

ANALYSIS OF THE RELATIONSHIP BETWEEN HOUSEHOLD
LIVESTOCK KEEPING AND MALNUTRITION OF UNDER-FIVE
YEARS CHILDREN IN RURAL PARTS OF EASTERN PROVINCE OF
ZAMBIA.

BY

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Epidemiology

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DECLARATION

I, Yolani Banda do hereby declare that the contents of the dissertation being submitted herein are my original work and they have not been previously submitted to any university for the award of a degree or any other qualification.

Signature.....Date.....

CERTIFICATE OF APPROVAL

This dissertation submitted by Yolani Banda has been approved as fulfilling the requirements for the award of the Master of Science in One Health Analytical Epidemiology by the University of Zambia.

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ABSTRACT

The levels of malnutrition in Zambia are some of the highest in Africa with 51.9% of children less than 5 years of age undernourished. The prevalence of the wasting form of malnutrition is 6%, with Eastern province having the third highest prevalence of stunting in the country, only better than Luapula and Central provinces. At the same time, Eastern province is among the provinces with the highest number of livestock in the country.

A case-control study was conducted in Chipata, Chadiza and Lundazi districts of the Eastern Province of Zambia to determine whether there was a relationship between livestock keeping at household level and presence of malnutrition in under-five years aged children. Two sampling frames one for cases (malnourished children) and the other for controls were generated from the health centre under-five years of age children's registers. The sampled malnourished children were confirmed by use of the Mid Upper Arm Circumference tape and presence of odema. A household was considered as keeping livestock if it had one or a combination of the following: two or more cattle, six or more goats and sheep, fifteen or more full grown birds such chickens. A questionnaire was used to capture all the data on hypothesised risk factors. Fisher's exact test was used to determine associations between categorical variables and binary logistic regression analysis was used to determine predictors of malnutrition among under-five years aged children. All statistics were considered significant at $p \leq 0.05$.

One hundred and forty-five households were sampled using systematic sampling method, of these ninety seven were controls and forty eight were cases. About 72.4% (95% C.I = 63.9 – 81.0%) of households in the study area kept livestock. Although the percentage of households that kept livestock among the cases was slightly lower (31.4%, 95% CI = 22.5 – 40.3%) than among the control (68.6%, 95% CI = 57.9 - 59.3%), livestock keeping alone was not significantly associated with the reduction of malnutrition in under-five years children ($p=0.243$). Crop farming alone was also found not to be significantly associated with the reduction malnutrition of under-five children at household level ($p = 0.447$). However, mixed farming (growing crops and keeping livestock) at households level was found to be significantly associated with the low malnutrition levels in the under-five years children ($p = 0.008$). The percentage of household who practiced mixed farming among the case was lower (31.6%, 95% CI = 17.7 – 45.5%) than those among the controls 68.3% (95% CI = 59.1 - 77.5%).

Other variables that were found to be significantly associated with low malnutrition level in under-five years aged children in the study area were birth interval of the siblings and the number of children in the household. It is, therefore, recommended that households in Eastern province should be encouraged to do mixed farming, reduce the number of children they bear and also increased child spacing.

DEDICATION

I dedicate this work to my dear wife Sawopa Banda, sons Chimango and Nathan, daughter Yolanda Taonga Banda, niece Nchimunya and mother Martha A Banda for their inspiration. They sacrificed their time staying without a husband and father and never stopped encouraging me to go on with the pursuit of my studies.

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LIST OF ABBREVIATIONS

CSO:	Central Statistical Office
FSRP:	Food Support and Relief Programme
NCHS:	National Centre for Health Statistics
NFNC:	National Food and Nutrition Commission of Zambia
MDG:	Millennium Development Goals
MUAC:	Mid Upper Arm Circumference
UNICEF:	United Nation International Children's Fund
UN:	United Nations
WHO:	World Health Organization

CHAPTER ONE

1.0 Introduction

Malnutrition is insufficient, excessive or imbalanced consumption of dietary energy and nutrients. It manifests in different forms, such as under nutrition, over nutrition and micronutrients malnutrition (Smith and Haddad, 1999). Malnutrition in early childhood is associated with functional impairment in adult life as malnourished children are physically and intellectually less productive when they become adults (Smith and Haddad, 1999). Children that are malnourished tend to have increased risk of morbidity and mortality and often suffer delayed mental development and reduced intellectual achievement (Babatunde, 2007). Among all the countries in the southern part of Africa, Zambia is reported to have very high rates of malnutrition, with a prevalence of stunted growth among children being 51.9%, while 19.7% of them are underweight and 6% wasted (UNICEF, 2013). Previous studies done in Zambia indicate that malnutrition is greater in rural areas than in urban areas (Lisa *et al.*, 2005). However, the prevalence of wasting, indicates that current poor nutritional status, is significantly higher in the urban population (NFNC, 1993)

Livestock production can provide income, quality food, fuel, draught power, building materials and fertilizer, thus contributing to livelihood of household, food security and nutrition, (Delgado, Narrod and Tiongco, 2009). Furthermore, it had been found that livestock keeping contributed about 42.6% of the mean annual income in household in the Southern province of Zambia. It had also been found that income from small-holder livestock operation had a positive and statistically significant effect on improving nutrition, household food security, and consequently, rural poverty reduction in Zambia (Lubungu *et al.*, 2012). However, the actual impact that livestock keeping has on the nutritional levels of under-five children in resource poor rural households has not been assessed. This is despite having a number of studies that have looked into factors that cause malnutrition (Lubungu *et al.*, 2012). Therefore, this study was conducted to assess the relationship between household livestock keeping and malnutrition levels of under-five years children in the rural parts of the Eastern Province of Zambia.

1.1 Statement of the Problem and Justification of Study

Eastern province has the third highest prevalence of stunting at 11% in Zambia, only better than Luapula and Central provinces (Lubungu *et al.*, 2012). This is despite the province having one of the largest cattle populations in the country. This makes one hypothesize that livestock keeping has no impact on the malnutrition level of under-five years children in this province.

This may be contrary to a number of studies that have shown that ownership of livestock directly and indirectly reduces the malnutrition levels of children and the general welfare of a given household (Thornton, 2007). Livestock keeping also makes a family be more resilient and easily to cope when faced with adverse events such as draught or flooding (Thornton, 2007).

Therefore, there is a need to analyse and quantify the impact of livestock keeping at household level on the presence malnutrition in under-five years aged children at in the Eastern province of Zambia. Quantifying such benefits of livestock keeping will also be beneficial to resource poor people as it will encourage governments and other donors to invest more in livestock production as this will not only improve household wellbeing, but also have a direct effect on the nutritional status of growing children.

1.2 Objectives

The aim of this study was to determine whether there was a relationship between livestock keeping t household level and the presence of malnutrition in the under-five years children in rural household of Eastern Province. The specific objectives of this study were:

- i. To determine whether households that keep livestock had more malnourished children than those who did not keep livestock.
- ii. To establish the relationship between rural household livestock keeping and the malnutrition level of the under-five years children.
- iii. To investigate other factors apart from livestock keeping that might be determinants of malnutrition in under-five years children in the study area.

1.3 Operational definitions

In this study a number of terms have been used and for the purpose of this study the following terms will be operationalized as;

- i. **Under - five years child** – was a child aged 6-59 months
- ii. **Household** - as any collective living where all individuals at that place recognize one person as a final decision maker and feed from one kitchen.
- iii. **Livestock keeping** - a household was considered as keeping livestock if they had one or a combination of the following , two or more cattle, six or more goats, six or more sheep, 15 or more full grown birds such chickens.
- iv. **Crop farming** – a household was considered to be growing crops if it was able to harvest crops which will last more than six months
- v. **Underweight child** –.the under-five years aged child with weight below the lower dotted line on the Zambian under five years card.
- vi. **Malnourished child** - for this study was any child whose name was included in the under five years aged children's register as malnourished and confirmed by the MUAC tape and/or had odema at the time of sampling.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Malnutrition is a condition which occurs when there is a deficiency of certain vital nutrients in a person's diet. This deficiency results in failure to meet the demands of the body thereby negatively effecting growth, physical health, mood, behaviour and other functions of the body. Malnutrition commonly affects children and the elderly (Mei, 2002). It may also result from situations where diet does not contain the right balance of nutrients. This might mean a diet high on calories but deficient in vitamins and minerals. Those in the second group are individuals that may be overweight or obese but are still considered malnourished. Thus being malnourished does not always mean that the person is underweight or thin (Mei, 2002). In short Malnutrition is insufficient, excessive or imbalanced consumption of dietary energy and nutrients. It manifests in different forms, such as under nutrition, over nutrition and micronutrients malnutrition (Smith and Haddad, 1999).

Some of the major symptoms of malnutrition include pale skin that is thick, dry, and bruises easily. Rashes and changes in pigmentation are common. Hair may be thin, tightly curled, and pulls out easily. There may be joint pain and the bones may be soft and tender. The gums may bleed easily, and the tongue may be swollen or shriveled and cracked. Visual disturbances, including night blindness and increased sensitivity to light and glare maybe experienced (Beers et al, 2004). Other symptoms of malnutrition include anemia, diarrhea, disorientation, night blindness, irritability, anxiety, and attention deficits. Goiter (enlarged thyroid gland), loss of reflexes and lack of muscular coordination, muscle twitches and scaling and cracking of the lips and mouth may also be seen. Malnourished children may be short for their age, thin, listless, and have weakened immune systems (Beers *et al*, 2004).

2.2 Causes of Malnutrition

Malnutrition may result from inadequate or unbalanced diet, problems with digestion or absorption of nutrients and certain medical conditions. Malnutrition in children can occur if they do not eat balanced diet. Starvation is a form of malnutrition. A lack of a single vitamin in the diet may result in malnutrition (UNICEF, 2013). In some cases, malnutrition may be very mild and no symptoms may be evident. However, it may sometimes be so severe that the damage done to the body may become permanent, if the patient survives the disease. Malnutrition continues to be a significant problem all over the world, especially among children. Poverty, natural disasters, political problems, and war, all contribute to occurrence of this problem. Thus, it is not just a problem of developing countries (UNICEF, 2013).

2.2.1 Forms of Malnutrition

Malnutrition manifests in a number of forms namely; Marasmus, Kwashiorkor, iron deficiency and Vitamin A deficiency (Oldewage and Kruger, 2008). Kwashiorkor is a severe form of malnutrition that is due to a deficiency in dietary protein. The extreme lack of protein causes an osmotic imbalance in the gastro-intestinal system causing swelling of the gut diagnosed as an edema or retention of water (Oldewage and Kruger, 2008). Other signs of kwashiorkor are edema of the hands and feet, irritability, anorexia, a desquamative rash, hair discolouration, and a large fatty liver. The typical swollen abdomen observed in such patients is due to two causes: ascites, because of hypoalbuminemia (low oncotic pressure), and an enlarged fatty liver (Oldewage and Kruger, 2008).

The second form of malnutrition is Marasmus. This is also a severe form of malnutrition that is caused by energy deficiency. A child with Marasmus looks emaciated. Body weight is reduced to less than 60% of the normal (expected) for the age (Appleton, 2013). Marasmus occurrence increases prior to the age of one year, whereas kwashiorkor occurrence increases after 18 months of age. Marasmus can be distinguished from kwashiorkor in that kwashiorkor results from protein deficiency with

adequate energy intake whereas Marasmus is inadequate energy intake in all forms, including protein. Protein wasting in kwashiorkor may lead to oedema (Appleton, 2013).

