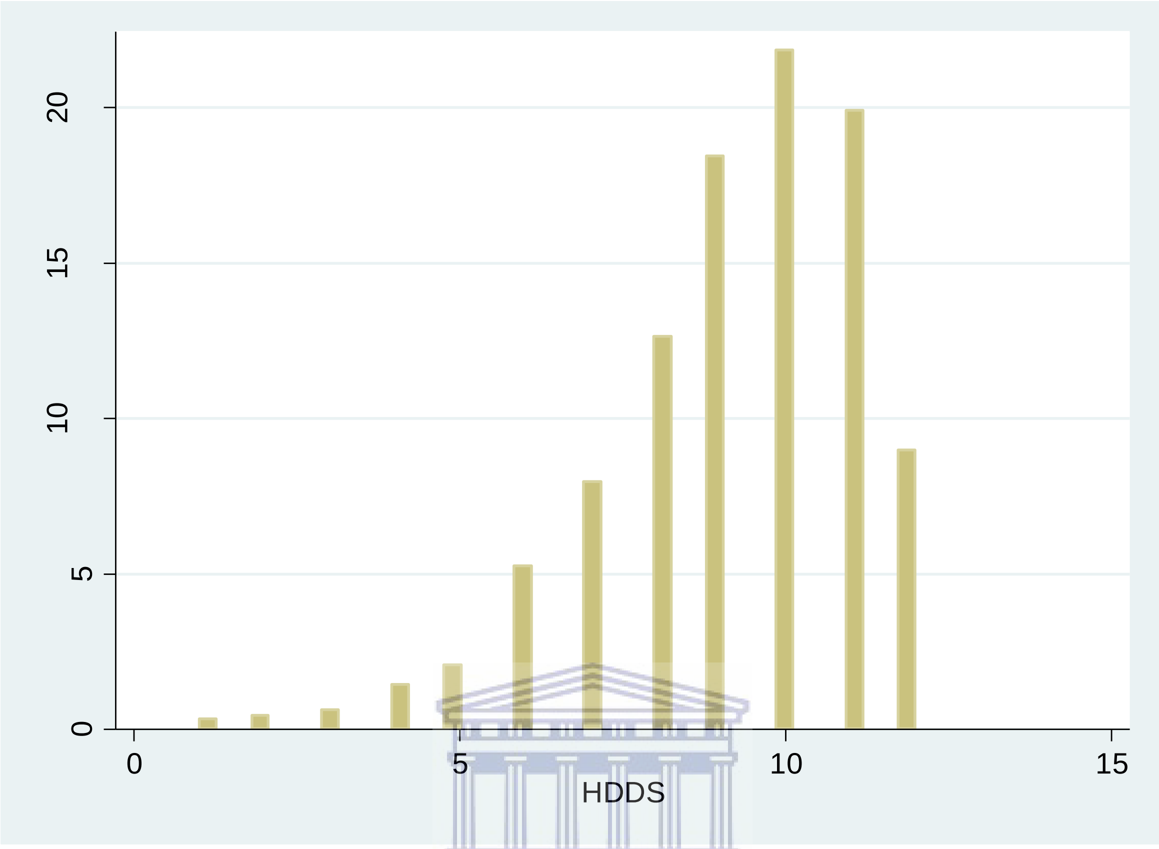
Table 7: Food groups by overall poverty status

Food Groups	Overall Poverty Status	
	Poor	**Non Poor**
Cereals	97.24%	98.60%
Roots and tubers	62.44%	84.52%
Pulses	72.33%	83.66%
Vegetables	89.70%	97.42%
Meats, poultry and offal	38.67%	74.28%
Fish and seafood	33.43%	35.43%
Eggs	18.23%	45.60%
Milk and milk products	76.26%	92.89%
Oils and Fats	89.38%	95.61%
Fruits	60.26%	83.66%
Sugars and honey	86.19%	93.77%
Spices, beverages and other miscellaneous	97.64%	98.84%

4.3.2 Household Dietary Diversity Score

Figure 8 below shows the distribution of households based on Household Dietary Diversity Score (HDDS), which is the sun ... e 12 possible food groups that a household can consume from. Fc ... households consume are given a score of 1, and the HDDS is then ... all the food groups with the scores of 1. As shown below, out of the ... than 1 percent consume from one food group while 22.3 percent con... roups. Approximately 9 percent of the households consume from all the 12 food groups.

Figure 8: Household dietary diversity scores across households



Swindale & Bilinsky (2006) recommend that the HDDS targets be set based on the average dietary diversity of the 33 percent of the households with the highest diversity. The group with high dietary diversity represents the group with a score that is equal to or greater than the average HDDS for 33 percent of the households with the highest dietary diversity (upper tercile of dietary diversity). Based on this, the mean HDDS for 33 percent of the households with highest dietary diversity is 10.74. For the purposes of this study, the HDDS will be divided into three groups: low, medium and high dietary diversity. Table 8 displays the distribution of households based on these three groupings. Out of the 13, 158 households, 54.0 percent of the households consume diets that are of medium dietary diversity, while only 29.4 percent consume highly diversified diets.

Table 8: Dietary diversity groups by number of households

Dietary Diversity	**Percentage**
Low Diet Diversity	16.63
Medium diet diversity	54.00
High diet diversity	29.37

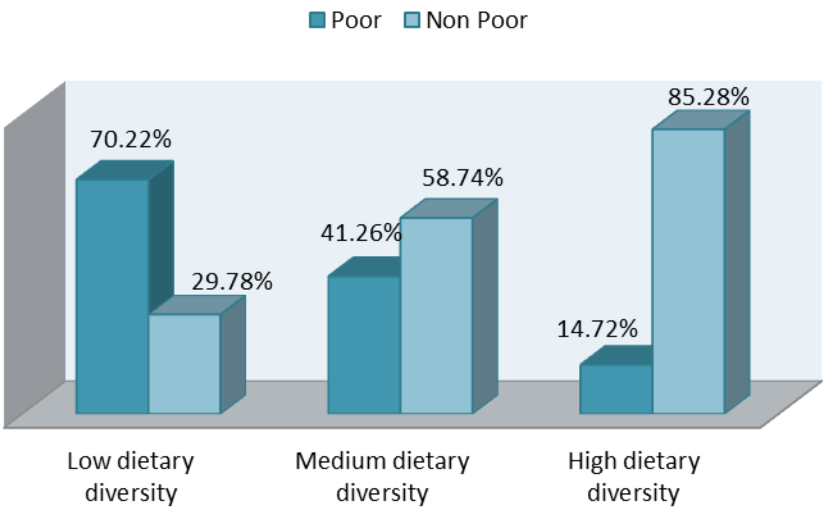
An analysis of dietary diversity groupings against households' areas of residence reveals the results shown in the table below, which are statistically significant at the 95 percent confidence interval. Urban households appear to have higher dietary diversity compared to rural ones. Of the households that reside in urban areas, 45.0 percent consume foods with high dietary diversity, more than 4 times those whose consumption is composed of low dietary diversity in the same area. Compared to urban areas, only 24.1 percent of households in rural areas consume foods with high dietary diversity. More households in rural areas (18.9 percent) than in urban areas (10.1 percent) consume foods low in dietary diversity. Food variety is normally greater in urban areas than in rural ones, due to the vast supply of food markets and the ease of accessibility (FAO, 2007).

Table 9: Dietary diversity by households' areas of residence

Dietary Diversity	Rural Households	Urban Households
Low dietary diversity	18.87%	10.08%
Medium dietary diversity	57.08%	45.02%
High dietary diversity	24.05%	44.91%
Pearson chi2(2) = 748.5318 Pr = 0.000		

Poor households are usually characterised by lack of food access. In most cases, where food is available, it is often monotonous and lacks proper dietary composition. This is illustrated in the graph below which shows that poor households consume foods low in dietary diversity. Of the households that consume foods low in dietary diversity, 70.2 percent are poor while only 14.7 percent of households who consume foods with high dietary diversity are classified as poor. A chi-square test confirms that the differences in dietary diversity levels across the different poverty status are statistically significant at the 95 percent confidence interval.

Figure 9: Dietary diversity groups by overall poverty status



Pearson chi2 (2) =1.9e+03 Pr = 0.000

Figures 10 and 11 below display positively sloped trend lines, indicating a rise in HDDS with increase in income[9]. The horizontal straight lines cutting through the trend lines represent the respective overall poverty lines. The figures show that higher household incomes are associated with higher HDDS, in both urban and rural areas. In both cases, HDDS appear to rise with every increase in the household income, even before households attain the point where the overall poverty lines cross the trend lines.

[9] The horizontal axis represents income which is expressed in logarithm form.

Figure 10: HDDS and household income (urban areas)

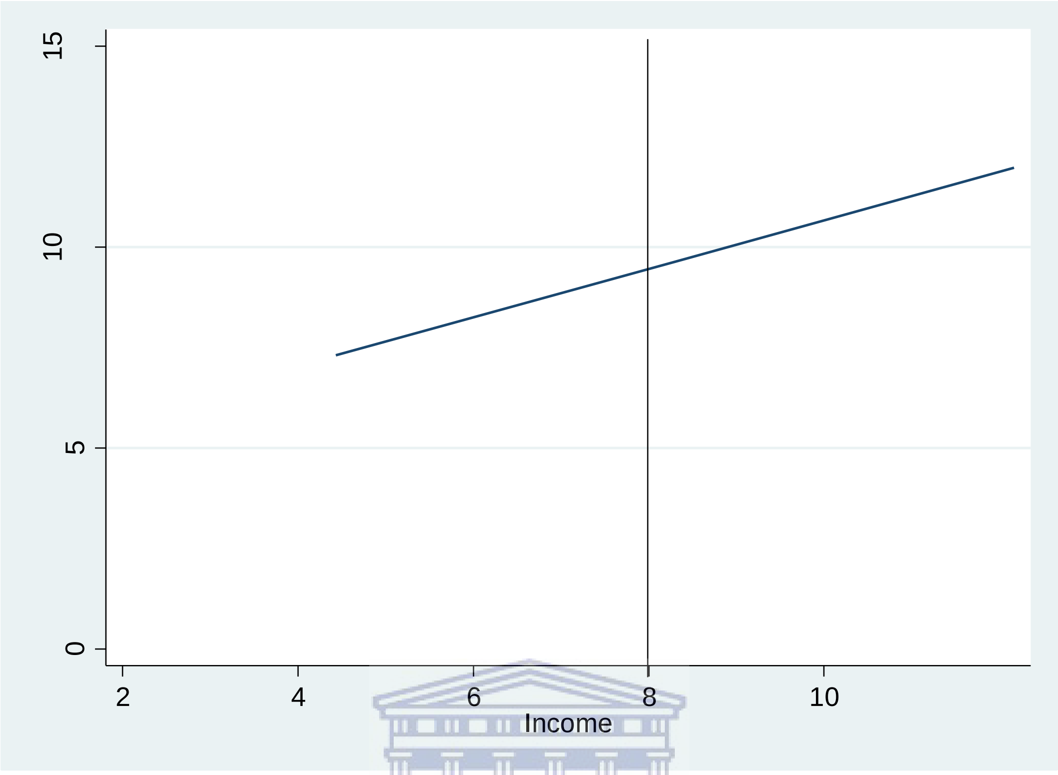
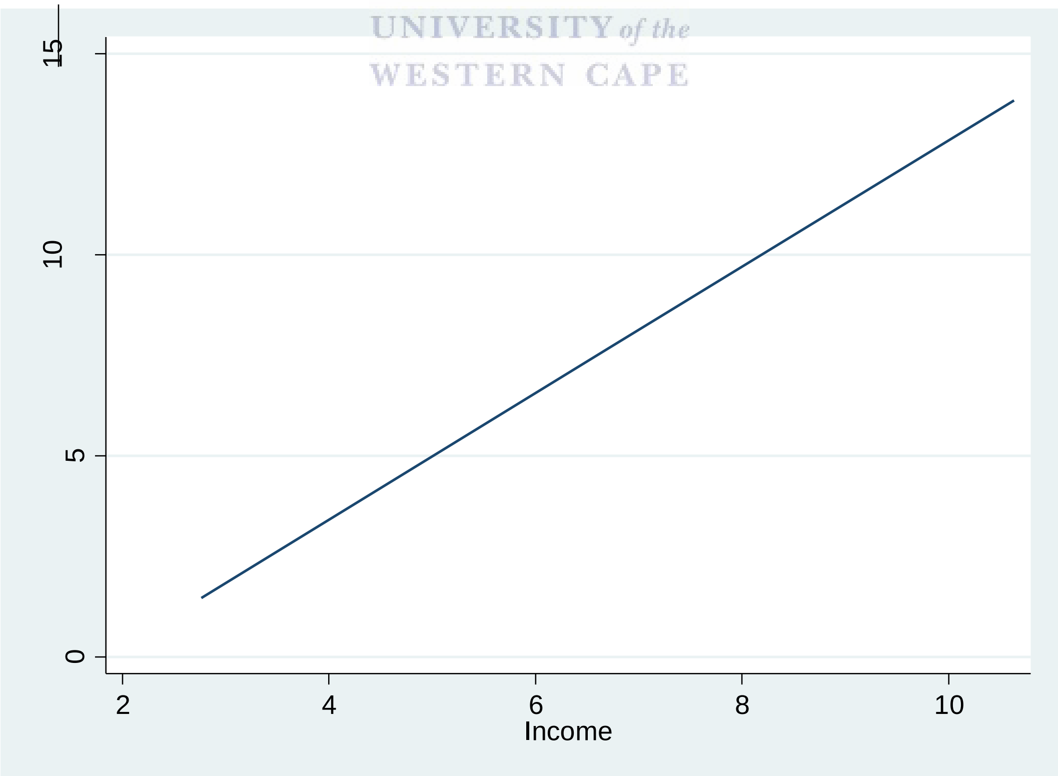


