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„Dietary diversity and gender roles in nutrition among households with young children in the rural area of the Southern Province of Sierra Leone"

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Diana Höppel, BSc

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Statutory Declaration

I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.

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Date Signature

Acknowledgments

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Abbreviations and acronyms

24HR	24-hour dietary recall
CCVI	Climate change vulnerability index
EVD	Ebola virus disease
FAO	Food and Agriculture Organization
FSMS	Food Security Monitoring Survey
GDP	Gross domestic product
GII	Gender Inequality Index
HDI	Human Development Index
IYC(FP)	Infant and young children (feeding practices)
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity of women of reproductive age
MMR	Maternal maternity rate
MPI	Multidimensional poverty index
WHO	World Health Organization
SSA	Sub-Saharan Africa
VAD	Vitamin A deficiency

1. INTRODUCTION

1.1. Identifying the nutritional situation and gender roles in Sierra Leone

While in many parts of the world the prevalence of hunger and undernourishment could be reduced in the last years, it is on the rise in Africa. The prevalence of undernourishment across Sub-Saharan Africa (SSA) stands at 22,8% and is the highest worldwide. In Sierra Leone, 25,6% of the population is suffering from undernourishment [FAO, 2019].

The Global Hunger Index 2019 ranks Sierra Leone 103rd out of 117 countries. Sierra Leone scores 30,4%, which means that the country suffers from a serious level of hunger (20 – 34,9%). Hunger refers to undernourishment and is defined by an uncomfortable or painful physical sensation caused by insufficient consumption of dietary energy, which becomes chronic when the person does not meet a sufficient amount of calories (dietary energy) on a regular basis to lead a normal, active and healthy life [FAO, 2020a]. The Global Hunger Index composites of three dimensions and four indicators: Inadequate Food Supply: Undernourishment, Child Mortality: Under-five-mortality rate and Child Undernutrition: Wasting and Stunting [Global Hunger Index, 2019].

Malnutrition is one of the biggest contributors for under-five morbidity and mortality. It leads to deficiencies in growth and development of children, which results in long term health consequences [WHO, 2017]. Malnutrition remains a serious problem in most parts of Sierra Leone. It is caused by poor food consumption, insufficient dietary diversity and poor infant and young children feeding practices (IYCFP). In less favorable environments it is also associated with livelihood shocks, low quality sanitation and lack of clean water. 5,1% of children under five suffer from acute malnutrition, 13,6% are underweight while the prevalence of stunting (height-for-age) is 31,3%, which is high and of public health significance according to the World Health Organization (WHO) [MoHS, 2017, WHO, 2010]. The prevalence of wasting (weight-for-height) is 9,3% [Akombi et al., 2017].

Sierra Leone is a male dominated country. Among other factors, notable in the differences of the income between men and women. Men play a pivotal role in

providing money for their families and are predominant in the position of decision making, while women are responsible for childcare, food preparation and serving the household, mostly in addition to farm work. Despite the fact that women and children are more vulnerable to an insufficient diet and a lack of micronutrients, men are often seen as more important in terms of food allocation within the household. It is important to empower women in various dimensions to reduce their own and their children's risk of under- and malnutrition and related diseases. [MoHS, 2017, Na et al., 2015]

1.2. Hypothesis

The overall objective of the current study was to determine and evaluate the dietary diversity and nutritional habits of mothers, fathers or caregivers and their children aged between 6-24 months, who live in rural areas of Bo and Pujehun district, with a focus on gender roles and disparities in nutrition.

Special objectives:

1. To determine the socio-demographic and socio-economic characteristics of the households
2. To identify the dietary diversity of women, men and children
3. To determine which foods are eaten frequently and which food groups are little consumed or not at all
4. To evaluate if there are differences in dietary diversity and food consumption patterns between Bo and Pujehun district
5. To identify determinants of dietary diversity
6. To identify gender roles, differences and disparities in nutrition

The necessity of this study lies in the fact that Sierra Leone is a country, where hunger and malnutrition is as present as ever. This research intents to give an overview of the dietary habits among mothers and fathers and the feeding practices of their young children living in rural areas, as they are expected to be at an insufficient level. This is due to a range of various factors. Bad infrastructure with poorly maintained roads can lead to restricted access to local markets. Especially during rainy season, the high amounts of rainfall can lead to flooded

and therefore not passable roads. Some villages are surrounded by lakes due to these massive rainfalls. The high levels of poverty make it difficult for inhabitants to afford a motorbike- or boat ride to the nearest market and/or to purchase food items. Therefore, many of them rely on subsistence farming, living off what they can grow and cultivate close to their homes. The climate often creates multiple difficulties for farming, due to the lasting rainfalls during the rainy season or on contrary, the long duration of the dry season without any rainfalls – both potentially leading to crop losses and thus to less availability of food.

Traditionally, women are responsible for cooking meals and providing food for the family. Men are often seen as the most valued family member, who deserves the best and most amount of food. In this study differences in dietary diversity between men and women and the roles in decision-making on nutrition will be described.

This study may be helpful for researchers or institutions in identification if and which further studies or interventions are needed to improve the nutritional status of families with young children living in rural areas and to take further steps to close occurring gender gaps in terms of nutrition.

2. GENERAL BACKGROUND

This chapter gives an overview about Sierra Leone. It will introduce its economic, social and health situation and describes the country's history, leading to a better understanding of the current circumstances existing in Sierra Leone.

2.1. Geography

Sierra Leone is located on the North Atlantic coast of West Africa. It is surrounded by two neighboring countries. The Republic of Guinea borders Sierra Leone on the north and northeast and the Republic of Liberia borders the country on the east and southeast. The Atlantic Ocean stretches over a distance of approximately 340 kilometers on the west and southwest of the country [MoHS, 2017].

Figure 1: Geographic location of Sierra Leone in the world [SSL and ICF-International, 2014

2.2. Area

The total area of Sierra Leone is 71.740 square kilometers. It is ranked 119th comparing the area size worldwide. Sierra Leone is divided into Eastern, Northern, North Western and Southern province and the Western area (Figure 2). Each region is divided into districts and each district is again divided into chiefdoms. In total, there are 14 districts with 149 chiefdoms. Freetown is Sierra Leone's capital and also the largest city of the country. It is located in the Western area. Sierra Leone has four distinct physical regions: the Freetown Peninsula, the Coastal Plains, the Interior Lowlands and the Interior Plateau [MoHS, 2017].

Figure 2: Map of Sierra Leone [SSL and ICF-International, 2014]

2.3. Climate

The general weather conditions in Sierra Leone are hot and humid. Sierra Leone's climate is tropical with the main seasonal change from rainy to dry season. During the rainy season from May to October the sky is usually very cloudy with minimal sunshine. During these months rain falls almost every day, reaching its peak time in July and August. The rainy season is also known as the *lean season* or *hunger season*, when access and availability of food is limited. The dry season from November to April is characterized by a hot and dry wind called "Harmattan", which is coming from the Sahara. The rainy season has cooler daily maximum temperatures than the dry season by about 6 C°. The relative humidity is especially high in July - September, reaching up to 90%. The temperature varies between 16 to 33 C° throughout the year [WFP and FAO, 2015].

2.4. Demography

Sierra Leone is a rapidly growing country with an estimated population of 7.9 million according to the latest data of the United Nations. That is an increase of about 285.000 people compared to 2018 and an increase of about 1,5 million people compared to 10 years ago (2010). The estimated average yearly population growth rate stands at 2,10% and the population forecast for 2030 is 9.6 million people [Worldometer, 2020].

The population density is 111 inhabitants per square kilometer. The south and west of the country are much more densely populated than the north. 43,3% of people live in urban areas and 57,5% of the population inhabit rural areas. The rural to urban migration increases from year to year and is expected to continue growing [WFP, 2019a]. Freetown has a population of about 802.000 people, followed by Bo, the second most populous city with a population of about 175.000. Kenema and Makeni are the only two other cities with populations over 100.000 [Worldometer, 2020, World Population Review, 2020].

Sierra Leone has a young population with about 60-70% under the age of 25 and only around 7% of the population is 55 years or older (Figure 3). The median age of the total population is 18,9 years, which is disproportionately young. Sierra

Leone's youthful and growing population is a result of the total fertility rate, which remains high although it slightly decreased over the last two decades. The average woman gives birth to roughly 4,3 children. [Worldometer, 2020, World Population Review, 2020]. The desire of large families is still persistent, contraceptive use remains low and the early start of childbearing is very common [CIA, 2019].

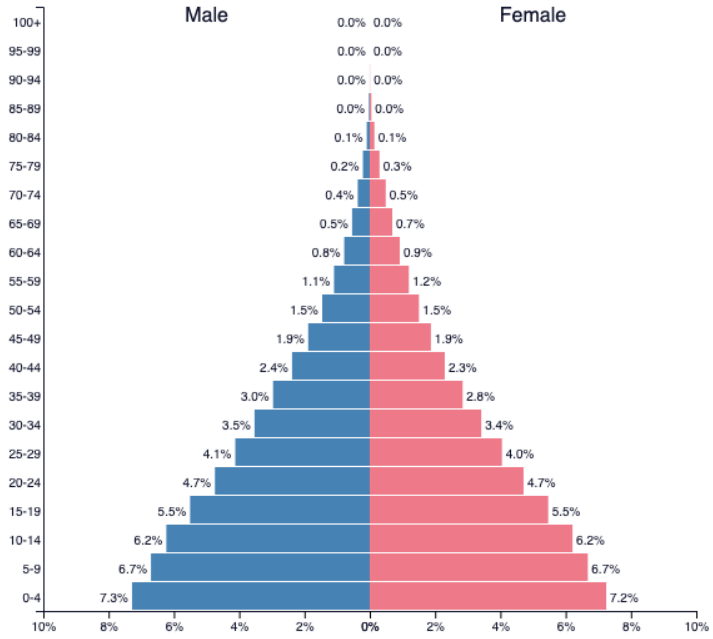

Figure 3: Population Pyramid of Sierra Leone, 2020. https://www.populationpyramid.net/sierra-leone/2020/

2.5. Education

The analysis on education of the 2018 Sierra Leone Integrated Household Survey presents that 61,3% of the population have attended formal schools and 38,7% have never attended school. There has been a remarkable decrease of people not attending school since 2011, where the rate was as high as 48%. Amongst those who have never attended school 59,4% were female and about 40,6% were male [SSL, 2018]. The reasons for not going to school are presented in figure 4. The most prominent one is that parents don't value education, followed by the fact that school education is too expensive.

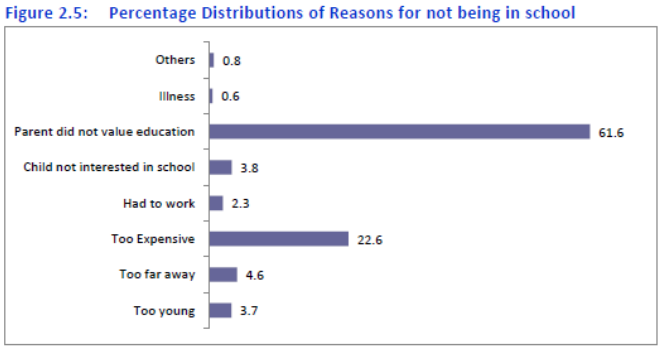

Figure 4: Reasons for not being in school [SSL, 2018]

High levels of illiteracy remain a persistent challenge in Sierra Leone. Almost 60 % of the population aged 10 years and above are not able to read and write in any language. In accordance with the rates of school attendance, more males (59,4%) than females (43,9%) are literate. 44,2% are literate in English language only, while only 2,6% are literate in a local language [SSL, 2016]. Among others, like unskilled labor, a lack of private sector jobs and low pay, illiteracy is one of the main causes for the high youth unemployment rate in Sierra Leone [CIA, 2019].

2.6. Religion, Ethnics and Languages

There is no official religion affiliation in Sierra Leone. The greater part of Sierra Leone's population are Muslims, which are more than two thirds (78%). Christians make up for around 20% of the population [SSL and ICF, 2014]. Sierra Leone is known to be one of the world's most religiously tolerant nations. Muslims and Christian live side by side and also intermarry; children learn both, Muslim and Christian prayers at school. Sierra Leone is ethnically diverse. There are at least 16 different ethnic groups in Sierra Leone and each of the groups has its own language. The two main ethnic groups and therefore spoken languages are Temne (around 35%) and Mende (around 31%). The Temne are mainly located in the North and the Mende in the South of the country. English is the official language in Sierra Leone, but its regular use is very limited. Krio, a language based on English, is the first language for around 10% of Sierra Leone's inhabitants but understood by nearly 95%. Further ethnic groups and languages among others are Kono, Kissi, Limba and Susu [World Population Review, 2020, CIA, 2019].

2.7. History

During the 15th century the Portuguese explored Sierra Leone on a discovery journey of a sea route to India. The area was called *Sierra Lyoa*, meaning lion mountains, by the explorers, due to the high coastal ranges resembling lions to them. That was, when the trade between Europe and Sierra Leone started. Manufactured goods from Europe were traded for cravings, fruits and gold from Sierra Leone. In the 16th century another dimension of trade was introduced – the slave trade – which lasted for centuries. African slaves were brought to America by ship. In 1789, the settlement for freed slave was founded. The British Government took responsibility for this new settlement and declared Sierra Leone to be a Crown Colony in 1808. In 1961, the country gained independence from Britain. Ten years later, in 1971, Sierra Leone was declared a republic within the British Commonwealth of Nations. In 1978, the country adopted a single-party state but reverted to a multiparty state with the two main political parties, the Sierra Leone Peoples Party (SLPP) and the All Peoples Congress (APC), couple of years later in 1991 [SSL, 2014].

In 1991 the brutal civil war, instigated by the Revolutionary United Front (RUF) started and lasted over a decade. The fight for the control of the countries diamonds is seen as one of the root causes for this 11-year-long war. It was characterized by an extreme violence, thousands of child soldiers were widely used, numerous women were raped and used as sex slaves and a majority of people became refugees. Besides the tremendous suffering of the people, the conflict led to a collapse of the economy system and the destruction of social infrastructure [Umilta et al., 2013].

In 2002, Sierra Leone emerged from the war and slowly began to recover and rebuild its economic and social status. The country made a steady progress over the years. People started to rebuild their lives, farms were restored, the trade of food commodities with Guinea and Libera increased and household incomes gained. The political stability of the country during the years after the war and the investment of development actors helped Sierra Leone in its slow process of recovery [WFP, 2008, Kodish et al, 2019].

However, the country had to face another heavy stroke in 2014: the outbreak of the deadly Ebola virus disease (EVD). More than 14.000 cases were reported

and almost 4.000 people died as a consequence of the disease in Sierra Leone. Also, up to 30.000 people were quarantined during the outbreak. The health system was tremendously impacted, many health workers died and the healthcare utilization was dramatically reduced. The outbreak led to major socio-economic consequences, including weak community cohesion, education loss, reduced child protection, widespread job losses and food insecurity. Also, increased morbidity and mortality as well as reduced expected life expectancy were reported. Today, survivors are still affected by their illness episodes and many persons are struggling with mental health issues due to Ebola experience. Since the end of the outbreak in 2015 and up until now, the country is making considerable progress in getting back on its feet. [Elston et al, 2017, Jalloh et al., 2018]

2.8. Poverty

Sierra Leone is known as a low-income country and has extremely high poverty levels. Insufficient food supply, poor housing, poor health, high infant and maternal mortality, high illiteracy and limited access to clean water as well as lack of money are the main poverty indicators [WFP, 2008]. Another indication of some level of poverty is the high percentage of money households spend on food. Up to 61% of total household expenditure are spend on food purchases [SSL, 2018]. More than half of Sierra Leone's population (53%) is living below the poverty line of USD 1.25 per day [WFP, 2020]. The country's food poverty line at 54,5% indicates, that more than half of the population do not have enough money available to buy a sufficient amount of food, following the local diet and providing the minimum required caloric intake [SSL, 2018].

According to the Sierra Leone National Multidimensional Poverty Index (MPI) 2019 almost two-thirds (64,8%) of the country's population was identified as 'MPI poor" (deprived in at least 40% of indicators). Sierra Leone's National MPI has five dimensions, health, education, living standards, housing and energy, and 14 indicators. However, there is a wide disparity of poverty in the geographic distribution.

The incidence of poverty in rural areas is significantly higher than in urban areas (86,3% and 37,6%, respectively). Additionally, the intensity of poverty in rural areas is 10% higher than urban poverty (0,9% and 60,3%, respectively), and the MPI in rural areas is also more than double that in urban areas. Poverty rates per region were the highest in the South (76%) and in the North (75,8%), followed by the East (67,6%), while the western region had the lowest rates (36,2%) [UNDP, 2019a].

According to the findings from the Sierra Leone Integraded Household Survey from 2018 the three poorest districts are Pujehun, Tonkolili and Falaba with total poverty rates at 84,6%, 84,8% and 81,3%, while the least poor districts are Western Area Urban and Rural, Kambia and Bonthe (16,3%, 37,7%, 45,8% and 51,9%).

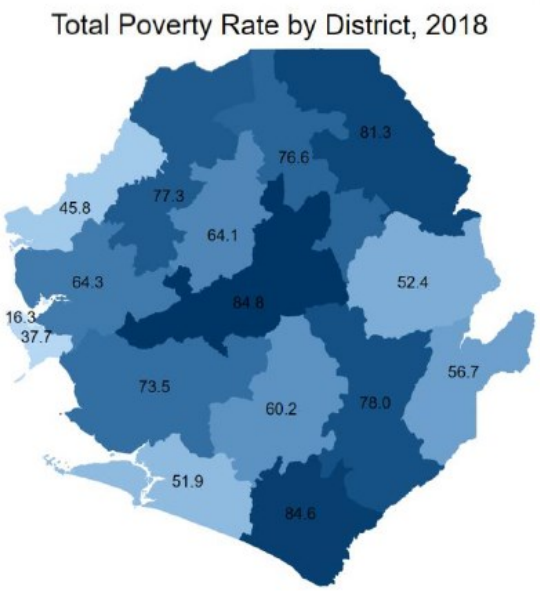

Figure 5: Total Poverty Rate by District [SSL, 2018]

2.9. Economy

Sierra Leone's economy is still recovering from various shocks from the recent years, starting with the 11-year civil war from 1991-2002 that destroyed its national infrastructure, basic social services and many institutions. Agriculture remains to be the mainstay of Sierra Leone's economy, which generates about half of the gross domestic product (GDP) and provides employment for a large proportion of the population. Coffee, cocoa and fish are the most common agricultural exports of the country [WFP, 2019a, MoHS, 2017]. Apart from agriculture, mineral mining plays a crucial role for the national economy. Especially iron ore but also diamonds and rutile are the countries principal exports. In early 2013 the GDP peaked at almost 21%, compared to about 5,7% in 2010-2011, due to strong mining exports. However, Sierra Leone's economy is highly vulnerable to fluctuations in international prices, so the remarkable decline in international iron ore prices starting in late 2013 to early 2014, hit the country very hard. This price drop coupled with the EVD outbreak in 2014 had a

tremendous effect on the country's economy leading to a significant contraction of activity in all economic areas and to one of the biggest fiscal shortfalls in 2015-2016.

Julius Maada Bio, Sierra Leone's president, who was elected in March 2018, considers agriculture and its subsectors as "key drivers of the country's economic development and achievement of Vision 2035 for attaining a middle-income status" and shows commitment to the economic and social recovery following the EVD outbreak and the drop in iron ore prices. Even tough, Sierra Leone has experienced a resumption of economic growth recently, various factors keep holding back further growth and stability of the country's economy - including poverty, lack of education and job opportunities, vulnerability to climate change and poor resourcing in the agricultural and health sectors [WFP, 2019a].

A low electrification rate is also seen as one of the main obstacles for the long-term economic growth. In 2017, 6 million people were living without any access to power with the majority in rural areas. Also, the lack of passable roads constitutes a problem. As a consequence of all these factors the country is still reliant on rising commodities prices and remains dependent on foreign aid. Various reports address that Sierra Leone needs to increase the effort to diversify its sources for further economic growth. [CIA, 2019, WFP and FAO, 2015]

2.10. Farming and food production

As mentioned in the previous chapter, the livelihood of a large proportion of Sierra Leone's population rely on agricultural production, mainly for domestic consumption but to some extent also for export. The most common agricultural technique in the country is "Shifting Agriculture", a cultivation system in which a plot of land is cultivated only for a specific period of one or two years. After harvesting the planted crops, the farmer moves on to another plot and leaves the land uncultivated to regenerate [Matus and Acs, 2012]. Throughout the country, only about a fifth of an estimated 5.4 million hectares of arable land is used for agriculture [WFP, 2020].

The primary staple food in Sierra Leone is rice. It is consumed in all Sierra Leonean households regardless of the income levels. Therefore, it is cultivated by almost all small-scale farmers. Sierra Leone ranks highest in SSA in terms of

contribution of rice to total calorie intake. However, Sierra Leone is a rice deficit nation, thus a high amount of rice has to be imported. The civil war contributed to a dramatic fall in rice production, but even before the war the country was not self-sufficient. Statistics show that between 1970 and 2000, 1975 was the only year in which the rice production of the country met the population's need. Even though there has been a recovery in rice production since 2002, self-sufficiency still remains elusive [Johny and Manseray, 2019]. The production recently declined in such an extent that only 4% of farmers produce enough to meet the needs of their family for one year [WFP, 2020]. Other cultivated food crops are cassava, sweet potatoes, yams, bananas, plantains and a variety of vegetables. Cassava is the second most important staple food; the tuber and the leaves are consumed. The dietary pattern of Sierra Leoneans did not remarkably change over the decades. Rice accounts for more than 50% of the total dietary energy, followed by roots and tubers, pulses, animal products and others. [Johny and Manseray, 2019].

The agricultural production is limited through a range of factors including traditionally farming methods with an absence of any mechanization in the production, the very restricted use of quality seeds and fertilizers, labour shortage at household level and high post-harvest losses. Other factors contributing to a limited food production are deforestation and land degradation, which results in decreasing soil fertility and reducing yields. At the Western Peninsula area, deforestation can on the one hand cause water shortages during the dry season and on the other hand raise the possibility of flooding during the rainy season due to increased water run-off [WFP and FAO, 2015].