The other common form of malnutrition associated with micronutrients is iron deficiency (Appleton, 2013). This is the most prevalent form of malnutrition worldwide, affecting millions of people. Iron forms the molecules that carry oxygen in the blood, as a result, symptoms of iron deficiency include tiredness and lethargy. Lack of iron in large segments of the population severely damages a country's productivity. It also impedes cognitive development, affecting forty to sixty percent of children aged between six to twenty four months in developing countries (UNICEF, 2013).

Vitamin A deficiency weakens the immune systems of a large proportion of under-fives in poor developing countries, increasing their vulnerability to diseases. A deficiency in vitamin A, for example, increases the risk of dying from diarrhoea, measles and malaria by twenty to forty percent (UNICEF, 2013). In 2005, it affected one hundred and forty millions of pre-school children in one hundred and eighteen countries and more than seven million pregnant women. It is also a leading cause of child blindness across developing countries (UNICEF, 2013).

Iodine deficiency affects 780 million people worldwide (Appleton, 2013). The clearest symptom is a swelling of the thyroid gland, called goitre. But the most serious impact is on the brain, which cannot develop properly without iodine. According to a UN (UNICEF, 2013) research, some 20 million children are born mentally impaired because their mothers did not consume enough iodine. The worst-hit suffer cretinism, associated with severe mental retardation and physical stunting (Appleton, 2013).

Zinc deficiency contributes to growth failure and weakened immunity in young children. It is linked to a higher risk of diarrhoea and pneumonia, resulting in nearly 800,000 deaths per year (UNICEF, 2013).

2.3 Assessment of growth status in under-five years children

In children, the four most commonly used anthropometric indices to assess growth status are Mid Upper Arm Circumference (MUAC), weight-for-height, height-for-age and weight-for-age and assessment for odema (Myatt *et al*, 2006).

2.3.1 The Mid-Upper Arm Circumference

The Mid Upper Arm Circumference (MUAC) is used to determine whether a child is malnourished or not (Myatt *et al*, 2006). The measurements on the tape are interpreted as follows

RED: measurement of one hundred and fifteen mm or less indicates that the child is severely malnourished and an extremely high mortality risk. ORANGE: measurement of one hundred and sixteen to one hundred and twenty four mm indicates that the child is moderately malnourished. YELLOW: measurement of one hundred and twenty five to one hundred and thirty five mm indicates that the child is at risk, but not malnourished. GREEN: measurement of one hundred and thirty five mm or above indicates that child is not malnourished (Myatt *et al*, 2006).

2.3.2 Assessment for Odema

Oedema is the retention of water in the tissues of the body. Bilateral oedema is usually a sign of kwashiorkor, a form of severe acute malnutrition. Children presenting oedema must be referred to the closest health centre. To diagnose oedema, normal thumb pressure is applied to the top of the feet for about three seconds. If there was oedema, an impression remains for some time (at least a few seconds) where pressure had been applied. The child is only to be recorded as oedematous if both feet presented pitting oedema. Such children are at high risk of mortality and needed to be treated in a therapeutic feeding program urgently. Nutritional oedema always starts from the feet and extends upwards to other parts of the body (Encu, 2008).

2.3.3 Low weight-for-height

Wasting or thinness indicates in most cases, a recent and severe process of weight loss, which is often associated with acute starvation and/or severe disease (Myatt, *et al*, 2006). However, wasting may also be the result of a chronic unfavourable condition. Provided there is no severe food shortage, the prevalence of wasting is usually below 5%, even in poor countries. A prevalence exceeding 5% is alarming given a parallel increase in mortality that soon becomes apparent (Myatt, *et al.*, 2006). Lack of evidence of wasting in a population does not imply the absence of current nutritional problems: stunting and other deficits may be present (Myatt, *et al*, 2006).

2.3.4 High weight-for-height

"Overweight" is the preferred term for describing high weight-for-height. Even though there is a strong correlation between high weight-for-height and obesity as measured by adiposity, greater lean body mass can also contribute to high weight-for-height. On an individual basis, therefore, "fatness" or "obesity" should not be used to describe high weight-for-height. However, on a population-wide basis, high weight-for-height can be considered as an adequate indicator of obesity, because the majority of individuals with high weight-for-height are obese, (Myatt, *et al*, 2006).

2.3.5 Low height-for-age

Stunted growth reflects a process of failure to reach linear growth potential as a result of suboptimal health and/or nutritional conditions. On a population basis, high levels of stunting are associated with poor socioeconomic conditions and increased risk of frequent and early exposure to adverse conditions such as illness and/or inappropriate feeding practices (Myatt, *et al.*, 2006). Similarly, a decrease in the national stunting rate is usually indicative of improvements in overall socioeconomic conditions of a country. The worldwide variation of the prevalence of low height-for-age is considerable, ranging from 5% to 65% among the less developed countries. In many such settings, prevalence starts to rise at the age of about three months; the process of stunting slows

down at around three years of age, after which mean heights run parallel to the reference (Myatt, *et al*, 2006).

For children in the age group below 2-3 years, low height-for-age probably reflects a continuing process of "failing to grow" or "stunting"; for older children, it reflects a state of "having failed to grow" or "being stunted". It is important to distinguish between the two related terms, length and stature: length refers to the measurement in recumbent position, the recommended way to measure children below 2 years of age or less than 85 cm tall; whereas stature refers to standing height measurement. For simplification, the term height is used throughout this document to cover both measurements (Myatt, *et al*, 2006).

2.4 The Global Context of Malnutrition

The United Nations has included two nutrition-based indicators, defined as the prevalence of underweight children (under-five years of age) and the proportion of population below minimum level of dietary energy consumption, to monitor progress towards its Millennium Development Goal (MDG) number one (eradication of extreme poverty and hunger) (Black *et al*, 2008). Thus, nutritional status is often used as a measure of social development. Furthermore, nutritional status is strongly connected to health outcomes (Black *et al*, 2008). The most recent estimates on deaths attributable to malnutrition indicate that about 20% of all deaths and 20% of health loss (measured in Disability- Adjusted Life Years (DALYs)) among children aged below five years living in low-income countries can be attributed to nutritional deficiency (Black *et al*, 2008). DALYs are used by the World Bank and the World Health Organization (WHO) to represent a composite measure of mortality and non-fatal consequences of disease or ill-health. Furthermore, children afflicted by severe or chronic malnutrition also go on to suffer diminished functional and intellectual capacity as adults (Black *et al*, 2008).

2.4.1 Determinants of Malnutrition at Global level

As a step towards reducing the prevalence, there is need to identify the important determinants of malnutrition in the specific context. A study to determine prevalence and determinants of malnutrition among under-five children of farming households in

Kwara State, Nigeria, indicated that 23.6%, 22.0% and 14.2% of the sampled children were stunted, underweight and wasted, respectively (Park, 2002). The results from this study further showed that the significant determinants of malnutrition were gender and age of the child, education and body mass index of mother, calorie intake of the households, access to clean water and presence of a toilet in the households. To reduce the reported high rate of malnutrition in the area, the study suggested targeting of women with education programmes and provision of clean water, including the enforcement of healthy environment in the rural areas (Park, 2002).

The malnutrition level of the under five years children at household level are also determined by the number of under five years children the family has as the food in terms of quantity will be compromised. The family size is an important determinant of child health and a study conducted by Park (2002) in New Delhi India, indicated that about thirty nine percent of the respondent had five to six children. Seventy four percent of the respondent had one to two children in the family less than five years, which meant that the higher the families size the lower care given to the children. About thirty three percent of children lived in a rented house and twenty percent lived in scattered house (Park, 2002).

Another study by Mengistu *et al*, (2013) in Ethiopia, revealed that, 47.6%, 30.9% and 16.7% of children were stunted, underweight and wasted, respectively. The main factors that were associated with stunting were found to be child age, family monthly income, and children who received butter as pre-lacteal feeding and family planning.

2.4.2 Prevalence of Malnutrition at Global level

Globally, one quarter of under-five children are stunted or an estimated 162 million children in 2012 (WHO, 2013). Sub-Saharan Africa and South Asia have particularly high prevalence, at about 38 percent in both. This indicates an urgent need to accelerate integrated programmes addressing nutrition during the mother's pregnancy and before the child reaches two years of age, the period of children's most rapid physical and mental growth and development (WHO, 2013).

Children who suffer from wasting face a markedly increased risk of death (World Bank, 2013). In 2012, nearly seventy percent of the world's wasted children lived in Asia. These children were at substantial increased risk of severe acute malnutrition and death (UNICEF, 2013). In nineteen out of eighty countries with recent estimates, wasting prevalence was at ten percent or higher, requiring immediate intervention, such as emergency feeding programmes. In South Asia, prevalence of wasting was at an alarmingly high level of sixteen percent while in West and Central Africa it was estimated at eleven percent, East and Southern Africa it was at seven percent and East Asia and Pacific at four percent (UNICEF, 2013).

South Asia has staggeringly high levels of underweight children which is at 46 per cent of its children and India, Bangladesh and Pakistan together account for half the world's underweight children, despite being home to just 29 per cent of the developing world's under-five population (Aguayo *et al*, 2005). In South Asia, there has been some progress in the levels of under-five years' malnutrition, in that the prevalence of underweight children has been declining from 53 per cent in 1990 at an average annual rate of 1.7 per cent. Improvement at this modest level would be insufficient to meet the MDG target by 2015, although there is a wide divergence between the performances of individual countries in the region. Afghanistan, Bangladesh, Bhutan, Maldives and Sri Lanka were all on track to halve the proportion of under-fives who were underweight by 2015 (Aguayo *et al*, 2005).

In Bangladesh, prevalence of underweight children declined from 66 per cent to 48 per cent between 1990 and 2004, though this still leaves the proportion of underweight children higher than that of any other country in the region apart from Nepal. Bhutan managed to reduce its prevalence of underweight children by half in about 10 years, from 38 per cent in 1988 to 19 per cent in 1999. Afghanistan and Maldives have also made significant progress with Afghanistan reducing the prevalence from 49 per cent in 1997 to 39 per cent in 2003–2004 and Maldives reducing it from 39 per cent in 1994 to 30 per cent in 2001 (Aguayo *et al*, 2005).

Both India and Pakistan were making modest improvements in the reduction of under five years malnutrition, but this progress may be insufficient to reach the target. Nepal, however, did not make much progress in reducing prevalence of underweight children during the 1990s. Other forms of under nutrition in South Asia have persisted at high levels and have proved stubbornly resistant to improvement, with about 44 per cent of under-five children in the region being stunted and 15 per cent wasted (WHO, 2004).

The Eastern/Southern Africa region as a whole is far from making progress towards the MDG target of reducing hunger by half by 2015. This region has shown no improvement at all since 1990 in the proportion of prevalence of children who are underweight. The absolute number of underweight children has actually increased in the region over the past 15 years. This is due mainly to declines in agricultural productivity, recurring food crises associated with drought and conflict, and increasing levels of poverty (WHO, 2004). At the same time, HIV/AIDS, especially when coupled with drought-related food crises, has posed serious challenges to nutrition development, particularly in the southern African countries of Lesotho, Malawi, Mozambique, Swaziland, Zambia and Zimbabwe (WHO, 2004). Positive trends seen in the early 1990s have been slowed or reversed, with, for example, Lesotho and Zimbabwe showing increased levels of underweight children and Zambia experiencing no change over the 1990–2004 period (Aguayo *et al*, 2005).