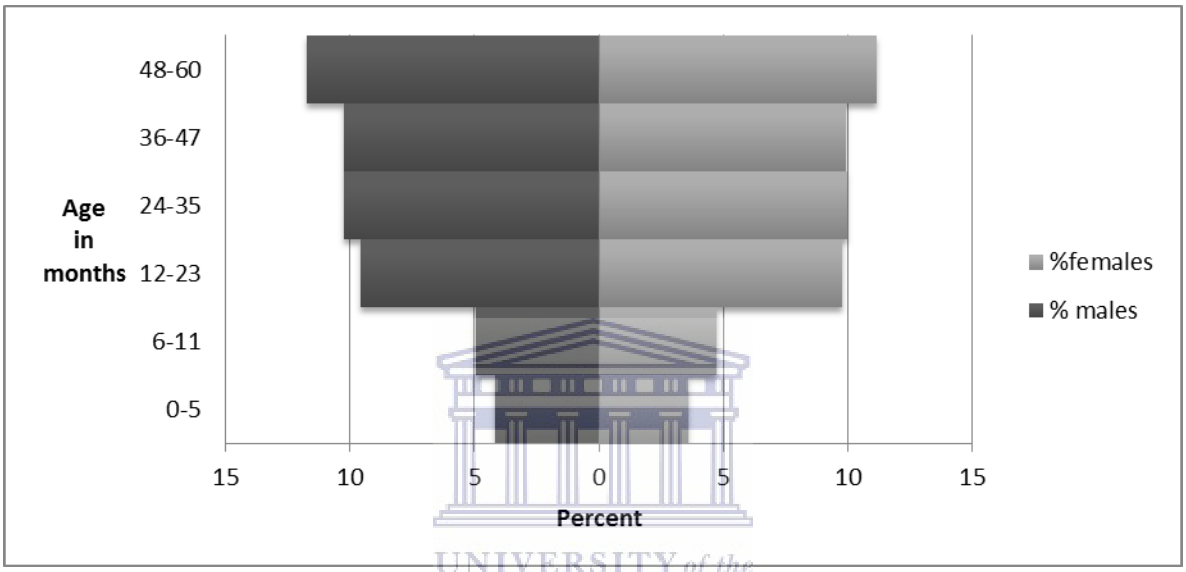
Figure 11: HDDS and household income (rural areas)



4.4 Child Demographics and Characteristics[10]

The total number of children aged 60 months and below is 11, 461. The figure below shows the distribution of the children by gender. The number of males is slightly higher than that of females, with the former constituting 50.8 percent and the later 49.2 percent. The figure also shows that there are more males than females in all age groups except 12-23 and 48-60 where female population is slightly higher than that of males.

Figure 12: Population pyramid



More children live in rural areas than in urban ones; 85.1 percent of children live in households located in the rural areas, while only 14.9 percent live in households that belong to locations classified as urban.

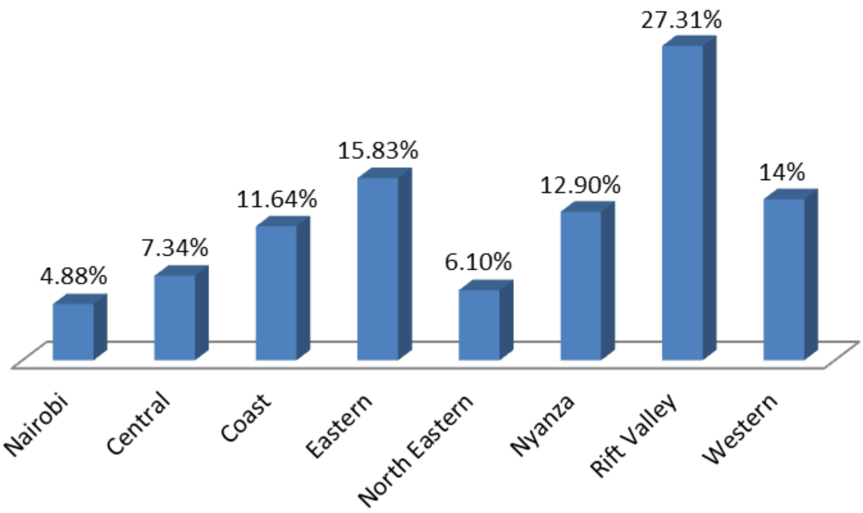
Table 10: Distribution of children under five by their area of residence

Area of residence	Percentage
Rural	**85.14**
Urban	**14.86**

A look at the distribution of children across provinces displays the results in figure 13 below. Rift Valley, the largest province in Kenya, has the highest percentage of children, standing at 27.3 percent. This is followed by Eastern at 15.8 percent. On the other hand, Nairobi, the smallest province in size, has the lowest percentage of children aged less than 5 years (4.9 percent).

[10] For the purposes of this study, "child" will refer to a child who is aged 5 years and below.

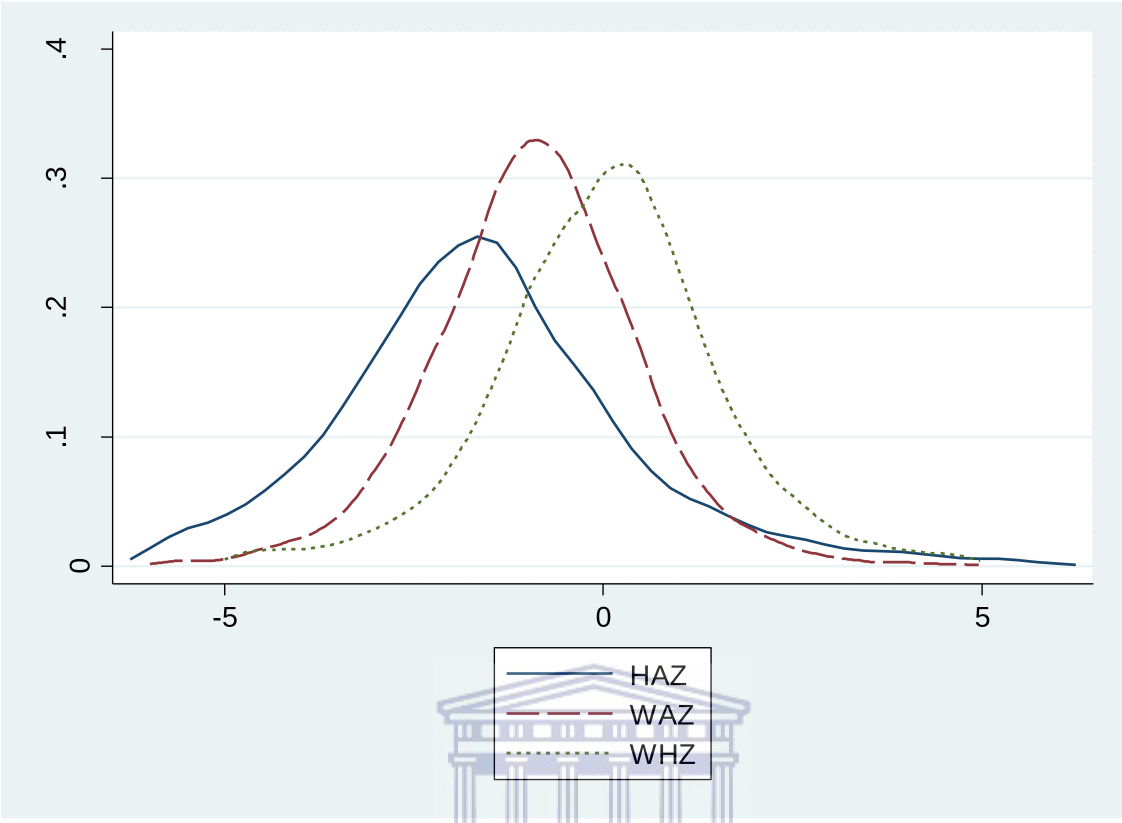
Figure 13: Child population across provinces



4.5 Child Malnutrition

The kennel density graph below shows the distribution of the height-for-age, the weight-for-age and the weight-for-height Z scores. The mean HAZ, WAZ and WHZ scores are -1.64, -0.91, and 0.092 respectively. The HAZ mean is lowest, a sign that there are more children who have low height for age, than there are those who have low WAZ and WHZ. The peak of HAZ is lower and to the left of the WAZ and WHZ peaks, which suggests that more children had poorer heights-for-ages as compared to the other two anthropometric indices. The WHZ peak is tilted to the right of the HAZ and WAZ peaks, showing that fewer children have low weights-for-heights as compared to ones who have low HAZ and WAZ.

Figure 14: HAZ, WAZ and WHZ (kdensity graph)



The mean HAZ for females is -1.4 while that of males is -1.7; showing that females are taller for their age as compared to their male counterparts. The mean WAZ for females is -0.8 and that of males -1.0. Results from the study also show that the mean WHZ for females is higher than that of males; with females recording a mean 0.1 and males -0.01. A t-test carried out shows that the difference in the means of the two groups (females and males) for HAZ and WAZ is statistically significant. The above results show that the means of females is higher than that of males for all the three categories of Z scores; an indication that females record better anthropometric measurements than their male counterparts.

4.5.1 Prevalence of Stunting, Wasting and Underweight

4.5.1.1 Stunting

Children whose HAZ fall below the minus two standard deviations (-2 SD) from the WHO median of the reference population are considered to have low height-for-age or stunted. From the table below, it is clear that the rates of stunting among children under the age of five are high in Kenya. 2,963 children are stunted representing 43.5 percent of the population.