On top of that, the consequences of climate change can have a tremendous effect on food production in Sierra Leone. According to the climate change vulnerability index (CCVI), Sierra Leone is ranked on 2nd place of all countries worldwide to be most vulnerable of the effects of climate change. Some climate related shocks already occurred recently, like the major floods in 2015 and 2019 and the huge flooding and landslide in 2017 [WFP, 2019b]. The food production is affected by irregular rainfalls and weather conditions, threating the livelihoods of the population that relies on agriculture for sustenance. Further impacts on agricultural productivity are education, infrastructure, disaster preparedness and access to finance [WFP, 2019a].

Agricultural development is considered to play a pivotal role in improving nutrition. However, farm work is very time consuming, especially for women as they play a key role in agriculture. Women struggle with finding the balance of time dedicated to agricultural and domestic work and resting, childcare and food preparation for the family. Overall, farm work places a heavy workload on them, which may lead to an unintended negative effect for their own and the family's nutrition and welfare. Nutritional impacts of agriculture are varied, mainly depending on the way households cope with the time burden and the heavy workload. The number of household members who can take up domestic work, plays an essential role and can lead to either a positive or a negative impact on the household's nutrition [Johnston et al., 2015].

2.11. Life Expectancy, health and death rates

The estimated total life expectancy of newborn children of both sexes in Sierra Leone is 55,9 years [Worldometer, 2020].

The burden of child deaths remains high in Sierra Leone. According to recent data Sierra Leone's infant and child mortality is among the highest in the world with an estimate of 78,5 deaths per 1.000 life births for infants and 105 per 1.000 children under five [UN-IGME, 2020]. From a global point of view, the world made a remarkable progress in reducing the rate of child deaths in the last decades. The under-five mortality rate has dropped tremendously between 1990-2018 – it decreased by 59% from 93 to 39 deaths per 1.000 live births from 1990 to 2018. However, globally an estimate of 6.2 million children between 0-14 years died in 2018 and about half of those deaths occurred in SSA, which makes it the region with the highest under-five mortality rate in the world. One in 13 children dies before reaching the age of five - a number which is 16 times higher than in high income countries [UN-IGME, 2019].

Maternal mortality is defined as death due to complications from pregnancy or childbirth. This rate could also be reduced on a global level during the last decades. Africa achieved a reduction of 39% between 2000 and 2017. However, SSA accounted for roughly 66% of global maternal deaths in 2017. Sierra Leone is one of three countries with extremely high maternal maternity rate (MMR), with an estimate of 1.120 deaths per 100.000 life births. The only two countries having

higher MMR are South Sudan and Chad (1.150 and 1.140 deaths per 100.000 life births) [WHO, 2019].

Malaria is one of the most common critical public health problems in Sierra Leone. Malaria and malaria-related illnesses are responsible for 38% of all mortality in children below the age of five. There has been a progress in fighting malaria in the recent past, due to efforts at treatment and prevention through Sierra Leone's government. The number of households with insecticide-treated mosquito nets increased from 37% to 62% from 2008 to 2013. However, only 17% of households had at least one of these nets for every two members.

Malaria is seen as a key contributor to anemia. Thus, preventing malaria may also lead to a decrease of anemia. The prevalence rates of anemia in women and children goes beyond 40% and is therefore seen as a severe public health burden according to classifications of the WHO. The prevalence of anemic children aged 6-59 months declined among the wealthiest Sierra Leoneans from 2008-2013 from 69,4% to 52,2%; while the prevalence rates among children of households with lower levels of wealth remained as high as 80% [Wirth et al, 2016]. Anemia is a serious concern, especially for children. It can lead to impaired cognitive performance, behavioral and motor development, coordination and language development as well as poorer educational achievement. It can also result in an increased morbidity from infectious diseases [SSL and ICF, 2014].

There is a wide variety of causes of anemia, mostly they coexist. Besides malaria, inflammation is also associated with anemia. A further significant contributor is iron deficiency caused by a low intake of iron, poor absorption of iron from diets high in phytate or phenolic compounds and being in a period of life when iron requirements are especially high, like growth and pregnancy [De Benoist et al, 2008]. That is the potential reason why the prevalence in children is the highest between 6-11 months of age, which is the usual period of complementary food introduction. The food intake of children may be insufficient and low in nutrient quality and quantity, which can go hand in hand with a reduced nutrient absorption. Besides iron, other micronutrient deficiencies like a lack of vitamin B12, have also been identified as a cause of anemia. In women, consequences of anemia reach from reduced work capacity to poor pregnancy outcomes and increased maternal and perinatal mortality and morbidity [Wirth et al, 2016].

Vitamin A is important for the immune system and its deficiency can lead to eye damage, a possible increase of infection severity and contributes to the high mortality rate in Sierra Leone. Children benefit from breastfeeding due to the amount of vitamin A in breast milk. Adequate nutrition with an appropriate amount of vitamin A-rich foods and vegetables as well as an adequate fat content, which enhances the absorption of the vitamin, is crucial to achieve the health benefits associated with vitamin A. Since 2004, children between 6-59 month of age receive mass vitamin A supplementation twice a year, which covers around 90% of children and is seen as a key intervention to reduce child mortality [SSL and ICF, 2014, Hodges et al, 2015].

Diarrheal diseases and cholera are also described as public health problems. Especially diarrhea often results from poor access to clean and portable water and sanitation facilities – indicators, which are closely correlated with poverty. [Johny and Manseray, 2019]. Access to safe drinking water remains to be a critical health risk. Many of the limited number of water resources like wells and boreholes are contaminated with biological or chemical pollutants. A study, which examined the water quality in Bo, reports that only 25% of water sources met the safe drinking water criteria [Jimmy et al, 2012]. Overall, 52,5% of the population in rural areas and 15,1% in urban areas do not have access to improved water sources [CIA, 2019].

A key factor to prevent maternal and child deaths is adequate knowledge about health care. Based on the findings of a study conducted in 2014, women's knowledge on maternal and child health care is insufficient in rural Sierra Leone, mostly depending on the educational level of women. Health promotion activities focusing on prevention of the diseases mentioned, including education on health-related knowledge on pregnancy, delivery, neonatal care and environmental sanitation should be part of an intervention to improve the survival of mothers and young children [Kanu et al., 2014].

3. Nutrition Situation in Sierra Leone

This chapter gives an overview about the dietary diversity of the country's population, the current food and nutrition security and how it is influenced by Sierra Leone's history.

3.1. Food and Nutrition Security in Sierra Leone

"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."
[World Food Summit, 1996]

This definition emphasizes the four dimensions of food security: food availability, physical access to food, food utilization and stability over time.

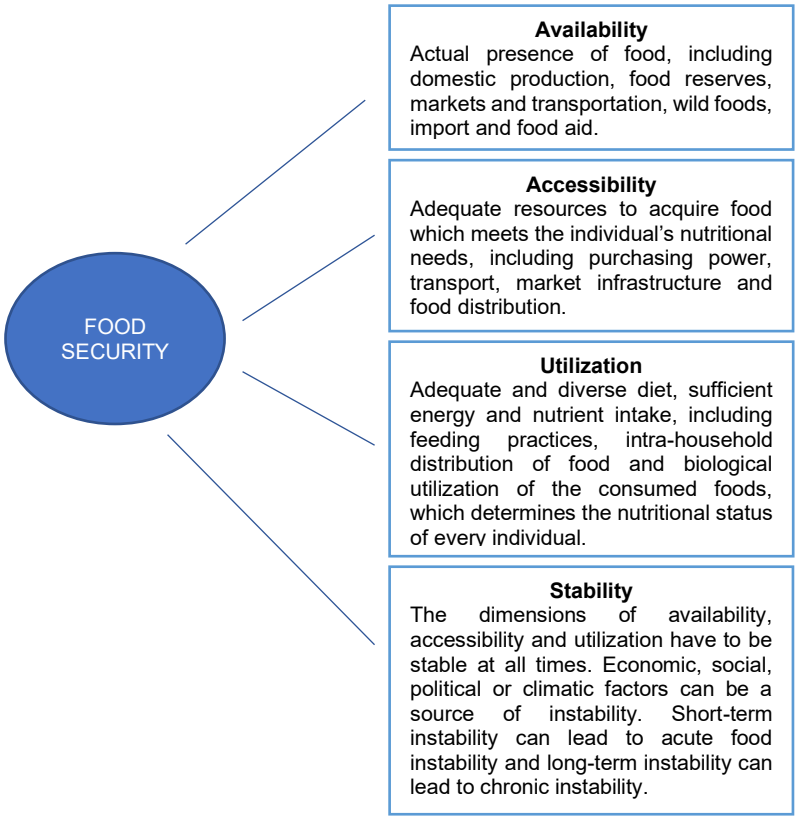

Figure 6: Dimensions of Food Security. Own representation based on FAO, IFAD, UNICEF, WFP and WHO. 2019.

The third dimension of food security, *utilization*, brings out the link to nutrition security. These two concepts are often connected, but nutrition security differs

from food security due to consideration of biological, sociological and health and sanitation concerns while food security is focused on food production, food systems and socio-economic aspects. Nutrition security has three determinants.

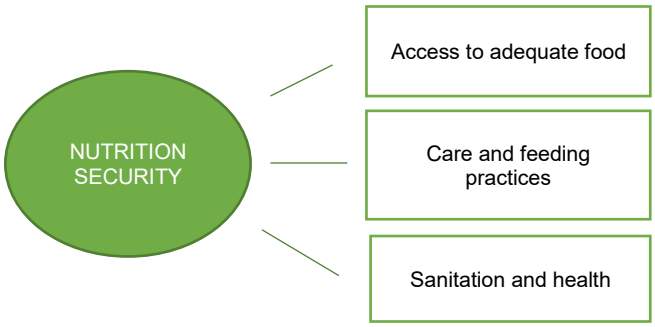

Figure 7: Determinants of Nutrition Security. Own presentation based on FAO, IFAD, UNICEF, WFP and WHO. 2019.

The term *food and nutrition security* has become into wide-spread use. It is seen as an integrated way to combine both concepts and emphasizes to achieve both: food security and nutrition security [UNSCN, 2013]. The UNSCN therefore proposes the following definition:

> "Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life."
>
> [UNSCN, 2013]

The two heavy strokes in Sierra Leone's history – the civil war and the Ebola outbreak – had a significant impact on the country's nutritional situation. The war led to a dramatic fall in food production throughout the 1990's, thereby growing poverty and exacerbating food security in the country. Prior to the Ebola outbreak, Sierra Leone was effectively emerging from civil war. The recovery of rice production has been impressive and significant improvements in economic growth have taken place [WFP, 2008]. From 2008 to 2013, the proportion of underweight children decreased from 21% to 16%, which is a key indicator of an improving nutrition situation. However, food insecurity, hunger and malnutrition

remained to be a significant problem, especially in rural areas. In 2013, 38% and 9% of children below the age of five remained stunted and wasted, and only 32% of children below six months were exclusively breastfed. The Ebola outbreak in 2014-2015 affected the entire food value-chain and therefore worsened the induvial-, household- and population-level nutritional status. To protect the population from the EVD, the government restricted people's movement by blocking roads and imposing quarantines. This resulted in various negative impacts on food availability, food access and food utilization. During the EVD era people were not able to go to and harvest their farms, to process foods or go to markets. This affected the quality and quantity of food intake of Sierra Leone's inhabitants tremendously, especially the number of times and the timeliness of the food intake [Kodish et al., 2019].

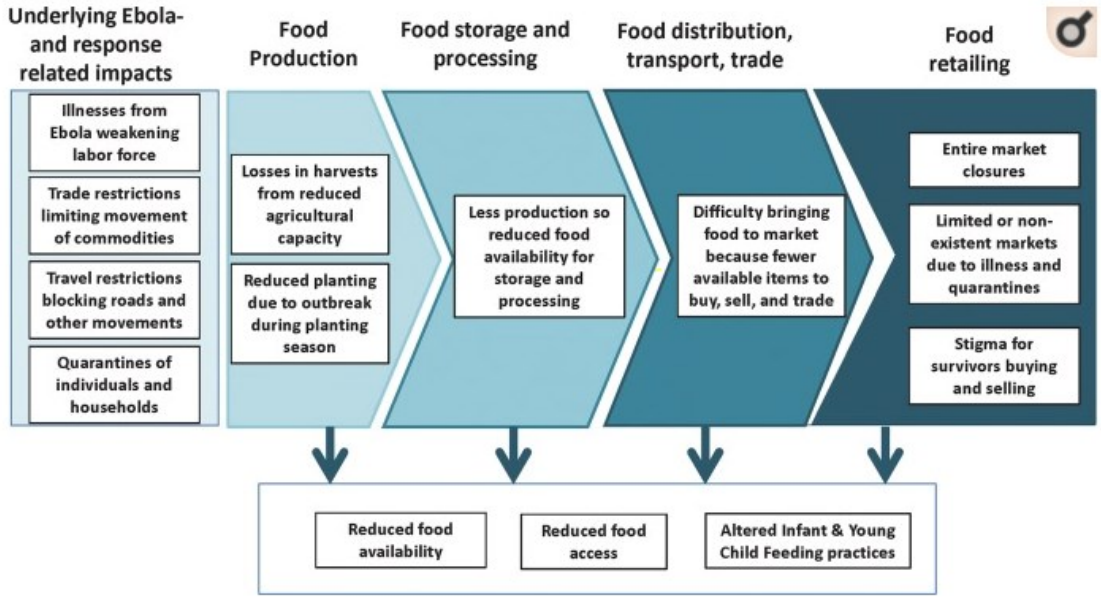

Figure 8: Key EVD impacts along abbreviated food value-chain [Kodish et al, 2019]

After the outbreak the nutritional status of the country started to recover. Findings of the report of Sierra Leone's Food Security Monitoring System (FSMS) from 2018 showed that the food security situation has improved since September 2015. The proportion of the food insecure population decreased from 49,8% to 43,7% in Sierra Leone [WFP, 2018]. However, more recent data show a concerning deterioration of food security since September 2018 and report a decline of this successful development. The amount of food insecure people

increased from 43,7% to 53,4%. These figures come from a data collection conducted during the height of lean season (August – September), a time when access to and availability of food is reduced. [WFP, 2019b]. To effectively monitor food security levels and better understand their dynamics, the FSMS is implemented twice per year. Once during the lean season, and once in January – February, the dry season and post-harvest period. The findings of January 2020 show a dramatically increase of the total food insecure population (47,7%) compared to February 2019 (34%). According to those results, almost half of Sierra Leone's population does not meet their dietary needs to live a healthy life. Considering that access to and availability of food should be the highest during the post-harvest period, this significant increase is of high concern. This deterioration in food security reflects the increasing vulnerability of poor households in Sierra Leone. Recurrent climatic shocks, including flooding and erratic precipitation levels during the seasonal rains, in addition to a challenging macroeconomic situation, are described to be the main drivers of the increasing food insecurity. These shocks not only led to short-term hunger, but also hampered the resilience of poor households. Food insecurity remains to be highest in rural areas, but there is also a sharp increase of urban residents living in food insecurity [Govt. Sierra Leone and WFP, 2020].

3.2. Food availability, access and stability

As mentioned in the previous chapter, food availability is especially limited during the lean season in the months of July to September. This seasonal food shortage is explained by insufficient supplies in store due to poor harvest, a lack of skills in storage and crop loss as a result of inefficient processing or preservation techniques. Apart from that, there are several constraints in agricultural production which were mentioned in chapter 4.10. Access to food is constricted by a variation of factors like income poverty and low purchasing power as well as physical isolation and inadequate market and transportation infrastructure. It is estimated that around 70% of Sierra Leone's population eat only one meal per day. Due to the increase of food prices, the number of poor people living in urban areas going without food for days, is growing. The stability of food is especially compromised during the lean season and/or as a result of shocks. Because of

the poor infrastructure and undeveloped or unpassable roads, it is difficult to transport the food crop harvest from surplus producing in highly productive but remote areas to the markets of deficit ones. The lack of effective agricultural processing and adequate storage facilities make the situation worse. Occurring shocks result in exacerbated hardship among already vulnerable households. Households are often forced to reduce the food consumption as a coping strategy. Besides these consumption-based coping strategies, there are also livelihood-coping strategies including borrowing money or spending savings, selling productive assets or selling one's land or house [Johnny and Mansaray, 2019].

3.3. Food utilization, sanitation and health and feeding practices

The absorption of food is not only limited due to a lack of access to food, especially micronutrient rich foods, but also to safe drinking water. Impure drinking water can affect the individuals' health and can lead to illnesses, which reduce the body's ability to absorb nutrients. Also, the access to sanitation facilities and basic health services plays a crucial role in this context. Insufficient knowledge about a healthy balanced diet and hygiene compounds the problem. Only an estimated amount of 25% of the population has access to safe drinking water, around 11% has access to sanitation facilities and the minority of the population is knowledgeable about a healthy and well-balanced diet [Johnny and Manseray, 2019]. The Sierra Leone National Nutrition Survey 2017 reports that more than 70% of the children receive undiversified and poor monotonous diets throughout the country. More than 50% of the children aged 6-24 months, do not meet the recommended minimum meal frequency, taking into account the breastfeeding status, and only very few children are fed on vitamin A rich foods [MoHS, 2017].

3.4. Food Security in Bo and Pujehun districts

A detailed look will be taken on Bo and Pujehun district during the lean season, because those districts and this time of the year is relevant for the present study.

In Bo district, food insecurity increased from 37% in 2015 to 46% in 2018. Factors contributing to this increase may be the economic downturn in the country and less focus on food security programming in this district due to more favorable food security situation reported in 2015. Bo has the second lowest proportion of households engaged in agricultural production according to the Comprehensive Food Security and Vulnerability Analysis 2015, which results in a low food production in the district. Therefore, households in Bo are more dependent on purchases from markets. Increments in the prices of food commodities may have negatively impacted household food security [WFP and FAO, 2015]. However, the data from 2019 show that there has been a significant decrease in the amount of food insecure population in Bo district. The proportion of moderate to severe food insecure households could be decreased to a level of 29,5%, which is even lower than in 2015 [WFP, 2019b].

In Pujehun district, food insecurity reclined but remained high, falling from 68% in 2015 to 41% in 2018. The reduction in food insecurity might be explained by the normalization of economic conditions after strict movement and trade restrictions enforced by district authorities to prevent the spread of the Ebola virus. Apart from that, significant food security investments have been made by development partners, which may have contributed to a higher level of food production. However, the data from 2019 reports a renewed increase of moderate and severe food insecurity in Pujehun district to 49,6%. Even though the rate remains lower than in 2015, it shows that almost half of the population of this district is food insecure [WFP and FAO, 2015, WFP, 2019b].

Figure 9: Food security by district [WFP, 2019b]

3.5. Dietary diversity and infant and young child feeding practices

To maintain a balanced diet and ensure good health it is obligatory to consume a diverse range of food. People should eat a variety of food from eight different food groups every week, namely: cereals, pulses, dairy, protein rich foods, vegetables, fruits, oils/fats, sugar. The level of food and nutritionally security increases, the higher the variation of types of food from these different food groups is on a weekly basis [WFP and FAO, 2015]. Households in Sierra Leone tend to eat too monotonous. A typical family's diet consists of cereals, especially rice or cassava, with leafy vegetables on a daily basis, no matter their level of food insecurity or poverty. Sometimes it is complemented by beans or locally sourced fish, chicken or so called "bushmeat". The leafy greens are usually prepared with a high amount of palm oil, which is commonly used in Sierra Leone's cuisine and is generally produced locally [Yengoh and Armah, 2015]. Consumption of other food groups is not as common and mostly depends on the purchasing power of the household. This leads to implications of the health status, especially in vulnerable groups like pregnant or lactating women or children under the age of five [WFP and FAO, 2015]. Focusing on children, infants aged 6-8 months are at a significant higher risk to not meet the minimum dietary diversity compared to children aged between 9-23 months. Robert et al. identified that the variety of available food groups within the household, intra-household distribution and/or caregiver selection of foods may all limit the infant and young children diet diversity [Robert et al, 2017]. A recent study of Kalanda and Cheboi focused on the caregiver feeding practices in Sierra Leone. Less than half of the children (46%) are breastfed exclusively until six months. 28% of children get less than three meals a day and 13% of mothers report that the diet of their children is insufficient. If a children's diet is insufficient, it mostly lacks in vegetables and fruits as well as protein rich foods [Kalanda and Cheboi, 2018]. The first two years of life are well known as the "cricital window" for optimal growth and development of the child. Therefore, a sufficient quantity and quality of complementary food together with optimum breastfeeding is of upmost importance to reduce the risk of malnutrition and support the children's physical and intellectual development [Issaka et al, 2015].

4. Gender inequality in Sierra Leone

The following chapter provides information about the current gender inequality situation in Sierra Leone, which can directly and indirectly influence the nutritional status of mothers and children.

The Human Development Index (HDI) refers to the inequalities in human development worldwide in the 21st century. Sierra Leones HDI for 2018 is 0.438. Even though the value increased over the last years, Sierra Leone is positioned in the low human development category and ranks 181st out of 189 countries [UNDP, 2019b]. Moreover, the increase of the value is not equally shared between women (0.411) and men (0.465) [UNDP, 2020a].

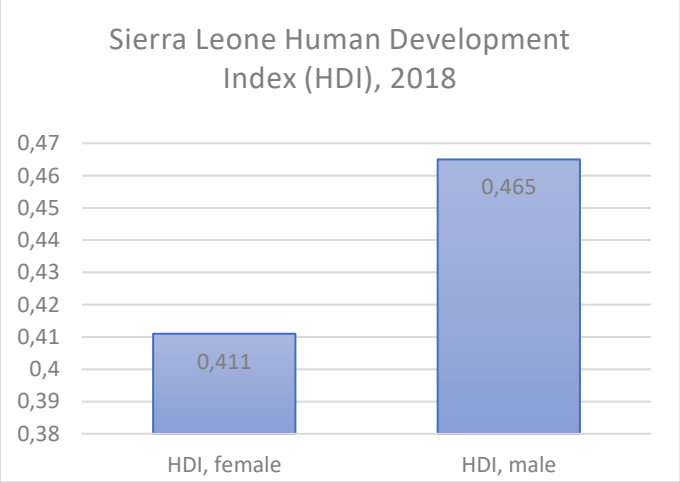

Figure 10: HDI female and HDI male. Own presentation based on UNDP, 2020a

The Gender Inequality Index (GII) measures gender inequality in three important dimensions of human development - reproductive health, empowerment and labour market. A GII of 0 indicates equality between women and men. Sierra Leone has a GII of 0.644 and is therefore positioned among the countries with the lowest GII, ranking 153rd out of 162 countries [UNDP, 2019b]. This represents that Sierra Leone's women are amongst that most marginalized in the world.