In Eritrea, Kenya, Malawi, Mozambique, Namibia, Rwanda and the United Republic of Tanzania, steady progress is being made, but not sufficient to meet the MDG target (WHO, 2004). Of these countries, Eritrea has the highest proportion of underweight children at about 40 per cent of the under-five years children population. South Africa, the wealthiest country in the region, has a lower proportion of underweight children (12 %) than any other nation except Swaziland. Far from there being any room for complacency, however, South Africa has been going backwards, with its proportion of underweight children rising by an average of 5.6 % a year since 1994–1995 (WHO, 2004).

In Ethiopia, almost half of children are underweight, and along with Nigeria (from the West/Central Africa region) it accounts for more than a third of all underweight children in sub-Saharan Africa. Like the region as a whole, Ethiopia is standing still – its

proportion of underweight children has remained more or less static since 1990 (WHO, 2004). The proportion of underweight children in Burundi and Madagascar exceeded 40 % of under-fives, with no sign of improvement. Burundi had, (at 57 %), a much higher rate of stunting than any other country in the region. Somalia, meanwhile, had the highest rate of wasting in Eastern/Southern Africa of 17 %. The profound impact of HIV/AIDS in the region inevitably affects its nutritional position, although the pandemic's relationship to under nutrition is complex (Aguayo *et al*, 2005).

A 2003 study in six southern African countries affected by drought, for example, found that prevalence of underweight children increased more rapidly in relatively prosperous communities close to urban centres than in other areas due to the high prevalence of HIV/AIDS (WHO, 2004). This suggests a new vulnerability in areas once thought to be better off. Of the 17 countries in Southern Africa with sufficient trend data to assess progress towards the MDG target, only Botswana is on track to reach the target, and nine countries are either showing no change or getting worse. Botswana's achievement is remarkable given the dire effects of the AIDS pandemic on the country (WHO, 2004). After Swaziland, it has the highest adult HIV prevalence rate in the world, at 37 % (39 % in Swaziland). In these circumstances, Botswana's progress in reducing prevalence of underweight children's significant, considering that it dropped from 17 % in 1996 to 13 % in 2000 (WHO, 2004).

There were insufficient data to estimate whether Swaziland would achieve the MDG target, but it was worthy to note that it not only had a lower proportion of underweight children (10 %) than any other country in the region but has also reduced the proportion of under-fives who suffer from wasting to just one per cent (WHO, 2004).

There is little difference in underweight prevalence between girls and boys in Africa (UNICEF, 2013). Yet, in all regions of the world, children living in rural areas were more likely to be underweight than those in urban areas (UNICEF, 2013). In developing countries, children were twice as likely to be underweight in rural areas as in urban areas. Data disaggregated according to wealth showed that children from the poorest twenty percent of households in the world were more likely to be underweight than those from the richest twenty percent (UNICEF, 2013).

In Africa, malnutrition prevalence in under-five years children is estimated at twenty five percent (Smith, 1999). Furthermore, the 2003 Nigeria Demographic and Health Survey revealed that thirty eight percent of under-five children in Nigeria were stunted, twenty nine percent underweight and nine percent wasted (Ajieroh, 2010). In a Food Consumption and Nutrition Survey in Nigeria, Ajieroh (2010), reported similar trends with forty two percent stunted, twenty five percent underweight and nine percent wasted. This survey also revealed significant variations between the rural and urban areas, with children from rural areas most affected by malnutrition (Ajieroh, 2010).

The study by Mahgoub (2006), in Botswana found that the level of wasting, stunting, and underweight in children under three years of age was six percent, thirty nine percent and sixteen percent respectively. Malnutrition was significantly ($p < 0.01$) higher among boys than among girls. Underweight children were less prevalent among those whose parents worked in the agricultural sector than among children whose parents were involved in informal business. Children brought up by single parents were underweight to a significantly higher level than children living with both parents ($p < 0.01$). The prevalence of underweight decreased significantly ($p < 0.01$) as family income increased. The levels of underweight children decreased as the level of education of the mother increased. Breastfeeding was found to reduce the prevalence of underweight children (Mahgoub, 2006).

2.4.3 Livestock keeping

Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fibre and labour. Farming practices vary dramatically worldwide and between types of animals. Livestock are generally kept in an enclosure, are fed by human-provided food and are intentionally bred, but some livestock are not enclosed, or are fed by access to natural foods, or are allowed to breed freely, or any combination thereof. Livestock raising historically was part of a nomadic or pastoral form of material culture (Muir, 2004).

The herding of camels and reindeer in some parts of the world remains unassociated with sedentary agriculture. The transhumance form of herding in the Sierra Nevada of California still continues, as cattle, sheep or goats are moved from winter pasture in lower elevation valleys to spring and summer pasture in the foothills and alpine regions, as the seasons progress. Cattle were raised on the open range in the Western United States and Canada, on the Pampas of Argentina, and other prairie and steppe regions of the world (Muir, 2004).

The enclosure of livestock in pastures and barns is a relatively new development in the history of agriculture. When cattle are enclosed, the type of 'enclosure' may vary from a small crate, a large fenced pasture or a paddock. The type of feed may vary from natural growing grass, to animal feed. Animals are usually intentionally bred through artificial insemination or through supervised mating. Indoor production systems are typically used for pigs, dairy cattle and poultry, as well as for veal cattle, dairy goats and other animals, depending on the region and season (Muir, 2004).

Table 2.1 below presents the density of livestock keepers defined as defined in the section 1.3. This updates the maps in Thornton *et al.* (2010) rural poverty rates a slightly different method that excludes the urban areas from the calculations. There are particularly high densities of rural poor livestock keepers throughout South Asia (India, Pakistan and Bangladesh), and in parts of sub-Saharan Africa (particularly Nigeria, Ethiopia, Uganda, Burundi, Rwanda, Malawi, and in some systems in Kenya, South Africa and Niger). The highest densities occur mostly in the mixed crop–livestock systems: irrigated mixed systems in parts of South Asia, and the rain-fed mixed systems in parts of India and in most of sub-Saharan Africa. Regional estimates of the numbers of rural people and of poor livestock keepers in 2010 are presented in table 2.1 and are compared with estimates for 2000, (Thornton *et al.* 2010).

Globally, the number of poor livestock keepers has increased by 56 million (15 percent) in eight years, bearing in mind that the 2000 estimates here have been corrected to include only the rural populations, with respect to those presented in Thornton *et al.* (2010). While the numbers have declined in Latin America and the Caribbean and in

East Asia and the Pacific, all other regions have seen an increase; in sub-Saharan Africa, the number has risen by 38 percent to more than 170 million.

Table 2.1 Estimates of rural populations and of rural poor livestock keepers (PLKs) in 2000 and 2010

Region	Rural Population		Rural PLKs		Annual change in PLKs,
	2000	2010	2000	2010	2010 to 2010
East Asia and Pacific	1, 148	1, 020	64	52	-2.05%
China	808	714	15	13	3.75%
Eastern Europe and Central Asia	60	64	9	13	3.75%
Latin America and Caribbean	155	115	36	31	-1.48%
Middle East and North Africa	96	130	14	22	4.62%
South Asia	916	1100	130	142	0.89%
India	672	820	95	99	0.41%
Sub-Saharan Africa	442	532	123	171	3.35%
All regions	2817	2961	376	431	1.40%

Developing regions are based on 2010 World Bank country classification (World Bank, 2010), Data for China and India also included separately and all the figures are in millions, using rural, national poverty lines, and the compounded, annualized rate of change in poor livestock keepers from 2000 to 2010.

A review of livestock keeping carried out by the WHO (2013) found out that it was generally successful in reducing poverty and encouraged parents to invest in the health and education of their children

2.5 Malnutrition Situation in Zambia

2.5.1 Prevalence of Malnutrition in the Eastern province of Zambia

Zambia is located in the Sub-Saharan region, where the prevalence of malnutrition is among the highest in the world (Black, 2008). It is estimated that just over half (i.e. 52%) of all children aged below five years are stunted, while one in five are underweight. The prevalence of the wasting form of malnutrition was six percent (Black, 2008).

In the Eastern province of Zambia, under- five years children malnutrition levels were below eleven percent between 2009 and 2011. Figure 2.1 below shows the under-five years aged children prevalence rate of malnutrition per district in the last three years in the province. In 2009, Chadiza district had the highest prevalence at ten percent, with Chipata having the lowest at two percent. Chipata continued to have the lowest

prevalence at one point three percent while Chadiza still continued to have the highest prevalence at six percent (National Statistical Bulletin, 2012).

Prevalence of underweight children is the percentage of children aged 0-59 months whose weight for age is less than minus three standard deviations (below the dotted line on the Zambian under five years clinic card) below the median weight for age of the international reference population (UNICEF, 2013). The international reference population, often referred to as the World Health Organization (WHO) reference population, was formulated by the National Centre for Health Statistics (NCHS) as a reference for the United States and later adopted by WHO. The WHO reference standard represents the distribution of height and weight by age and sex in a well-nourished population. In a well-nourished population, 0.1 percent of children fall below minus three standard deviations (UNICEF, 2013).

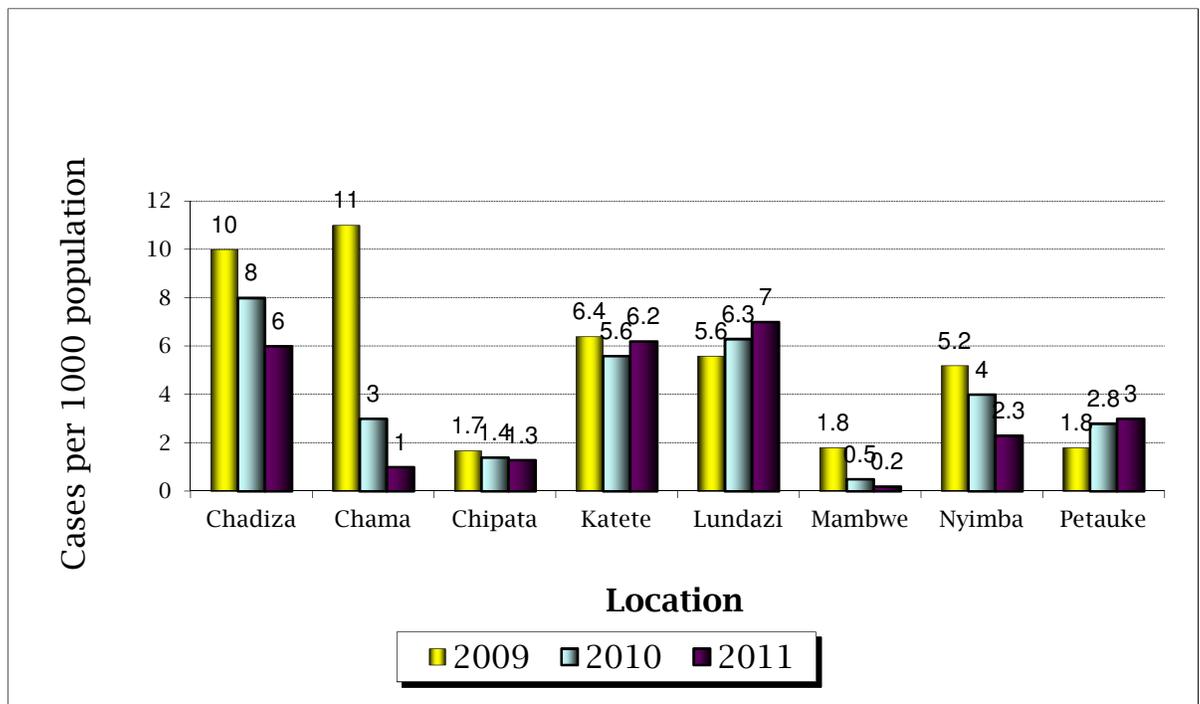


Fig 2.1 Malnutrition Levels in the Eastern Province. (Source Eastern Province Statistical Bulletin 2012).

