part of the country is rarely consumed with 65.6 percent households in large villages saying that they never consume the caterpillar. The caterpillar is a source of protein. In most cases, the caterpillar is harvested for commercial purposes and it is sometimes used as an occasional snack, therefore people would rarely use it as a regular source of protein

The general trend observed for consumption of meat and meat products, is repeated when milk and milk products are examined. Results that are not presented here show that 32.2 percent of households from small villages seldom consume milk and other milk products compared to about 7 percent in urban and large villages. The study population recorded relatively high consumption levels of milk and milk products.

3.3.3 Consumption pattern of fruits and vegetable by clusters

Table 9 presents results comparing the consumption pattern of fruits and vegetables by the different clusters.

Table 9: Eating patterns of fruits and vegetables by the different clusters

Food frequency	Towns	Large villages	Small villages
Fruits			
Daily	52(45.6)	3(3.1)	9(5.1)
3-6 a week	22(19.3)	12(12.5)	6(3.4)
1-2 a week	12(10.5)	25(26.0)	7(4.0)
2-3 a month	10(8.8)	19(19.8)	6(3.4)
Seldom	15(13.2)	26(27.1)	100(56.8)
Never	3(2.6)	11(11.5)	48(27.3)
Green leafy vegetables			
Daily	53(46.5)	9(9.4)	46(26.1)
3-6 a week	33(28.9)	40(41.7)	19(10.8)
1-2 a week	22(19.3)	31(41.7)	35(19.9)
2-3 a month	1(0.9)	3(3.1)	9(5.1)
Seldom	4(3.5)	9(9.4)	60(34.1)
Never	1(0.9)	4(94.2)	7(4.0)

Numbers in brackets are percentages

As is the case with meat and meat products, urban dwellers are more likely to consume fruits and vegetables daily compared to rural households. The difference in the consumption pattern between the three clusters is statistically significant ($p=0.000$). Fruits and vegetable are readily available in towns because of prevalence of markets as they are mostly not home grown in part because of inadequate water throughout the country. Moreover, we know from poverty studies that rural areas are the most hit.

3.3.4 Consumption patterns of cereal products

Table 10 presents results on the consumption pattern of cereals and cereal products.

Table 10: Consumption pattern of cereal and cereal products by clusters

Food frequency	Towns	Large villages	Small villages
Daily	90(78.9)	91(94.8)	166(94.3)
3-6 a week	15(13.2)	1(1.0)	9(5.1)
1-2 a week	7(6.1)	3(3.1)	0(0.0)
2-3 a month	1(0.9)	0(0.0)	0(0.0)
Seldom	0(0.0)	1(1.0)	1(0.6)
Never	1(0.9)	0(0.0)	0(0.0)

Numbers in brackets are percentages

Cereals and cereal products are the most frequently consumed foods. This is expected because the bulk of the cereal food items are staple foods. According to Table 10 villages recorded more than 90 percent of households who consume cereals daily compared to 78.9 percent of the urban households.

3.4 Water and sanitation

Factors associated with nutritional status of populations are multifaceted. Undesirable methods of waste disposal and lack of access to potable water are important determinants of poor nutrition. One of the objectives of this study was to examine the extent to which the study population has access to potable water and to determine methods of waste disposal. Results are presented in Table 11.

Almost all households in this study had access to potable water. In the rural areas less than 2 percent of households had piped water inside their houses compared to 63.6 percent in urban areas. The rural areas are dependent on public standpipes. The difference between the two cluster areas in having access to potable water is statistically significant ($p=0.000$).

Table 11: Sources of water supply and waste disposal by urban and rural cluster areas

	Towns	Large villages	Small villages
Water source *			
Piped in doors	70(63.6)	1(1.1)	8(1.7)
Stand pipe in plot	28(25.5)	64(67.4)	26(14.9)
Communal	12(10.9)	23(24.2)	143(82.2)
Borehole	0(0.0)	0(0.0)	1(0.6)
Other	0(0.0)	7(7.4)	1(0.6)
Waste disposal *			
Own flush toilet	67(58.8)	1(1.1)	1(0.6)
Own pit latrine	21(18.4)	81(86.2)	73(42.7)
Neighbours' flush toilet	1(0.9)	1(1.1)	3(1.8)
Neighbours pit latrine	2(1.8)	10(10.6)	32(18.7)
Communal flush toilet	7(6.1)	0(0.0)	0(0.0)
Communal pit latrine	16(14.0)	0(0.0)	38(22.2)
Bush	0(0.0)	1(1.1)	24(14.0)

Numbers in brackets are percentages
 (* P=0.000)

When it comes to waste disposal results in Table 11 show that 58.8 percent households had own flush toilets while less than 2 percent households had the same facility in rural areas. The difference between large and small villages is negligible. A total of 14 percent of the households from small villages use the bush for waste disposal. Despite being an environmental problem, a significant number of households in both urban and rural areas continue to use pit latrines. In large villages 86.2 percent indicated that they used own pit latrine compared to 18.4 percent and 42.7 percent in urban and small villages respectively. Pit latrines tend to contaminate under ground water sources resulting in frequent diarrhoeal outbreaks and poor nutrition especially among under-fives. Most of the households in the small villages would be in the cattle posts and lands where the population is sparsely distributed. The use of the bush in such situation may not pose a big problem at the moment because the excreta dries quickly or is mixed with the soil by animal movements.