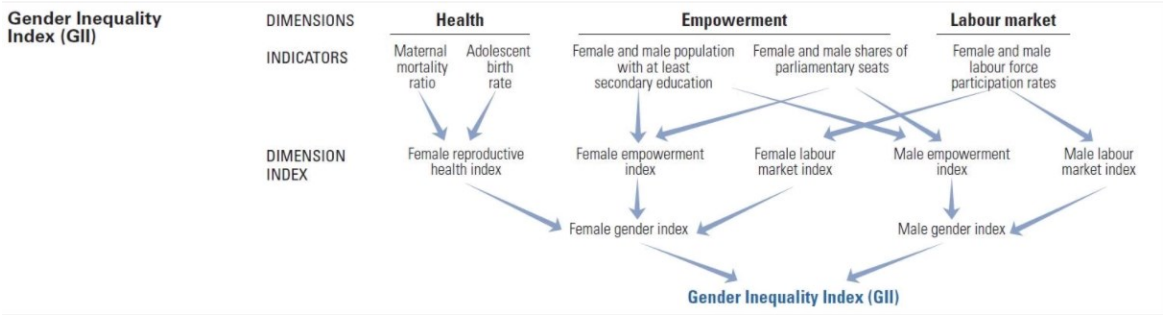

Figure 11: Dimensions, indicators and dimension index of GII [UNDP, 2020b]

Gender inequality has many different faces in Sierra Leone, including political, economic and social issues. Inequality takes place on a “public” level in groups and organizations as well as on a “private” level within households. Women have poor access to land, information, technology and high poverty levels. Only 12,3% of parliamentary seats are held by women and the number of women above the age of 25 having at least some secondary education is significant lower, compared to their male counterparts (19,9%, 32,9%) [UNDP, 2020a]. Also, as mentioned in Chapter 4.5, the illiteracy rate is higher in women than in men (43,9%, 49,4%). The lack of education, especially of rural women, affects economic growth and prosperity and can negatively impact the health, nutrition and socio-economic development of the country.

Patriarchal norms remain to shape the gender roles and responsibilities in Sierra Leone. Women are socialized to be submissive, while men are usually in the decision-making position. In many cases women have no say over the number and spacing of children, they cannot say otherwise if the husband decides to withdraw girls from school or send them into marriages. In rural areas particularly, women’s roles are very rigid and place a heavy work burden on them. Women contribute 75% of the labour force in food production, processing, preservation, marketing and preparation. In addition, they are responsible for maintenance of the household, taking care of family members, including the sick. Women are the ones who cook, fetch water and clean and launder clothes. With this heavy workload women face time constraints, which can lead to lower productivity while working on the farm and inadequate care for themselves and their children. Also, different forms of violence against women are still widespread within the country. Almost half of women above the age of 15 (48,8%) reported to have experienced

violence from their intimate partner. Over the period 2010-2017, around 50% of women believed that husbands are justified in beating their wife for reasons like arguing, burning food or neglecting children [FAO and ECOWAS, 2018].

4.1. Gender, food security and nutrition

Women have to stand back in terms of determining household priorities, spending patterns and distribution of benefits. This can lead to inequal food allocation within the household and a gender gap in food and nutrition security. Women and children are the predominant victims of malnutrition and disease. Women are vulnerable to nutritional and health problems due to frequent and early starting childbirth, together with their heavy workload on the farm and at home. Suboptimal child feeding practices reaching from the lack of exclusive breast-feeding in the first six months, a too early introduction of complementary foods and insufficient quality and quantity of foods are recognized as the leading causes of child undernutrition. Poor nutrition early in life can lead to reduced learning potential, increased reproductive and maternal health risks and lower productivity.

Women's empowerment plays a significant role in enhancing their lives on an economic, socio-familial and legal level. Economically empowered women are able to generate more income and therefore gain control over finances and food purchases, either to their children's benefit or to the improvement of their own diet. Women's socio-familial empowerment refers to freedom of mobility and decision-making regarding interpersonal family affairs. It is pivotal to reduce the risk of being unhealthy, mentally depressed or injured due to limited access to reproductive health services and higher risk of domestic violence. Legal empowerment refers to property rights over land and houses.

Poor physical and mental health of women can result in insufficient feeding and childcare. The improvement of this multidimensional construct of women's empowerment can lead to better IYCF and women's welfare [Na et al., 2015].

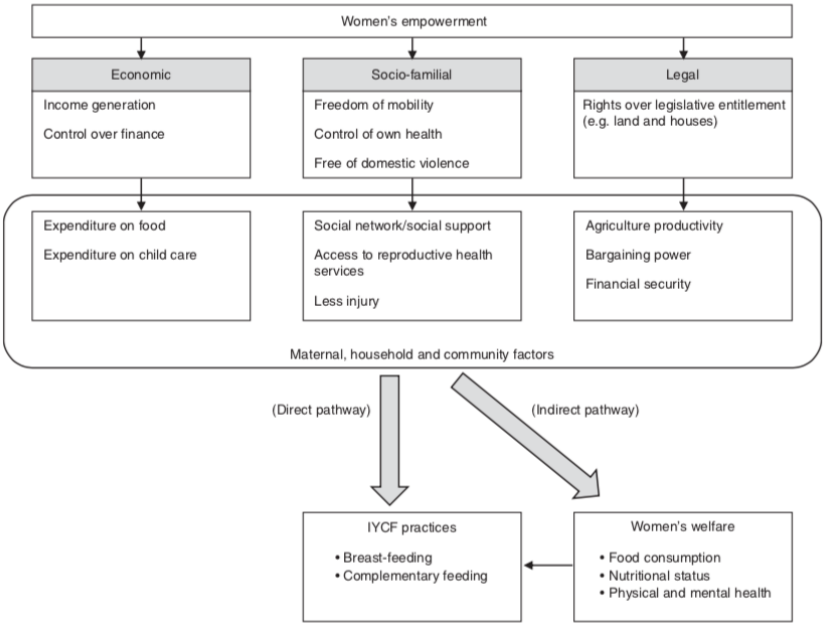

Figure 12: Framework of women's empowerment with infant and young child feeding practices [Na et al., 2015]

Further studies on gender equality and women's empowerment and their relation to the nutritional status of women and their children will be important to better understand how great the impact is and to tackle gender gaps in terms of nutrition.

5. Subjects and methods

After better understanding Sierra Leone's economic, historic, social, health and nutritional aspects, this chapter is going to provide detailed information about the study design and the methods which have been used for the assessment of this study.

5.1. Study design

A cross-sectional study design was used in this present community-based study. This methodology provides a basic method to gather information about a household's dietary diversity, meal frequency as well as associated factors including owning livestock and/or growing vegetables or fruits. The research team, consisting of 12 research assistants, the head of the research and PhD student Memuna K. Sawi and me, collected the data over a period of 4 weeks starting on September 2nd, 2019. This time of the year is the high peak of rainy season and availability of different foods is scarce compared to the dry season.

5.2. Research partners and collaboration

This study was conducted in collaboration with Mrs. Memuna K. Sawi, PhD student at the University of Hohenheim, Germany and the Njala University, Moyambe in Sierre Leone.

5.3. Study area and target population

The study was carried out in selected villages of the chiefdoms Wonde and Valunia in Bo district and Sowa and YKK in Pujehun district in the Southern province of Sierra Leone. These districts are reported to suffer from chronic food insecurity and have high prevalence rates of stunting (32,1% and 38,7%) [WFP and FAO, 2015, MoHS, 2017]. The study population consisted of children between 6-24 months, their mothers or primary female caregivers as well as fathers or primary male caregivers. This study targeted families with children in that age because they are particularly vulnerable to under- and malnutrition due to the risk of poor IYCFP and associated infections [MoHS, 2017].

5.4. Household selection

768 households with children between the age of 6-24 months living in selected villages in Bo and Pujehun district were included in the sample. In some cases, the father was not available for the interview as he had to leave for work. If the women's interview was already taken, it was still included for the assessment as the female survey contains more detailed questions about the household and IYCFP. The households taking part in this study were randomly selected. In each of the villages a maximum of ten households were recruited. Once ten households were conducted, further households were excluded. Households with children under the age of six months and above the age of 24 months or without any children were excluded. In general, women and men were very keen on taking part in this study.

5.5. Survey Design

Data collection

The survey team was divided into six teams of two, one female assistant who interviewed the women together with one male assistant who interviewed the men. I was assisting a different team each day. The survey team stayed at the villages during the data collection. If possible, the whole team stayed at the same house. Each day it was randomly chosen which team is going to which village. The teams were helping each other out if they finished earlier in one village or if there were less than ten households available. The local chief of each community was contacted by a member of the survey team and helped to gather the families at a chosen village square, where the research team explained the procedure of the study to the participating families. The interviews were later taken next to the homes of the interviewees in a quiet surrounding in avoidance of any distractions. Data was collected by using the Software *AkvoFlow*, downloaded on tablets. Every member of the survey team owned a tablet for the electronic data collection. As some technical problems occurred, some interviews were implemented on paper and later transferred into excel sheets.

Consent

If the participants decided to be part of this study, a consent was reached and needed to be signed beforehand to better understand what this study is about, how the information is going to be used and to ensure that the participation in this study happens voluntarily. The consent was written in English language. As many of the participants did not speak English, it was translated from the research assistant into the participant's mother language, which was mainly Mende. Particular attention was taken that the questionnaires were administered to the participants in a quite surrounding with no other people or activities interfering. The consent was either signed with a pen or by fingerprint, depending on the participants ability to write. If the mother or father was younger than 18 years, the closest family member available had to sign the consent form for them.

In-depth Interviews (IDI)

Two household surveys were composed – one for the female and one for the male respondents. The surveys included following sections: socio-demographic information, dietary intake and food consumption pattern. The female survey included more variables than the male one, like child's nutrition and nutrition related decision-making power of men and women. The enumerators were trained before the data collection and the questionnaires were pre-tested before actual data collection. The questionnaires were structured with open- and close-ended questions. The language of the interview questions was English, the interviewers translated them for the respondents into their mother language and translated their answers back to English.

Dietary Assessment

To assess the dietary intake of the participants 24HR were conducted. All food intakes, including snacks and beverages, consumed in the last 24 hours prior the interview had to be listed. Mothers were additionally asked to describe the food intake of their child. To assess every food that had been consumed the day before, the enumerators were asking neutral questions. For example, it was not asked what was eaten for breakfast the day before but what was the first food they ate after getting up in the morning. Furthermore, if the interviewee did not mention common ingredients for typical and widespread meals in the area, the

interviewer asked again to make sure they did not miss out on anything. Every food was first coded into 18 food groups and further aggregated into ten food groups according to the Food and Agriculture Organization (FAO) *Minimum Dietary Diversity for Women: A Guide for Measurement* guidelines, to identify the minimum dietary diversity (MDD) score for both, women and men, as there are no specific guidelines for dietary diversity among men. In regard to the *Indicators for assessing infant and young child feeding practices* of the WHO, the food groups where aggregated into seven groups for the assessment of the minimum dietary diversity for infants and children (MDD-IYC).

Food Groups during the interview	**Aggregated food groups for MDD for women and men**	**Aggregated food groups for MDD-IYC for children**
Food made from Grains (A)	Grains, white roots, tubers and plantains (A, B)	Grains, roots and tubers (A, B)
White roots and tubers and plantains (B)	Pulses (Peas, Beans and Lentils) (C)	Legumes and Nuts (C, D)
Pulses (C)	Nuts and Seeds (D)	Dairy products (E)
Nuts and Seeds (D)	Dairy (E)	Flesh foods (F, G, H)
Milk and milk products (E)	Meat, Poultry and Fish (F, G, H)	Eggs (I)
Organ meat (F)	Eggs (I)	Vitamin A rich fruits and vegetables (J, K, L)
Meat and poultry (G)	Dark green leavy vegetables (J)	Other fruits and vegetables (M, N)
Fish and seafood (H)	Vitamin A rich fruits and vegetables (K, L)	
Eggs (I)	Other vegetables (M)	
Dark green leavy vegetables (J)	Other fruits (N)	
Vitamin A rich vegetables, roots and tubers (K)		
Vitamin A rich fruits (L)		
Other vegetables (M)		
Other fruits (N)		
Other food with sugar (O)		
Beverages (P)		
Oils and Fats (Q)		
Spices and Condiments (R)		

Table 1: Food groups for MDD assessment for women, men and children

5.6. Data management and analysis

Data entry, including quality check, was performed with Microsoft Excel. MDD was calculated by summing the number of consumed food groups by each of the household member over the 24-hour dietary recall (24HR) period. If a food group was consumed, a score of one was given. Leading to a maximum score of ten among women and men and seven among children. For analysis, the data was entered into Statistical Package for Social Science (SPSS) version 22 (IBM SPSS Statistics 22). The impact of determinants on dietary diversity were assessed using (M)ANOVA ((Multivariate) Analysis of Variance). The answers on qualitative questions were summarized for each of the questions and categorized into groups.

6. Results

The average MDD of the 768 women and the 738 men conducted for this study was calculated to be 4,21+/- 1,11 and 4,39 +/- 1,05. Those results showed a significant difference between the MDD of women and men ($p = 0,002$). A minimum dietary diversity is achieved by consuming foods from at least five different food groups per day. Therefore, the average MDD is slightly below the recommendation. 438 women (57%) and 373 men (50,5%) scored an MDD below five, which means that more than a half of women and men had an insufficient dietary diversity. From those, more women were living in Bo than in Pujehun (N=225 (51,4%), N=213, (48,6%)). On contrast, more men living in Pujehun consumed less than five food groups compared to Bo (N=196 (52,5%), N=177 (47,5%)). In general, 811 women and men of the whole sample (53,9%, N=1505) scored an MDD below five. From those, 402 (49,6%) live in Bo and 409 (50,4%) in Pujehun, which represents that there is almost no difference in reaching the recommended food group intake between the individuals of those two districts.
The mean meal frequency was 2,14 +/- 0,72 for women and 2,07 +/- 0,63 for men with a minimum of one meal and up to four meals a day. The mean meal frequency is significantly lower in Bo compared to Pujehun (1,97 +/- 0,69, 2,23 +/- 0,64, $p < 0,001$).
Neither the age nor the district seems to correlate with the MDD. Growing own vegetables and/or fruits as well as owning livestock also do not show a significant

effect on the diversity of the diet. However, owning livestock in addition to growing vegetables shows the highest number of individuals consuming more than five food groups.

768 children were assessed in this study. 32 children were breastfed only, 539 children were breastfed and received complementary feeding and 197 were not breastfed anymore and only received solid, semi-solid and soft food. 16 children of the ones who were breastfed only were older than six months, meaning that the introduction to complementary feeding happened to late.

The average MDD-IYC of breastfed children was 3,04 +/- 1,45, showing that the diversity in these children's diet is too low. The MDD-IYC of non-breastfed children was calculated to be 3,96 +/- 1,06, which is just slightly below the recommendation of four or more food groups. 237 of 539 breastfed children (44%) consumed foods from four or more different food groups, while 149 of 197 non-breastfed children (75,6%) reached this recommendation.

96 children were between the age of 6-8 months, 21 of them only received breastmilk. Three of them were not breastfed anymore. The remaining 72 children had a mean meal frequency of 2,33 +/- 0,67, which represents a sufficient amount of meals for that age. Eight of these children consumed one meal only. One single child ate a snack. 666 children of the sample were between 9-24 months old. 463 were breastfed and received complementary food. Eleven of them received breastmilk only and 192 were not breastfed anymore. The mean meal frequency was 2,3 +/- 0,69 meals, which is too low for that age. 409 of 655 children (62,4%) consumed one or two meals, which is an insufficient amount of meals a day for that age. 246 children (37,6%) received three or four meals. Almost 90% of children in that age did not eat any snacks, around 10% consumed one or two snacks. The age of six children is missing, two of them were not breastfed anymore.

In both, adults and children, the least frequent consumed foods are vitamin A rich fruits and vegetables. Vitamin A deficiency (VAD) and its negative health impacts remain a concerning public health burden throughout Sierra Leone, especially for children and women at reproductive age. Therefore, a higher intake would be beneficial. [Hodges et al, 2015].

Socio-demographic and -economic characteristics of the sample

Examining women and men together, the mean age was 31,9 +/- 9,7 years. Table 2 shows the minimum and maximum age of the sample, including mean age and standard deviation, separated between women and men. The age of six women and five men remained unknown.

	N	MIN	MAX	MEAN +/- SD
WOMEN	762	15	70	28,2 +/- 7,6
MEN	733	18	82	35,8 +/- 10,2

Table 2: Summary of age of women and men in years

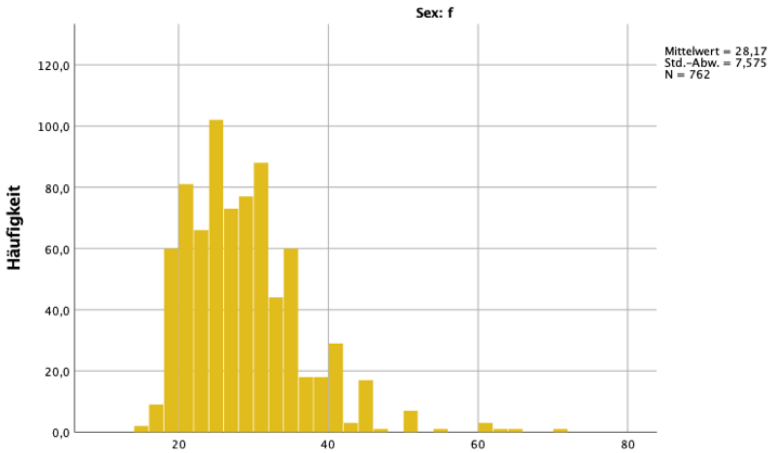

Table 3: Age distribution of women

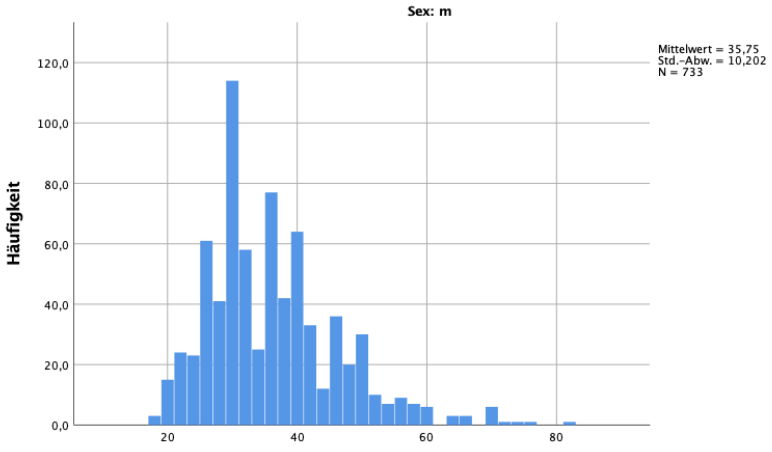

Table 4: Age distribution of men

Of the 768 included children in this study, 402 (52,3%) were female and 366 (47,4%) were male. The mean age was 15,5 +/- 5,56 months. The age of six children is missing.

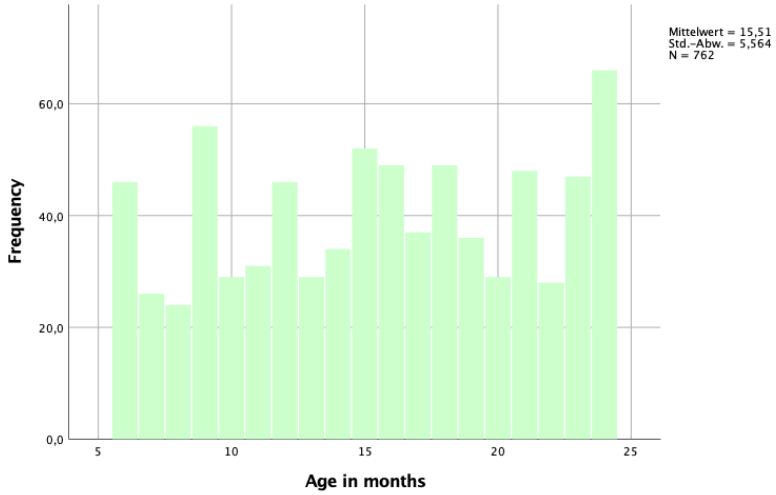

Table 5: Age distribution of children

Religion

87% of the sample were Muslims and 13% were Christians.

Employment

As mentioned in chapter 4.10, farming is the main livelihood in Sierra Leone. This is also represented in the present study. 667 women and 500 men reported to be farm workers, accounting for 77,5% of the study sample. Other occupations mentioned were miner, employee in a formal or informal sector, motor bike rider or trader.

Literacy

84,1% of women and 55,5% of men were not able to read and write. The following table gives detailed information about the levels of literacy of the sample. It shows that literacy levels among men are higher than among women.

	Women	Men	Total
Not able to read and write	646 (84,1%)	409 (55,4%)	1055 (70,1%)
Able to read and write to some extent	102 (13,3%)	213 (28,9%)	315 (20,9%)
I can read and write	20 (2,6%)	110 (14,9%)	130 (8,6%)
No data	0 (0,0%)	6 (0,8%)	6 (0,4%)
Total	768 (100%)	738 (100%)	1506 (100%)

Table 6: Literacy levels of women and men

Growing food crops and owning livestock

The majority of the sample stated to grow vegetables and/or fruits and to own livestock. Dark green leavy vegetables are the most grown vegetables. Further vegetables mentioned were okra, tomatoes and cucumber. Also, corn/maize and beans were named. Bananas and mangos were the most mentioned fruits, which were grown by the households of this sample. Also, citrus fruits, pineapples and guavas were named frequently. If a household owned livestock it was mostly chicken, followed by goats and sheep.

Table 7 shows the number of households growing vegetables and/or fruits and owning livestock during the past 12 months and details about how the food crops or animals and their products are used.