2.5.2 Determinants of Malnutrition in Zambia

A representative national survey to measure the effect of a range of factors that influence the malnutrition among Zambian children was conducted (Masiye *et al*, 2009). This survey revealed a strong wealth gradient, with children from poorer households having poor nutritional status. The result from this survey further revealed that children from poor households with less income to spend, did exhibit a greater proneness to malnutrition, particularly stunting and underweight. However, just as had been reported elsewhere (Paxson and Abledinger, 2003), household income was not a significant predictor of a child's weight-for-height nutritional status. Sex and age were shown to be strong predictors of child nutritional status (Masiye *et al*, 2009). The education level of the head of the household was found to be an important positive predictor of better nutritional status, although its effect was tempered by the inclusion of the education of the biological mother of the child. When included alone, the mother's education was a significant predictor. Apart from giving better knowledge about nutrition, education also usually implies empowerment of women. In this way, education can give a woman more informed choices in allocating household resources towards adequate diet for children (Masiye *et al*, 2009). Masiye's findings were in agreement with Yousef (2000) and Ahmed (2003), who observed that the higher educational level of the mothers, the lower the malnutrition levels in their children.

In the same study Masiye *et al* (2009), examination of geographical effects revealed useful findings. First, the study showed that being in a rural area produce an adverse effect on nutritional attainment of children. Secondly, significant unmeasured effects that operate at the geographic (for example, community) level also affected children's nutritional status. These results also pointed to the significance of environmental context in influencing the nutritional status of children, after all individual and household factors were adjusted for (Masiye *et al*, 2009).

People have different understanding of the cause of malnutrition in the under-five years aged children. For example, a study by the United Nation Department of Economic and Social Affairs in sub-Sahara Africa (UNICEF, 2013), found that there was a link between a breadwinner in a family dying and/or suffering from HIV/AIDS and the low nutritional status of children. The link was that the death or suffering would mean loss of income which would have helped to purchase food for the family. It was argued that “The change in food intake leads to malnutrition, especially among children. For example, households affected by HIV/AIDS tend to decrease food intake consumption and switch to cheaper goods which later result in malnutrition.” (UNICEF, 2013). However, such impacts would not have been experienced if, a particular household had other sources of income such as livestock.

A study by Tembo and Nicholas (2013) found that the cause of under-five year malnutrition was due to a high household population which leads to overcrowding, resulting in reduced amount of food available for each member of the family. This overcrowding made it impossible for the household to be food secure. The end product of this food insecurity was insufficient household nutrition resulting in malnutrition among the under- five years aged children. The study further found out that, this coupled with other factors, contributed to increased pressure on household’s food security, health care, sanitation, and education, increasing levels of poverty, particularly for the poorest and most vulnerable segments of the population. Poor sanitation and poor health care would contribute to children suffering from diarrhoeal diseases which later if not properly handled could lead to poor feeding habits of the children, aggravating the malnutrition status (Tembo and Nicholas, 2013).

2.6 Status of the Livestock Industry in Eastern Province

“Livestock population among the smallholder sector in Zambia has increased over time. In 2001, the livestock population was estimated at one point five million cattle, one point two million goats, five hundred thousand pigs, and fifty one thousand sheep (Lubungu, et al, 2012). By 2008, the population of livestock had grown to about two

point eight million cattle, two point two million goats, one million pigs, and one hundred and fifty seven thousand sheep (Lubungu, *et al*, 2012). However, these increases have been spatially uneven with livestock populations even decreasing or remaining stagnant in some provinces (Lubungu, *et al*, 2012). It was evident that about fifty percent of cattle, over a third of goats and close to 40% of sheep are found in Southern Province, while Eastern Province accounts for more than 60% of all pigs kept in the country. For all the livestock species, Luapula, Lusaka, North-western, and Copperbelt Provinces have relatively low populations (Lubungu, *et al*, 2012).

Table 2.2 below shows the statistics of the cattle population in Eastern province. Chipata district has the highest cattle population with 25.3%, of the provincial total. The district with the lowest number of cattle 1.2% was Mambwe district (Anon, 2013).

Further table 2.3 shows the livestock species. The highest number of species kept in the province are chickens at 57.4% followed by the pigs at 17.4 % and the least are sheep at zero point eight percent.

Table 2.2: Cattle Status in the Eastern Province

	CHIPATA	%	CHADIZ A	%	KATETE	%	LUNDAZ I	%	NYIMBA	%	MAMBWE	%	PETUAK E	%	TOTAL
Bulls	2,957	23	1,042	8	2,175	17	2,009	16	1,730	13	337	3	2,617	20	12,867
Cows	26,211	27	8,190	8	18,236	18	16,228	16	10,288	10	982	1	18,578	19	98,713
Oxen	16,459	22	6,011	8	16,931	22	11,298	15	7,377	10	1,227	2	16,242	21	75,545
Steers	6,953	25	2,029	7	6,982	25	3,511	12	2,488	9	437	2	5,867	21	28,267
Heifers	9,825	25	2,459	6	7,553	19	8,865	23	3,398	9	437	1	6,711	17	39,248
Bulls Calves	7,352	29	1,752	7	5,310	21	2,893	11	3,005	12	245	1	5,127	20	25,684
Heifers Calves	7,504	30	1,589	6	4,859	19	3,634	14	3,288	13	39	0	4,480	18	25,393
Total	77,261	25	23,072	8	62,046	20	48,438	16	31,574	10	3,704	1	59,622	20	305,717
Estimated sales	77261		23072		2048		969		2542		67		2385		
Percentages	25		8		20		16		10		1		20		100

Source Anon, 2013

Table 2.3: Population Livestock Species in the Eastern Province

	CHIPATA		CHADIZ		KATETE		LUNDAZ		NYIMBA		MAMBWE		PETUAK		TOTAL
		%	A	%		%	I	%		%		%	E	%	
Goats	3,955	3	7,439	5	49,012	33	9,546	7	14,981	10	25,742	18	35,947	25	146,622
Sheep	920	9	291	3	1,888	19	285	3	5,534	56	809	8	211	2	9,938
Pigs	8,845	4	1,781	1	43,836	20	14,106	6	22,184	10	70,534	32	58,413	27	219,699
Chickens	119,031	16	46,843	6	137,757	19	38,961	5	121,395	17	115,851	16	142,885	20	722,723
Ducks	4,462	18	1,597	7	2,689	11	1,550	6	4,062	17	4,502	19	5,302	22	24,164
Fowls	1,850	8	569	3	4,624	21	2,013	9	4,931	23	3,736	17	4,176	19	21,899
Rabbits	383	15	54	2	155	6	106	4	843	33	546	21	460	18	2,547
Dogs	4,382	9	2,817	6	4,748	9	5,009	10	9,542	19	9,762	19	14,881	29	51,141
Pigeons	10,340	17	2,558	4	2,331	4	2,289	4	28,521	47	6,597	11	7,942	13	60,578
Donkeys	4	1	12	2	60	12	166	34	59	12	46	9	140	29	487
Total	154,172	13	63,961	6	247,100	22	74,031	6	212,052	18	238,125	21	270,357	24	1,147,592
Percentages	13		6		22		6		18		21		24		100

Source Anon: 2013

However, livestock keeping is negatively affected by a number of factors including diseases. For example, between the 1980's and early 1990's, a tick-borne disease (corridor disease) reduced the cattle population in the Kafue Flats (Lubungu *et al*, 2012). This meant that families that depended solely on livestock in sustaining their livelihoods had difficulties in providing for their families. In addition to livestock disease, livestock keeping is also negatively affected by lack or inadequate grazing land for the animals. Households usually would spare a bigger portion of the land for crop farming as opposed to livestock keeping. Further, increasing inequalities in land ownership were observed and identified as an impediment to livestock keeping (Lubungu *et al.*, 2012). What this means is that land for animals to graze on may not be enough, as a result affecting livestock production at household level (Lubungu *et al*, 2012).

2.7 Livestock's contribution to the livelihoods of communities

Increasing livestock's contribution to the livelihoods of developing communities requires an understanding of the multiple and complex roles that livestock plays. The contribution of food of animal origin to the nutritional status of the children is well documented (Ndlovu, 2010). Livestock products account for almost thirty percent of human protein consumption. Livestock production can provide income, quality food, fuel, and draught power, building materials and fertilizer, thus contributing to livelihood of household, food security and nutrition (Delgado, 2009). Furthermore, it has been found that livestock keeping contributed about 42.6% of the mean annual income in household in the Southern province of Zambia. It has also been found that income from small-holder livestock operations have a positive and statistically significant effect on improving nutrition, household food security, and consequently, rural poverty reduction in Zambia (Lubungu *et al*, 2012).

In marginal areas with harsh environments, livestock provide a means of reducing the risks associated with crop failure and a diversification strategy for resource poor small scale farmers and their communities (Freeman *et al*, 2007). The contribution of livestock to crop production through the provision of draught animal power and manure cannot be over-emphasized. Livestock contribute to achieving more efficient and more sustainable resource use through enhanced energy and nutrient cycling (Freeman *et al*, 2007).

Livestock enables saving, provide security, allow resource-poor households to accumulate assets, and help finance planned expenditures as well as those that are unplanned (e.g. illness). Livestock functions as insurance policies and bank accounts in many parts of the developing world (Freeman *et al*, 2007).

As improved incomes and urbanization shift diets towards high value commodities such as meat and milk, the contribution of livestock to economic growth increases through its multiplier effects with agriculture and other sectors outside agriculture. Increased economic activity in livestock fosters forward linkages through growth in livestock processing and marketing, and backward linkages through increased demand for inputs and livestock services (Freeman *et al*, 2007). Livestock has an important function in sustainable land use and, in fact, can have both positive and negative environmental impacts, especially due to the rapidly evolving livestock systems. Thus, it is important to increase the understanding of livestock's effect on the environment and undertake the management needed to achieve sustainable use and development of the livestock industry (Freeman *et al*, 2007).