Table 11: Prevalence of stunting in children under-five years

Stunting	Percentage
Stunted	**43.45**
Not Stunted	**56.55**

A child who's HAZ score falls below the -3 WHO median of the reference population threshold are classified as severely stunted. 1, 533 (21.42 percent) of the children are severely stunted.

4.5.1.2 Wasting

A child whose WHZ falls below the minus two standard deviation (-2 SD) from the WHO median of the reference population is considered to be wasted. The rates of wasting among children are not as high as those of stunting. The number of children who have low weight-for-height is 473 (6. 5 percent).

Table 12: Prevalence of wasting in children under five years

Wasting	Percentage
Wasted	**6.51**
Not wasted	**93.49**

Approximately 2 percent of the children have WHZ z-scores which are below -3 WHO median of the reference population and are therefore classified as severely wasted.

4.5.1.3 Underweight

A child is categorised as underweight if their WAZ is below minus two standard deviation (-2 SD) from the WHO median of the reference population. As demonstrated in the table below, 19.1 percent of the children are too light for their age.

Table 13: Prevalence of underweight in children under five years

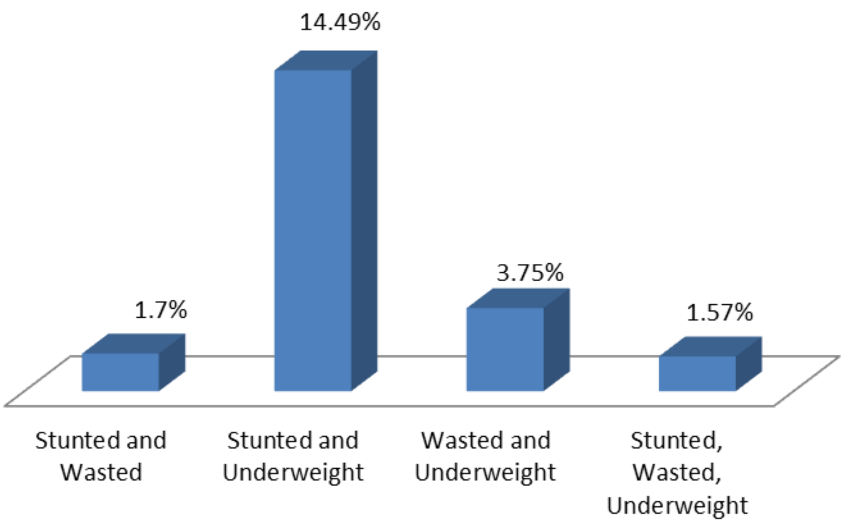
Underweight	Percentage
Underweight	**19.05**
Not Underweight	**80.95**

Children whose weight-for-age fall below the minus three standard deviations (-3 SD) from the WHO median of the reference population are considered severely malnourished. The proportion of children who are severely malnourished (WAZ<-3) is 5.7 percent.

4.5.2 Percentage of Children Suffering from more than one form of Malnutrition

The proportion of children who are stunted is 43.5 percent while those who are wasted and underweight are 6.5 percent and 19.1 percent respectively. Stunting is the highest form of malnutrition followed by underweight. The prevalence of wasting is not as high as that of stunting and underweight. Other studies (Smuts et.al, 2008; Ekesa, Blomme & Garming, 2011) have also found stunting to be the most common form of malnutrition, and wasting the lowest. A child can suffer from multiple problems of malnutrition. Each indicator can overlap the other; stunted children can experience wasting or underweight, while some children can experience all the three forms of malnutrition (Nandy & Miranda, 2008). Nandy and Miranda (2008) also argue that the use of each of the above indicators separately does not adequately reflect the overall burden of malnutrition, and suggest the use of a composite index of anthropometric failure (CIAF) that takes into account the three forms of malnutrition. The figure below shows the proportion of children affected by more than one form of malnutrition at the same time. Less than 2 percent of the children are both stunted and wasted, while 14.5 percent are stunted and underweight.

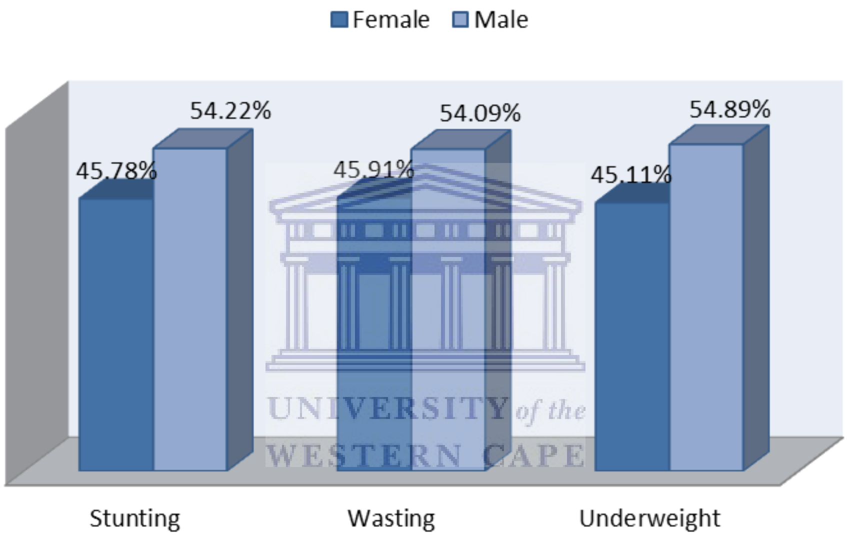
Figure 15: Proportion of children suffering from more than one form of malnutrition



4.5.3 Child Malnutrition and Gender

As already suggested, poor anthropometry appears to be more prominent among male children. This is further elaborated by the figure 16 which shows the malnutrition rates against the gender of a child. In all forms of malnutrition, there are higher numbers of male children affected compared to the female ones. The proportion of females who are stunted (44.9 percent) is less than those of males who suffer from the same problem (55.1 percent). A chi-square test reveals that the differences in malnutrition across sex are significant at the 95 percent confidence interval.

Figure 16: Prevalence of stunting, wasting and underweight by gender



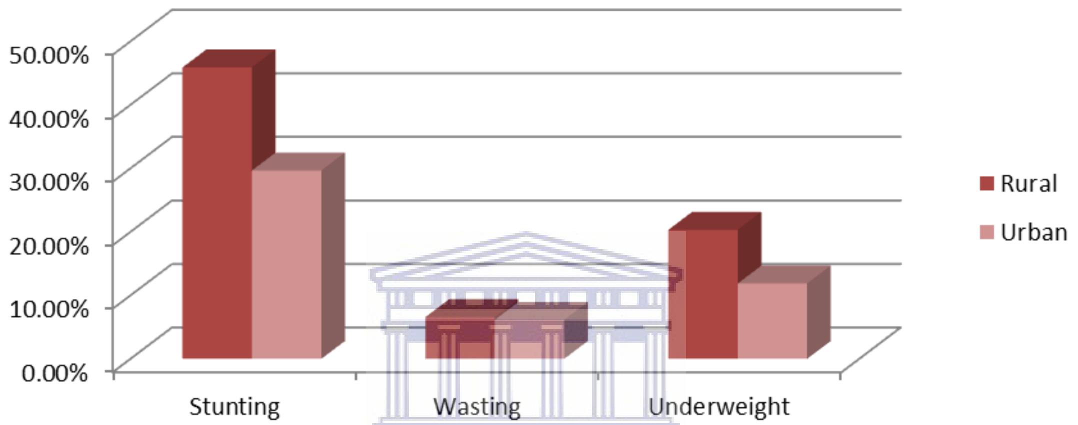
Stunting:	Pearson chi2(1) = 30.8669	Pr=0.000
Wasting:	Pearson chi2(1) = 9.2864	Pr =0.002
Underweight:	Pearson chi2(1) = 32.5454	Pr =0.000

The above results are similar to past research which has shown that malnutrition is more pronounced in male children than in female ones. An analysis of Kenya Demographic and Health Survey (1998 to 2003) found that male children were more likely to suffer from malnutrition than females (Ndeng'e, 2005). Results from Democratic Republic of Congo also show that male children have higher rates of stunting, wasting and underweight, as compared to females (Ekesa, Blomme & Garming, 2011).

4.5.4 Prevalence of Stunting, Wasting, Underweight by Area of Residence

Figure 17 below presents an analysis of child malnutrition by area of residence. Stunting, wasting and underweight are higher in rural areas than in urban areas. A chi-square test reveals that the differences in stunting and underweight across the two areas of residence are statistically significant at the 95 percent confidence interval. Rural areas are normally characterised by poor economic and social infrastructure, including lack of access to health and education facilities. Standards of living are also generally lower in rural areas. Past research show that rural areas in Africa are characterised by low school enrolment rates, higher infant mortality rates and low proportion of births attended by skilled health professionals (Sahn & Stifel, 2002).

Figure 17: Prevalence of stunting, wasting, underweight by area of residence



Stunting:	Pearson	chi2(1)= 82.9650	Pr = 0.000
Wasting:	Pearson	chi2(1)= 1.8546	Pr = 0.173
Underweight:	Pearson	chi2(1)= 44.1216	Pr=0.000

An examination of malnutrition by province shows that stunting is highest in Eastern and North Eastern provinces of Kenya with each recording 53.8 percent and 48.1 percent prevalence. The high rates of malnutrition in the Eastern province can be explained by the high levels of food insecurity and low production of food caused by persistent droughts and fuelled by an erratic climate and unreliable rainfall (Odumbe, 2007). The province is also largely rural and is characterised by scarce water resources which are also inadequate and unsafe resulting in proliferation of water borne diseases (Odumbe, 2007). Poverty is also widespread, and the presence of poorly developed food markets with high and unpredictable food prices appear to worsen the situation (Odumbe, 2007). Wasting is highest in North Eastern province and lowest in Central. The high prevalence of wasting in North Eastern Kenya (22.5 percent) can be attributed to the droughts that hit the area from 2004 (KNBS, 2007), and resulted in high livestock mortality rates and loss of livelihoods (Grobler-Tanner, 2007). North Eastern also records a high prevalence of underweight (26.6 percent). In addition to lack of food access, northern Kenya is also characterised by poor child feeding practices, poor access to public health, lack of access to safe water, poor sanitation and low literacy rates among women (Grobler-Tanner, 2007). Previous results also show that households in the province record the lowest rates of consumption across majority of the food groups (see 4.3.1) and majority of households do not have access to safe drinking water (see 4.2.4). Nairobi, an urban area, has the lowest prevalence of stunting and underweight.

Table 14: Prevalence of stunting, wasting, underweight by province

Province	Stunting	Wasting	Underweight
Nairobi	32.98%	3.48%	11.66%
Central	40.71%	2.78%	12.59%
Coast	45.86%	5.16%	20.87%
Eastern	53.77%	8.9%	28.19%
North Eastern	48.09%	22.5%	26.62%
Nyanza	43.66%	7.66%	14.05%
Rift valley	40.02%	7.12%	18.49%
Western	40.12%	3.26%	17.56%

4.5.5 Prevalence of Stunting, Wasting and Underweight by Age Groups

The table below shows the prevalence of stunting, wasting and underweight across different age groups. There are no malnutrition rates for children aged 0 to 5 months because they were not included in the anthropometric measurements during the survey. Stunting and underweight rates appear to be lowest for those children aged between 6 and 11 months, but increase in the second year of life. Stunting rates increase by more than 18 percent amongst children from the first year to the second year of life, and increase by almost 4 percent in the case of underweight. Wasting is prominent amongst those aged between 6 and 11 months, perhaps due to the possible introduction of solid foods into a child's diet that may not meet the nutritional requirements. The age group 48-60 seems to record the highest percentage of underweight children (21.4 percent). Generally, malnutrition rates appear to be higher with older children. These results are similar to previous studies which have shown that malnutrition is more pronounced among older children. In a study of the socio-demographic profiles and anthropometric status of 0 to 71 month children in the Eastern Cape and KwaZulu-Natal provinces of South Africa, Smuts et.al (2008) found that malnutrition prevalence increased by almost double from the first to the second year of life, possibly due to the introduction of family diets to children as they are weaned.