	N (% of total households)	Own consumption	Own consumption and sale	For sale	To give as a gift
Growing vegetables	550 (71,6%)	185 (33,6%)	312 (56,7%)	53 (9,7%)	
Growing fruits	388 (50,5%)	154 (39,7%)	189 (48,7%)	45 (11,6%)	
Owning Livestock	471 (61,3%)	227 (48,2%)	181 (38,4%)	52 (11,1%)	11 (2,3%)

Table 7: Use of food crops and livestock of households in the sample

Food crops were reported to be mainly used for both, own consumption and for sale, whereas the majority owned livestock for own consumption only. If vegetables, fruits or livestock were sold, it was either at the main local market or locally in the village. The money generated from selling the crops and/or animals or their products, are mostly spent on children's school fees, other foods, medicine or clothes.

Food shortages

661 (86,1%) women reported about not having enough food during the last 12 months. From those, 606 (91,7%) said that rice was the food they did not have enough of. Rice is the most desired and valued food item. Almost all of the women mentioned that they would like to add more rice to their meals to make them healthier. Other foods lacking were cassava, yam and green vegetables. Food shortages were mostly reported during the rainy season in August and September, followed by July. The months from January to June were also mentioned frequently. The least mentioned months were October to December.

6.1. Dietary diversity of women and men

More than half of both, women and men, did not consume the recommended five or more food groups. However, more men than women reached the recommended dietary diversity. The following table shows the MDD scored by women and men of the study sample.

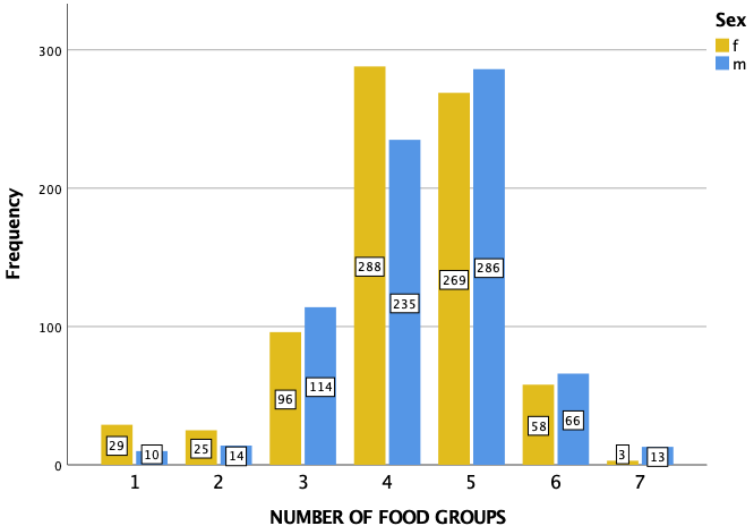

Table 8: MDD of women and men of the study sample

The following two tables (Table 9 and Table 10) show the percentage of consumed food groups by the various scores of dietary diversities, separated for men and women. As shown in Table 8, the dietary diversity scores range from one to seven groups in both sexes

MDD-Women	1 (N=29)	2 (N=25)	3 (N=96)	4 (N=288)	5 (N=269)	6 (N=58)	7 (N=3)
Food made from Grains (A)	72,4	64,0	71,9	90,6	99,3	100	100
White roots and tubers and plantains (B)	58,6	60	58,3	56,6	59,9	48,3	33.3
Pulses (C)	0,0	0,0	1,0	1,7	6,7	75,9	66,7
Nuts and Seeds (D)	0,0	8,0	9,4	33,7	92,2	100	100
Milk and milk products (E)	0,0	0,0	0,0	0,0	0,7	3,4	33,3
Organ meat (F)	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Meat and poultry (G)	0,0	0	2,1	3,1	5,9	10,3	0,0
Fish and seafood (H)	0,0	44	85,4	96,6	98,3	100	91
Eggs (I)	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Dark green leavy vegetables (J)	0,0	32	61,5	73,6	98,1	100	100
Vitamin A rich vegetables, roots and tubers (K)	0,0	8,0	3,1	1,7	2,2	8,6	66,7
Vitamin A rich fruits (L)	0,0	0,0	0,0	0,0	0,0	1,7	0,0
Other vegetables (M)	0,0	8,0	39,6	91	97,8	100	100
Other fruits (N)	3,4	4,0	1,0	0,7	2,2	10,3	33,3

Table 9: Consumed food groups of women by various MDD scores, in %

MDD-Men	1 (N=10)	2 (N=14)	3 (N=114)	4 (N=235)	5 (N=286)	6 (N=66)	7 (N=13)
Food made from Grains (A)	50	42,9	82,5	94,9	99,0	100	100
White roots and tubers and plantains (B)	80,0	64,3	71,1	58,3	58,7	66,7	61,5
Pulses (C)	0,0	0,0	0,9	3,4	11,2	54,5	61,5
Nuts and Seeds (D)	0,0	0,0	7,9	34,0	85	92,4	100
Milk and milk products (E)	0,0	0,0	0,0	0,9	2,1	15,2	38,5
Organ meat (F)	0,0	0,0	0,9	0,0	0,3	0	0
Meat and poultry (G)	0,0	7,1	3,5	6,8	11,9	16,7	30,8
Fish and seafood (H)	0,0	78,6	86,0	97,4	97,6	97,0	100
Eggs (I)	0,0	0,0	0,0	0,0	0,3	3,0	15,4
Dark green leavy vegetables (J)	0,0	0,0	64,9	79,6	94,4	98,5	100
Vitamin A rich vegetables, roots and tubers (K)	0,0	0,0	0,9	2,1	2,8	7,6	7,7
Vitamin A rich fruits (L)	0,0	0,0	0,0	0,0	1,0	3,0	15,4
Other vegetables (M)	0,0	21,4	36	80,9	97,2	98,5	100
Other fruits (N)	0,0	0,0	1,8	1,3	5,9	27,3	61,5

Table 10: Consumed food groups of men by various MDD scores, in %

The diet of women and men is dominated by *Food made from Grains* and *White roots, tubers and plantains*, followed by *Meat and poultry* and *Fish and seafood.* Around 80% consumed *Dark green leavy vegetables* or *Other vegetables*. More than half of women and men consumed *Nuts and Seeds.* On contrast, the consumption of *Other fruits* and *Vitamin A rich fruits and vegetables* was very low. However, men tend to eat more of those food groups. The least consumed food groups were *Milk and milk products* and *Eggs,* as they were not available in most of the villages. Further details of each of the food groups are listed in Chapter 8.3.

Meal frequency

Most women and men consumed two meals on that day. More women than men consumed three meals a day, but also more women than men consumed only one meal. A very small number of women and men consumed four meals.

Number of meals	Women	Men
1	144 (18,8%)	118 (16,0%)
2	385 (50,1%)	451 (61,1%)
3	230 (29,9%)	166 (22,5%)
4	9 (1,2%)	3 (0,4%)

Table 11: Meal frequency of women and men

The majority of women and men did not eat any snacks. 158 women responded to have eaten one, two or three snacks, while 239 men consumed at least one and up to five snacks.

Number of snacks	Women	Men
0	610 (79,4%)	499 (67,6%)
1	129 (16,8%)	150 (20,3%)
2	28 (3,6%)	68 (9,2%)
3	1 (0,1%)	16 (2,2%)
4	0 (0,0%)	2 (0,3%)
5	0 (0,0%)	3 (0,4%)

Table 12: Snack consumption of women and men

6.2. Dietary diversity of children

Breastfed infants 6-8 months

96 children of the sample were between the age of 6-8 months, 21 of them received breastmilk only. 72 infants were breastfed and received solid, semi-solid and soft food. The mean MDD was calculated to be 2,12 +/- 1,11. Only 7 children met the recommendations and consumed four or more food groups.

Breastfed young children 9-24 months

666 children of the sample were between 9-24 months old. Eleven of them received breastmilk only. These eleven children had an insufficient diet because the introduction to solid, semi-solid or soft food happened too late. 463 of those were breastfed and additionally fed solid, semi-solid and soft food. The MDD is 3,17 +/- 1,44 and therefore below the recommendation of four or more food groups.

Non-breastfed children, 6-24 months

Three infants aged 6-8 months and 192 children aged 9-24 months were not breastfed anymore. They scored the highest mean MDD of 3,96 +/- 1,06. Thus, this group of children was most likely to meet the recommended dietary food group intake.

Meal frequency of children

Infants 6-8 months, breastfed

The mean meal frequency among infants was 2,33 +/- 0,66, which represents a sufficient amount of meals for that age. Eight of the children (10,7%) consumed one meal only, while 64 children (89,3%) reached the recommendation of two-three meals a day. One single child in that age group ate a snack.

Children 9-24 months, breastfed

This group of children scored a mean meal frequency of 2,21 +/- 0,68, which is too low for that age. Only around a third of these children (N=157, 33,9%) consumed the recommended three or more meals a day. The majority of children at that age (almost 90%) did not eat any snacks, the remaining 10% consumed one or two snacks.

Children 6-24 months, non-breastfed

The mean meal frequency among non-breastfed children was 2,39 +/- 0,69, which is slightly higher compared to both of the other groups, but still too low for non-breastfed children. Less than half of these children (N=93, 47,2%) consumed three or more meals.

Minimum acceptable diet

The minimum acceptable diet (MAD) of children consists of the two indicators *Minimum Dietary Diversity*, which should be four or more out of seven food groups and the *Minimum Meal Frequency*. According to the WHO guidelines, breastfed infants 6-8 months old should be fed 2-3 meals per day and children between 9-23 months should be fed 3-4 meals per day, with optional 1-2 additional snacks. Non-breastfed children should be given 3-4 meals, including 1-2 cups of milk per day [WHO, 2010].

According to this definition, only seven infants 6-8 months (9,3%) and 138 children 9-24 months (21,2%) reached a MAD, which represents a consumption of at least two meals for infants and three meals for young children a day and a score of four or more food groups.

The following figures visualize that non-breastfed children were more likely to consume a higher number of meals than children which are still breastfed.

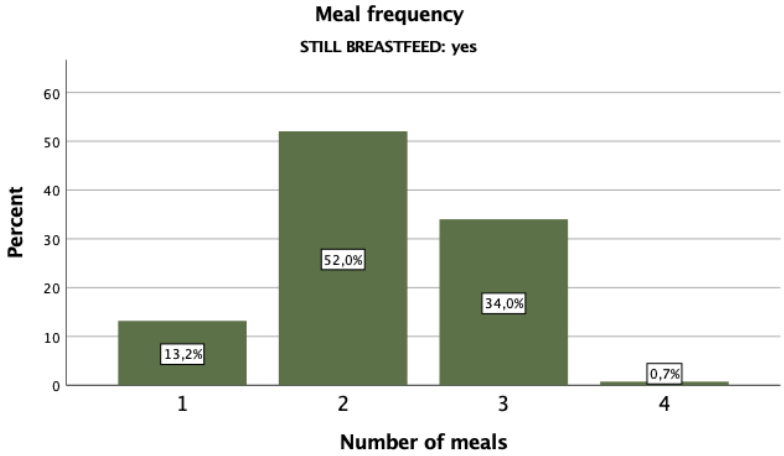

Table 13: Meal frequency of breastfed children

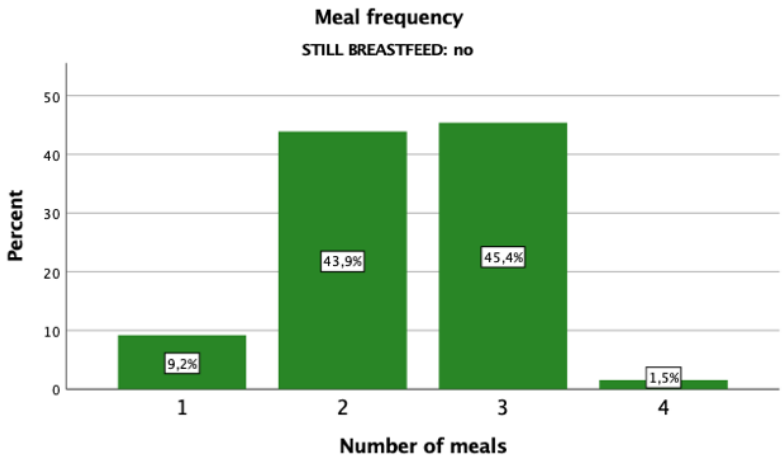

Table 14: Meal frequency of non-breastfed children

Additionally, the next tables (table 15 and 16) show the scored food group intake and illustrate that non-breastfed children were more likely to consume food from four or more different food groups and therefore having a sufficient diversity in their diet.

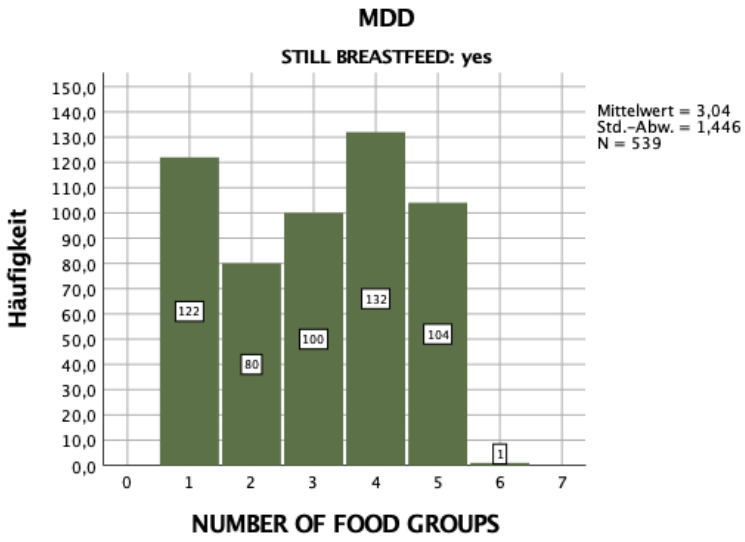

Table 15: MDD among breastfed children

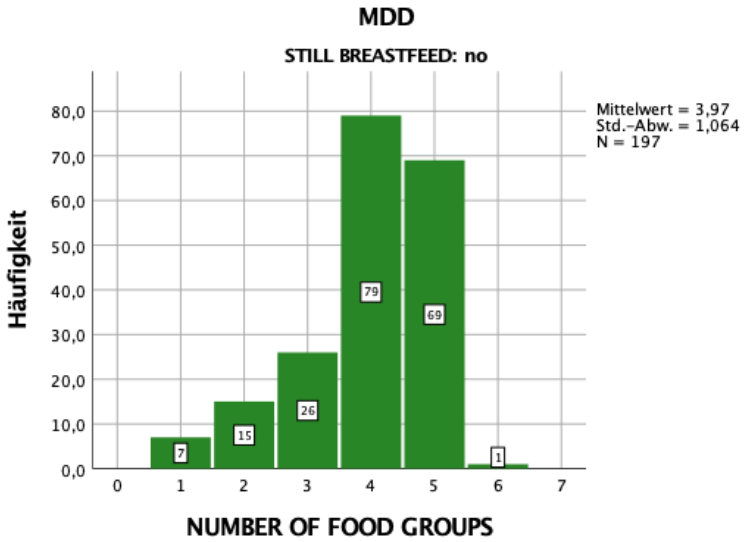

Table 16: MDD among non-breastfed children

Dietary patterns of children

The following table provides an overview about the MDD, meal frequency and the food group intake of all children, excluding only breastfed children.

INFANTS AND YOUNG CHILDREN 6-24 MONTHS	
N	736
MDD, mean +/- SD	3,28 +/- 1,41
MDD >= 4	386 (52,4%)
MDD < 4	350 (47,6%)
Meal frequency	2,27 +/- 0,68
Grains, white roots, tubers and plantains (A, B)	725 (98,5%)
Legumes and Nuts (C, D)	379 (51,5%)
Dairy products (D)	18 (2,4%)
Flesh foods (F, G, H)	507 (68,9%)
Eggs (I)	2 (0,3%)
Vitamin A rich fruits and vegetables (J, K, L)	395 (53,7%)
Other fruits vegetables (M, N)	391 (53,1%)

Table 17: MDD, meal frequency and food group consumption of children, excluding only breastfed children (N=32)

Due to different dietary needs of breastfed and non-breastfed children at different ages, the next table is separated by age and breastfeeding status, to get a better knowledge of the dietary supply of the children in this sample.

	BREASTFED INFANTS 6-8 MONTHS	BREASTFED CHILDREN 9-24 MONTHS	NON-BREASTFED CHILDREN 6-24 MONTHS
N	72	463	197
MDD, mean +/- SD	2,12 +/- 1,11	3,17 +/- 1,44	3,96 +/- 1,06
MDD >= 4	7 (7,3%)	227 (49,0%)	147 (76,6%)
MDD < 4	68 (90,7%)	236 (51,0%)	45 (23,4%)
Meal frequency, mean +/- SD	2,33 +/- 0,67	2,21 +/- 0,68	2,39 +/- 0,69
Grains, roots and tubers (A, B)	71 (94,7%)	457 (98,7%)	194 (98,5%)
Legumes and Nuts (C, D)	43 (57,3%)	233 (50,3%)	105 (53,3%)
Dairy products (E)	3 (3,1%)	10 (2,2%)	5 (2,5%)
Flesh foods (F, G, H)	27 (28,1%)	304 (65,7%)	171 (88,8%)
Eggs (I)	0 (0,0%)	2 (0,4%)	0 (0,0%)
Vitamin A rich fruits and vegetables (J, K, L)	8 (8,3%)	236 (51,0%)	148 (75,1%)
Other fruits and vegetables (M, N)	7 (7,3%)	227 (49,0%)	154 (78,2%)

Table 18: MDD, meal frequency and food group consumption separated by age; excluding only breastfed children (N=32) and breastfed children whose age is missing (N=4)

Similar to the parents, the children's diet is also dominated by *Grains, roots and tubers*. More than a half in every age group consumed *Legumes and Nuts*. A very common meal for children is the so-called rice pap, which is rice flour mixed with boiled water. Other ingredients like nuts and seeds or beans can also be added. The second most consumed food group are *Flesh foods*, mainly fish, and is especially high among non-breastfed children. The consumption of vegetables and fruits was very low among the youngest group, around 50% of breastfed children aged 9-24 months have eaten fruits or vegetables. The highest consumption rate was seen in the group of non-breastfed children.

Table 19 shows the percentages of the consumed food groups by the various scores of dietary diversities of all children assessed, ranging from one-five. Two children consumed six food groups, which is not representative for that sample and therefore not shown in this table.

MDD-IYC	1 (N=129)	2 (N=95)	3 (N=126)	4 (N=212)	5 (N=172)
Food made from Grains (A)	90,7	86,3	88,9	93,9	99,4
White roots and tubers and plantains (B)	10,1	15,8	34,1	50,9	50,6
Pulses (Beans, Peas and lentils) (C)	1,6	32,6	34,9	6,1	21,5
Nuts and Seeds (D)	3,9	69,5	47,6	33,0	94,8
Milk and milk products (E)	0,8	8,4	2,4	0,9	1,2
Organ meat (F)	0,0	0,0	0,0	0,0	0,0
Meat and poultry (G)	0,0	0,0	1,6	2,8	5,8
Fish and seafood (H)	0,0	17,9	89,7	94,8	99,4
Eggs (I)	0,0	0,0	0,8	0,5	0,0
Dark green leavy vegetables (J)	0,0	4,2	34,9	79,2	98,8
Vitamin A rich vegetables, roots and tubers (K)	0,0	0,0	1,6	2,8	2,3
Vitamin A rich fruits (L)	0,0	0,0	0,0	0,0	0,6
Other vegetables (M)	0,0	2,1	23,8	87,7	99,4
Other fruits (N)	0,0	0,0	0,0	1,4	0,6

Table 19: Consumed food groups of children by various by various MDD scores (in %)

6.3. Description of food groups

Food made from Grains (A)

Rice is the main staple food in Sierra Leone and accounts for a high amount of the daily energy intake. The majority of women, men and children ate rice at least once and up to three times on that day. Rice is the main ingredient in most common local dishes. It is mainly composed of carbohydrates and to a small content of proteins. Even though rice does not bring a very high nutritional value to the diet of Sierra Leoneans, it is seen as one of the healthiest food items. If available, rice is eaten several times a day. Industrial fortification of rice with vitamins and minerals could be a way to reduce micronutrient deficiencies, especially in countries like Sierra Leone, where people have limited access to

diversified foods. Rice can be fortified with zinc, iron and vitamin A. The fortification of rice with iron and vitamin A is recommended by the WHO to improve the iron status and vitamin A nutrition of populations. It has already been practiced for several years in many different countries worldwide and is seen as a way to reduce hidden hunger [Majumder, 2019, WHO, 2018].
Maize/corn is not a very common staple food in Sierra Leone, but a popular snack. Some women and men mentioned to have eaten roasted maize.

White roots and tubers and plantains (B)

Cassava is the second staple food in Sierra Leone and therefore also the most frequently mentioned food of this group. The roots can be eaten boiled or in raw form. It is mainly processed into Gari, a flour made of fermented cassava, or consumed as the main ingredient of a dish called foo-foo. To prepare this dish fermented and cooked cassava is formed into a ball with a dough-like consistency. It is either served with stew or green leavy vegetables. Cassava mainly consists of carbohydrates but is a better plant-based protein source than yams and potatoes, which are further foods mentioned during the 24HR, belonging to this food group. Cassava contains vitamins of the B complex group and minerals like calcium, iron, magnesium and zinc, but their content is found to be trivial. However, cassava is a good source of vitamin C, as the levels found in cassava roots are relatively high [Salvador et al., 2014]. Green bananas also belong to this group and were sometimes consumed together with oil and condiments as an alternative to staples.

Figure 13: Men producing Gari © Diana Höppel

Figure 14: Fermented and ready-to-eat cassava © Diana Höppel, 2019

Pulses (Peas, beans and lentils) (C)

Only a small number of women and men conducted in this present study mentioned to have eaten beans. If so, mostly broad beans were consumed. Compared to adults, children were eating beans more frequently, as they were often mixed into rice pap or porridge. Adding beans to these cereal-based meals for children enhances the nutritive density. Broad beans are rich in protein and fiber. Furthermore, they are a good source for iron [Negash et al., 2014].