3.5 Energy sources

Access to energy sources is a determinant of nutritional status. Often the cooking methods and the type of food prepared can be dependent upon accessibility and affordability of reliable energy source. In this study energy for cooking and lighting was used as a proxy measure of both the socio-economics status and possible impact on the nutritional status of the study population.

Table 12: Energy sources for cooking and lighting by cluster areas

	Towns	Large villages	Small villages
Cooking energy			
Electricity	9(8.7)	0(0.0)	1(0.7)
Gas	80(77.7)	14(37.8)	2(1.4)
Paraffin	12(11.7)	1(2.7)	0(0.0)
Wood	2(1.9)	22(59.5)	142(97.9)
Lighting energy			
Electricity	71(65.7)	5(11.9)	7(6.0)
Gas	2(1.9)	0(0.0)	0(0.0)
Paraffin	32(29.6)	33(78.6)	57(49.1)
Wood	0(0.0)	0(0.0)	8(6.9)
Candle	3(2.8)	4(9.5)	43(37.1)
Diesel	0(0.0)	0(0.0)	1(0.9)

Numbers in brackets are percentages
(* P=0.000)

According to Table 12, 77.7 percent of households in towns use gas for cooking followed by households from large villages. In small villages gas is rarely used for cooking; 97.9 percent households use wood for cooking in small villages. Any nutrition intervention program should take this factor into account. The difference in the type of energy used for cooking between the three areas is statistically significant (p=0.000).

When it comes to energy for lighting, results show that 69.7 percent of the households in towns use electricity for lighting while 29.6 percent use paraffin (Table 9). The most commonly used energy for lighting in large villages is paraffin. On the other hand 49.1 percent households used paraffin in small villages.

3.6 Food storage facilities

This study examined the type of food storage facilities used by households in both urban and rural areas. Storage is vital in ensuring that food is safe for consumption. Results are presented in Table 13.

Table 13: Type of household food storage facilities by the three cluster areas

Storage facility	Towns	Large villages	Small villages
Refrigeration	2(5.3)	0(0.0)	1(0.6)
Food store room	4(10.5)	0(0.0)	25(15.1)
Kitchen	11(28.9)	51(64.6)	40(24.1)
Bedroom	21(55.3)	28(35.4)	100(60.2)

Numbers in brackets are percentages
(* P=0.000)

In this study population refrigeration is not commonly used. It is possible that most of the households did not own refrigeration facilities to keep their perishable food items. A significant number of households kept their foods in bedrooms. Even in towns 55.3 percent used bedrooms as food storages while 60.2 percent used the same in small villages. Results show that refrigeration is rarely used to store foods. This ties in with the frequency of perishable food (meat and vegetable) consumption mentioned above. Villagers rarely consume these and therefore would not really need a refrigerator

3.7 Food markets

In Botswana, own food production is very limited in part because of frequent drought and poor farming methods. Most households depend on the market to purchase their food requirements. Food prices often vary depending on locality and source. Table 14 presents results on the different sources of food for purchasing.

Table 14: Types of food sources for purchasing by cluster areas

Food market	Towns	Large villages	Small villages
Kiosk	0(0.0)	1(4.5)	66(77.6)
General dealer	0(0.0)	8(36.4)	16(18.8)
Supermarket	13(86.7)	13(59.1)	2(2.4)
Wholesale	2(13.3)	0(0.0)	1(1.2)

Numbers in brackets are percentages
(* P=0.000)

As expected 86.7 percent households purchased their food items from supermarkets in towns while 77.6 percent dependent on kiosks for their food supplies in small villages. Kiosks and general dealers usually sell food items at higher prices compared to large supermarkets and wholesalers. Depending on kiosk for people residing in small villages could be a problem given the level of poverty in small and remote places in Botswana (Jefferis, 1998).

Kiosks are likely to have only basic items such as mealie-meal (corn flour), few tomatoes, sugar, tea, milk, tobacco, sweets, matches, paraffin etc. This would imply that

a lot of people in the rural areas have little access to purchasing fresh foods such as fruits and vegetables, coupled with the fact that these shops are usually expensive, yet they are targeting the rural population, which is mostly poor!

3.8 Nutritional status

One of the objectives of the study was to assess the nutritional status of adults using Body Mass Index (BMI).

The following cut-off points were used to interpret the body mass index (BMI) of individual adults;

< 18.5	Low BMI (Underweight)
18.5 – 24.9	Normal BMI
25 – 29.9	Overweight
>= 30	Obese

Table 15: BMI distribution by cluster areas

BMI category	Towns	Large villages	Small villages	Total
< 18.5	9(7.9)	18(18.9)	46(26.0)	73(18.9)
18.5 – 24.99	62(54.4)	42(44.2)	86(48.6)	190(49.2)
25.0 – 29.99	27(23.7)	19(20.0)	24(13.6)	70(18.1)
>= 30.0	16(14.0)	16(16.8)	21(11.9)	53(13.7)

Numbers in brackets are percentages
(* P=0.005)

According to Table 15, 18.9 percent of the study population was underweight while 13.7 percent were obese. These results show that obesity has become a problem in Botswana. When the different cluster areas were examined results show that 26 percent of those residing in small village were underweight compared to 7.9 percent in towns (p=0.005). As expected, overweight and obesity were more common in large villages (often called urban villages) and towns. This is due to changing lifestyles such as eating high fat diet and doing less physical exercise. As we have seen above, the consumption of fat and carbohydrates is very high compared to fruits and vegetables or high fibre foods and the energy expenditure is bound to be less because of improved transportation and reduced manual work