Table 15: Rates of stunting, wasting, underweight by age groups

Age Groups	Stunting	Wasting	Underweight
6-11	30.61%	8.33%	14.33%
12-23	48.98%	7.00%	18.29%
24-35	45.85%	6.33%	20.44%
36-47	46.30%	6.06%	18.09%
48-60	38.39%	5.99%	21.38%

4.5.6 Child Malnutrition Status by Diarrhoea

Diarrhoea has been identified as one of the risk factors associated with child malnutrition and causes child mortality. Previous studies have shown that diarrhoea is a serious health problem and one of the leading causes of under-five mortality (Schoeman et.al, 2010). The results presented below show that in Kenya, 1, 023 (11 percent) children were reported to have had diarrhoea 2 weeks prior to the survey interview.

Figure 18: Proportion of children under 5 who suffered from diarrhoea 2 weeks prior to interview

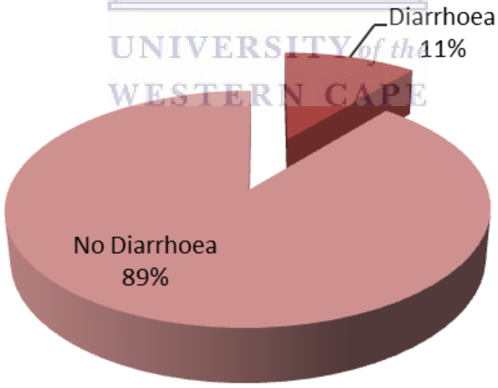
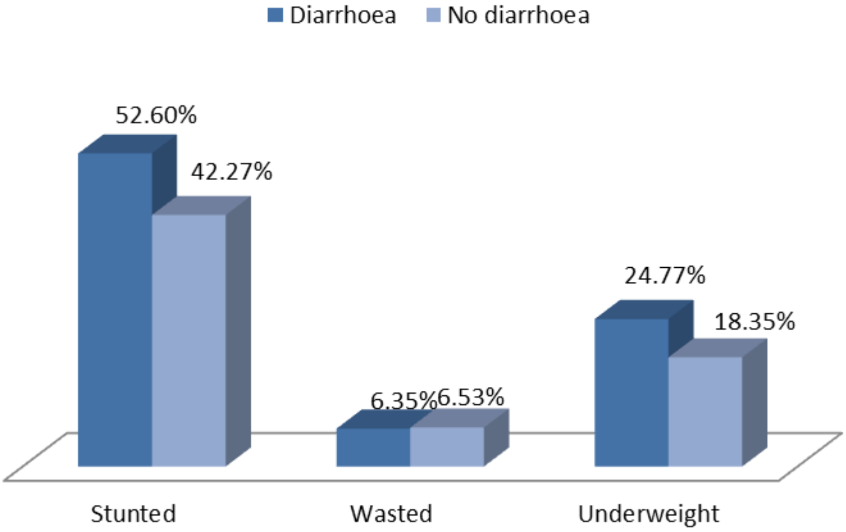


Figure 19 displays the proportion of children who had diarrhoea and are also malnourished. Of the 628 of the children who had diarrhoea and are malnourished, 52.1 percent of them are stunted, while the proportion of those who are wasted and underweight is 6.4 percent and 24.8 percent respectively. The fraction of children who were stunted and had diarrhoea is highest, followed by those who are underweight. As shown below, a chi-square test run reveals that the results are statistically significant at the 95 percent confidence interval.

Figure 19: Malnutrition rates by diarrhoea

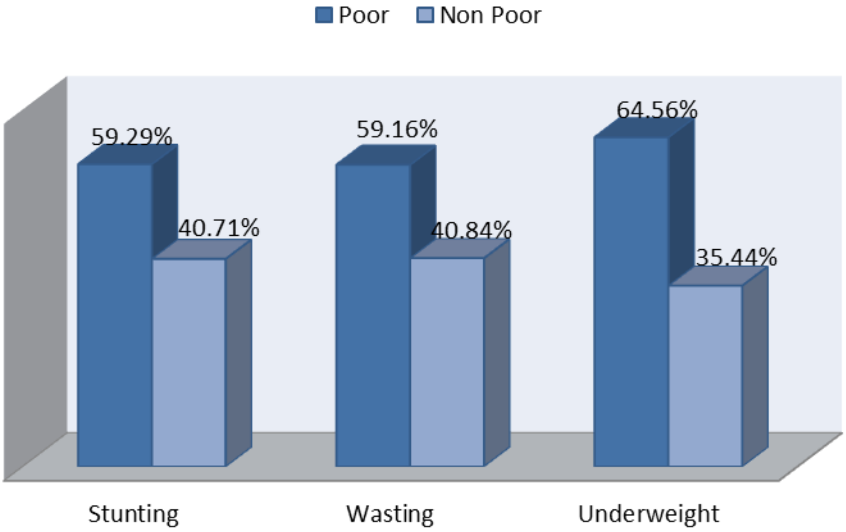


Stunting: Pearson chi2(1) = 34.2686 Pr = 0.000
Wasting: Pearson chi2(1) = 6.3711 Pr = 0.012
Underweight: Pearson chi2(1) = 21.8556 Pr = 0.000

4.5.7 Child Malnutrition by Poverty Status

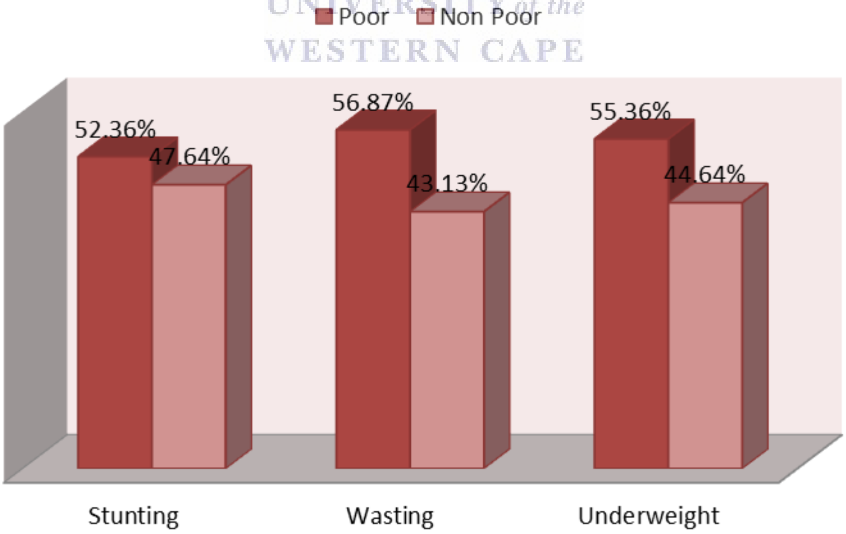
The proportion of children who are stunted, wasted and underweight is higher amongst poor households compared to those that are non-poor, based on both the overall and food poverty lines. This is illustrated in the figures below which shows the different rates of malnutrition against the poverty status of a household. A chi-square test confirms that all the results are statistically significant at the 95 percent confidence interval. With the overall poverty line, stunting prevalence is higher amongst poor households at 59.4 percent. The same pattern repeats itself with wasting and underweight, with the fraction of those in poor households being 59.2 percent and 64.6 percent respectively compared to those in non-poor households (40.8 percent and 35.4 percent respectively). However, the fractions of children who suffer from malnutrition and belong to poor households reduce in the case of food poverty. Generally, poor households are often unable to afford the necessary nutrient requirements and provide the care and support needed to ensure that children are not malnourished; this could account for the high rates of malnutrition amongst the poor. Previous analysis on household dietary diversity shows that a small percentage of poor households consume highly diversified diets (see 4.3.2). The results displayed below are statistically significant at the 95 percent confidence interval.

Figure 20: Child malnutrition by overall poverty status



Stunting:	Pearson chi2(1) = 55.5172	Pr = 0.000
Wasting:	Pearson chi2(1) = 17.5560	Pr = 0.000
Underweight:	Pearson chi2(1) = 84.4211	Pr = 0.000

Figure 21: Child malnutrition by food poverty status

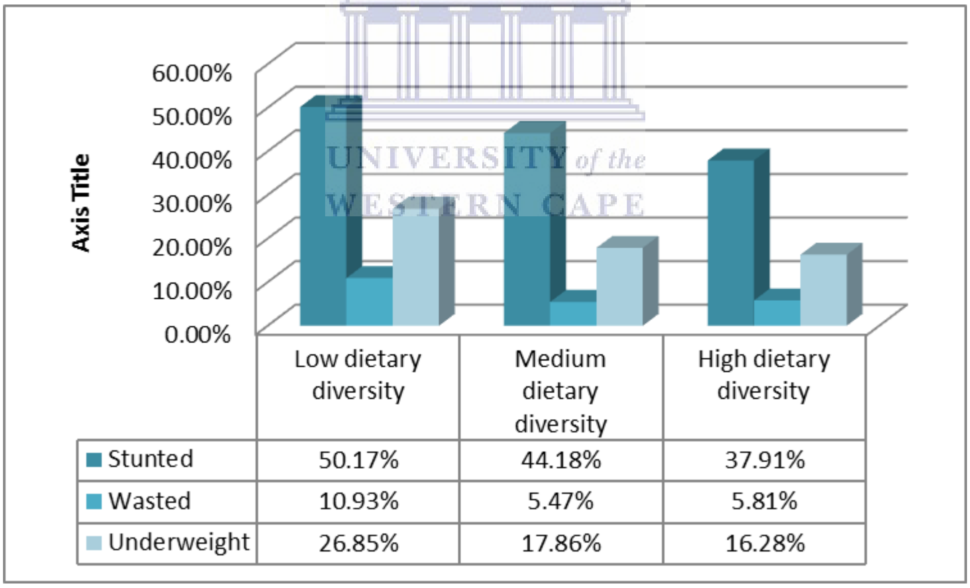


Stunting:	Pearson chi2(1) = 21.5619	Pr = 0.000
Wasting:	Pearson chi2(1) = 27.6339	Pr = 0.000
Underweight:	Pearson chi2(1) = 40.8121	Pr = 0.000

4.5.8 Child Malnutrition by Household Dietary Diversity Score (HDDS)

The rates of malnutrition are higher for those households with low dietary diversity scores, as compared to those who have high dietary scores. Stunting, wasting and underweight rates for those with low dietary diversity are 50.2 percent, 10.9 percent and 26.9 percent respectively, while the rates for those with high dietary diversity scores are 37.9 percent, 5.8 percent and 16.3 percent respectively. The prevalence of stunting, wasting and underweight appear to reduce with increase in the household dietary diversity level. As shown below, these differences in malnutrition rates across dietary diversity levels are statistically significant at the 95 percent confidence interval. High rates of malnutrition are associated with poor households (see 4.5.7). Similarly, poor households are characterised by low dietary diversity; 70.5 percent of households that consume low dietary diversity are poor (see 4.3.2). All these are possible contributing factors to the high fraction of malnourished children whose households consume foods low in dietary diversity.