Nuts and Seeds (D)

Groundnuts (peanuts) are widespread in Sierra Leone. Around 50% of women and men mentioned to have eaten them. They are locally produced and processed. The nuts get grounded with water until they reach a creamy and liquid consistency and are consumed as a soup or added to stew, served over rice or cassava. Boiled groundnuts are also a popular snack. Groundnuts contain many high valued nutritional compounds like proteins, fibers, polyphenols, antioxidants, vitamins and minerals. Apart from that, they are also an important source of resveratrol, phenolic acids, flavonoids and phytosterols, which have the function to block the absorption of cholesterol from diet. Recently, groundnuts have been recognized to be disease preventing and thought to promote longevity because of their high concentration of valuable bioactive compounds [Arya et al., 2016]. Benni are sesame seeds and also frequently eaten in Sierra Leone, especially by children, again as an ingredient of rice pap or porridge. Sesame seeds contain high amounts of polyunsaturated fatty acids, antioxidants and tocopherol homologues and have therefore numerous health benefits. Sesame seeds have antioxidative and anti-carcinogenic effects and are recently studied in tumor prevention and heart protection. They are also high in protein, vitamin B, dietary fiber and minerals like iron, magnesium, calcium, manganese, copper and zinc [Pathak et al., 2014].

Milk and milk products (E)

There are hardly any fresh milk or milk products consumed in Sierra Leone. Not a single person in this study mentioned to have consumed it. The only way milk was consumed was in form of powdered milk added to black coffee or tea, or as an ingredient of industrial biscuits.

Organ meat (F)

Organ meat did only occur once in this present study. One man mentioned to have eaten liver from a wildlife animal.

Meat and poultry (G)

The consumption of meat and poultry is moderate to low, as it is often too expensive or not available. If meat is consumed, it is either bushmeat or more often chicken. Bushmeat is meat of wildlife animals (including squirrels, bats, monkeys, rats, and snakes) hunted for human consumption. It is consumed either smoked, dried or cooked and provides a source of protein. Apart from the nutritional value for Sierra Leone's population, hunting and selling bushmeat can serve as an important source of income. However, people who hunt and prepare or consume undercooked bushmeat are at high risk of becoming infected with zoonotic diseases. Bushmeat related activities and bushmeat consumption have already been linked to numerous infection diseases outbreaks, for instance Ebola [Kurpiers et al, 2016]. Apart from that, bushmeat hunting is seen as an extinction threat for African wildlife, as hunting predominantly happens unregulated, illegal and unsustainable [Ripple et al., 2016]. Many households keep chicken. The meat is boiled or fried and added to green leavy vegetables or soups with rice or cassava. Keeping poultry is also seen to improve the livelihood of households, as the animals or animal products can also be sold instead of consumed.

Fish and seafood (H)

The majority of women, men and also children (9-24 months) of this study consumed fish. Fish is an important part of Sierra Leone's diet and the most commonly consumed animal-source food. Fish can be bought as dried fish or fresh sea fish in local markets. It is consumed either cooked or fried. Fish is an important food to improve the diets of Sierra Leoneans, because it is a relevant source of micronutrients, essential fatty acids and protein. Consumption of fish is especially important for young children, as the fatty acids promote optimal brain and neurological development.

Figure 15: Fresh sea fish at a market © Diana Höppel, 2019

Fish production also leads to an improved food and nutrition security, income generation and livelihood opportunities in Sierra Leone [Pasquallino et al, 2016].

Eggs (I)

Even though many households keep chicken, there are hardly any eggs consumed. The majority of mothers would like to add eggs to the meals and also give it to their children but claim that they are not available and/or not affordable.

Dark green leavy vegetables (J)

Dark green leavy vegetables are very common and consumed to a high extent among women, men and children. Potato and cassava leaves are mentioned most frequently, followed by crain crain or okra leaves. Leavy vegetables are not eaten in their unprocessed and raw form but rather cooked. The leaves are usually prepared with oil, peppers and condiments and served over rice. Cooking vegetables lead to better hygienic quality, enhanced digestibility and to an increased nutritional value. According to findings of a study, cooking leavy vegetables decreases the vitamin C content but leads to a release of more phenolic compounds and higher antioxidant activities [Adefegah and Oboh, 2011].

Figure 16: Raw cassava leaves © Diana Höppel, 2019

Figure 17: Raw potato leaves © Diana Höppel, 2019

Figure 18: Cooked potato leaves with palm oil, served over rice © Diana Höppel, 2019

Vitamin A rich vegetables, roots and tubers (K)

Only a very small percentage of women and men consumed food from this group. The only mentioned vegetable belonging to this group was pumpkin. Carrots are not common and were not mentioned at all. The low consumption of pumpkin might be due to unavailability and/or unaffordable prices. A more frequent consumption would be desired, especially among young women and children, to reduce the risk of vitamin A deficiencies. In course of the interview, women were asked what special foods pregnant and lactating women need, only 43 answered vitamin A rich fruits and vegetables. 49 women would like to add some pounded pumpkin into the children's food to make it more nutritious. Vitamin A deficiency remains a serious health problem among children and can lead to an increase in morbidity and mortality due to common childhood infections, like diarrheal disease and measles, and visual impairment [Sesay et al., 2015]. Therefore, children in Sierra Leone aged 6-59 months receive vitamin A supplementation (VAS) twice a year through Maternal and Child Health Week [Hodges et al., 2013]. Additionally, an educational intervention focusing on special needs of vitamins might be beneficial to raise more awareness about the importance of vitamin A.

Vitamin A rich fruits (L)

The only fruit consumed fitting in this food group is pawpaw, which is the local word for papaya and is only consumed to a very low extent. More than half of the women mentioned, that they do not give pawpaw to their children because it is not available in their communities. Therefore, the low consumption of pawpaw and other vitamin A rich fruits like mangos might be due to unavailability during the rainy season and may improve during the months of dry season.

Other vegetables (M)

The score of this food group was high. If both, men and women, scored an MDD of three, around a third consumed vegetables belonging to this group. When scoring five food groups, nearly all (97%) consumed some vegetables. Onions are an essential ingredient of stews and soups served with starchy staples. Another very common vegetable, mostly also added to the stew of leavy vegetables, was okra. Furthermore, tomatoes were mentioned to have been used

to prepare meals, either in fresh or tinned form. Men also mentioned to have eaten cucumbers as a snack.

Other fruits (N)

The consumption rates of this group were very low. Fruits, which were available during the rainy season but rarely eaten were guavas, coconuts and ripe bananas. A reason for the low consumption might be that fruits are not consumed as a part of a meal. Hardly any women and just a few men ate a fruit as a snack.

Other food with sugar (O)

Sugar is not consumed very often. If so, it is added to a cup of tea or coffee and sometimes to self-baked biscuits or consumed as an ingredient of industrial biscuits. Compared to adults, more children consume sugar, as it is often added to rice pap or porridge. Some children get fed with imported “corn milk pap” or “glucose biscuits”, which also contain sugar.

Beverages (P)

Not a single industrial sugar-sweetened beverage was mentioned during the 24HR. The only beverages sometimes consumed were black tea and coffee with added sugar by the customer.

Oils and Fats (Q)

Hardly any women or men consumed animal fat. Mayonnaise was the only product mentioned very seldom. Some people ate it along with bread and tea. Plant-based oil is very important and consumed a lot, as it is used in a large amount to prepare the most common dishes. It is either vegetable oil or locally produced palm kernel oil or red palm oil. Palm kernel oil is extracted from the palm kernel seeds and rich in saturated fatty acids and acidic amino acids. It contains high levels of minerals like potassium, phosphorus, magnesium and calcium and is also rich in niacin [Kok et al., 2011]. Red palm oil is produced from the flesh of the palm fruit. It is seen as one of the world’s richest natural plant source of highly bioavailable beta-carotene and alpha-carotene, which give the oil it’s orange-red color. The oil is known to be an excellent source of phytonutrients and vitamin A. It has already been used as a food-based

intervention to reduce VAD in some human feeding studies [Burri, 2012]. Red palm oil is also considered to have several health benefits due to possible antiatherogenic, antihemorrhagic, antihypertensive, anticancer, and anti-infective prosperities [Loganathan et al., 2017].

Figure 19: Woman preparing palm kernel oil © Diana Höppel, 2019

Figure 20: Woman filling red palm oil into containers for storage © Diana Höppel, 2019

Spices and Condiments (R)

Maggi, a spice mix and food flavor enhancer in cube form, and salt were components of almost every meal. As Sierra Leoneans love to eat hot and spicy, several (chili) peppers were pounded and used to season meals.

Figure 21: Maggi and other seasonings at the market © Diana Höppel, 2019

Figure 22: Red and green peppers © Diana Höppel, 2019

6.4. Determinants of dietary diversity

Sex

Men had a significant higher MDD compared to women. Also, the intake of *Dairy, Meat, Poultry and Fish, Eggs* and *Other fruits* was significantly different between women and men (Appendixes 3-5). In all of the food groups, except for *Other Vegetables*, men were the ones consuming more of it. These results show, that the sex influences the dietary diversity and food consumption patterns to some extent.

The following table (Table 20) shows the mean MDD +/-SD, MDD < / >= 5, the mean meal frequency and the food consumption patterns of women and men.

	WOMEN	**MEN**	**p-value**
N	768	738	-
MDD, mean +/- SD	4,21 +/- 1,11	4,39 +/- 1,05	**p = 0,002**
MDD >= 5	330 (43,0%)	365 (49,5%)	**p = 0,012**
MDD < 5	438 (57%)	373 (50,5%)	
Meal frequency	2,14 +/- 0,72	2,07 +/- 0,63	p = 0,074
Grains, white roots, tubers and plantains (A, B)	765 (99,6%)	737 (99,7%)	p = 0,337
Pulses (Peas, Beans and Lentils) (C)	70 (9,1%)	85 (11,5%)	p = 0,125
Nuts and Seeds (D)	517 (54,3%)	406 (55%)	p = 0,780
Dairy (E)	5 (0,7%)	23 (3,1%)	**p < 0,001**
Meat, Poultry and Fish (F, G, H)	704 (91,7%)	706 (95,7%)	**p = 0,001**
Eggs (I)	0 (0,0%)	5 (0,7%)	**p = 0,022**
Dark green leavy vegetables (J)	604 (78,6%)	609 (82,5%)	p = 0,058
Vitamin A rich fruits and vegetables (K, L)	24 (3,1%)	27 (3,7%)	p = 0,567
Other vegetables (M)	626 (81,5%)	591 (80,1%)	p = 0,482
Other fruits (N)	18 (2,3%)	48 (6,5%)	**p < 0,000**

Table 20: MDD and food group intake of women and men in %, p-values: ANOVA, significance p < 0,05

Age

The Following figures show that there is no indication of a correlation between the age and the food group intake of women and men. This concludes, that the age does not influence the food group intake of women and men.

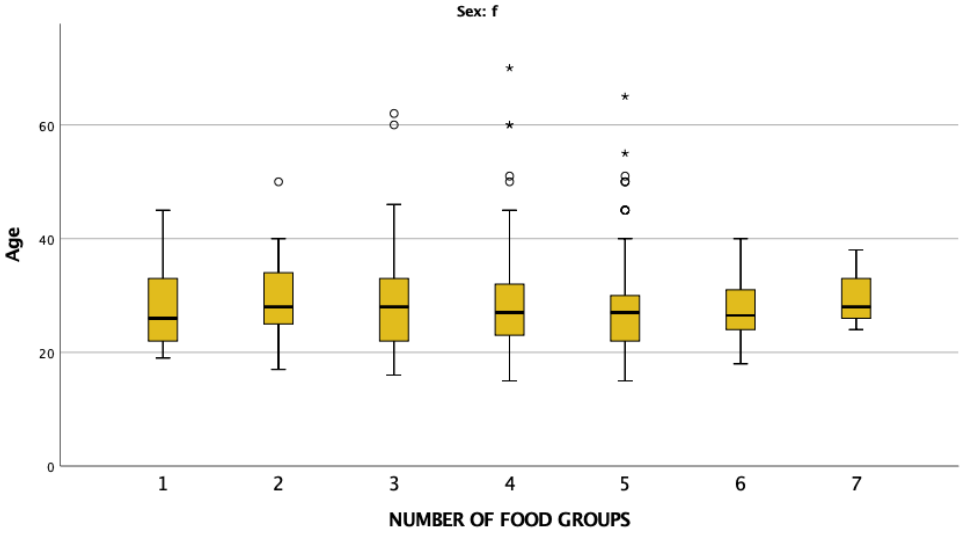

Table 21: Boxplot for MDD and age of women

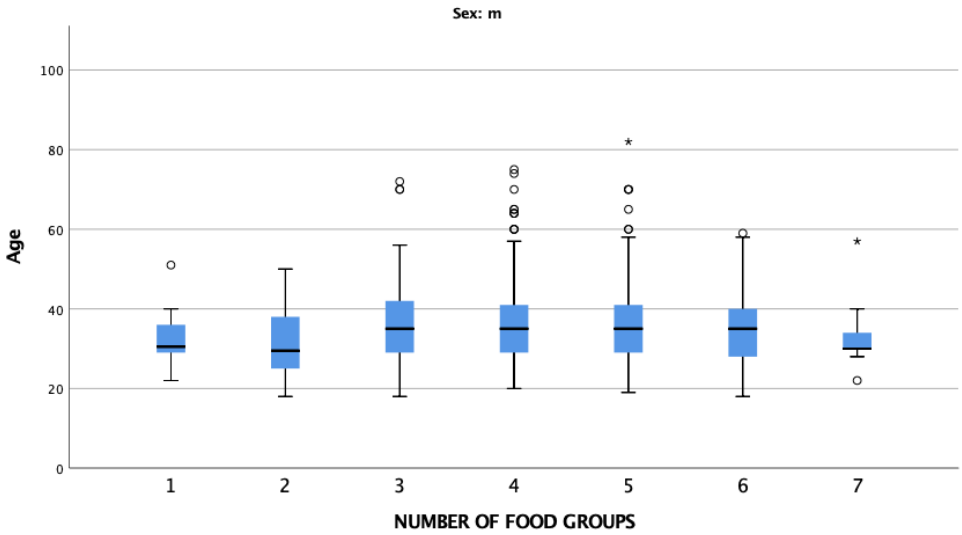

Table 22: Boxplot for MDD and age of men

The next boxplot shows that the MDD seems to increase with the age of children. Therefore, a Spearman Correlation was done, which confirmed that there is a correlation between the age of the children and the food group intake (Appendix 6). The number of consumed food groups rises with the age.

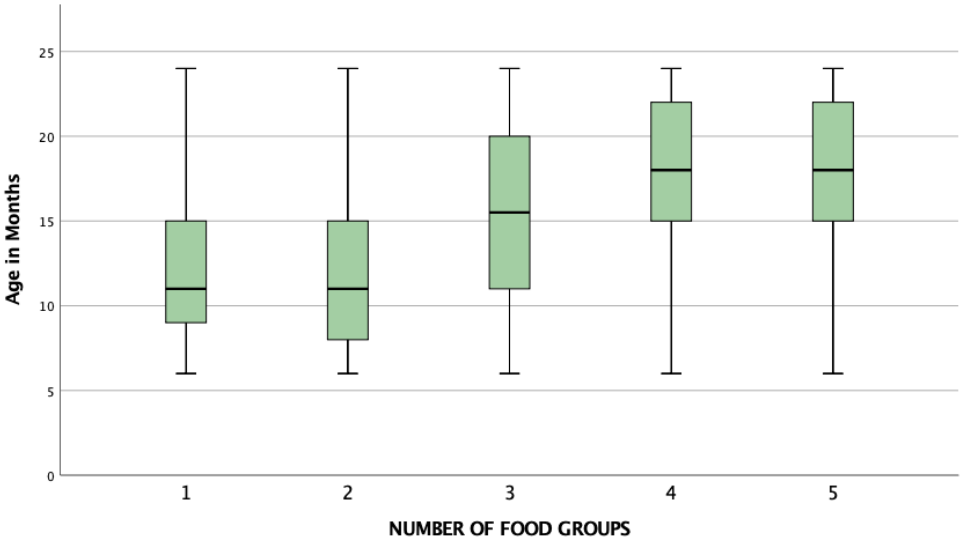

Table 23: Boxplot for MDD-IYC and age

District

The total sample consists of 745 women and men from Bo and 761 women and men from Pujehun. In both districts less than half of women and men consumed five or more food groups a day. The numbers are very similar – 343 people in Bo (46,0%) and 354 people in Pujehun (46,3%) reached a MDD of five or more. The mean MDD of women and men together is 4,30 +/- 1,08 in Bo and 4,29 +/- 1,08 in Pujehun, which represents that there is almost no difference between the dietary diversity of individuals living in Bo and Pujehun.

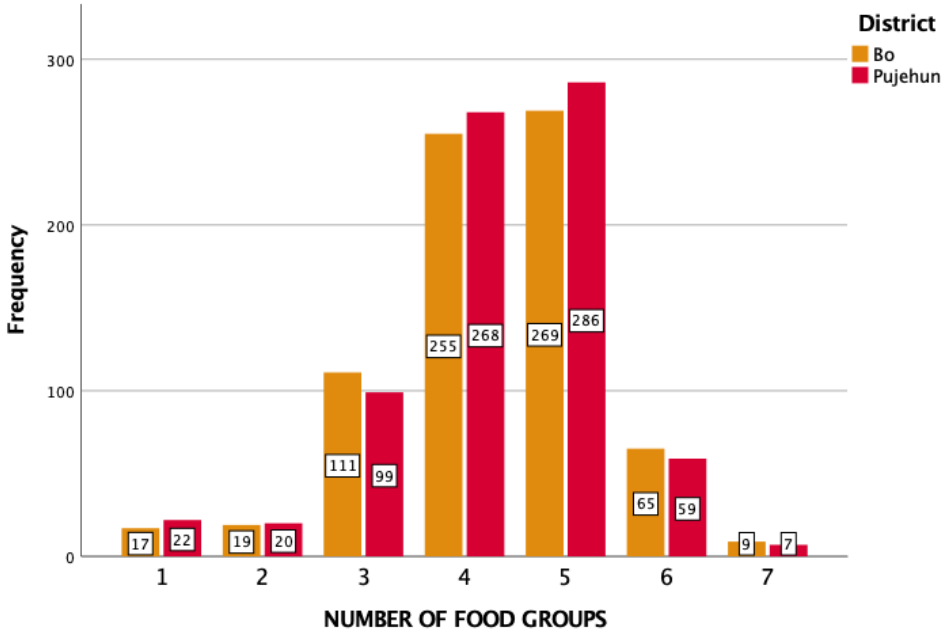

Table 24: MDD of women and men in Bo (N=745) and Pujehun (N=761)

Table 25 shows the MDD, meal frequency and consumption patterns of women and men conducted for this study separated by district to get a better understanding of the differences between Bo and Pujehun district. There are significant differences of the meal frequency and the consumption of *Pulses*, *Meat, Poultry and Fish* and *Vitamin A rich fruits and vegetables* between the individuals of both districts (Appendixes 7-8).

	BO	PUJEHUN	p-value
N	745	761	-
MDD, mean +/- SD	4,30 +/- 1,09	4,29 +/- 1,09	p = 0,799
MDD >= 5	343 (46,0 %)	352 (46,3 %)	p = 0,933
MDD < 5	402 (54,0 %)	409 (53,7 %)	
Meal frequency	1,97 +/- 0,69	2,23 +/- 0,64	**p < 0,001**
Grains, white roots, tubers and plantains (A, B)	743 (99,7 %)	759 (99,7 %)	p = 0,983
Pulses (Peas, Beans and Lentils) (C)	89 (11,9 %)	66 (8,7 %)	**p = 0,037**
Nuts and Seeds (D)	392 (52,6 %)	431 (56,6 %)	p = 0,117
Dairy (E)	17 (2,3 %)	11 (1,4 %)	p = 0,113
Meat, Poultry and Fish (F, G, H)	690 (92,6 %)	720 (94,6 %)	**p = 0,001**
Eggs (I)	3 (0,4 %)	2 (0,3 %)	p = 0,637
Dark green leavy vegetables (J)	606 (81,3 %)	607 (79,8 %)	p = 0,439
Vitamin A rich fruits and vegetables (K, L)	42 (5,6 %)	9 (1,2 %)	**p < 0,001**
Other vegetables (M)	589 (79,1 %)	628 (82,5 %)	p = 0,088
Other fruits (N)	35 (4,7 %)	31 (4,1 %)	p = 0,554

Table 25: MDD, meal frequency and consumption patterns of women and men, separated by district

The following table (table 26) describes the impact of the district on MDD and food consumption patterns of women and men. There was no significant difference in the MDD and the number of consumed food groups between women and between men living either in Bo or in Pujehun. On contrast, the meal frequency showed a significant difference. The meal frequency of both women and men was higher in Pujehun. Additionally, there were significant differences between women in consuming *Vitamin A rich fruits and vegetables* as well as *Other Vegetables*. Women in Bo consumed clearly more *Vitamin A rich fruits,* while women in Pujehun had a higher intake of *Other Vegetables*. Men showed a significant difference in the intake of *Pulses* and also *Vitamin A rich fruits*, both food groups were more consumed in Bo (Appendixes 9-12).

	Women		p-values	Men		p-values
District	**Bo**	**Pujehun**		**Bo**	**Pujehun**	
N	380	388		365	373	
MDD, mean +/- SD	4,19 +/- 1,11[a]	4,23 +/- 1,12	p = 0,575	4,42 +/- 1,05[a]	4,35 +/- 1,06	p = 0,326
MDD >= 5	155 (40,8%)[a]	175 (45,1%)	p = 0,228	188 (51,5%)[a]	177 (47,5%)	p = 0,227
MDD < 5	225 (59,2%)[a]	213 (54,9%)		177 (48,5%)[a]	196 (52,5%)	
Meal frequency	1,97 +/- 0,72	2,30 +/- 0,67 [a]	**p < 0,001**	1,98 +/- 0,64	2,17 +/- 0,60 [a]	**p < 0,001**
Grains, white roots, tubers and plantains (A, B)	379 (99,7%)	386 (99,5%)	p = 0,576	364 (99,7%)	373 (100%)	p = 0,312
Pulses (Peas, Beans and Lentils) I	38 (10%)	32 (8,2%)	p = 0,399	51 (14%)	34 (9,1%)	**p = 0,039**
Nuts and Seeds (D)	200 (52,6%)	217 (55,9%)	p = 0,360	192 (52,6%)	214 (57,4%)	p = 0,193
Dairy I	3 (0,8%) [a]	2 (0,5%)[b]	p = 0, 637	14 (3,8%)[a]	9 (2,4%)[b]	p = 0,267
Meat, Poultry and Fish (F, G, H)	344 (90,5%)[a]	360 (92,8%)[b]	p = 0,258	346 (94,8%)[a]	360 (96,5%)[b]	p = 0,252
Eggs (I)	0 (0,0%)	0 (0,0%)	-	3 (0,8%)	2 (0,5%)	p = 0,637
Dark green leavy vegetables (J)	305 (80,3%)	299 (77,1%)	p = 0,280	301 (82,5%)	308 (82,6%)	p = 0,969
Vitamin A rich fruits and vegetables (K, L)	20 (5,3%)	4 (1,0%)	**p = 0,001**	22 (6,0%)	5 (1,3%)	**p = 0,001**
Other vegetables (M)	292 (76,8%)	334 (86,1%)[a]	**p = 0,001**	297 (81.4%)	294 (78,8%)[a]	p = 0,387
Other fruits (N)	10 (2,6%)[a]	8 (2,1%)[b]	p = 0,602	25 (6,8%)[a]	23 (6,2%)[b]	p = 0,707

*Table 26: MDD, meal frequency and consumption patterns of the sample, separated by sex and district – p-values show differences between women of Bo and Pujehun and men of Bo and Pujehun district; values within a row sharing a common superscript letter (a,b) are significantly different between men and women within the same district, *significance p < 0,05 ANOVA and MANOVA*

Table 20 compares the food intake between women and men in general, while table 26 compares the food intake between women and men additionally by district. The mean MDD, as well as the number of women and men scoring less than five or more food groups is significantly different between women and men within Bo but not within Pujehun. The consumption rates of *Dairy*, *Meat*, *Poultry* and *Fish* and *Other fruits* remained significantly different between women and men in both districts. The consumption of *Other vegetables* only remained significantly different between women and men in Pujehun. (Appendixes 13-17).