2.8 The linkage between Livestock keeping and Nutritional status of the under-five years children at a household.

2.8.1 Direct effects of animal origin foods on child nutrition

Foods of animal origin have high energy densities and provide low bulk diets, compared to foods from non-animal origin. This makes it possible for children to obtain more calories in tolerable quantities. These foods also provide high quality protein, micronutrients and better nutrition for pregnant and breastfeeding women (Freeman *et al*, 2007). The importance of milk consumption for child growth has been demonstrated numerous times (Freeman *et al*, 2007). It was found in urban Nicaragua that non-breastfeeding children between the ages of two point five and five years who drank cow's milk were less than half as likely to be stunted as non-breastfeeding children of the same age who did not drink milk (Freeman *et al*, 2007).

In rural Dominican Republic, milk and sausage consumption were shown to have a significant positive association with children's nutritional (Smith and Haddad, 1999).

Similar evidence from rural Embu District in the Eastern Province of Kenya points to milk, fat and potatoes as key dietary elements in influencing the linear growth in toddlers (children aged between eighteen and thirty months) (Babatunde and Qaim, 2011). The dietary intake of stunted and non-stunted children in Kingston, Jamaica, indicated less dairy product consumption in stunted children. The standard for the dietary intake for under five years aged children were calculations based on 2% fat milk. If 2 cups of whole milk were substituted, 48 kilocalories of discretionary calories will be utilized. The American Academy of Pediatrics recommended that low fat or reduced fat milk not be started before 2 years of age (<http://www.heart.org>, 2015). A similar pattern has been reported in Seoul, South Korea. After adjusting for energy intake of children, animal protein intake correlated most significantly with height-for-age (Babatunde and Qaim, 2011).

Weiss (1998) found that controlling for morbidity, maternal education and nutritional knowledge, and socio-economic status, higher consumption of animal-origin foods (as percentage of energy or protein intakes) was associated with Mexican children being heavier and taller at 30 months. In Indonesia, children consuming animal-origin foods were found to be less likely to suffer from malnutrition than those fed on vegetarian diets (Weiss, 1998).

The addition of cow's milk to the diet of children after weaning can increase linear growth and reduce stunting in populations with low milk intake (Weiss, 1998). In the Khartoum Province of Sudan for example, three hundred children aged six to 26 months were fortnightly given dry skimmed milk supplement and another group beans to take home. Each group of children was followed for three to six months. The group receiving skimmed milk showed a significant increase in length, compared to the group receiving beans (Whitaker *et al*, 1997).

In another study in Malaysia, Whitaker *et al*, (1997) found that food insecurity at household level, cause low birth weight, frequent infection, inadequate nutrients intake, and large number of children as significant predictors of childhood malnutrition. Some variables which were found to be significant only at univariate analyses included income

poverty, low maternal education, nonworking mothers, female children, underweight mothers, and lack of maternal ownership of asset. Food insecurity problem was more common among the cases. More than half (62%) of the cases reported that they experienced some kind of food insecurity; with 19% of them reported at household level, 23% at individual level and 20% at child hunger level. These cases had significantly lower intake of energy, protein, vitamin A and iron as compared to the controls ($p < 0.05$) (Whitaker *et al*, 1997). The study recommended that emphasis should be focused on poverty reduction, improved access to health facilities, community-based nutrition and hygiene education programmes. Comprehensive interventions such as improving the nutritional status of pregnant mothers, improving quality of complementary feeding for children together with extensive family planning programmes and de-worming programmes were necessary to combat childhood malnutrition (Whitaker *et al*, 1997).

2.8.2 Indirect effects of animal ownership and technology use on child nutrition

Ownership of livestock and livestock technologies can give households more opportunities to improve the nutritional status of their children. For example, introducing ruminant livestock technologies—such as intensified dairying using crossbred cows—increased household incomes via the sale of surplus milk and dairy products. This allowed households to respond in ways that favour nutritional improvements of children other than direct consumption of milk and dairy products (Must, 2003). Higher incomes from sales of milk and dairy products may enable households to purchase high quality non-dairy foods, hire labour, which may substitute women's daily labour input, and thus reduce their workload and give them more time for food preparation and childcare; spend money on improving their sanitation and environment, thereby reducing exposure to infectious diseases, and improve the household's access to better quality and increased quantities of water (Must, 2003).

In a study conducted in rural coastal Ecuador, access to market foods, as measured by per capita food expenditures and ownership of livestock, mostly cows, showed the

strongest correlation with children's nutritional status (H/A, W/A and mid-arm circumference measures). Children from farm households owning livestock were less likely to be growth retarded than children of farmers without livestock (Manley *et al.*, 2011).

Analysis of data from Zona Da Mata and Minas Gervais in Brazil, showed that only farm households deriving above average percentage of total income from livestock tended to have healthier children according to all three nutrition anthropometrics measures (W/A, H/A and W/H) (Manley *et al.*, 2011). The same study indicated that families who depended more heavily on off-farm employment as a source of income tended to fare worse, both in terms of caloric intake and nutritional status. The study, however, did not observe a direct correlation between higher incomes and better nutritional status of children. Although dairy and coffee farmers registered the highest and second highest income per capita, respectively, only on dairy farms did high incomes accompany healthier children, according to W/A, W/H and H/A anthropometrics measures of nutritional status. The presence of well-nourished children in households with ruminant livestock was probably due to the availability and consumption of high quality protein and calories from dairy products (Kabubo *et al.*, 2006).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

The study was conducted in Chipata, Chadiza and Lundazi districts of the Eastern Province of Zambia. The province was chosen for this study because it remains among the top three in Zambia with high prevalence of malnutrition, (National Statistical Bulletin, 2012). Further, Chadiza district was chosen because in 2009, 2010 and 2011, it had the highest underweight (malnutrition) level among the under-five years children in the province, whilst in Lundazi the level of this problem had been increasing each of these three years. Chipata district had remained with the lowest levels of malnutrition in the years under review, (National Statistical Bulletin, 2012).

Eastern Province has a population of 1,707,731 people, of which 104, 255 (six percent) are from Chadiza, 452,428 27% from Chipata and 314,281 18% from Lundazi. Of this population, 49% are males while 51% are females. The number of children who are under-five years of age for Chadiza, Chipata and Lundazi are 20 851, 90 486 and 62 856 respectively, representing 20% of the population in the districts (CSO, 2010). Livestock kept in the province include; chickens, pigs, goats, sheep and cattle (CSO, 2010).

3.2 Research design

This was a case-control study in design. For the purpose of this study, a case was defined as a household with at least one malnourished child, while a control group was households with no malnourished children, matched for locality and age with the cases. Cases were identified from the communities through the health centre registers and followed up through community based growth promoters. For each case identified, two appropriate controls of the same age, and living within the same community as the case, were identified (matched case-control study). This was done to increase the power of the study and also to control for confounding.

Further, a household was considered as keeping livestock if they had one or a combination of the following: two or more cattle, six or more goats, six or more sheep,

15 or more full grown birds such chickens. Furthermore, a household was considered growing crops if it is able to harvest crops which would last more than six months. The crops which were considered in the study included; maize, sorghum, millet, groundnuts and cash crops.

3.3 Study Population

For this study the reference population were under-five years of age children in the study area, while the study population were those children who met the inclusion criteria set out below. However, from this population, cases were any child who had been reported underweight from the clinical records at the health centre and in community registers and confirmed using the MUAC tape and/or presence of odema at the time of sampling.

3.3.1 Inclusion Criteria

All children who were between the ages of six months and fifty nine months old and were on treatment of malnutrition or found to be malnourished during data collection in the area were included in this study.

3.3.2 Exclusion Criteria

Children who were exclusively breast feeding, previously treated for malnutrition and had recovered were also excluded from the study.

3.4 Sampling Process and Sampling Size

The households in the study districts (Chipata, Chadiza and Lundazi) were sampled using systematic sampling method. Two sampling frames were generated from the health centres' register for under five years children. One list was for households with children who were under weight or reported to be malnourished while the other was that of children who were reported not malnourished. Based on the size of the sampling frame, the sampling interval was determined for each list using the formula (sampling interval = N/n). Where N was the study population and n was the sample size. For each case that was sampled, two households, who had children of the same age with no

malnutrition children, and coming from the same area were identified from the list and included as controls. Where it was not possible to identify the non-malnourished children from the health centre records, such children were identified upon visit to the affected community where the malnourished child came from. If all efforts to identify appropriate controls for a given case failed, another case was chosen from the register and whole process started again.

3.4.1 Sample size

For this study in which two proportions are compared based on the normal approximation to the binomial distribution, the equation for sample size is.

$$N = 2[Z_{crit} \sqrt{\hat{p}(1-\hat{p})} + Z_{pwr} \sqrt{p_1(1-p_1) + p_2(1-p_2)}]^2 / D^2 \text{ (Eng. 2003)}$$

where p_1 and p_2 are pre-study estimates of the two proportions to be compared, $D = p_1 - p_2$ (i.e., the minimum expected difference), $p = (p_1 + p_2)/2$, and N , z_{crit} , and z_{pwr} are obtained from the table. The two groups comprising N are assumed not to be equal in number, and it was assumed that two-tailed statistical analysis was to be used but the two groups comprising N were assumed to be 1/3 cases and 2/3 controls in number, and two tailed statistical analysis was used (Eng. 2003). Therefore, Equation requires the investigator to estimate p_1 and p_2 , as well as their difference, before performing the study. However, Equation does not require an independent estimate of SD because it is calculated from p_1 and p_2 within the equation. A significance criterion of .05 and a power of 0.90 are chosen. Therefore, a significant criterion of 0.05 and a power of 0.95 were chosen, with assumptions, $p_1 = 0.53$, $p_2 = 0.90$, $D = 0.17$, $\hat{p} = 0.85$, $Z_{crit} = 1.960$ and $Z_{pwr} = 0.842$. The equation yielded the sample size of $N = 145$. Of this sample size 48 were cases and 97 controls (Eng. 2003).

Table 3.1 Distribution of the sample size per district.

No	Districts	Cases	Controls	Total
1	Chadiza	10	37	47
2	Chipata	20	22	42
3	Lundazi	18	38	56
4	Total	48	97	145

3.5 Data Collection Methods

The Mid-Upper Arm Circumference (MUAC) tape measurement and oedema assessment methods were used to confirm whether a child was still malnourished or not. Each and every child had to be measured on arm using the MUAC and assessed for oedema. This was done in order to rule out oedema once MUAC measurement indicated green which sometimes may show as if the child is not malnourished when in fact he/she is malnourished. On how to conduct the assessment refer to chapter two, sections 2.3.1 and 2.3.2 above.

3.5.3 Questionnaire Administration

A structured questionnaire was administered to each household in order to collect data that would assist in determining factors that were associated with malnutrition in under five years aged children. The structured questionnaire was prepared in English and translated into local languages (Tumbuka, Chewa and Nyanja) during interviews. The data that was captured included the demographic characteristic of the households, sources of income for sustenance and whether a household keeps livestock or not, types and number of livestock kept, uses of livestock and their management, health seeking behaviours, nutritional aspects of the family especially children, size of land cultivated and the types of crops that the family grows (see Appendix 1).

3.6 Data Analysis

The main response variable was whether an under-five years aged child was malnourished or not. Initially, descriptive statistics were generated for each of the variables under study. Stratified analysis was used to check for confounders. Any differences larger than 10% between the crude and specific estimates (odds ratio) were considered to be due to confounding. Then associations between categorical variables were determined using the Fisher's Exact test.