Figure 22: Malnutrition prevalence by household dietary diversity levels



Low dietary diversity:	Pearson chi2(2) = 36.8996	Pr =0.000
Medium dietary diversity:	Pearson chi2(2) = 76.2539	Pr =0.000
High dietary diversity:	Pearson chi2(2) = 88.0720	Pr =0.000

4.6 Bivariate Analysis

4.6.1 Household Dietary Diversity and Food Expenditure

A pairwise correlation indicates that dietary diversity has a moderately strong positive correlation with household food expenditure. The relationship is significant at the 95 percent confidence interval. This shows that households that have high food expenditures are likely to consume more diverse diets. Dietary diversity has a low positive but significant correlation with household income of 0.2, an indication that households with increasing incomes also display increasing household dietary diversity scores and signifying that the households are able to allocate more of their expenditure to foods that are more diverse in nature. These results are similar to past findings obtained in Bangladesh which found a strong correlation between dietary diversity and per capita total food expenditure (Throne-Lyman et.al, 2010).

Table 16: Pairwise correlations between HDDS and selected variables

	Correlation coefficient	P value
Total food expenditure	0.4164	0.0000
Household income	0.2498	0.0000

4.6.2 Correlations between Malnutrition Rates and Other Risk Factors

4.6.2.1 Height-for-age (HAZ)

HAZ displays a positive and significant association with household dietary diversity scores and the average years of schooling for all females in a household; an indication that households with increasing HDDS scores and education years for females have children who display higher height-for-age scores. Household size and the age of the child have an inverse association with HAZ. The table below shows that households with increasing sizes display decreasing HAZ scores, while older children display lower HAZ scores. This is synonymous with earlier analysis on malnutrition and age, which showed that prevalence of stunting, wasting and underweight, was highest amongst older children (see 4.5.5).

Table 17: Height-for-age (HAZ) correlates

	Correlation coefficient	P value
HDDS	0.0638	0.0000
Education (females)	0.0662	0.0000
Household size	-0.0401	0.0007
Age of child in months	-0.0473	0.0001

4.6.2.2 Weight-for-height (WHZ)

An analysis presented below shows low, positive but significant associations between HDDS and education (average years of schooling for all females), a sign that households with high HDDS and increasing education years also display higher WHZ scores. Just like HAZ, WHZ scores have a negative but significant relationship with the size of the household and the age of the child. This shows that households with increasing sizes and whose children are older display lower WHZ scores. Previous analysis shows that the prevalence of wasting was high among older children (see 4.5.5).

Table 18: Weight-for-height (WHZ) correlates

	Correlation coefficient	P value
HDDS	0.1170	0.0000
Education (females)	0.0650	0.0000
Household size	-0.0501	0.0000
Age of child in months	-0.0585	0.0000

4.6.2.3 Weight-for-age (WAZ)

Weight-for-age Z scores appear to increase with an increase in the HDDS and the number of years of education. This is evident from the table below which shows the correlation results; all of which are significant. However, the household size and age of the child have negative association with the WAZ; an indication that the Z scores decrease with increase in the size of the household and with the age of the child. The positive association between HDDS and WAZ is similar to other studies in Burundi which found a positive association between WAZ and dietary diversity (Ekesa, Bloome & Garming, 2011).

Table 19: Weight-for-age (WAZ) correlates

	Correlation coefficient	P value
HDDS	0.1622	0.0000
Education (females)	0.1135	0.0000
Household size	-0.0848	0.0000
Age of child in months	-0.1379	0.0000

4.7 Multivariate Analysis

This section presents the results of multivariate analysis carried out. Linear regressions are used to explain the relationship between HAZ, WHZ and WAZ, and household dietary diversity. Logistic regressions results are also carried out to explain the relationship between the three indicators of malnutrition-stunting, wasting and underweight- and HDDS. The multivariate analysis is based on the model shown in chapter three, where dietary diversity is included as one of the household characteristics that influence the well-being of children. As was evident in the literature review, other risk factors such as age and sex of the child, education, household size, residence area, diarrhoea and income have also been associated with poor anthropometry. Consequently, the multivariate analysis in this section will also include them in the model.

4.7.1 Ordinary Least Square Regression

4.7.1.1 Height-for-age (HAZ)

The results of the linear regression model with HAZ as the dependent variable are shown in the table below. The model has an F statistic of 24.8, and is statistically significant as a whole showing that the independent variables explain the dependent one better than a flat line. The r-squared is 0.05 percent, which indicates that the independent variables in the model explain 5 percent of the variation of the dependent variable holding all other variables in the regression constant. Focusing first on the independent variable of interest; an increase in HDDS by 1 percent results in a predicted increase in HAZ by 1.8 percent. However, the effect of HDDS on HAZ is not statistically significant at the 95 percent confidence interval. Except for HDDS and education, all other variables are statistically significant at the 95 percent confidence interval. Household size has a negative association with HAZ, signifying that an increase in the size of a household by 1 percent results in a predicted decrease in HAZ by 2.9 percent. The results also show a positive relationship between HAZ and the area of residence, which has a coefficient of 0.5. This implies that children living in households located in urban areas have 0.5 times higher HAZ than those living in rural areas. Empirical results suggest that HAZ is lower in older children. An increase in the age of the child by 1 percent causes a predicted decrease of HAZ by 0.7 percent, an indication that older children display lower Z scores. In the case of diarrhoea, children who did not have any diarrhoea two weeks prior to the interview have on average 0.4 times higher Z scores than those who did. Z scores appear to be lower for male children. This is indicated by the results which show that male children have on average 0.3 times less Z scores than their female counterparts. HAZ appears to increase as households move into higher income groups. The results displayed in the table below indicate that a movement of a household from a lower income group to a higher one, there is a predicted increase in the HAZ of a child living in that household by 16.1 percent.

Table 20: Linear regression results (HAZ)

Variable	**Coefficient**	**Robust Std. Err.**	**t**	**P>|t|**
Household Dietary Diversity Score (HDDS)	0.0177392	.0199721	0.89	0.374
Education (females)	0.0158212	.0097459	1.62	0.105
Household Size	-0.0285766	.0096033	-2.98	0.003
Area of residence (0=rural, 1=urban)	0.4542831	.0848004	5.36	0.000
Age of child (months)	-0.0068631	.0018813	-3.65	0.000
Diarrhoea (0=yes, 1=no)	0.415929	.0917108	4.54	0.000
Gender (0= female, 1=male)	-0.2713138	.0570812	-4.75	0.000
Household income (5 deciles)	0.1609923	.0273219	5.89	0.000
Number of observations=6,860 F (8, 6865)= 24.80 Prob>F=0.0000 R squared=0.0487				

4.7.1.2 Weight-for-Height (WHZ)

Table 21 displays the results of the linear regression on WHZ and HDDS. The model as a whole is statistically significant, with an F statistic of 3.9 and the R2 shows that this model to predict a larger share of the variation in the dependent variable. As in the case of HAZ, the effect of HDDS on WHZ is not statistically significant at the 95 percent confidence interval; though the results show that an increase in the dietary diversity score by 1 percent results in a predicted increase of WHZ by 1.7 percent. Empirical results from the survey also show that household size has a negative association with WHZ which is statistically significant at 95 percent confidence interval. For every increase in household size by one, there is a predicted decrease of WHZ score by 2.2 percent. The outcomes also show that an increase in the age of child by 1 percent results in a predicted decrease of WHZ scores by 0.5 percent, an indication than older children are more likely to display lower Z scores than younger ones.

As in the case of HAZ, children living in households with higher incomes have better WHZ scores than those whose incomes are on the lower side. This is depicted in the table below which shows that for every movement of a household from a lower income group to a higher one, there is a predicted increase in the WHZ of a child living in that household by 4.7 percent.

Table 21: Linear regression results (WHZ)

Variable	Coefficient	Robust Std. Err.	t	P>|t|
Household Dietary Diversity Score (HDDS)	0.0172058	.0150912	1.14	0.254
Education (females)	0.0117865	.0080187	1.47	0.142
Household Size	-0.022752	.0076617	-2.97	0.003
Area of residence (0=rural, 1=urban)	-0.0535206	.0736839	-0.73	0.468
Age of child (months)	-0.0044765	.0016516	-2.71	0.007
Diarrhoea (0=yes, 1=no)	-0.0240094	.0677762	-0.35	0.723
Gender (0= female, 1=male)	-0.0491412	.0462123	-1.06	0.288
Household income (5 deciles)	0.0472091	.0218828	2.16	0.031
Number of observations= 6829 F (8, 6865)= 3.94 Prob>F=0.0001 R squared=0.0093				

4.7.1.3 Weight-for-Age (WAZ)

A linear regression of WAZ and other independent variables reveals the results below. The model as a whole has an F statistic of 34.4 and is statistically significant at the 95 percent confident interval. The r-squared is 0.7 showing that the independent variables in the model explain 7 percent of the variation in WAZ. All the independent variables results are statistically significant at the 95 percent confidence interval. There is a positive relationship between WAZ and HDDS, showing that WAZ increases with the increase in the household dietary diversity score. For every 1 percent increase in HDDS, there is a predicted increase of WAZ by 4.1 percent. In the case of education, an additional year of schooling results in a predicted increase of WAZ by 2.4 percent. A similar pattern is seen in the case of household size, where an increase in the size of a household by one member results in a predicted decrease of WAZ for a child living in that household by 3.5 percent. Children living in urban areas appear to have higher Z scores compared to those living in rural ones. Results illustrated in the table below show that on average children living in urban areas have Z scores that are 0.2 times higher than those living in rural areas.

Older children display lower weight-for-age Z scores. This is evident from the table below which shows that an increase in the age of a child by 1 percent results in a predicted decrease of WAZ by 1.2 percent. In the case of diarrhoea, children who do not have diarrhoea have 0.3 times higher WAZ than those who have. Similarly male children have Z scores which are 0.2 times lower than those of their female counterparts, indicating that male children are more at risk of malnourishment. As in the case of HAZ and WHZ, a household belonging to a higher income group is likely to have better WHZ. Results illustrated below show that the movement of a household from a lower income group to a higher one results in a predicted increase in WHZ of 11.1 percent for a child living in that household.

Table 22: Linear regression results (WAZ)

Variable	**Coefficient**	**Robust Std. Err.**	**t**	**P>|t|**
Household Dietary Diversity Score (HDDS)	0.0409333	.0138685	2.95	0.003
Education (females)	0.0242746	.0072344	3.36	0.001
Household Size	-0.0349165	.0077458	-4.51	0.000
Area of residence (0=rural, 1=urban)	0.1984621	.0613116	3.24	0.001
Age of child (months)	-0.0122577	.0014025	-8.74	0.000
Diarrhoea (0=yes, 1=no)	0.2638138	.0678492	3.89	0.000
Gender (0= female, 1=male)	-0.1706738	.0410087	-4.16	0.000
Household income (5 deciles)	0.1108188	.0189776	5.84	0.000
Number of observations= 7281 F (8, 6865)= 34.38 Prob>F=0.0000 R squared=0.0747				

4.7.2 Logistic Regression Models

4.7.2.1 Stunting

The table below shows results from a logistic regression of stunting, HDDS and other control variables. The Wald chi-square is 155.5 and the p value is 0.0000, showing that the model as a whole is statistically significant at 5 percent significance level. A likelihood ratio test gives a p value of less than 0.05, showing that the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model. Except for HDDS and the age of the child, all other results are statistically significant at the 95 percent confidence interval. Household dietary diversity score has an odds ratio of close to 1.00, showing that it has no effect on the odds ratio; hence this also explains why it is not significant. Were it significant, then the odds of a child being stunted compared to one who is not would decrease by a factor of 0.99. In the case of education, the odds of a child being stunted decreases by a factor of 0.97 for each increase in school years, showing that higher education years are associated with a reduction in the probability of a child being stunted. In contrast, the odds of a child being stunted increase by a factor of 1.03 for every increase in household size, an indication that large households are associated with increase in the probability of children in that house being stunted.