Meal frequency

The biggest difference of consumed meals comparing the districts was seen in consuming one meal a day and three meals a day. In Bo more participants consumed only one meal a day (Bo 23,8%, Pujehun 11,2%), while in Pujehun more people consumed three meals a day (Bo 18,9%, Pujehun 33,5%).

Number of meals	Bo	Pujehun
1	177 (23,8 %)	85 (11,2 %)
2	419 (56,2 %)	417 (54,8 %)
3	141 (18,9 %)	255 (33,5 %)
4	8 (1,1 %)	4 (0,5 %)

Table 27: Meal frequency of the sample, separated by district

The following three tables (separated by age and if breastfed or not) describe, if the district where the children grow up has an impact on their MDD, meal frequency and food consumption patterns.

Breastfed infants 6-8 months			p-value
	Bo	**Pujehun**	
N	33	39	
MDD, mean +/- SD	1,94 +/- 1,03	2,28 +/-1,17	p = 0,195
MDD >= 4	2 (6,1%)	5 (12,8%)	p = 0,342
MDD < 4	31 (93,9%)	34 (87,2%)	
Meal frequency, mean +/- SD	2,24 +/- 0,66	2,38 +/- 0,67	p = 0,372
Grains, roots and tubers (A, B)	32 (97%)	38 (97,4%)	p = 0,906
Legumes and Nuts (C, D)	18 (54,5%)	22 (56,4%)	p = 0,876
Dairy products (E)	3 (9,1%)	0	p = 0,056
Flesh foods (F, G, H)	7 (21,2%)	18 (46,2%)	**p = 0,027**
Eggs (I)	0	0	-
Vitamin A rich fruits and vegetables (J, K, L)	2 (6,1%)	6 (11,5%)	p = 0,215
Other fruits and vegetables (M, N)	2 (6,1%)	5 (12,8%)	p = 0,342

Table 28: MDD, meal frequency and food group intake among breastfed infants 6-8 months

There was a significant difference in the intake of *Flesh foods* between Bo and Pujehun among breastfed infants – 18 children at that age ate food belonging to this group in Pujehun, while only seven consumed it in Bo (Appendix 18).

Breastfed children 9-24 months			p-value
	Bo	**Pujehun**	
N	243	220	
MDD, mean +/- SD	3,16 +/- 1,5	3,19 +/- 1,4	p = 0,847
MDD >= 4	117 (48,1%)	110 (50%)	p = 0,691
MDD < 4	126 (51,9%)	110 (50%)	
Meal frequency, mean +/- SD	2,31 +/- 0,68	2,13 +/- 0,67	**p = 0,004**
Grains, roots and tubers (A, B)	241 (99,2%)	216 (98,2%)	p = 0,345
Legumes and Nuts (C, D)	118 (48,6%)	115 (52,3%)	p = 0,426
Dairy products (E)	6 (2,5%)	4 (1,8%)	p = 0,631
Flesh foods (F, G, H)	156 (64,2%)	148 (67,3%)	p = 0,488
Eggs (I)	2 (0,8%)	0 (0,0%)	p = 0,178
Vitamin A rich fruits and vegetables (J, K, L)	131 (53,9%)	105 (47,7%)	p = 0,185
Other fruits and vegetables (M, N)	114 (46,9%)	113 (51,4%)	p = 0,340

Table 29: MDD, meal frequency and food group intake among breastfed children 9-24 months

Table 29 compares breastfed children between 9-24 months of age. There is a significant difference between the meal frequency of children in both districts. The mean meal frequency was higher in Bo (Appendix 19). The consumption patterns of each food group were not significantly different between the districts.

Non-breastfed children 6-24 months			p-value
	Bo	**Pujehun**	
N	87	110	
MDD, mean +/- SD	3,95 +/- 1,03	3,97 +/- 1,09	p = 0,903
MDD >= 4	66 (75,9%)	83 (75,5%)	p = 0,948
MDD < 4	21 (24,1%)	27 (24,5%)	
Minimum Meal Frequency, mean +/- SD	2,33 +/- 0,76	2,45 +/- 0,62	p = 0,217
Grains, roots and tubers (A, B)	84 (96,6%)	110 (100%)	p = 0,050
Legumes and Nuts (C, D)	46 (52,9%)	59 (53,6%)	p = 0,916
Dairy products (E)	4 (4,6%)	1 (0,9%)	p = 0,103
Flesh foods (F, G, H)	74 (85,1%)	101 (91,8%)	p = 0,136
Eggs (I)	0 (0,0%)	0 (0,0%)	-
Vitamin A rich fruits and vegetables (J, K, L)	72 (82,8%)	76 (69,1%)	**p = 0,028**
Other fruits and vegetables (M, N)	64 (73,6%)	90 (81,8%)	p = 0,165

Table 30: MDD, meal frequency and food group intake among non-breastfed children 6-24 months

Table 30 describes the differences among non-breastfed children. The only significant difference was seen in the consumption of *Vitamin A rich fruits and vegetables*, which is lower in Pujehun district (Appendix 20).

Growing vegetables or/and fruits and owning livestock

The MDD of men and women growing vegetables and/or fruits and/or owning livestock does not show a significant difference (Appendix 21). The most people consuming five or more food groups were among the ones which grow vegetables and own livestock. The difference of the number of people scoring a MDD of five or more to scoring a MDD of less than five, is highest among the ones growing vegetables only and growing vegetables and fruits.

	N	MDD	MDD <5	MDD >= 5
Growing Veg	178 (11,8%)	4,22 +/-1,20	101 (56,7%)	77 (43,4%)
Growing Fruits	28 (1,9%)	4,57 +/-0,96	14 (50,0%)	14 (50%)
Owning Livestock	124 (8,2%)	4,33 +/-1,18	62 (50,0%)	62 (50%)
Growing Veg*Fruits	154 (10,2%)	4,08 +/-1,04	96 (62,3%)	58 (37,7%)
Growing Veg*Livestock	218 (14,5%)	4,41 +/- 1,022	102 (46,8%)	116 (53,2%)
Growing fruits*livestock	56 (3,7%)	4,34 +/- 1,07	31 (55,4%)	25 (44,6%)
Growing Veg*Fruits *Livestock	525 (34,9%)	4,34 +/-1,04	282 (53,7%)	243 (46,3%)
Not growing anything/owing Livestock	223 (14,8%)	4,23 +/- 1,15	123 (55,2%)	100 (44,8%)

Table 32: Summary of women and men growing vegetables, fruits and owning livestock

6.5. Gender roles in nutrition

Men can influence the diet of women and children indirectly, as they are traditionally seen to be the most important family member and mainly in decision-making positions. To evaluate the situation among the assessed households, women were also asked about the use of income to purchase food, who is the one purchasing food items, who decides which food from own production has to be sold and what is prepared for the own household.

The following table (table 32) summarizes that usually men provided the income used to buy food items and had the power to decide how much money is spent on food. Purchasing food items was mainly women's responsibility, while up to almost 40% of men decided which food items were purchased. Almost 60% of women reported, that they were the ones deciding which food is cooked.

	Husband	**Wife**	**Husband & wife**	**Mother/ Father**	**No Answer**
Who decides how much money is spend on food?	581 (75,7%)	128 (18,7%)	40 (5,2%)	19 (1,5%)	-
Whose income is used to buy food items?	538 (70,1%)	121 (15,8%)	73 (9,5%)	36 (4,6%)	-
Who decides which food items are purchased?	302 (39,3%)	414 (53,9%)	37 (4,8%)	-	15 (2,0%)
Who purchases the food?	184 (24%)	417 (54,3%)	154 (20,1%)	-	13 (1,6%)
Who decides what food is cooked?	228 (29,7%)	456 (59,4%)	71 (9,2%)	-	13 (1,7%)

Table 33: Decision-making on food purchase and cooking

Additionally, women were asked who is or who they see in the decision-making position in terms of selling or consuming food crops or animal foods from own production. Around half of the women answered, that this decision is made by their husbands. 5-10% replied, that husband and wife make the decision together. 17-24% of women reported, that they are the ones making those decisions. A few women mentioned, that their mothers or fathers are in the decision-making position. 14-24% did not give an answer to those questions.

	Husband	Wife	Husband & wife	Mother/ Father	No answer
Who decides if food crops from own production are sold?	394 (51,3%)	180 (23,4%)	79 (10,3%)	7 (0,9%)	108 (14,1%)
Who decides if animal foods are sold?	372 (48,4%)	144 (18,8%)	51 (6,6%)	8 (1,1%)	193 (25,1%)
Who decides if animal foods are consumed?	403 (52,5%)	131 (17,1%)	44 (5,7%)	8 (1,0%)	182 (23,7%)

Table 34: Decision-making on selling/consuming food crops and livestock products

A study from Tanzania suggests that men should be sensitized to avoid selling the farm produce to ensure the households food security. For this, thoughtful planning and consultation with local leaders, men and women is necessary. Furthermore, it is suggested that men and women should plan together how their farm can produce healthy food, which provides nutritious food every household member can benefit from [Ochieng et al., 2017]. Interventions focusing on that topic might also be beneficial for the dietary diversity among households in Sierra Leone and would be a step forward in closing gender gaps in terms of nutrition.

7. Limitations

One limitation is the subconsciously and consciously under- or overreporting of food intake, which can distort the results of the present study. It is not known to which extend this might affect the results of food and nutrient intakes. Especially underreporting is a commonly documented problem among dietary surveys in African countries [Orcholski et al., 2015]. A second 24HR on another day of the week would also have strengthened the validity of the results.

Furthermore, the enumerators conducting the interviews were not educated in nutrition. Despite the intensive training before data collection it might be possible that some errors occurred due to missing knowledge about nutrition. Also, it is possible that errors occurred in translating the data from English to Mende and back to English.

One further limitation is, that during data collection the tablets used from some enumerators did not work for several days and the interviews had to be done by hand. The data had to be transferred into Excel-sheets later, which has possible been a source of errors.

Besides of that, the season when the data collection took place may influence the dietary diversity and eating habits tremendously, especially in remote areas like the ones this study took place. The present study was conducted during the rainy season, a time when less food is available than usual. Comparing the results of this study with data from the dry season would lead to a better representation of the dietary diversity and eating habits of Sierra Leoneans.

8. Discussion

Generally, the diet of women and men in Bo and Pujehun district in Sierra Leone is predominated by rice, cassava, fish, green leavy vegetables, other vegetables and oil. Women had a mean MDD-W of 4,2 and men had a mean MDD of 4,4, using the aggregated ten food groups, recommend by FAO. To have a sufficient diet diversity, five or more food groups have to be consumed on a day. According to that, around 43% of women and 50% of men assessed in this study had a sufficient diet. The majority of women and men consumed two-three meals.

The districts where the women and men live, do have an impact on the dietary intake to some extent. The intake of *Pulses* and *Meat, Poultry and Fish* is significantly higher in Pujehun, while the intake of *Vitamin A rich fruits and vegetables* was significantly higher in Bo. The latter shows the highest difference between the districts (Bo 5,6%, Pujehun 1,2%). Comparing women from Bo with women from Pujehun the intake of V*itamin A rich fruits and vegetables* (higher in Bo) and of *Other vegetables* (higher in Pujehun) is significantly different, while the intake of *Pulses* and *Vitamin A rich fruits and vegetables* differs significantly between men of Bo and men of Pujehun – both higher in Bo. The mean MDD of women and men growing food crops and/or owning livestock ranges from 4,1 – 4,6 and does not show a significant difference. That means that own food crops or livestock did not influence the food group intake of women and men in Bo and Pujehun on a significant level.

Infants and young children have a sufficient diet diversity if they consume four out of seven food groups per day. Overall, infants and young children had a mean MDD of 3,3, which is below the recommendation. However, 52% of all children achieved a consumption of four or more food groups. Separated by age and if breastfed or not, breastfed infants between 6-8 months had a mean MDD-IYC of 2,1, breastfed children between 9-24 months had a mean MDD-IYC of 3,2 and non-breastfed children between 6-24 months had an MDD-IYC of 4,0. These findings show that mostly non-breastfed children did meet the recommendations. The overall meal frequency was 2,3. Anew, separated between the age groups and if breastfed or not, the mean frequencies were 2,3, 2,2 and 2,4, representing that infants 6-8 months met the recommended meal frequency of two-three meals but children between 9-24 consumed too less meals a day, as three meals are

recommended. Comparing the districts, the number of children scoring four or more food groups as well as the mean MDD-IYC was higher among children from Pujehun. Only 145 out of 736 children did meet the recommended MAD.
It is widely accepted that men are mostly in the decision-making position and seen as the most important family member, which deserves the best amount of food. Along with that, this study revealed that in the majority of households the husband's income is used to buy food items and that men usually decide which food items are bought and which food crops and animal products are to be sold or consumed. Women mainly purchase the food and decide what to cook for the family.

9. Conclusion

A considerable number of mothers and fathers did reach the recommended dietary diversity. Nevertheless, half of men and up to almost 60% of women had an insufficient diversity in their diet. Overall, men had a slightly better diet diversity than women. The MDD-IYC showed similar results, about half of the children between 6-24 months consumed four or more food groups. However, only 20% of children reached a minimum acceptable diet, as their meal frequency is at an insufficient level.
The food groups most frequently reported where grains, roots and tubers, meat, fish and poultry and vegetables – either dark green leavy or other vegetables. The diet of children was similar to the diet of adults, apart from the higher consumption levels of legumes and nuts. Fruits are hardly ever consumed, especially vitamin A rich fruits. Therefore, food promotion should target the consumption of fruits.
No significant correlation could be observed between the food group intake and the age of women and men, while it correlates among children. The older the children were, the more diverse was their diet. The district did not influence the MDD of women, men and children significantly but there was a significant difference in consumption rates of particular food groups. In general, the meal frequency was higher in Pujehun district. Growing food crops and/or owning livestock did not improve the dietary diversity significantly. However, the results

indicated that households growing vegetables additionally to owning livestock do have the highest dietary diversity.

There are multifactorial causes for a poor diet. Starting with the high levels of poverty as well as bad infrastructure, which often makes the accessibility of diverse food items impossible, over old and insufficient farming procedures and high quantities of post-harvest losses due to restricted knowledge and possibilities of storage, to low educational levels, especially among women, and insufficient knowledge about a healthy and well balanced diet. Even though women are usually in task of cooking and providing meals for the household, future interventions and programs focusing on enhancing nutritional knowledge should also include men as they mainly decide about the amount of money used to purchase foods and which plant- and animal-based food products from own production are consumed or sold. A regular training with both, women and men, could decrease the current levels of malnutrition and micronutrient deficiencies of all household members and lead to a sustainable shift from a mostly monotonous into a more diverse diet.

Apart from nutrition, insufficient knowledge about hygiene and sanitation and common sicknesses like anemia, malaria and diarrheal diseases affects the health of adults and children. In addition to a mostly already low intake of micronutrients, it can further weaken the absorption, which puts especially children and women at reproductive age are at a high risk of malnutrition due to periods of higher needs like growth and lactating. Programs should therefore also put a focus on enhancing hygiene and sanitation practices and adequate health care. Strategies to improve women’s empowerment are seen as a key element to improve their own and their children’s health.

To ensure good quality of future interventions and programs leading to sustainable and long-lasting improvements of Sierra Leonean’s dietary diversity and health status, adequate monitoring, documenting and evaluation is necessary.

10. ABSTRACT

Introduction

Even tough overweight and obesity rates are at record levels, under- and malnutrition remains a persistent burden worldwide. Especially micronutrient deficiencies are a serious health concern in developing countries like Sierra Leone, which is one of the poorest countries in the world. Due to their enhanced need of nutrients, infants, young children and women at reproductive age are amongst others the most vulnerable group. Therefore, families with children between 6 to 24 months of age were conducted for the present study. Men were included in this study as they can indirectly influence the nutritional status of women and children and their nutritional condition should also be considered. The study describes the dietary diversity of women and men and the feeding practices of their children in rural areas of Bo and Pujehun district in the Southern province of Sierra Leone. This study assesses if sex, age, the district where the households are located and growing own vegetables and fruits or/and owning livestock has an impact on dietary diversity. Furthermore, it addresses the gender roles and disparities in terms of nutrition and decision-making on food consumption and purchase. It needs to be understood which interventions are needed, and which further steps have to be taken to reduce malnutrition and its health consequences, to enhance dietary practices and to eliminate gender inequality in nutrition.

Subjects & Methodology

The subjects of this cross-sectional study were mothers and fathers or caregivers and their children between 6 and 24 months, living in selected villages of Bo and Pujehun district in the Southern province of Sierra Leone. The In-depth-interview for both, mothers and fathers, included information about their sociodemographic and -economic status, their food intake and meal frequency during the past 24 hours (24-hour dietary recall method) and questions about growing own food crops and owning livestock. The mothers were additionally asked to describe the child's food intake of the last 24 hours as well as nutrition related roles of the household members. To evaluate the quality of the participants' diet, the consumed foods listed in the 24-hour dietary recalls (24HR) were assigned into

18 food groups and further aggregated into 10 food groups according to the FAO guidelines to assess the minimum dietary diversity among women (MDD-W) and into 7 food groups based on the WHO guidelines to assess the minimum dietary diversity of infants and young children (MDD-IYC) [FAO, 2016, WHO,2010]. To gain more information about the nutritional status of children, the minimum acceptable diet (MAD) has been assessed, which includes meal frequency additionally to dietary diversity. As there are no specific guidelines for the minimum dietary diversity (MDD) among men, the guidelines for women were used. The answers to qualitative questions were summarized and categorized into groups. Data analysis was done using SPSS.

Results

The average age of the 768 women and 736 men is 28,2 +/- 7,6 and 35,8 +/- 10,2 years, with a mean MDD of 4,21 +/- 1,11 for women and 4,39 +/- 1,05 for men, which represents that the dietary diversity is below the recommendation of five or more food groups per day and is therefore at an insufficient level. The MDD differs significantly between women and men ($p = 0,002$). The age of women and men does not influence the dietary diversity. The mean meal frequency was 2,14 +/- 0,72 for women and 2,07 +/- 0,63 for men. Comparing the food intake of women and men separated by district, the MDD of men (4,42 +/- 1,05) remains significantly higher than the MDD of women (4,19 +/- 1,11) within Bo ($p = 0,003$), but not within Pujehun, whereas the meal frequency differs significantly between women (2,30 +/- 0,67) and men (2,17 +/-0,60) from Pujehun ($p < 0,001$), but not from Bo. The MDD of men and women growing vegetables and/or fruits and/or owning livestock does not differ significantly.

Of 768 children 32 were breastfed only. The mean MDD-IYC is 3,28 +/- 1,41, indicating that the dietary diversity is too low. The MDD-IYC rises with the age. However, more than half of the children (N=386, 52,4%) reached the recommendation of four or more food groups. In contrast, only 145 children achieved the minimum acceptable diet, representing that the meal frequency is at a low level. The MDD-IYC does not differ significantly between Bo and Pujehun district. The diet of women, men and children is based on grains and roots and tubers, mainly rice and cassava, followed by fish and dark green leafy or other vegetables. Vitamin A rich fruits and vegetables are consumed very scarcely.

More than 70% of women reported that their husband's income is used to buy food items and that it is for them to decide how much money is spent on food. Around 50% of women state that it is their husband's decision only, whether food crops and livestock or animal products are to be sold or consumed.

Conclusions

The dietary diversity of more than a half of women and men is insufficient, which put them at higher risk of malnutrition and its health consequences. Not enough children receive a minimum acceptable diet, mainly because their meal frequency is too low. Approximately half of the children have a sufficient dietary diversity. In general, Bo and Pujehun district show similar results concerning dietary diversity and consumption patterns. The majority of men is in decision-making positions when it comes to money spent on food and selling or consuming food crops and animal products from own production.

11. Zusammenfassung

Einleitung

Die Zahl der übergewichtigen und adipösen Menschen ist weltweit so hoch wie nie zuvor. Dennoch leiden viele Menschen an Unter- und Mangelernährung und deren gesundheitlichen Folgen, Besonders der Mangel an Mikronährstoffen stellt nach wie vor ein ernstzunehmendes Problem für die Gesundheit vieler Menschen dar, ganz besonders in Entwicklungsländern wie Sierra Leone, welches zu den ärmsten Ländern der Welt zählt. Aufgrund ihres erhöhten Nährstoffbedarfs sind vor allem Säuglinge, Kleinkinder und Frauen betroffen. Die Zielgruppe dieser Studie waren demnach Familien mit Kindern im Alter von 6-24 Monaten. Da Männer den Ernährungszustand von Frauen und Kindern indirekt beeinflussen können und auch ihr Ernährungszustand berücksichtigt werden soll, wurden Männer in dieser Studie inkludiert. Die Studie beschreibt die Nahrungsmittelvielfalt der Frauen und Männer sowie die Ernährungspraktiken für Säuglinge und Kleinkinder in abgelegenen Dörfern in den Bezirken Bo und Pujehun im Süden von Sierra Leone. Es wurde erfasst, ob das Geschlecht, das Alter, der Wohnbezirk und der Eigenanbau von Obst und Gemüse und/oder Tierhaltung einen Einfluss auf die Ernährungsvielfalt hat. Zusätzlich werden

Geschlechterrollen und -unterschiede in Bezug auf die Entscheidungskraft über den Kauf, Konsum und die Zubereitung von Lebensmitteln beschrieben. Diese Studie soll eine Hilfestellung für zukünftige Interventionen sein, um Mangel- und Unterernährung zu minimieren, die Ernährungsgewohnheiten zu verbessern und existierende ernährungsbezogene geschlechtsspezifische Unterschiede in Bezug auf Ernährung zu reduzieren.