In order to quantify the effect of livestock keeping and other variables on the nutritional status of under-five children, a stepwise binary logistic regression was used. Independent variables that had a p-value of not more 0.25 in the univariate analysis were included in the model. Criteria used in determining whether each of the constructed

models adequately fitted the data were, a non-significant Hosmer and Lemeshow Test ($p > 0.05$) and a significant Omnibus Test of Model Coefficients ($p < 0.05$). All statistical tests were considered significant at $p \leq 0.05$.

3.7 Ethical Matters

The Informed consent was sought from each participant (under-five years child's parent or guardian) prior to data collection (See the inform consent form in the appendix II). Ethical clearance was obtained from the Excellence in Research Ethics and Science (ERES) Converge reference number “2014-Feb-007” (see appendix III).

CHAPTER FOUR

4.0 RESULTS

A total of 145 households were included in the study of which 48 were cases and 97 were controls. Of the sampled cases 52.4% (95% C.I = 31.5 – 73.3) were from Chipata, 21.3% (95% C.I = -4.1 – 46.7%) from Chadiza and 32.1% (95% C.I = 10.5 – 53.7%) from Lundazi.

Lundazi district had the highest percentage of households that kept livestock (33.9%) followed by Chipata district (29.0.0%), and Chadiza (27.7%) had the lowest among the cases. Then among the controls, Chipata district had the highest percentage of households that kept livestock (81.0%), followed by Chadiza district (72.3%) and Lundazi district had the lowest (66.1%). The livestock that these households kept included cattle, goats, chicken and sheep as defined in section 3.2 of the Materials and Methods section.

The results of the association between presence of malnutrition in under five years children and livestock keeping at household level in the study area are shown in table 4.1. The percentage of households that kept livestock among the cases (31.4%, 95% CI = 22.5 – 40.3%) was slightly lower than that among the controls (68.6%, 95% CI = 57.9 – 59.3%), although the difference was not statistically significant ($p=0.243$).

Table 4.1: The association between livestock keeping at household level and presence of malnutrition among under five years children.

Variable		Keeping livestock at HH		Confidence Interval	p-value
	Category	Number	%		
Malnutrition	Cases	73	31.4	22.5 - 40.3	0.243
	Control	72	68.6	57.9 - 59.3	

The results of the association between presence of malnutrition in under-five years aged children and crop farming only at household level in the study area are shown in table 4.2. Crop farming at households was found not to be significantly associated with the presence of malnutrition in under-five years children ($p = 0.182$).

Table 4.2: The association between presence of malnutrition in under-five years aged children and crop farming only at household.

Variable	Category	Crop Farming only		Confidence Interval	p-value
		Number	%		
Malnutrition	Cases	93	66.9	57.3 – 76.5	0.182
	Controls	46	33.1	19.5 – 46.7	

The results of the association between presence of malnutrition in under-five years children and mixed farming (both livestock and crop farming) at household level in the study area are shown in table 4.3. The percentage of households that practiced mixed farming among the cases (31.6%, 95% CI = 17.7 – 45.5%) was significantly lower than those among the controls (68.3%, 95% CI = 59.1 - 77.5%) ($p = 0.008$).

Table 4.3: The association between mixing farming at household and presence of malnutrition in under five years children.

Variable	Category	Mixed Farming		Confidence Interval	p-value
		Number	%		
Malnutrition	Cases	43	31.6	17.7 – 45.5	0.008
	Controls	93	68.3	59.1 - 77.5	

The percentage of guardians who went to school among the cases (58.8 %, 95% CI = 37.2 – 80.4%) was slightly higher than those among the controls (41.2%, 95% CI = 15.4 – 66.9 %) (Table 4.4), although the difference was not significant ($p = 0.411$).

Table 4.4: The association between education level of guardians and presence of malnutrition in under five years aged children

Variable	Category	Education level of guardians		Confidence Interval	p-value
		Number	%		
Malnutrition	Cases	20	58.8	37.2 - 80.4	0.411
	Controls	14	41.2	15.4 – 66.9	

The results of the association between presence of malnutrition in under five years aged children and marital status of the guardians at household level in the study area are shown in Table 4.5. The marital status of the guardian was significantly associated with presence of malnutrition in under-five years children ($p = 0.014$).

Table 4.5: The association between marital status of the guardians and presence of malnutrition in under five years aged children

Variable		Marital Status of the Guardians		Confidence Interval	p-value
		Number	%		
Malnutrition	Single guardians				0.014
	Cases	4	44.4	-4.3 – 93.1	
	Controls	5	55.6	12.1 – 99.2	
	Married guardians				
	Cases	38	30.4	15.8 – 45.0	
	Controls	87	69.3	12.6 – 42.2	
	Pre married guardians				
	Cases	8	72.7	41.8 – 103.6	
	Controls	3	27.3	44.8 – 95.2	

The results of the association between presence of malnutrition in under-five years aged children and birth intervals of siblings at household level in the study area are shown in table 4.6. There was an association between birth interval and presence of malnutrition in under five years children ($p = 0.018$). Furthermore, the current number of children in a given household was significantly associated with presence of malnutrition in under-five years children ($p = 0.013$) (Table 4.7).

Table 4.6: The association between birth interval of the under five years old at a household and presence of malnutrition in under five years aged children

Variable	The birth interval		Confidence Interval	p-value
	No sibling	Number %		
Malnutrition	No sibling			
	Cases	16 43.2	18.9 – 67.5	
	Controls	21 56.8	35.6 – 78.0	
	< 2 years interval			
	Cases	10 50.0	19.0 - 81.0	0.010
	Controls	10 50.0	19.0 - 81.0	
	Between 2 and 5 years interval			
	Cases	15 21.7	0.84 – 42.6	
	Controls	54 78.3	1.0 - 48.6	

Table 4.7: The association between current number of under five years children at a household and presence of malnutrition in under five years aged children

Variable	Under five years children		Confidence Interval	p-value
	1 child	Number %		
Malnutrition	1 child			
	Cases	32 35.2	18.7 – 51.8	
	Controls	59 64.8	52.6 – 77.0	
	2 children			
	Cases	12 25.5	0.8 – 50.2	0.010
	Controls	35 74.5	21.2 – 78.1	
	3 children			
	Cases	6 85.7	57.7 – 113.7	
	Controls	1 14.3	60.0 – 112.3	

The results of the association between presence of malnutrition in under-five years aged children and employment status of the guardians at household level in the study area are shown in table 4.8. The percentage of households heads who were formerly employed among the cases (38.7% 95% CI = 11.1 -66.3%) was slightly lower than those who were formerly employed among in the control (61.3%, CI 95% 39.4 – 83.2%), although the difference was not significant (p = 0.396).

Table 4.8: The association between employment status of guardian and presence of malnutrition in under five years aged children

Variable	Category	Guardians employed		Confidence Interval	p-value
		Number	%		
Presence of Malnutrition	Cases	12	38.7	11.1 -66.3	0.396
	Control	19	61.3	39.4 -83.2	

The results of the association between presence of malnutrition in under-five years aged children and selling of farming products at household level in the study area are shown in table 4.9. The percentage of household selling of farm products among the cases (32.1%, 95% CI = 16.6 – 47.6%) was slightly lower than that among controls (67.9%, 95% CI 57.3 – 78.5%), although the difference was not significantly different $p = 0.396$.

Table 4.9: The association between employment status of guardian and presence of malnutrition in under five years aged children

Variable	Category	Households Selling farming products		Confidence Interval	p-value
		Number	%		
Malnutrition	Cases	35	32.1	16.6 – 47.6	0.318
	Controls	74	67.9	57.3 – 78.5	

The results of the association between presence of malnutrition in under-five years aged children and religious belief of the guardians at household level in the study area are shown in table 4.10. The percentage of guardians who had Christian background guardians among the cases (35.8% 95% CI 22.2 – 49.4%) was lower than that among those among controls (64.2 %, 95% CI 54.1- 74.3%). However religious belief of the guardians was found not to be significantly associated with the malnutrition level of under-five years aged children ($p = 0.311$).

Table 4.10: The association between religious belief of the guardians at a household level and presence of malnutrition in under five years aged children

Variable	Category	Religious belief of the guardians		Confidence Interval	p-value
		Number	%		
Malnutrition	Cases	48	35.8	22.2 – 49.4	0.331
	Control	86	64.2	54.1 – 74.3	

The results of the association between presence of malnutrition in under five years aged children and the types of meal per day at household level in the study area are shown in table 4.11. The type of meal the under five years children were fed per day was found not to be significantly associated with the presence of malnutrition among under-five years children ($p = 0.599$).

Table 4.11: The association between types of meal taken per day at a household level and presence of malnutrition in under five years aged children

Variable	Category	Households eating balanced diet		Confidence Interval	p-value
		Number	%		
Presence of Malnutrition	Cases	27 (32.5%)	32.5	14.8 - 50.2	0.599
	Control	56 (67.5%)	67.5	55.2 – 79.8	

The results of the association between presence of malnutrition in under-five years aged children and feeding frequency per day at household level in the study area are shown in table 4.12. It was found that the number of times the household's under five children were fed per day was not significantly associated with presence of malnutrition ($p = 0.617$).

Table 4.12: The association between feeding frequency per day at a household and presence of malnutrition in under five years aged children

Variable	Category	Fed three times or more/day		Confidence Interval	p-value
		Number	%		
Presence of Malnutrition	Cases	8	40.0	-8.0 – 88.0	0.617
	Control	12	60.0	32.3 – 87.7	

4.1 Predictors of Malnutrition in Under-five Years Children in the Study Area

The logistic regression analysis was used to determine predictors of malnutrition in under-five years aged children in Chipata, Chadiza and Lundazi District. The Hosmer lemeshow test was non-significant ($p > 0.050$) and the Omnibus test for Model Coefficients was significant ($p < 0.050$), indicating that the model fitted the data. The results of the analysis indicated that marital status of the guardian; mixed farming and birth interval of the siblings were significant predictors of the status of under-five children (Table 4.13). The confidence intervals were wide, indicating the levels of uncertainty in the estimates.

Children in households in which their guardians were married were 0.16 (95% CI 0.04 – 0.69) times less likely to be malnourished compared to those whose guardians were previously married (Divorced or widowed) ($p = 0.014$). Further, households with sibling who had the birth interval of between 2 and 5 years were 0.14 (95% CI = 0.16 – 1.03 $p = 0.059$) times less likely to have under-five malnourished children compared to those with no sibling ($p = 0.047$). Households who practiced mixed farming were 0.09 (95% CI = 0.01 – 0.75) less likely to have malnourished children compared to those who did not practice mixed farming ($p = 0.026$).

Table 4.13: Maximum likelihood estimates of predictors of malnutrition in under-five children in Eastern Province.

Variable	Categories	Odds Ratio	95.0% C.I. for Odds ratio	p-value
Marital status	Previously married*			
	Never Married (single)	0.22	0.03 – 1.60	0.134
	Current Married	0.16	0.04 – 0.69	0.014
Interval	No subsequent sibling Interval*			
	> 2 yrs birth interval of under-5 yrs	0.93	0.27 -3.18	0.904
	Between 2 and 5 years birth interval	0.41	0.16 – 1.03	0.059
	More than 5 yrs birth Interval	1.34	0.42 – 4.26	0.622
Farming activities	Mixed Farming	0.09	0.01 -0.75	0.026
	No mixed farming*			.