In the case of area of residence, living in rural areas is associated with stunting. The table shows that the odds of a child being stunted decreases by a factor of 0.66 for a child living in urban areas as compared to one living in a rural area. Similarly, the odds of a child being stunted decreases by a factor of 0.67 for a child who did not have diarrhoea compared to one who did, an indication that a child having diarrhoea increases the risk of that child being stunted.

Male children are more at risk of being stunted. Results displayed in the table below show that the odds of being stunted increase by a factor of 1.38 for a male child as compared to a female one. In the case of income, a higher income group is associated with a decreased risk of a child being stunted. Regression results show that the odds of a child being stunted decreases by 0.82 units with every movement of a household from a lower income group to a higher one.

Table 23: Logistic regression results (Stunting)

Variable	Coefficient	Std. Err.	Z	P>|z|
Household Dietary Diversity Score (HDDS)	.9933253	.0211337	-0.31	0.753
Education (females)	.973856	.0112014	-2.30	0.021
Household Size	1.031087	.0137153	2.30	0.021
Area of residence (0=rural, 1=urban)	.6630456	.0713907	-3.82	0.000
Age of child (months)	1.001045	.0022091	0.47	0.636
Diarrhoea (0=yes, 1=no)	.6715193	.0707325	-3.78	0.000
Gender (0= female, 1=male)	1.375827	.0928275	4.73	0.000
Household income (5 deciles)	.8202801	.0261399	-6.22	0.000
Number of observations=6,860 Wald chi2 (8)= 155.50 Prob>chi2=0.0000 Pseudo R2=0.0316 **Likelihood ratio test:** chi2(2)= 627.23279 Prob > chi2=6.28e-137				

4.7.2.2 Wasting

Wasting or low height-for-weight is caused by food insecurity, and disease. The table below shows the results from the logistic regression run on wasting as the dependent variable and HDDS as the independent one, together with other control variables. The model as a whole is statistically significant and has a likelihood ratio chi-square of 29.7. Just as in the case of stunting, a likelihood ratio test done to show the impact of including HDDS in the model gives a p value of less than 0.05. Hence the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model. Apart from the HDDS, all other results are not statistically significant.

The results show that an increases of HDDS by a factor of 0.89 reduces the odds of a child being stunted indicating that a more diverse diet is adequate for better nutritional status of a child.

Table 24: Logistic regression results (Wasting)

Variable	Coefficient	Std. Err.	Z	P>|z|
Household Dietary Diversity Score (HDDS)	.8922556	.0320078	-3.18	0.001
Education (females)	.9982532	.0225757	-0.08	0.938
Household Size	.9977081	.0271756	-0.08	0.933
Area of residence (0=rural, 1=urban)	1.228152	.2528879	1.00	0.318
Age of child (months)	.9922686	.0044394	-1.73	0.083
Diarrhoea (0=yes, 1=no)	1.082083	.1946185	0.44	0.661
Gender (0= female, 1=male)	1.206777	.1588178	1.43	0.153
Household income (5 deciles)	.9190096	.0575504	-1.35	0.177
Number of observations= 6,829 Wald chi2 (8)= 29.72 Prob>chi2=0.0002 Pseudo R2=0.0133 **Likelihood ratio test:** chi2(2)= 16.623282 Prob >chi2= 0.00024564				

4.7.2.3 Underweight

Table 25 displays results from a logistic regression. The model is statistically significant with a likelihood ration chi-square of 119.7. Except for education and area of residence, all other results are statistically significant at the 95 percent confidence interval. To determine the effect of including the HDDS in the model, a likelihood ratio test is performed and gives a p value of less than 0.05, showing that the inclusion of HDDS as a predictor model results in a statistically significant improvement in the model.

Higher dietary diversity scores are associated with better nutritional statuses. This is illustrated in the table below which shows that the odds of a child being underweight compared to one who is not reduce by a factor of 0.93 for every increase in HDDS.

Empirical results illustrated in the table below shows that the odds of a child being underweight increase by 1.05 with an increase in household size by one, implying that children living in larger households are more at risk of being underweight compared to their counterparts. Similarly, older children appear to be more at risk of malnutrition compared to younger ones. Results illustrated below show an increase in age by one month results is associated with an increase in the odds of a child being underweight by a factor of 1.01. Diarrhoea appears to be one of the strong indicators of malnutrition in the model; the odds of a child being underweight reduce by a factor of 0.62 for children who did not suffer from diarrhoea two weeks before the survey. On the contrary, the odds of a child being underweight increase by a factor of 1.29 for male children compared to female ones, signifying that male children are more at risk of being underweight. Just as in the case of stunting, higher income levels are associated with the reduced probability of a child being underweight. As illustrated below, the odds of being underweight reduce by a factor of 0.84 for every movement of a household from a lower income group to a higher one.

Table 25: Logistic regression (Underweight)

Variable	**Coefficient**	**Std. Err.**	**Z**	**P>|z|**
Household Dietary Diversity Score (HDDS)	.932325	.0237901	-2.75	0.006
Education (females)	.9800243	.0150237	-1.32	0.188
Household Size	1.047235	.0172065	2.81	0.005
Area of residence (0=rural, 1=urban)	.7685374	.1037338	-1.95	0.051
Age of child (months)	1.009134	.0028106	3.26	0.001
Diarrhoea (0=yes, 1=no)	.6218881	.077028	-3.83	0.000
Gender (0= female, 1=male)	1.287331	.1075493	3.02	0.003
Household income (5 deciles)	.8370367	.0339156	-4.39	0.000
Number of observations=7,281 LR chi2 (8)= 119.67 Prob>chi2=0.0000 Pseudo R2=0.0325 **Likelihood ratio test:** chi2(2) = 24.558067 Prob > chi2 = 4.648e-06				

4.8 Discussion of Regression Results

4.8.1 Malnutrition and Dietary Diversity

Dietary Diversity is dependent on the socio-economic status of a household. Households with low income levels often display low dietary diversity scores since their food expenditure is low. Results from bivariate analysis have shown that the HDDS is highly correlated with food expenditure; low food expenditure results in low dietary diversity scores (see 4.6.1). Low food expenditure and household income show patterns of poverty. Descriptive figures also show that poor households have higher rates of stunting; wasting and underweight (see 4.5.7). Poor households are often characterised by low incomes which in turn normally result in low food expenditure. In addition, poor households are also characterised by monotonous diets and consume from fewer food groups. Monotonous diets lack dietary diversity and lack adequate nutrition, and hence this increases the risk of children being malnourished. A diverse diet is thus necessary for the proper growth of a child. Descriptive statistics also show that a high percentage of poor households do not consume animal source foods, which are considered to be rich in nutrient content required for proper growth. Past research has shown that consumption of animal source foods result in better nutritional status of children (Bwibo & Neumann, 2003).

Controlling for the influence of income reveals significant association between some aspects of malnutrition and Household Dietary Diversity Score (HDDS). WAZ scores increase by a factor of 4.1 percent for every increase in HDDS by 1 percent. Interestingly, while a positive relationship was observed between WHZ and HDDS, it was not found to be significant. However, logistic results showed a significant association between HDDS and wasting, with the odds of a child being wasted decreasing with increase in the dietary diversity score. The same was observed in the case of underweight. However, HAZ and stunting were not found to be significantly associated with HDDS. This is probably because low HAZ and stunting that is represents, result from past shocks which take longer to manifest. Hence an analysis based on a one week dietary diversity may not adequately reflect the effects of HDDS on HAZ and stunting. Results from the bivariate analysis found significant associations between HDDS and HAZ, WHZ, and WAZ scores when correlation analysis was carried out (see 4.6.2). This is also clear from the descriptive analysis which showed that malnutrition rates are lower amongst households that have high dietary diversity scores as compared to those who have low dietary diversity scores (see 4.5.8). These results support the hypothesis that a household's dietary diversity level has an effect on the nutritional status of a child, holding other predictors of child nutritional status constant, including household income. Dietary diversity thus appears to exert an influence on some aspects of child malnutrition than is independent of current household economic status.

Previous studies have found similar results. A study of dietary diversity and child nutritional status in eleven countries in Africa, Asia and Latin America by Arimond & Ruel (2006) found significant associations between HAZ and dietary diversity in seven out of the eleven countries studied. Onyango & Koski (1998) also found positive significant associations between dietary diversity and HAZ, WAZ, and WHZ scores in Western Kenya, with dietary diversity found to be the strongest and most consistent predictor of the anthropometric status of children. Hatloy et.al (1999) found associations between dietary diversity scores, stunting and underweight in Mali, with those children living in households with low dietary diversity being at more than double the risk of being malnourished. Rah et.al (2001) established that lack of dietary diversity was a strong predictor of stunting in rural Bangladesh. However, empirical results from this study did not find such strong associations, perhaps due to the controlling of household income, which as previously discussed is correlated to dietary diversity scores.

4.8.2 Malnutrition and Other Risk Factors

4.8.2.1 Education

Empirical results from the linear and logistic regressions show that malnutrition increase with a reduction in the number of schooling years. Results show that education is positively and significantly associated with WAZ. In the case of logistic regression, a significant relationship was observed between stunting and education, but no significant associations were observed in the case of wasting and underweight. The association observed between stunting, and education shows that lack of or poor education can have a negative effect on the long term nutrition of a child. These results reiterate the role of maternal education in the nutritional status of children. In Kenya, the caretakers of children are mostly females, and range from a child's mother to other female siblings and members of the household. Well-educated caretakers are better equipped to deal with illnesses when they occur, and are also more informed on the dietary needs of a child. Therefore, it is of paramount importance for caregivers to have adequate knowledge needed to make informed decisions on child growth, nutritional statuses, and more diverse diets.

This result accord with past studies that have shown that maternal education is associated with better nutritional status. A study in the KwaZulu-Natal and Eastern Cape provinces of South Africa found that low maternal education was a determinant of underweight (Lesiapeto et.al, 2010), with children whose mothers had low education being more at risk of being underweight. Ajao et.al (2010) also found a substantial association between maternal education and stunting in Nigeria, with results showing that educated women were more likely to be knowledgeable about nutrition and child health.

4.8.2.2 Age of the child

The likelihood of a child being malnourished appears to rise with an increase in the child's age. Linear regression results show that there is negative and significant relationship between HAZ, WHZ, and WAZ and the age of the child, with the Z scores decreasing with an increase in the age of the child. Logistic regression results also show that the risk of a child being underweight increases with age. A previous analysis shows that malnutrition rates were higher amongst older children (see 4.5.5). Stunting is highest for children aged 12-23 months, while the age groups recording the highest rates of wasting and underweight are 6-11 and 48-60 respectively. Once again, past studies show similar results. Lesiapeto et.al (2010) found, in KwaZulu-Natal and Eastern Cape provinces in South Africa, that a child is more at risk of being stunted or wasted as they grew older. In Ethiopia, Teshome et.al (2009) found that the highest percentage of children who are stunted were in the second year of life. Similarly, older ages were also found to be associated with stunting and underweight in Zambia (Nzala et.al, 2011).