Vorgehensweise

Für die vorliegende Querschnittsstudie wurden Mütter und Väter respektive die Betreuungspersonen von Kindern zwischen 6 und 24 Monaten herangezogen, welche in den Bezirken Bo und Pujehun im Süden von Sierra Leone leben. Informationen über den soziodemographischen und -ökonomischen Status, die Nahrungsmittelaufnahme und Mahlzeitenhäufigkeit der letzten 24 Stunden (24h Recall-Methode), sowie Fragen über den Eigenanbau von Obst und Gemüse und die Haltung von Tieren, waren Inhalt der In-Depth-Interviews für Männer und Frauen. Zusätzlich wurden Frauen über die Nahrungsmittelaufnahme und die Mahlzeitenfrequenz der Kinder und über Geschlechterrollen in ernährungsbezogenen Entscheidungsprozessen befragt. Um die Diversität der Ernährung zu analysieren wurden die Lebensmittel des 24h Recalls in 18 Lebensmittelgruppen eingeteilt und anschließend in 10 Lebensmittelgruppen für Frauen und Männer bzw. 7 Lebensmittelgruppen für Kinder aggregiert. Um ein besseres Verständnis des Ernährungsstatus der Kinder zu erhalten wurde die „minimum acceptable diet“ analysiert, welche sich aus der Mahlzeitenfrequenz und der Diversität der Lebensmittelaufnahme zusammensetzt. Die Antworten zu qualitativen Fragen wurden zusammengefasst und in Gruppen kategorisiert. Die Datenanalyse erfolgte mittels SPSS.

Ergebnisse

Das Alter der 768 Frauen und 736 Männern liegt im Durchschnitt bei 28,2 +/- 7,6 und 35,8 +/- 10,2 Jahren mit einem MDD von 4,21 +/- 1,11 bei den Frauen und 4,39 +/- 1,05 bei den Männern. Dies zeigt, dass die Lebensmittelvielfalt unterhalb der Empfehlungen von mindestens fünf verschiedenen Lebensmittelgruppen am Tag liegt und somit unzureichend ist. Der MDD zwischen Männern und Frauen unterscheidet sich signifikant voneinander ($p = 0,002$). Das Alter der Frauen und

Männer hat keinen Einfluss auf den MDD. Die Mahlzeitenhäufigkeit lag im Mittel bei 2,14 +/- 0,72 bei den Frauen und 2,07 +/- 0,63 bei den Männern. Beim Vergleich der Lebensmitteldiversität von Männern und Frauen getrennt nach den Bezirken wurde festgestellt, dass der MDD der Männer (4,42 +/- 1,05) nur in Bo signifikant höher ist, als der MDD der Frauen (4,19 +/- 1,11, p = 0,003), während die Mahlzeitenhäufigkeit zwischen Frauen (2,30 +/- 0,67) und Männern (2,17 +/- 0,60) nur in Pujehun einen signifikanten Unterschied aufweist (p < 0,001). Das Alter und der MDD der Frauen und Männer zeigt keinen Zusammenhang. Der MDD von Frauen und Männern mit oder ohne Eigenanbau von Gemüse und/oder Obst und/oder eigener Tierhaltung, zeigte keine signifikant unterschiedlichen Ergebnisse. Von 768 Kindern, wurden 32 ausschließlich gestillt. Der MDD-IYC lag im Durchschnitt bei 3,38 +/- 1,41, hindeutend darauf, dass die Nahrungsmittelvielfalt unter den Kindern zu niedrig ist. Der MDD-IYC steigt mit dem Alter der Kinder an. Mehr als die Hälfte der Kinder (N=386, 52,4%) erreichte jedoch die Empfehlung von vier oder mehr Lebensmittelgruppen. Im Gegensatz dazu, erreichten nur 145 Kinder eine „minimum acceptable diet“, was darauf schließen lässt, dass die Mahlzeitenhäufigkeit zu gering ist. Der MDD-IYC unterscheidet sich nicht signifikant zwischen den Kindern aus Bo und Pujehun. Getreide sowie Wurzeln und Knollen, vorwiegend Reis und Cassava, vor Fisch und grünem blättrigem Gemüse oder anderem Gemüse prägen die Ernährung von Männern, Frauen und Kindern. Obst und Gemüse, welches reich an Vitamin A ist, wird nur sehr selten konsumiert. Mehr als 70% der Frauen gaben an, dass das Einkommen ihres Ehemanns für den Einkauf von Lebensmittel herangezogen wird und auch sie diejenigen sind, die entscheiden wie viel Geld dafür ausgegeben wird. Rund 50% der Frauen berichteten, dass die Entscheidung beim Ehemann liegt, ob Nahrungsmittel aus dem eigenen Anbau sowie Tiere und deren Produkte verkauft oder konsumiert werden.

Fazit

Mehr als die Hälfte der Frauen und Männer haben eine unzureichende Nahrungsmitteldiversität. Daraus ergibt sich ein erhöhtes Risiko einer Mangelernährung und dessen gesundheitlichen Folgen. Die Anzahl an Kindern, die eine „minimum acceptable diet“ aufweisen, ist aufgrund einer geringen Mahlzeitenfrequenz zum Großteil niedrig. Die Ergebnisse zeigen, dass rund 50%

der Kinder eine ausreichende Diversität in der Ernährung haben. Im Allgemeinen zeigen die Bezirke Bo und Pujehun ähnliche Ergebnisse bezüglich des Ernährungsverhaltens bei Frauen, Männern und Kindern. Die Mehrheit der Männer trifft die Entscheidungen über die Höhe der Ausgaben für Lebensmittel und dem Verkauf bzw. Konsum von Lebensmittel aus eigenem Anbau und Nutztieren bzw. tierischer Produkte.

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13. Appendix

Annex 1: Consent

INFORMED CONSENT FORM FOR HOUSEHOLD SURVEY

COMPARING DIETARY INTAKE IN TWO DISTRICTS WITH A SPECIAL FOCUS ON MICRONUTRIENT INTAKE OF CHILDREN 6-24 MONTHS.

Hello. We are working with Memuna Sawi, a PhD student based at Njala University, Moyamba district in Sierra Leone. We are conducting a household survey in nutrition to better understand various types of nutritional problems such as anaemia, and vitamin and mineral deficiencies in women and children and how they relate to the type of food they consume. This information will help the government to plan for better health in the future. We would very much appreciate your household's participation in this survey. The survey usually takes about 45 minutes to 1 hour to complete and includes answering questions and a visit to another place (your court barry/chief's veranda) to take the height and weight of the father, mother/caregiver and child (6-24 months) in the household. Whatever information you provide will be kept strictly confidential and will not be shown to other persons except the supervisors of this work.

Participation in this survey is voluntary, and if we should come to any question you do not want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time. However, we hope that you will participate in this survey since your views are important. After these questions to you, another team member will have a short group discussion (FGD) with some of the women and men in this community which you are also free to join.

May I start now?

YES, PERMISSION/CONSENT IS GIVEN- BEGIN THE INTERVIEW. NO, PERMISSION IS NOT GIVEN -COMPLETE THIS COVER PAGE. DISCUSS RESULT WITH TEAM LEADER.

Sign/thumb print of interviewee/respondent…… Date: ……..

Sign of Interviewer: …… Date: ……

ID of Research Assistant: ……

Annex 2: Female Household survey*

*some sections/questions were excluded for my master thesis.

SECTION A: BASIC AND DEMOGRAPHIC INFORMATION

1. District code
2. Chiefdom code
3. Section name
4. Village code
5. GPS
6. Name of interviewee/respondent
7. Gender of respondent
8. Study code/household ID
9. Age of interviewee/respondent. (in Years)
10. Are you pregnant?
11. Trimester of pregnancy
12. Religion
13. Marital status of the mother/caregiver.
14. Which of the following statements best describes your level of literacy?
15. What is the highest level of education you attained?
16. What is your main source of income/livelihood/ occupation?
17. Number of male children that are 0-5 months
18. Number of female children that are 0-5
19. Number of male children that are 6-23
20. Number of female children that are 6-23
21. Number of male children that are 24-59
22. Number of female children that are 24-59
23. What is your relationship to this child?

SECTION B1: 24-HOUR DIETARY RECALL FOR FEMALE RESPONDENT

24. How many meals did you eat yesterday?
25. Yesterday, did you eat less, the same or more?
26. Was there a special occasion or celebration?
27. Yesterday, what did you eat during your first meal?
28. Please describe/mention ALL the ingredients.
29. Yesterday, what did you eat during your second meal?
30. Please describe/mention ALL the ingredients.
31. Yesterday, what did you eat during your third meal?
32. Please describe/mention ALL the ingredients.
33. Yesterday, what did you eat during your fourth meal?
34. Please describe/mention ALL the ingredients.
35. Did you eat any snack yesterday?
36. How many times did you eat a snack?
37. Please describe/mention ALL the ingredients.

SECTION B2: FOOD GROUPS FOR 24-HOUR RECALL FOR FEMALE RESPONDENT

38. Please use the food groups table provided.

SECTION B3 24-HOUR DIETARY RECALL FOR THE YOUNGEST CHILD 6-24 MONTHS

39. Apart from breast milk, how many meals did this child eat?
40. Yesterday, did this child eat less, the same or more?
41. Was there a special occasion or celebration?
42. Yesterday, what did this child eat during the first meal?

43. Please describe/mention ALL the ingredients.
44. Yesterday, what did this child eat during the second meal?
45. Please describe/mention ALL the ingredients.
46. Yesterday, what did this child eat during the third meal?
47. Please describe/mention ALL the ingredients.
48. Yesterday, what did this child eat during the fourth meal?
49. Please describe/mention ALL the ingredients.
50. Did this child eat any snack yesterday?
51. How many times did this child eat snack?
52. Please describe/mention ALL the ingredients.
53. -

SECTION B4: FOOD GROUPS FOR 24-HOUR RECALL FOR CHILD

54. Please use the food groups table provided.

SECTION B5: HOUSEHOLD FOOD FREQUENCY

55. Enter the name of the food item.
56. In the last 7 days, did you or any member of your household eat this food item?
57. How many days did you or any member of eat this food item?
58. When should a child be first breastfed after birth?
59. Is the youngest child still breastfeeding?
60. How many times did the youngest child got breastfed?
61. How old was the youngest child when it was last breastfed?
62. How many months did you give your youngest child breast milk ONLY?
63. If it is very hot, or if a baby cries too much, is it necessary to give water in addition to breastmilk?
64. At what age was your last child introduced to other liquids/water or food apart from breast milk? Think about the youngest child in your household.

SECTION C: CHILD NUTRITION- ATTITUDE, KNOWLEDGE AND PRACTICE

65. What can you add to the child's food to make it more nutritious?
66. We know that some people do not give egg to their child, do you give egg to your child?
67. Please give reason(s) for your answer above.
68. We know that some people do not give papaya/pawpaw to their child, do you give papaya/pawpaw to your child?
69. Please give reason(s) for your answer above
70. In the last 2 weeks, did the youngest child get diarrhea?
71. Did you receive any nutrition training before?
72. From whom did you receive nutrition training?
73. Did you take part in any other NGO or government development intervention/program within the past 12 months?
74. What was the area of intervention?

SECTION D: WATER, SANITATION AND HYGIENE

75. What is the main source of drinking water for members of your household during the rainy season?
76. Which source does members of your household use for drinking during dry season?
77. What time do you take from your home to this main source of water from your home during the dry season?

78. What time do you take from your home to the source of water mentioned (above-walking time) during rainy season?
79. Who is responsible for fetching domestic water for your home use?
80. How do you store drinking water?
81. Is the drinking water container kept above floor level and away from contamination?
82. Do you treat your drinking water to make it safe to drink?
83. What do you normally do?
84. Do water containers used for drinking water collection and water storage have a narrow mouth / opening? Please ask to observe
85. Does the household have access to a latrine?
86. What type of latrine is it? Please observe.
87. Is there a cover over the pit?
88. Is a functioning hand facility nearby?
89. Is soap attached to the hand washing facility?
90. Where do you dispose of excreta in your household?
91. Who owns the latrine that you and your household regularly use?
92. Do you clean/wash your hands after using the toilet/defecation?
93. How do you clean/wash your hands after the toilet/defecation?
94. Do you wash your hands before eating?
95. How do you clean or wash your hands?
96. Do you wash fruits before cooking or eating?
97. Do you wash vegetables before cooking or eating?
98. Do you think it would have some health benefits?
99. Is there a plate rack?
100. Is the plate rack used or being used for its purpose?
101. Is there a hand washing facility by the plate rack?
102. Please mention all the moments when it is important to wash your hands.

SECTION E: VEGETABLE, FRUIT CROPS AND LIVESTOCK PRODUCTION AND USE

103. In the last 12 months, did your household grow vegetables?
104. Where did your household grow vegetable?
105. What kind of vegetables did you grow in the __?
106. What is the main use of the vegetables you
107. If vegetables are sold, where do you sell it?
108. What are the THREE main uses of the income from selling it?
109. In the last 12 months, did your household grow fruit crops?
110. Where did your household grow fruit crops?
111. What kind of fruit crops did you grow in the __?
112. What is the main use of the fruit crops that you grow?
113. If fruit crops are sold, where do you sell it?
114. What are the THREE main uses of the income from selling it?
115. Does this household own any livestock?
116. What kind of livestock do you own?
117. What is the main use of the livestock that you own?
118. What are the THREE main use of the income from selling it?

SECTION F: HOUSEHOLD FOOD DISTRIBUTION

119. In the past 12 months, starting from this time last year to now, were there months in which you did not have enough food?
120. Please select the month(s) In the past 12 months.

121. Within that or those month(s), what was the food that was really lacking or inadequate in your household?
122. Who mainly decides how much money will be spent on food preparation?
123. Whose income do you use to buy food items?
124. Who purchases the food?
125. Who mainly decides on what food items are purchased for the daily household meals?
126. Who mainly decide, if food crops from own production (vegetables /fruits/nuts/legumes/seeds/staples) are to be sold?
127. Who mainly decide, if ANIMAL SOURCE FOODS from own production (milk and milk products, meat, fish, etc.) are to be consumed?
128. Who mainly decide, if ANIMAL SOURCE FOODS from own production (milk and milk products, meat, fish, etc.) are to be sold?
129. Who gets the main share of following food types. Cereals, white tubers and staples?
130. Who gets the main share of Animal source foods such as milk and milk products, meat, fish etc.?
131. Who mainly gets the main share of all fruits and vegetables?
132. Which of the following meals do you consider to be a healthy meal?
133. Name 3 types of food you would like to add more of to your meals to make them healthier
134. Do you like to eat a meal where half of it consists of vegetables and fruits?
135. Which family members have special or additional nutritional needs?
136. Who should get the best part of the meat/fish within your household?
137. What special foods should a pregnant and lactating woman eat?
138. Did your husband do anything to support you in preparation of nutritious meals for the family?
139. Please give examples of the support your husband.
140. Who usually decides what food is cooked within the household?
141. Do you use (collect or buy) wild food in the dry season?
142. What wild foods do you collect or use in the dry season?
143. Do you use (collect or buy) wild food in the rainy season?
144. What wild foods do you collect or use in the rainy season?
145. What can you say is the share of wild food in the dry season?
146. What can you say is the share of wild food in the rainy season?

SECTION H: ANTHROPOMETRIC MEASUREMENT FOR MOTHERS/CAREGIVERS

147. Weight (in KG)
148. Height (in CM)
149. MUAC (in CM)

SECTION I: ANTHROPOMETRIC MEASUREMENT FOR CHILD

150. Name of the child
151. Age of child (in months)
152. Sex of child
153. Child's relationship to mother/caregiver?
153. Child's relationship to mother/caregiver?
154. Weight (in KG)
155. Height /Length (in CM)
156. MUAC (in CM)

Appendix 3: Anova for MDD and sex

Tests der Zwischensubjekteffekte

Abhängige Variable: NUMBER OF FOOD GROUPS

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	11,730	1	11,730	9,977	,002
Konstanter Term	27807,802	1	27807,802	23652,994	,000
Sex	11,730	1	11,730	9,977	,002
Fehler	1768,188	1504	1,176		
Gesamt	29576,000	1506			
Korrigierte Gesamtvariation	1779,918	1505			

Appendix 4: Anova for MDD < / >= 5 and sex

Tests der Zwischensubjekteffekte

Abhängige Variable: MDD >= 5

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	1,585	1	1,585	6,396	,012
Konstanter Term	321,505	1	321,505	1297,472	,000
Sex	1,585	1	1,585	6,396	,012
Fehler	372,681	1504	,248		
Gesamt	695,000	1506			
Korrigierte Gesamtvariation	374,266	1505			

Appendix 5: Manova for food groups and sex

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,002	1	,002	,924	,337
	PULSES (BEANS, PEAS AND LENTILS) (C)	,217	1	,217	2,354	,125
	NUTS AND SEEDS (D)	,019	1	,019	,078	,780
	DAIRY (E)	,229	1	,229	12,626	,000
	MEAT, POULTRY AND FISH (F, G, H)	,601	1	,601	10,130	,001
	EGGS (I)	,017	1	,017	5,232	,022
	DARK GREEN LEAVY VEGETABLES (J)	,565	1	,565	3,609	,058
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,011	1	,011	,327	,567
	OTHER VEGETABLES (M)	,077	1	,077	,495	,482
	OTHER FRUITS (N)	,651	1	,651	15,686	,000

Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1497,492	1	1497,492	564903,530	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	16,021	1	16,021	173,560	,000
	NUTS AND SEEDS (D)	449,693	1	449,693	1812,135	,000
	DAIRY (E)	,534	1	,534	29,484	,000
	MEAT, POULTRY AND FISH (F, G, H)	1320,718	1	1320,718	22248,874	,000
	EGGS (I)	,017	1	,017	5,232	,022
	DARK GREEN LEAVY VEGETABLES (J)	977,553	1	977,553	6244,902	,000
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	1,732	1	1,732	52,874	,000
	OTHER VEGETABLES (M)	982,722	1	982,722	6330,794	,000
	OTHER FRUITS (N)	2,946	1	2,946	70,948	,000
Sex	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,002	1	,002	,924	,337
	PULSES (BEANS, PEAS AND LENTILS) (C)	,217	1	,217	2,354	,125
	NUTS AND SEEDS (D)	,019	1	,019	,078	,780
	DAIRY (E)	,229	1	,229	12,626	,000
	MEAT, POULTRY AND FISH (F, G, H)	,601	1	,601	10,130	,001
	EGGS (I)	,017	1	,017	5,232	,022
	DARK GREEN LEAVY VEGETABLES (J)	,565	1	,565	3,609	,058
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,011	1	,011	,327	,567
	OTHER VEGETABLES (M)	,077	1	,077	,495	,482
	OTHER FRUITS (N)	,651	1	,651	15,686	,000
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	3,987	1504	,003		
	PULSES (BEANS, PEAS AND LENTILS) (C)	138,830	1504	,092		
	NUTS AND SEEDS (D)	373,227	1504	,248		
	DAIRY (E)	27,251	1504	,018		
	MEAT, POULTRY AND FISH (F, G, H)	89,279	1504	,059		
	EGGS (I)	4,966	1504	,003		
	DARK GREEN LEAVY VEGETABLES (J)	235,430	1504	,157		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	49,262	1504	,033		
	OTHER VEGETABLES (M)	233,464	1504	,155		
	OTHER FRUITS (N)	62,456	1504	,042		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1502,000	1506			
	PULSES (BEANS, PEAS AND LENTILS) (C)	155,000	1506			
	NUTS AND SEEDS (D)	823,000	1506			
	DAIRY (E)	28,000	1506			
	MEAT, POULTRY AND FISH (F, G, H)	1410,000	1506			
	EGGS (I)	5,000	1506			

	DARK GREEN LEAVY VEGETABLES (J)	1213,000	1506			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	51,000	1506			
	OTHER VEGETABLES (M)	1217,000	1506			
	OTHER FRUITS (N)	66,000	1506			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	3,989	1505			
	PULSES (BEANS, PEAS AND LENTILS) (C)	139,047	1505			
	NUTS AND SEEDS (D)	373,246	1505			
	DAIRY (E)	27,479	1505			
	MEAT, POULTRY AND FISH (F, G, H)	89,880	1505			
	EGGS (I)	4,983	1505			
	DARK GREEN LEAVY VEGETABLES (J)	235,995	1505			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	49,273	1505			
	OTHER VEGETABLES (M)	233,541	1505			
	OTHER FRUITS (N)	63,108	1505			

Appendix 6: Spearman Correlation for MDD-IYC and age

Korrelationen

			Age in Months	NUMBER OF FOOD GROUPS
Spearman-Rho	Age in Months	Korrelationskoeffizient	1,000	,438**
		Sig. (2-seitig)	.	,000
		N	728	728
	NUMBER OF FOOD GROUPS	Korrelationskoeffizient	,438**	1,000
		Sig. (2-seitig)	,000	.
		N	728	734

**. Die Korrelation ist auf dem 0,01 Niveau signifikant (zweiseitig).

Appendix 7: Anova for meal frequency and district for both sexes

Tests der Zwischensubjekteffekte

Abhängige Variable: Number of meals

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	25,595	1	25,595	57,990	,000
Konstanter Term	6663,045	1	6663,045	15096,101	,000
District	25,595	1	25,595	57,990	,000
Fehler	663,828	1504	,441		
Gesamt	7362,000	1506			
Korrigierte Gesamtvariation	689,424	1505			