* = reference category (March – May 2014)

CHAPTER FIVE

5.0 DISCUSSION

This study was conducted to determine whether there was any association between the presence malnutrition in under five years children and livestock keeping at household level in Chipata, Lundazi and Chadiza districts of Eastern province. The study also attempted to determine other factors that may be associated with the presence of malnutrition at household level.

This study found that the presence malnutrition in under-five children at household level was not associated with livestock keeping only in the study areas. This maybe because traditional farmers keep livestock such as cattle for prestige and are not able to sale them to raise money needed to supplement the nutrition of their children and other household needs. This finding is in agreement with Lubungu *et al* (2012), reported that families that depended solely on livestock in sustaining their livelihoods had difficulties in providing for their families. However, an association between practicing mixed farming (crop and livestock farming) and malnutrition in under-five years children was determined. The lack of an association between livestock keeping alone and malnutrition in under-five years children could have been attributed to observation in the study area that livestock does not directly contribute to availability of food in most household. Most traditional farmers use livestock to cultivate crops which are later consumed as food by the household. This could partly explain why there was an association between mixed farming and malnutrition in under-five years children. Household with livestock are able to cultivate larger field resulting in them having enough crops for sale and consumption throughout the year. Those with goats and other types of livestock as defined in section 3.2 are able to sale and raise money for either crop farming or buying food for their children. This is in agreement with what Freeman *et al* (2007) found, that livestock enables saving, provide security, allow resource-poor households to accumulate assets, and help finance planned expenditures as well as those that are unplanned (e.g. illness). Livestock function as insurance policies and bank

accounts in many parts of the developing world. This would clearly show that the resource poor households would prioritise other expenses as opposed to food for the under five years aged children. This finding is further in agreement with the study done by Mahgoub (2006), who found that the prevalence of underweight decreased significantly as family income increased due to conducting mixed farming. Additionally Freeman *et al.*, (2007) found that in marginal areas with harsh environments, livestock provided a means of reducing the risks associated with crop failure and a diversification strategy for resource poor small scale farmers and their communities. The contribution of livestock to crop production through the provision of draught animal power and manure cannot be over-emphasized. Livestock contribute to achieving more efficient and more sustainable resource use through enhanced energy and nutrient cycling.

This study further found no association between presence of malnutrition in under-five years aged children at household level and crop farming only. This is despite the number of households who reported producing crops. This could have been because most households were selling most of their farms products and could thus run out of food before the next farming season. In addition some of the households were not producing enough food to last the whole year. Notwithstanding this situation, the presence of malnutrition at household level in under-five years aged children doing crop farming was slightly lower than among those who were not. The majority of the households in the control group were doing crop farming as opposed to their counterparts in the cases group.

When it comes to other predictive factors, the study found that the employment status of the guardian was not significantly associated with the malnutrition level of under-five years old children. This is contrary to work done by Mahgoub (2006) in Botswana, who reported that underweight children were less prevalent among those whose parents worked in the agricultural sector than among children whose parents were involved in informal business. This findings of this study tends to suggest that a working guardian would concentrate on the work as opposed to feeding the children hence this situation. In this study no association was found because there were few guardians who were

employed and this could have diluted its effect on the presence of malnutrition in under-five years aged children in the study area.

The presence of malnutrition among households with under-five years old children whose guardians were married was significantly lower than those whose guardians were previously married (divorced or widowed) or single. This finding is in agreement with of the study by Mahgoub (2006) in Botswana who reported that children brought up by single parents were significantly under-weight than those children living with both parents. The married couples tend to share the responsibility of looking for resources to feed the family. In rural areas men may be involved in generating revenue, while female may concentrate on feeding the children while selling some little but viable goods at their door step.

This study found that level of education of the guardian was not a risk factor for the presence of malnutrition with under-five years aged children at household level in the study area. However, this is in contrast with what was reported by Masiye *et al* (2009), who found the education level of the head of the household was an important positive predictor of better nutrition. In this study, the area where the study was done could have contributed to the lack of an association between level of education of guardian and the malnutrition in the under-five years aged children. The study was done in rural areas of the three districts where almost all individuals had similar education background. Masiye *et al* (2009) findings were in agreement with Yousef (2000), who found that the higher educational level of the mothers, the better preparation and estimation of malnutrition in their children. Low level of mothers' education was associated with a high relative risk and high etiologic fraction for malnutrition (Khin-Maung *et al.*, 1999).

This study found that birth interval between siblings was found to be significantly associated with the presence of malnutrition at household level of the under-five children in both case and control group. In addition, the household that had only one child or no sibling was less likely to have malnourished children than those with more than one child in the household. This could be an indication that the number of children in a given household is significant in the reduction or increase of malnutrition levels in a

given household. This agrees with Tembo and Nicholas, (2013) who reported that malnutrition among under-five year children was high in households with a high population

The number of times the under five children were fed per day was not significantly associated with the presence of malnutrition, even though the presence of malnutrition among under-five children who fed less than 3 times per day was slightly higher than those who feed more than two times per day. Behrman (2006) also found that 60.8% of the mothers who fed their children three times a day or more, had significant bearing on presence of malnutrition. However, what need to have been done was to measure the quality of food given which this study did not aim to do.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

Conclusion

The aim of this study was to determine whether there was an association between livestock keeping and presence of malnutrition at household level in the under-five years children in rural household of Eastern Province. The study found no association between livestock keeping only at household level and presence of malnutrition in under-five years children. However, the study found that mixed farming (crop farming and keeping livestock) was associated with a significant reduction in malnutrition among under-five years children. The other factors that were significantly associated with malnutrition under-five years aged children included birth interval of siblings, marital status of the guardian and number of children in a household.

Recommendations

From the findings in this study, it can be recommended that:

- ✓ Households in the study area must be encouraged to practice mixed farming (keep livestock and grow crops) in order to avert malnutrition in children
- ✓ Households must properly space the subsequent children of at least two or more years to avoid under-five children from being malnourished.
- ✓ A much wider study must be undertaken so that the findings could well be generalised.

7.0: REFERENCES

Aguayo, Victor M., and Shawn K. Baker., (2005). 'Vitamin A Deficiency and Child Survival in sub-Saharan Africa: A reappraisal of challenges and opportunities', *Food and Nutrition Bulletin*, vol. 26, no. 4, pp. 348–355

Ahmed, A. F., (2003.). Assessment of the nutritional status of the primary school children aged 6 – 12 years, Khartoum: UAE.

Ajieroh, V., (2010). A Quantitative Analysis of Determinants of Child and Maternal Malnutrition in Nigeria, Lagos: International Food Policy Research Institute.

Appleton, A., (2013). Metabolism and Nutrition, Medicine Crash Course (4th ed). Moseby: London Press.

Babatunde, R. O. and Qaim, M., (2007) Impact of off-farm income on food security and nutrition in Nigeria: Journal of Sustainable Development in Africa Lagos, (Volume 16, No.6.

Beers, Mark H., MD, and Robert Berkow, M.D., (2004) "Malnutrition." Section 1, Chapter 2. In *The Merck Manual of Diagnosis and Therapy*. Whitehouse Station: NJ: Merck Research Laboratories.

Black, R.E.; L. H. Allen; Z. A. Bhutta; L. E. Caulfield; M. de Onis; M. Ezzati; C. Mathers; and Rovera, J., (2008). "Maternal and child undernutrition: global and regional exposures and health consequences." *Lancet*, 371: 243-60.

Central Statistical Office, Ministry of Health, Tropical Diseases Research Centre, (2009). *Zambia Demographic and Health Survey 2007*. Calverton, Maryland, USA: CSO and Macro International Inc.

Delgado, C., (2009). *The State of Food and Agriculture, "Livestock, food security and poverty reduction."* Rome, Electronic Publishing Policy and Support Branch

Encu/Ewd/Moard., (2008). *Guidelines for Emergency Nutrition Surveys in Ethiopia, the mother and child health.*

Eng., J., (2003). Sample size estimation: how many individuals should be studied? *Radiology Journal*. 227:309-13.

Freeman, A. Kaitibie, S. Moyo, S. and Perry, B., (2007). *Livestock, livelihoods and vulnerability in selected SADC countries (Lesotho, Malawi and Zambia)*. Nairobi: Kenya ILRI Research Report 8. ILRI.

http://www.heart.org/HEARTORG/GettingHealthy/Dietary-Recommendations-for-Healthy-Children_UCM_303886_Article.jsp. Accessed on 07/06/2015 12:00

Kabubo M, J. Ndenge, G.K. & Kirii, D.M., (2006). Determinants of Children's Nutritional Status in Kenya, Nairobi: University of Nairobi.

Khin-Maung, (1994). Risk factor for persistent diarrhoea malnutrition in Burmese children. *J. Trop. Pediatrics. Journal of American Science*, 2011; 7(4)

Lisa, C. S., Marie, T. and Ruel, A., (2005). Why is child malnutrition lower in urban than in rural areas? Evidence from 36 Developing Countries, Great Britain: Elsevier Ltd.

Lubungu, M. Chapoto, A. and Tembo, G., (2012). Smallholder Farmers participation in livestock markets: The case of Zambian farmers, Lusaka: Indaba Agricultural Policy Research Institute.

Mahgoub, S., (2006). Factors affecting prevalence of Malnutrition among Children Under three years of age in Botswana, Gaborone: Fjmland.

Manley, J. Gitter, S. and Slavchevska V., (2011). How effective are Cash Transfer Programmes at Improving Nutritional Status? A Rapid Evidence Assessment of Programmes' Effects on Anthropometric Outcomes. London: EPPI Centre, Social Science Research Unit, Institute of Education, University of London.

Masiye, F., Chama, Chitah, B. and Jonsson, D., (2009). Determinants of child nutritional status in Zambia: An analysis of a national survey. University of Zambia, Lusaka: **Zambia Social Science Journal**: Vol. 1: No. 1, Article 4.

Mei Z, Grummer-Strawn L.M., (2002) Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *American Journal of Clinical Nutrition* 75:97–985

Mengistu Kebede, Kassahun Alemu and Bikes Destaw., (2013). Prevalence of Malnutrition and Associated Factors Among Children Aged 6-59 Months at Hidabu Abote District, University of Gondar, Gondar, Ethiopia, *Journal of Nutritional Disorders Therapy*. <http://dx.doi.org/10.4172/2161-0509.T1-001>

Muir Hazel., (2004-04-08). "[Ancient remains could be oldest pet cat](#)". [New Scientist](#). Retrieved 2007-11-23

Myatt, M, Khan, T., Collins, S., (2006). "A review of methods to detect severe malnutrition in the community for their admission to community based therapeutic feeding" *Centres Food and Nutrition Bulletin* No3 supplement. The United Nations University

National Food and Nutrition Commission, (1993) Annual Statistical Bulletin, Lusaka.

National Statistical Bulletin, (2012). Ministry of Health, Lusaka.

Ndlovu, L., (2010). Food, nutrition and health. In: Swanepoel, F.J.C., Stroebel, A. & Moyo, S. (Eds) The role of livestock in developing communities: Enhancing Multi-functionality. Wageningen: CTA.

Oldewage-Theron, W.H. & Kruger, R., (2008). Food Variety and Dietary Diversity as Indicators of the Dietary Adequacy and Health Status of an Elderly Population in Sharpeville, South Africa: *Journal of Nutrition for the Elderly*, 27(1/2):115-125, 2008.