The high rates of malnutrition amongst older children can be attributed to the introduction of household diets once children attain the six month age bracket and begin to be weaned. At this stage the children are vulnerable to diarrhoea and inappropriate feeding practices (Abalo, 2009), hence increasing the risk of them being malnourished. In addition, households' diet may not be adequate in energy and protein, which are important for a child's growth and development (Olack et.al, 2011). The rise in malnutrition could also be as a result of the continued accumulation of deprivation over time, and which ultimately leads to long-lasting malnutrition.

4.8.2.3 Household size

Linear regression results show a significant association between household size and HAZ, WHZ and WAZ, with an increase in household size resulting in lower Z scores. This shows that children living in large households are more likely to record poor Z scores compared to those who live in smaller households. Logistical regression results found significant associations between household size, stunting and underweight, showing that the risk of a child being either stunted or underweight increased if the child belonged to a large household. However, no significant associations were found between wasting and household size. This is similar to past research in Nigeria which found no significant association between family size and poor nutritional status of children (Ajao et.al, 2010).

4.8.2.4 Residence area

Children living in rural areas are more prone to malnutrition. Linear regression results indicate that children who live in the urban areas have higher HAZ and WAZ compared to their counterparts in the rural areas. Logistical regression results also show a significant relationship between the area of residence, stunting and underweight, with the risk of malnutrition increasing for children who live in rural areas. Research in other countries has found similar results. A study of child malnutrition in urban and rural areas using demographic and health survey data from 36 developing countries (in Asia, sub-Saharan Africa, Latin America, and Caribbean) by Smith, Ruel & Ndiaye (2005) found that child nutritional status was better in urban areas than in the rural ones, with urban areas recording significantly higher HAZ means.

Differentials in child's nutritional status in the urban and rural areas could be as a result of the inequalities that exist between these two areas. Descriptive results show that the prevalence of poverty is higher in rural areas (see 4.2.2). Rural households are also deprived in many ways, and lack important infrastructure like health and education. Access to safe water is limited (see 4.2.5). In addition, many households in rural Kenya rely on agriculture solely for their livelihoods, growing only a few crops that may not adequately cater for their nutritional requirements. This is illustrated in the descriptive statistics which shows that diets in rural areas are less diverse compared to the ones in the urban areas (see 4.3.2), perhaps because households in urban areas have access to developed food markets through which they can purchase food rich in variety. Earlier analysis also shows that education mean is higher in urban areas (see 4.2.1). According to Smith, Ruel & Ndiaye (2005), women in urban areas are far more likely to be educated as compared to those in the rural areas. Lack of proper education means that mothers and caregivers are not equipped with information that is important for the growth of a child.

4.8.2.5 Child health (diarrhoea)

The relationship between diarrhoea and malnutrition is bidirectional. Diarrhoea and other infections affect the nutritional status of children reducing their dietary intake and depriving them of nutrients essential for growth (Brown, 2003). On the other hand, malnutrition also increases the risk of a child contacting diarrhoea, since the poor nutritional status has a negative impact and weakens the child's body mechanism, in effect making the child prone to more infections (Brown, 2003). Undernourished children are at a higher risk of severe and frequent bouts of diarrhoea, which worsen nutritional statuses due to decreased food intake, reduced nutrient absorption and increased child's nutritional requirements during repeated diarrhoeal episodes. The presence of diarrhoea has also been found to reduce a child's caloric intake (Martorell et.al, 1980).

Empirical results from the linear regression indicate a positive and significant relationship between diarrhoeal incidence, and HAZ and WAZ. Children who did not have diarrhoea two weeks prior to the survey record higher HAZ and WAZ scores. Logistic regression results also indicate that the risk of stunting and underweight reduce for those children who did not have diarrhoea two weeks prior to the interview, probably due to the fact that malnourished children are less able to fight off infections. Similar results were observed by Lesiapeto et.al (2010) who found that that a child was more likely to be undernourished if they had experienced gastrointestinal symptoms like diarrhoea, partly due to under-nutrition being more prone to gastrointestinal issues due to its sensitivity to existing infections.

4.8.2.6 Gender

Male children are more at risk of malnourishment, and this is evident from linear regression results which show a decrease in Z scores if a child is male. A similar observation was made in logistic regressions which showed an increase in the risk of stunting and underweight if a child is male. These results support the hypothesis that male children are more prone to malnutrition. Descriptive results confirm the regression findings and show that malnutrition rates are more prominent among males compared to their female counterparts. They also show that the mean HAZ, WAZ and WHZ for females are higher than those of males (see 4.5 & 4.5.3).

Similar results have been obtained in other countries. Lesiapeto et.al (2010) found that male children were more likely to be stunted and underweight in KwaZulu Natal and Eastern Cape provinces of South Africa. Teshome et.al (2009) also made similar observations in Ethiopia, where male children recorded the highest rates of stunting. A study in Zambia by Nzala et.al (2011) attributed the high rates of malnutrition amongst male children to cultural practices that required male toddlers eat with their fathers, which then resulted in fewer meals per day for the children. The same practice is widespread in Kenya and could offer a partial explanation to the high rates of malnutrition among male children.

4.8.2.7 Household income

Children who belong to households with low incomes are more at risk of malnutrition. This is shown in the regression results where lower income groups are found to be associated with lower HAZ, WHZ and WAZ. Similarly, stunting and underweight are seen to decrease with every movement of a household from a low income group to a higher one. However, income does not appear to have any significant effect on wasting, possibly due to the fact that wasting is a short term condition and is normally associated with existing child and household conditions.

An increase in income is normally associated with increased food expenditure as households with higher incomes are likely to spend more on food quantity and quality, resulting in consumption of foods rich in dietary diversity. Earlier correlation analysis confirms this and shows that income is positively associated with HDDS (see 4.6.1). By controlling for HDDS, the regression also shows that income has an impact on child malnourishment that is independent of dietary diversity, and by implication, food insecurity. This would be both through the quantity of food consumed, as well as the effect of poor living conditions.

4.9 Conclusion

This section presented the results of descriptive statistics, bivariate and multivariate analysis. Evidence points to a high prevalence of malnutrition in the country, and low consumption of highly diversified diets. Only a small fraction of households consume diets that are highly diversified. Results also show that Household Dietary Diversity Score is a significant predictor of child malnutrition, with children living in households with lower HDDS recording lower HAZ, WAZ and WHZ, subsequently increasing the probability of them being stunted, wasted or underweight. Other risk factors associated with poor nutritional statuses were found to be the age of the child, gender, the area of residence, education, diarrhoea, and household size.

CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH

5.1 Introduction

This chapter presents the general conclusions based on the findings in chapter four and will also give recommendations. Finally, the section will discuss possible areas for future research.

5.2 Conclusion

The main objective of this study was to analyse the relationship between household food security and the anthropometric status of children aged five years and below. Specific objectives were: to identify the prevalence and predictors of poor anthropometric status of children in Kenya, to analyse the extent of food insecurity in Kenya and to investigate the link between food security and the anthropometric status of children in Kenya.

It is against these research objectives that the research was carried, using data from the Kenya Integrated Household Budget Survey (2005/2006). The research shows that the highest form of malnutrition is stunting, with underweight coming in at second place. Wasting is the least common form of malnutrition. The prevalence of stunting (44 percent) is more than double that of underweight (19 percent) and more than six times higher than the occurrence of wasting (7 percent). The prevalence of malnutrition is higher in rural areas than in urban ones. Eastern province, a largely rural province, has the highest prevalence of stunting and underweight while North Eastern the highest incidence of wasting and underweight. Only 29 percent of households consume diets with high dietary diversity. Urban areas were found to have higher dietary diversity when compared to rural areas, with results showing that a high percentage of those who consumed foods with low dietary diversity were from rural areas.

- Household dietary diversity has been found to be positively associated with height-for-age (HAZ), weight-for-age (WAZ) and weight-for-height (WHZ), with an increase in household dietary diversity score causing an increase in the Z scores, a sign that children belonging to households who consume more diverse diets have better anthropometry. Results also showed that the prevalence of stunting, wasting and underweight are lower in households that have high HDDS, as compared to those who don't. This effect of HDDS on child malnourishment is independent of the effect of income.

- Empirical results show that older children are more at risk of being malnourished, compared to younger ones. Children aged 6 to 11 months record the lowest forms of malnutrition. However, the prevalence of malnutrition more or less doubled in their second year of life.
- Male children are more prone to malnutrition. This is evident from the research which has shown that male children record the highest rates of malnutrition for stunting, wasting and underweight. Regression results also show that a male child has lower HAZ, WAZ and WHZ, and that the risk of being stunted, wasted or underweight is higher for males.
- Children living in urban households are less likely to be malnourished. Empirical results have shown that children in households that reside in rural areas have low HAZ, WAZ and WHZ as compared to those living in urban households. Stunting, wasting and underweight were also found to be lower in urban areas as compared to rural ones.
- The effects of diarrhoea were evident from the study. Children who had diarrhoea were found to be more at risk of malnutrition. The relationship between diarrhoea and the nutritional status of children is bidirectional, in that diarrhoea is not only a cause of poor anthropometry but is itself also caused by poor anthropometry.
- The study found that education and nutritional status have a positive relationship; higher education results in better nutritional statuses. HAZ and WAZ increased for children living in households that had higher number of years of education for all females. Stunting, wasting and underweight were also found to reduce with increase in the average number of education years for all females in a household.

5.3 Recommendations

5.3.1 Food Security and Dietary Diversity

It is evident that poor dietary diversity is associated with poor nutritional status amongst children, and as this measure is used as an indicator of food insecurity, that food insecurity results in poor child outcomes. Therefore, the introduction of more diverse diets into a household is of paramount importance. Kenyan diets are monotonous, cereal based and unequally distributed within households (Bwibo & Neumann, 2003). Animal source foods have been found to be the least consumed among households, despite past research showing that children in households consuming animal source foods had better nutritional status, performed better in cognitive tests, and achieved better results in school (Bwibo & Neumann, 2003). There is therefore an urgent need to ensure that households have access to a wide variety of foods. Dietary diversity can be enhanced through even the simplest means which include strengthening of home garden practices. While home gardening has been in the past been practised in some parts of the country, the effect on food security has been minimal partly due to the low yields reported and partly due to neglect of these farms (Musotsi, Sigot & Onyango; 2008). Home gardening can be enhanced through selective crop production that focuses on foods that contribute to the nutritional needs of a household (Smuts et.al, 2008).

Dietary diversity is affected by the access to food. Food policies such as subsidies can have a huge impact on a household's access to food. It increases the income share of a household, which then allows them to purchase more diversified foods, or allocate the additional income to other important amenities and services such as health services, nutrition, training and education which lead to increased and improved human capital that positively impacts labour productivity, higher incomes and expanded entrepreneurships (Pinstrup-Andersen, 1988).

The nutritional statuses of children appear to worsen as they grow older, possibly due to the increase in the probability of negative things happening to them as they grow older. This occurrence could also be due to the household diets that children are introduced to after weaning, which may not be diverse enough and may lack the essential nutrients needed by a child. The World Health Organisation (WHO) guidelines recommend that children be exclusively breastfed for six months, because the mother's milk contains all the nutritionally suitable nutrients. Other research also shows that children who are exclusively breastfed for 6 months, are less likely to be malnourished compared to those who are not.

5.3.2 Child Health

Quality health care is important and necessary for the proper growth of a child. The effects of infections such as diarrhoea do not just result in poor anthropometry but can also lead to mortality. Surprisingly, diarrhoea can be cured by simple home-made solutions. Despite this, caregivers seem not to be aware of such remedies, and the number of deaths attributed to diarrhoea in developing countries is high. The prevention of such infections can also be done through better sanitation and provision of clean and safe drinking water.