Park K., (2002). Park's Textbook of Preventive and Social Medicine. New Delhi: Banarsides Bharat.

Paxson, C. and Abledinger, J., (2003). "Orphans in Africa", working paper, New Jersey: Princeton University.

Smith, L.C. & Haddad, L., (1999) Explaining child malnutrition in developing countries: A Cross-Country, Washington, D.C: International Food Policy Research Institute.

Tembo, S. and Nicholas, S., (2013). Technical Compendium: Descriptive Agricultural Statistics and Analysis for Zambia, Lusaka: Indaba Agricultural Policy Research Institute (IAPRI).

Thornton, P. K., (2007). Coping strategies in livestock-dependent households in East and southern Africa: A synthesis of four case studies. *Human Ecology*, 35: 461-476

Thornton, P.K., Kruska, R.L., Henninger, N., Kristjanson. P.M., Reid, R.S. & Robinson, T.P., (2010). Locating poor livestock keepers at the global level for research and development targeting. In *Land Use Policy* 20, 311–322.

UNICEF. (2013) United Nations Children's Fund. Progress for Children – A Report Card on Nutrition. New York: new York Press.

Weiss, C., (1998). Evaluation: Methods for Studying Programmes and Policies. New Jersey: Prentice Hall

Whitaker R.C, Seidel KD and Dietz W.H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England: Journal of Medicine*. Sep 25; 337 (13):869-73.

World Health Organization and United Nations., (2004). Children's Fund, 'Focusing on Anaemia: Towards an integrated approach for effective Anaemia control' (joint statement), WHO, Geneva.

Yousef ,Y., (2000). Risk factor of Persistent Diarrhoea and Malnutrition under five years of age in Assiut. Khartoum: University Hospital.

8.0 APPENDICES

Appendix 1: Questionnaire



Questionnaire No:

THE UNIVERSITY OF ZAMBIA

SCHOOL OF VETERINARY MEDICINE

Research Questionnaire

Dear Respondent,

I am a student from the University of Zambia carrying out research on *the relationship between household livestock status and five nutritional statuses, in Chadiza, Chipata and Lundazi districts.*

The reason for doing such an exercise is to analyse if there is any relationship between livestock keeping and nutritional status of under five years children and the well-being of the family.

You have been randomly selected as one of the respondents to take part in this research. Please be free to answer the questions that follow as objectively as you can.

Be assured that your responses will be treated with the highest confidentiality. No information that will be given in this study will be passed on to third parties and no information which identifies you as an individual or family will be included in the reports.

Yours

Researcher.

INSTRUCTIONS

* Do not write your name or identity number on this questionnaire

* You are required to circle (2) the option that is applicable to you. Where no options are provided, give brief explanation in the space provided

QUESTIONNAIRE									
	Questions and filters	Responses				Code			
1.	What is your sex	Male.....1							
		Female.....2							
2.	What was your age as at last birth day?	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>							
3.	Marital status	Single.....1							
		Married.....2							
		Divorced.....3							
		Widowed.....4							
		Separated.....5							
3.	Relationship of the respondent and under-five child (ren) at the household.	Father.....1							
		Mother.....2							
		Dependent.....3							
		Other specify.....4							
4.	Age of the under-five child(ren)	Child	1	2	3	4			
		Age							
5.	What is your religious denomination	Catholic.....1							
		Protestant.....2							
		Muslim.....3							
		Other specify.....4							
6.	Education level of the guardian	None1							
		Primary2							
		Secondary3							
		University/college.....4							
7.	Which category of employment do you fall in?	Formal.....1							
		Informal.....2							
		Not employed.....3							
8.	Do you do any farming?	Yes.....1							
		No.....2							
9.	If yes to question 9 what type of farming? Tick all that apply	Fish farming.....1							
		Crop farming.....2							
		Livestock farming.....3							
		Others specify.....4							
10.	If its crop farming what do you produce?							
								
								

11	Do you sell any of your farm products	Yes.....1 No.....2				
12	If yes to 12 what do you sell?				
13	If yes to 12 how much do you earn?				
14	Explain how you use the income raised?				
15	What was the age of the mother at birth of the current under five child?				
16	Birth interval with the previous and subsequent children	Less 2 years.....1 Between 2 and 5 years.....2 Above 5 years.....3 None subsequent children.4				
17	If the respondent is not the mother, then what is the mother's ; Educational level..... Age.....	None1 Primary2 Secondary3 University/college.....4				
18	Current number of under-five year's children at the household.				
19	Does the child have edema?	Child	1	2	3	4
		Yes				
		No				
20	The MUAC tape reading for the under-five year's child?	Child	1	2	3	4
		Red				
		Yellow				
		Orange				
		Green				
		Reading				
21	Is the child (ren) malnourished?	Child	1	2	3	4
		Yes				
		No				
22	Do you keep any livestock at your Household?	Yes1 No.....2				
If yes what type of livestock and how many do you have for each type? If no go to question 30,						

<p>List the animals you have in order of importance.</p> <p>.....</p> <p>.....</p> <p>.....</p>	
<p>23. If you sell the livestock, what do you use the income for?</p> <p>.....</p> <p>.....</p>	
<p>24. If you do not have livestock, how do you provide food for the under-five?</p> <p>.....</p> <p>.....</p>	
<p>25. What type of food do you feed your child in a given day?</p> <p>.....</p> <p>.....</p>	
<p>26. What is the source of your protein food of your under-five year's children?</p> <p>.....</p> <p>.....</p>	
<p>27. How often do you feed your child in a day?</p>	<p>Once1</p> <p>Twice.....2</p> <p>Three times.....3</p> <p>More than 4 times.4</p>
<p>28. Indicate the type of housing unit</p> <p style="padding-left: 20px;">1. Traditional 2. Improved traditional 3. Modern 4. Others specify</p>	
<p>29. What is the main source of water?</p> <p style="padding-left: 20px;">1. Protected well 2. Unprotected well 3. Borehole 4. River/stream 5. Others specify</p>	
<p>30. What is the main type of toilet used by the members of the household?</p> <p style="padding-left: 20px;">1. No toilet</p> <p style="padding-left: 20px;">2. Ventilated Improved Pit latrine VIP</p> <p style="padding-left: 20px;">3. Flush</p> <p style="padding-left: 20px;">4. Pit latrine</p> <p style="padding-left: 20px;">5. Bucket</p> <p style="padding-left: 20px;">6. Others specify.</p>	

Thank you for your participation

May God bless.

Appendix II



THE UNIVERSITY OF ZAMBIA
SCHOOL OF VETERINARY MEDICINE

INFORMED CONSENT FORM

I have read and understood the information that has been presented to me both in vernacular and English languages. I have had all my questions answered to my satisfaction. I have been asked to participate in the above study and given free consent by signing this form.

My consent to participate is voluntary and I may withdraw from the survey at any time. I am further aware that the information I disseminate will be treated in confidence and I will not be personally identified.

(a) Signature or thumb print of patient..... (b) Signature of
Researcher.....

(c) Signature of witness..... (d) Place..... (e)

Date.....

Contacts: Banda Yolani MSc Student, School of Veterinary Medicine UNZA): 095-5-886040

Appendix III
EXCELLENCE IN RESEARCH ETHICS AND SCIENCE
(ERES) CONVERGE IRB
33 Joseph Mwilwa Road
Rhodes Park
LUSAKA
Tel: 0955 155633/4

IRB No. 00005948,
FWA No. 00011697

INFORMATION SHEET/CONSENT TO INCLUDE THE FOLLOWING:-

- Language: simple non-technical
- Introduction: state who you are
- Procedures: Blood sample, biopsy, surgery, asking questions etc.
- Confidentiality: It is a very important aspect of any research involving human (studies/research) participants
- Risks/Benefits
- Voluntary participation
- Right to withdraw or seek clarification
- Provision for standard of care
- The Investigator must give his/her name, address and telephone etc. In case any participant needs any clarification.
- If accepted the participant must give his/her signature or thumb print.
- All consent procedures should be witnessed to assure voluntary participation.

Project Title: Analysis of the Relationship between Household Livestock Keeping and Under-Five Years Children Nutritional Status in Rural Parts of the Eastern Province Of Zambia.

What is this study about?

This is a research project being conducted by Banda Yolani an MSc student at the University of Zambia. The supervisor of the study is Dr Martin Simuunza the Head of Department in the Disease Control Department School of Veterinary Medicine UNZA.

I am inviting you to participate in this research project because you reside in an area that has had cases of malnourished children in each of the past four years. The purpose of this research is to look at the relationship between household livestock keeping and the nutritional status of under five children in the rural parts of the Eastern Province of Zambia.

How was I selected?

From the under –five years registers at the sampled health centres all underweight children’s households will form the sampling frame. Once such a household is selected the guardian or head of that household will be the sample.

Further Two sampling frames will be generated from the health centres' register for households with under five children. One list will be of all households with children who are under weight or reported to be malnourished while the other will be that of children who will be reported not malnourished. Based on the size of the sampling frame, the sampling interval will be determined for each list using the formula (N/n) . For each case that will be sampled, two households with children, who are not malnourished, but of the same age and coming from the same area will be identified

from the list of children with no malnutrition. Where it may not be able to identify control from the hospital records, such children will be identified upon visit to the affected community where the malnourished child comes from. This kind of sampling will give the researcher to have a good proportion of presentation from both kinds of households and further increase the power. At each household a guardian will answer the questionnaire.

What will I be asked to do if agree to participate?

You will be asked to answer some questions related to your caring of the under-five years aged children and presence or absence of livestock in your household. The Mid Upper Arm Circumference, height and age of your under-five year's old children will be gotten. In addition, you will be asked questions relating to the demographic characteristic of the households, sources of income for sustenance and whether a household keeps cattle or not, types and number of livestock kept, uses of livestock and their management, your health seeking behaviors, nutritional aspects of the family especially for the under five years children, size of land cultivated and the types of crops that the family grows.

Would my participation in this study be kept confidential?

Everything possible will be done to keep your personal information confidential. To help protect your confidentiality, you will not be identified by your name to anyone not involved with this study but only codes will be used for transcribing the information on computer. Any information that identifies you individually or your family will not be included. If we write a report or article about this research project, your identity will be protected to the maximum extent possible.

What are the risks of this research?

There are no known risks associated with participating in this research project.

What are the benefits of this research?

You may not gain individual benefits from this study. However, if your child is found to be malnourished, she/ he will be linked to the under-five clinic at your nearest health centre where your child will start receiving food supplements. However, at National level, if it is found that livestock keeping is beneficial to the nutritional status of under-five children from resource poor families, it may encourage government and/ or other donors to invest more in livestock production as this would not only improve household wellbeing, but have a direct effect on the nutritional status of growing children. We hope that in future, many people might benefit from this study through increased investment in livestock keeping in rural communities.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this study or if you stop participating at any time, your way of life will not be compromised.

What if I have questions?

This is a research project being conducted by Banda Yolani an MSc student at the University of Zambia. The supervisor of the study is Dr Martin Simuunza the Head of Department of Disease Control Department in the School of Veterinary Medicine at University of Zambia. Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Banda Yolani

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P.O Box 511205,
CHIPATA. Tel: +260- 216 – 221298 or 0955886040