Immunization is central to a child health and can go a long way in preventing malnutrition. Vaccinations are more accessible today than they were ten years ago and it is up to the mothers or caregivers, nurses and doctors to ensure that early vaccinations are carried out.

5.3.3 Inequalities in Nutritional Statuses of Children (Rural and Urban Differentials)

Rural areas in developing countries are often characterised by poor economic and social infrastructure. Health and Education facilities are in deplorable conditions, while transport infrastructure is poorly maintained and often left in deteriorating states. Results from the study show that the average number of years of education is higher in urban areas than in rural ones. These severe shortcomings always put the communities living in this area at a more disadvantaged position and often contribute to poor health and nutritional status of children (Schoeman et.al, 2010). There is, therefore, an urgent need to ensure that communities living in these areas have access to education and healthcare. Through schooling and basic education, women and caregivers can attain basic knowledge on nutritional requirements of their children. Road networks need to be upgraded, rehabilitated and properly maintained so as to ensure that communities not only have access to education and health facilities, but that they are also able to access food markets where they can acquire wider food varieties. One way through which food security and infrastructural development can be attained is through labour-intensive public works which are instrumental in addressing numerous problems that face developing countries; poverty, food insecurity, unemployment and poor infrastructure[11]. At the household level, labour-intensive works can provide employment, positively affect income levels and increase the distributional effects of assets (von Braun, Teklu & Webb; 1992). The increased real income can be used to enhance the food security status of a household and also improve the nutritional status of household members (von Braun, Teklu & Webb; 1992). In addition, the construction of infrastructure such as health facilities, water and sanitation systems can contribute to disease alleviation and improve nutritional security.

5.3.4 Education

The access to education infrastructure has been shown to increase the socio-economic status of people. It has also been found to result in better nutritional status amongst children. Subsequently, the skills of care-givers should be developed with higher level education so as

[11] Public programmes that do not only provide employment but also generate physical infrastructure through labour-intensive means (von Braun, Teklu, Webb, 1992).

to equip them with knowledge that is needed to ensure better nutritional statuses of their children (Schoeman et.al, 2010). Hospitals, clinics and health centres should be equipped with qualified personnel who educate the mothers and caregivers on the most important diets for a child once they attain the 6 months age bracket. Schoeman, et.al (2010) reiterate the importance of breastfeeding and recommends that nursing capacities should be strengthened and human resource constraints be addressed so as to ensure long term continuity in the provision of essential health and nutritional information to mothers who need to be continuously advised on safe infant feeding practices.

5.3.5 Growth Monitoring

Growth monitoring has a positive effect on a child's health, since children who attend such centres receive food supplements, and the mothers offered information on proper child feeding practices (Adeladza, 2009). The Kenyan government should ensure the improvement of service delivery of Growth Monitoring Clinics (GMCs) which are supposed to monitor the progress of children. A survey carried out found that only 17.3 percent of clinics in Kenya conduct proper growth monitoring (Wamae et.al, 2009). Clinics should have a qualified nurse and other personnel who educate caregivers and assist in monitoring the situation of children. The growth monitoring clinics do not just monitor the progress of children through assessment of their anthropometric status, but can also serve as a platform for educating mothers on infant feeding practices and on proper caregiving. The clinics can also serve as a form of human capital development potential, with the involvement in nurses creating jobs and resulting in human development. However, it is important that parents be made aware of such initiatives and encouraged to take their children for monitoring. Lack of parental support for growth monitoring clinics can make it difficult to report on a child's progress (Faber et.al, 2009).

5.3.6 Health Sector Reforms

The need for proper health care means that qualified personnel and better health infrastructure should be made available. Unfortunately, in Kenya, health care facilities are often left in poor conditions, and personnel are often unable to cope with the large number of sick children. The number of health facilities in the country has increased over the years and stood at 8,006 in 2011 (KNBS, 2012). However, these facilities are often not well equipped and lack enough personnel. There is need for the Kenyan government to provide better health facilities, equipped with the proper equipment and required medication needed to cope with infections and diseases that affect children.

Through the Abuja Declaration in 2001, Heads of African States and Governments (including Kenya) committed themselves to ensuring that necessary resources are not only made available, but are utilized effectively and efficiently. The leaders also pledged to allocate at least 15 percent of their annual budgets to the improvement of the health sector. Unfortunately, the percentage of annual budget that has been allocated by the Kenyan Government is yet to meet this target.

5.3.7 Child Rights Framework

There is need for the formulation and implementation of a National policy that ensures that the interests of a child such as better nutrition are properly recognised. On a global level, Kenya is a signatory to the Convention on the Rights of the Chid (CRC) and African Charter on the Rights and Welfare of the Child (ACRWC) which require countries to reduce child mortality, and combat disease and malnutrition through the provision of sufficient nutritious foods. The Convention also requires that parents and all segments of society have access to education and are equipped with basic knowledge on child health and nutrition. On a national level, the Kenyan constitution recognises the rights of a child to basic nutrition and health care (GOK, 2010).

A rights framework is important for monitoring the progress of children and measuring outcomes. However, the existence of a child rights framework has not made much of a difference in the Kenya. Based on the National Food and Nutrition Policy, the Kenyan government set up the Nutrition and Food Security Framework to ensure the provision of nutritionally adequate foods (ROK, 2008). Despite this, the implementation of the framework is slow and lacks political backing. A UNICEF report (2009) points out that nutrition is not a major issue in the political agenda of the country, and adequate recognition has not been duly paid to the importance of nutrition on the country's development. There exists an urgent need for the government to pay more attention to nutritional matters. The government should also operate within the existing child rights framework and safeguard the provision of basic nutritional requirements for children. In addition, the government should also explore the possibility of publishing an annual report on the status of children in the country, something that is necessary for policy formulation, monitoring and evaluation of child nutritional interventions. This has been done in other countries like South Africa, where the *Children's Institute* at the *University of Cape Town*, publishes the Child Gauge; a report that monitors the well-being of children.

5.4 Areas for Further Research

Based on research findings, there is need to explore the causes of disparities in nutritional statuses of children living in rural and urban areas. There is also need to explore the causes of differentials and unequal access to basic needs, amongst rural and urban households. In addition, future research should concentrate on examining the huge gaps observed in nutritional status and food security in the provinces of Kenya.

A future possible research area is the creation of a universal Household dietary Diversity Score (HDDS) target which to date is non-existent. For the purposes of comparisons across groups and countries, a universal HDDS target needs to be developed. Lastly, a prospective research area is the comparison of HDDS and other measures of household food security in Kenya, and how they relate to the nutritional status of children.

However, it has to be recognised that dietary diversity in only one of many factors that influence the nutritional outcomes of children. There is no doubt that poverty, in all its multiple dimensions, has to be reduced if Kenya is to improve the position of its children.

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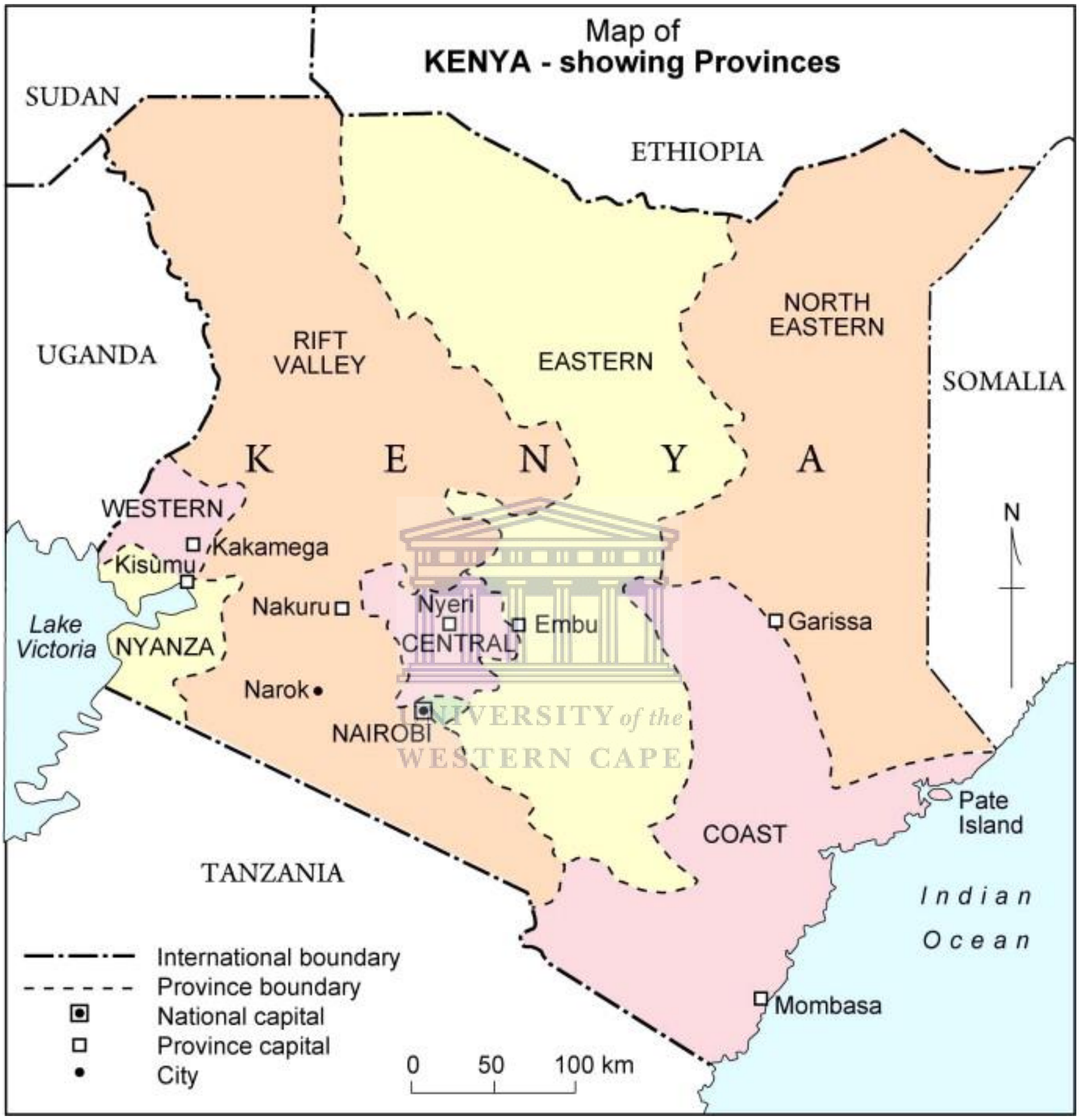
APPENDIXES

Appendix I: Provincial map of Kenya



(Source: Kithiia & Dowling, 2010).

Appendix II: Malnutrition rates: A comparison of different studies undertaken in different parts of Kenya

Author	Year of study	Location	Sample size	Age bracket of children studied	Malnutrition rates		
					Stunting	Wasting	Underweight
Kariuki et.al	2002	Kibera, Nairobi Province	353	6 to 23 months	34.6%	6.2%	26.5%
Kwena et.al	2003	Bondo, Western Kenya	2,103	<60 months	29.5%	4.2%	20.2%
Bloss et.al	2004	Ugunja, Nyanza Province	175	<60 months	47%	7%	30%
Abubakar et.al	2008	Kilifi, Coast Province	204	6 to 35 months	40%	**-**	19.6%
Adeladza	2009	Kwale, Coast Province	300	12 to 23 months	51%	7%	34%
Olack et.al	2011	Kibera, Nairobi Province	1,310	6 to 59 months	47%	2.6%	11.8%