Appendix 8: Manova for food groups and district for both sexes

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,199E-6	1	1,199E-6	,000	,983
	PULSES (BEANS, PEAS AND LENTILS) (C)	,403	1	,403	4,376	,037
	NUTS AND SEEDS (D)	,608	1	,608	2,454	,117
	DAIRY (E)	,026	1	,026	1,443	,230
	MEAT, POULTRY AND FISH (F, G, H)	,150	1	,150	2,511	,113
	EGGS (I)	,001	1	,001	,222	,637
	DARK GREEN LEAVY VEGETABLES (J)	,094	1	,094	,598	,439
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,747	1	,747	23,157	,000
	OTHER VEGETABLES (M)	,451	1	,451	2,912	,088
	OTHER FRUITS (N)	,015	1	,015	,350	,554
Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1497,841	1	1497,841	564688,085	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	16,005	1	16,005	173,621	,000
	NUTS AND SEEDS (D)	449,352	1	449,352	1813,621	,000
	DAIRY (E)	,523	1	,523	28,653	,000
	MEAT, POULTRY AND FISH (F, G, H)	1319,672	1	1319,672	22119,376	,000
	EGGS (I)	,017	1	,017	5,033	,025
	DARK GREEN LEAVY VEGETABLES (J)	977,098	1	977,098	6229,528	,000
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	1,751	1	1,751	54,274	,000
	OTHER VEGETABLES (M)	982,900	1	982,900	6342,113	,000
	OTHER FRUITS (N)	2,896	1	2,896	69,046	,000
District	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,199E-6	1	1,199E-6	,000	,983
	PULSES (BEANS, PEAS AND LENTILS) (C)	,403	1	,403	4,376	,037
	NUTS AND SEEDS (D)	,608	1	,608	2,454	,117
	DAIRY (E)	,026	1	,026	1,443	,230
	MEAT, POULTRY AND FISH (F, G, H)	,150	1	,150	2,511	,113
	EGGS (I)	,001	1	,001	,222	,637
	DARK GREEN LEAVY VEGETABLES (J)	,094	1	,094	,598	,439
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,747	1	,747	23,157	,000

	OTHER VEGETABLES (M)	,451	1	,451	2,912	,088
	OTHER FRUITS (N)	,015	1	,015	,350	,554
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	3,989	1504	,003		
	PULSES (BEANS, PEAS AND LENTILS) (C)	138,644	1504	,092		
	NUTS AND SEEDS (D)	372,638	1504	,248		
	DAIRY (E)	27,453	1504	,018		
	MEAT, POULTRY AND FISH (F, G, H)	89,731	1504	,060		
	EGGS (I)	4,983	1504	,003		
	DARK GREEN LEAVY VEGETABLES (J)	235,902	1504	,157		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	48,526	1504	,032		
	OTHER VEGETABLES (M)	233,090	1504	,155		
	OTHER FRUITS (N)	63,093	1504	,042		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1502,000	1506			
	PULSES (BEANS, PEAS AND LENTILS) (C)	155,000	1506			
	NUTS AND SEEDS (D)	823,000	1506			
	DAIRY (E)	28,000	1506			
	MEAT, POULTRY AND FISH (F, G, H)	1410,000	1506			
	EGGS (I)	5,000	1506			
	DARK GREEN LEAVY VEGETABLES (J)	1213,000	1506			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	51,000	1506			
	OTHER VEGETABLES (M)	1217,000	1506			
	OTHER FRUITS (N)	66,000	1506			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	3,989	1505			
	PULSES (BEANS, PEAS AND LENTILS) (C)	139,047	1505			
	NUTS AND SEEDS (D)	373,246	1505			
	DAIRY (E)	27,479	1505			
	MEAT, POULTRY AND FISH (F, G, H)	89,880	1505			
	EGGS (I)	4,983	1505			
	DARK GREEN LEAVY VEGETABLES (J)	235,995	1505			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	49,273	1505			
	OTHER VEGETABLES (M)	233,541	1505			
	OTHER FRUITS (N)	63,108	1505			

Appendix 9: Anova for meal frequency between women from Bo and Pujehun

Tests der Zwischensubjekteffekte

Abhängige Variable: Number of meals

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	20,320	1	20,320	41,441	,000
Konstanter Term	3496,148	1	3496,148	7130,123	,000
District	20,320	1	20,320	41,441	,000
Fehler	375,597	766	,490		
Gesamt	3898,000	768			
Korrigierte Gesamtvariation	395,917	767			

Appendix 10: Anova for meal frequency between men from Bo and Pujehun

Tests der Zwischensubjekteffekte

Abhängige Variable: Number of meals

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	6,911	1	6,911	17,840	,000
Konstanter Term	3168,369	1	3168,369	8178,234	,000
District	6,911	1	6,911	17,840	,000
Fehler	285,137	736	,387		
Gesamt	3464,000	738			
Korrigierte Gesamtvariation	292,049	737			

Appendix 11: Manova for food groups between women from Bo and Pujehun

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,001	1	,001	,313	,576
	PULSES (BEANS, PEAS AND LENTILS) (C)	,059	1	,059	,711	,399
	NUTS AND SEEDS (D)	,209	1	,209	,839	,360
	DAIRY (E)	,001	1	,001	,222	,637
	MEAT, POULTRY AND FISH (F, G, H)	,098	1	,098	1,279	,258
	EGGS (I)	,000	1	,000	.	.
	DARK GREEN LEAVY VEGETABLES (J)	,197	1	,197	1,170	,280
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,344	1	,344	11,499	,001
	OTHER VEGETABLES (M)	1,639	1	1,639	11,004	,001
	OTHER FRUITS (N)	,006	1	,006	,272	,602

Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	761,949	1	761,949	195393,868	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	6,392	1	6,392	77,036	,000
	NUTS AND SEEDS (D)	226,250	1	226,250	910,356	,000
	DAIRY (E)	,033	1	,033	5,043	,025
	MEAT, POULTRY AND FISH (F, G, H)	645,098	1	645,098	8436,991	,000
	EGGS (I)	,000	1	,000	.	.
	DARK GREEN LEAVY VEGETABLES (J)	475,171	1	475,171	2826,323	,000
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,761	1	,761	25,433	,000
	OTHER VEGETABLES (M)	509,598	1	509,598	3420,969	,000
	OTHER FRUITS (N)	,423	1	,423	18,435	,000
District	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,001	1	,001	,313	,576
	PULSES (BEANS, PEAS AND LENTILS) (C)	,059	1	,059	,711	,399
	NUTS AND SEEDS (D)	,209	1	,209	,839	,360
	DAIRY (E)	,001	1	,001	,222	,637
	MEAT, POULTRY AND FISH (F, G, H)	,098	1	,098	1,279	,258
	EGGS (I)	,000	1	,000	.	.
	DARK GREEN LEAVY VEGETABLES (J)	,197	1	,197	1,170	,280
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,344	1	,344	11,499	,001
	OTHER VEGETABLES (M)	1,639	1	1,639	11,004	,001
	OTHER FRUITS (N)	,006	1	,006	,272	,602
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	2,987	766	,004		
	PULSES (BEANS, PEAS AND LENTILS) (C)	63,561	766	,083		
	NUTS AND SEEDS (D)	190,373	766	,249		
	DAIRY (E)	4,966	766	,006		
	MEAT, POULTRY AND FISH (F, G, H)	58,569	766	,076		
	EGGS (I)	,000	766	,000		
	DARK GREEN LEAVY VEGETABLES (J)	128,782	766	,168		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	22,906	766	,030		
	OTHER VEGETABLES (M)	114,106	766	,149		
	OTHER FRUITS (N)	17,572	766	,023		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	765,000	768			
	PULSES (BEANS, PEAS AND LENTILS) (C)	70,000	768			
	NUTS AND SEEDS (D)	417,000	768			
	DAIRY (E)	5,000	768			
	MEAT, POULTRY AND FISH (F, G, H)	704,000	768			
	EGGS (I)	,000	768			

	DARK GREEN LEAVY VEGETABLES (J)	604,000	768			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	24,000	768			
	OTHER VEGETABLES (M)	626,000	768			
	OTHER FRUITS (N)	18,000	768			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	2,988	767			
	PULSES (BEANS, PEAS AND LENTILS) (C)	63,620	767			
	NUTS AND SEEDS (D)	190,582	767			
	DAIRY (E)	4,967	767			
	MEAT, POULTRY AND FISH (F, G, H)	58,667	767			
	EGGS (I)	,000	767			
	DARK GREEN LEAVY VEGETABLES (J)	128,979	767			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	23,250	767			
	OTHER VEGETABLES (M)	115,745	767			
	OTHER FRUITS (N)	17,578	767			

Appendix 12: Manova for food groups between men from Bo and Pujehun

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,001	1	,001	1,022	,312
	PULSES (BEANS, PEAS AND LENTILS) (C)	,435	1	,435	4,284	,039
	NUTS AND SEEDS (D)	,420	1	,420	1,695	,193
	DAIRY (E)	,037	1	,037	1,235	,267
	MEAT, POULTRY AND FISH (F, G, H)	,055	1	,055	1,315	,252
	EGGS (I)	,002	1	,002	,223	,637
	DARK GREEN LEAVY VEGETABLES (J)	,000	1	,000	,001	,969
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,405	1	,405	11,648	,001
	OTHER VEGETABLES (M)	,120	1	,120	,750	,387
	OTHER FRUITS (N)	,009	1	,009	,141	,707
Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	735,893	1	735,893	543105,195	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	9,834	1	9,834	96,791	,000
	NUTS AND SEEDS (D)	223,119	1	223,119	901,168	,000
	DAIRY (E)	,720	1	,720	23,830	,000

	MEAT, POULTRY AND FISH (F, G, H)	675,177	1	675,177	16261,927	,000
	EGGS (I)	,034	1	,034	5,044	,025
	DARK GREEN LEAVY VEGETABLES (J)	502,483	1	502,483	3474,154	,000
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	1,001	1	1,001	28,784	,000
	OTHER VEGETABLES (M)	473,388	1	473,388	2962,712	,000
	OTHER FRUITS (N)	3,125	1	3,125	51,262	,000
District	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,001	1	,001	1,022	,312
	PULSES (BEANS, PEAS AND LENTILS) (C)	,435	1	,435	4,284	,039
	NUTS AND SEEDS (D)	,420	1	,420	1,695	,193
	DAIRY (E)	,037	1	,037	1,235	,267
	MEAT, POULTRY AND FISH (F, G, H)	,055	1	,055	1,315	,252
	EGGS (I)	,002	1	,002	,223	,637
	DARK GREEN LEAVY VEGETABLES (J)	,000	1	,000	,001	,969
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,405	1	,405	11,648	,001
	OTHER VEGETABLES (M)	,120	1	,120	,750	,387
	OTHER FRUITS (N)	,009	1	,009	,141	,707
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,997	736	,001		
	PULSES (BEANS, PEAS AND LENTILS) (C)	74,775	736	,102		
	NUTS AND SEEDS (D)	182,225	736	,248		
	DAIRY (E)	22,246	736	,030		
	MEAT, POULTRY AND FISH (F, G, H)	30,558	736	,042		
	EGGS (I)	4,965	736	,007		
	DARK GREEN LEAVY VEGETABLES (J)	106,451	736	,145		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	25,607	736	,035		
	OTHER VEGETABLES (M)	117,600	736	,160		
	OTHER FRUITS (N)	44,869	736	,061		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	737,000	738			
	PULSES (BEANS, PEAS AND LENTILS) (C)	85,000	738			

	NUTS AND SEEDS (D)	406,000	738			
	DAIRY (E)	23,000	738			
	MEAT, POULTRY AND FISH (F, G, H)	706,000	738			
	EGGS (I)	5,000	738			
	DARK GREEN LEAVY VEGETABLES (J)	609,000	738			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	27,000	738			
	OTHER VEGETABLES (M)	591,000	738			
	OTHER FRUITS (N)	48,000	738			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,999	737			
	PULSES (BEANS, PEAS AND LENTILS) (C)	75,210	737			
	NUTS AND SEEDS (D)	182,645	737			
	DAIRY (E)	22,283	737			
	MEAT, POULTRY AND FISH (F, G, H)	30,612	737			
	EGGS (I)	4,966	737			
	DARK GREEN LEAVY VEGETABLES (J)	106,451	737			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	26,012	737			
	OTHER VEGETABLES (M)	117,720	737			
	OTHER FRUITS (N)	44,878	737			

Appendix 13: Anova for MDD between women and men from Bo

Tests der Zwischensubjekteffekte

Abhängige Variable: NUMBER OF FOOD GROUPS

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	10,529	1	10,529	8,983	,003
Konstanter Term	13806,315	1	13806,315	11778,559	,000
Sex	10,529	1	10,529	8,983	,003
Fehler	870,912	743	1,172		
Gesamt	14678,000	745			
Korrigierte Gesamtvariation	881,442	744			

Appendix 14: Anova for MDD </>= 5 between women and men from Bo

Tests der Zwischensubjekteffekte

Abhängige Variable: MDD >= 5

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	2,138	1	2,138	8,685	,003
Konstanter Term	158,595	1	158,595	644,111	,000
Sex	2,138	1	2,138	8,685	,003
Fehler	182,943	743	,246		
Gesamt	343,000	745			
Korrigierte Gesamtvariation	185,082	744			

Appendix 15: Anova for meal frequency between women and men from Pujehun

Tests der Zwischensubjekteffekte

Abhängige Variable: Number of meals

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	3,091	1	3,091	7,537	,006
Konstanter Term	3791,890	1	3791,890	9246,011	,000
Sex	3,091	1	3,091	7,537	,006
Fehler	311,274	759	,410		
Gesamt	4112,000	761			
Korrigierte Gesamtvariation	314,365	760			

Appendix 16: Manova for food groups between women and men from Bo

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	2,177E-6	1	2,177E-6	,001	,977
	PULSES (BEANS, PEAS AND LENTILS) (C)	,294	1	,294	2,796	,095
	NUTS AND SEEDS (D)	1,548E-5	1	1,548E-5	,000	,994
	DAIRY (E)	,173	1	,173	7,808	,005
	MEAT, POULTRY AND FISH (F, G, H)	,339	1	,339	4,980	,026
	EGGS (I)	,013	1	,013	3,141	,077
	DARK GREEN LEAVY VEGETABLES (J)	,090	1	,090	,594	,441
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,011	1	,011	,204	,652
	OTHER VEGETABLES (M)	,382	1	,382	2,306	,129
	OTHER FRUITS (N)	,331	1	,331	7,451	,006

Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	740,703	1	740,703	275912,302	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	10,699	1	10,699	101,820	,000
	NUTS AND SEEDS (D)	206,175	1	206,175	824,744	,000
	DAIRY (E)	,398	1	,398	18,000	,000
	MEAT, POULTRY AND FISH (F, G, H)	639,394	1	639,394	9388,653	,000
	EGGS (I)	,013	1	,013	3,141	,077
	DARK GREEN LEAVY VEGETABLES (J)	493,003	1	493,003	3242,309	,000
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	2,373	1	2,373	44,505	,000
	OTHER VEGETABLES (M)	466,014	1	466,014	2816,113	,000
	OTHER FRUITS (N)	1,673	1	1,673	37,651	,000
Sex	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	2,177E-6	1	2,177E-6	,001	,977
	PULSES (BEANS, PEAS AND LENTILS) (C)	,294	1	,294	2,796	,095
	NUTS AND SEEDS (D)	1,548E-5	1	1,548E-5	,000	,994
	DAIRY (E)	,173	1	,173	7,808	,005
	MEAT, POULTRY AND FISH (F, G, H)	,339	1	,339	4,980	,026
	EGGS (I)	,013	1	,013	3,141	,077
	DARK GREEN LEAVY VEGETABLES (J)	,090	1	,090	,594	,441
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,011	1	,011	,204	,652
	OTHER VEGETABLES (M)	,382	1	,382	2,306	,129
	OTHER FRUITS (N)	,331	1	,331	7,451	,006
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,995	743	,003		
	PULSES (BEANS, PEAS AND LENTILS) (C)	78,074	743	,105		
	NUTS AND SEEDS (D)	185,740	743	,250		
	DAIRY (E)	16,439	743	,022		
	MEAT, POULTRY AND FISH (F, G, H)	50,600	743	,068		
	EGGS (I)	2,975	743	,004		
	DARK GREEN LEAVY VEGETABLES (J)	112,975	743	,152		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	39,621	743	,053		
	OTHER VEGETABLES (M)	122,953	743	,165		
	OTHER FRUITS (N)	33,025	743	,044		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	743,000	745			
	PULSES (BEANS, PEAS AND LENTILS) (C)	89,000	745			
	NUTS AND SEEDS (D)	392,000	745			
	DAIRY (E)	17,000	745			
	MEAT, POULTRY AND FISH (F, G, H)	690,000	745			

	EGGS (I)	3,000	745			
	DARK GREEN LEAVY VEGETABLES (J)	606,000	745			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	42,000	745			
	OTHER VEGETABLES (M)	589,000	745			
	OTHER FRUITS (N)	35,000	745			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,995	744			
	PULSES (BEANS, PEAS AND LENTILS) (C)	78,368	744			
	NUTS AND SEEDS (D)	185,740	744			
	DAIRY (E)	16,612	744			
	MEAT, POULTRY AND FISH (F, G, H)	50,940	744			
	EGGS (I)	2,988	744			
	DARK GREEN LEAVY VEGETABLES (J)	113,066	744			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	39,632	744			
	OTHER VEGETABLES (M)	123,334	744			
	OTHER FRUITS (N)	33,356	744			

Appendix 17: Manova for food groups between women and men from Pujehun

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,005	1	,005	1,928	,165
	PULSES (BEANS, PEAS AND LENTILS) (C)	,014	1	,014	,180	,671
	NUTS AND SEEDS (D)	,040	1	,040	,161	,688
	DAIRY (E)	,068	1	,068	4,824	,028
	MEAT, POULTRY AND FISH (F, G, H)	,265	1	,265	5,216	,023
	EGGS (I)	,005	1	,005	2,086	,149
	DARK GREEN LEAVY VEGETABLES (J)	,578	1	,578	3,587	,059
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,002	1	,002	,156	,693
	OTHER VEGETABLES (M)	1,003	1	1,003	7,000	,008
	OTHER FRUITS (N)	,320	1	,320	8,266	,004
Konstanter Term	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	756,788	1	756,788	288689,223	,000
	PULSES (BEANS, PEAS AND LENTILS) (C)	5,733	1	5,733	72,209	,000
	NUTS AND SEEDS (D)	244,129	1	244,129	991,624	,000
	DAIRY (E)	,163	1	,163	11,490	,001
	MEAT, POULTRY AND FISH (F, G, H)	681,474	1	681,474	13425,597	,000
	EGGS (I)	,005	1	,005	2,086	,149
	DARK GREEN LEAVY VEGETABLES (J)	484,636	1	484,636	3008,707	,000

	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,107	1	,107	9,129	,003
	OTHER VEGETABLES (M)	517,145	1	517,145	3609,227	,000
	OTHER FRUITS (N)	1,288	1	1,288	33,220	,000
Sex	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	,005	1	,005	1,928	,165
	PULSES (BEANS, PEAS AND LENTILS) (C)	,014	1	,014	,180	,671
	NUTS AND SEEDS (D)	,040	1	,040	,161	,688
	DAIRY (E)	,068	1	,068	4,824	,028
	MEAT, POULTRY AND FISH (F, G, H)	,265	1	,265	5,216	,023
	EGGS (I)	,005	1	,005	2,086	,149
	DARK GREEN LEAVY VEGETABLES (J)	,578	1	,578	3,587	,059
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	,002	1	,002	,156	,693
	OTHER VEGETABLES (M)	1,003	1	1,003	7,000	,008
	OTHER FRUITS (N)	,320	1	,320	8,266	,004
Fehler	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,990	759	,003		
	PULSES (BEANS, PEAS AND LENTILS) (C)	60,262	759	,079		
	NUTS AND SEEDS (D)	186,859	759	,246		
	DAIRY (E)	10,773	759	,014		
	MEAT, POULTRY AND FISH (F, G, H)	38,526	759	,051		
	EGGS (I)	1,989	759	,003		
	DARK GREEN LEAVY VEGETABLES (J)	122,258	759	,161		
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	8,892	759	,012		
	OTHER VEGETABLES (M)	108,753	759	,143		
	OTHER FRUITS (N)	29,417	759	,039		
Gesamt	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	759,000	761			
	PULSES (BEANS, PEAS AND LENTILS) (C)	66,000	761			
	NUTS AND SEEDS (D)	431,000	761			
	DAIRY (E)	11,000	761			
	MEAT, POULTRY AND FISH (F, G, H)	720,000	761			
	EGGS (I)	2,000	761			
	DARK GREEN LEAVY VEGETABLES (J)	607,000	761			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	9,000	761			
	OTHER VEGETABLES (M)	628,000	761			
	OTHER FRUITS (N)	31,000	761			
Korrigierte Gesamtvariation	GRAINS, WHITE ROOTS AND TUBERS, AND PLANTAINS (A, B)	1,995	760			
	PULSES (BEANS, PEAS AND LENTILS) (C)	60,276	760			

	NUTS AND SEEDS (D)	186,899	760			
	DAIRY (E)	10,841	760			
	MEAT, POULTRY AND FISH (F, G, H)	38,791	760			
	EGGS (I)	1,995	760			
	DARK GREEN LEAVY VEGETABLES (J)	122,836	760			
	OTHER VITAMIN A-RICH FRUITS AND VEGETABLES (K, L)	8,894	760			
	OTHER VEGETABLES (M)	109,756	760			
	OTHER FRUITS (N)	29,737	760			

Appendix 18: Manova for food groups and district for breastfed infants 6-8 months

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, ROOTS AND TUBERS A,B)	,000	1	,000	,014	,906
	LEGUMES AND NUTS (C,D)	,006	1	,006	,024	,876
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,148	1	,148	3,792	,056
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	1,112	1	1,112	5,118	,027
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	,155	1	,155	1,564	,215
	OTHER FRUITS AND VEGETABLES (M, N))	,082	1	,082	,917	,342
Konstanter Term	GRAINS, ROOTS AND TUBERS A,B)	67,556	1	67,556	2432,500	,000
	LEGUMES AND NUTS (C,D)	22,006	1	22,006	86,680	,000
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,148	1	,148	3,792	,056
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	8,112	1	8,112	37,340	,000
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	,822	1	,822	8,273	,005
	OTHER FRUITS AND VEGETABLES (M, N))	,637	1	,637	7,151	,009
District	GRAINS, ROOTS AND TUBERS A,B)	,000	1	,000	,014	,906

	LEGUMES AND NUTS (C,D)	,006	1	,006	,024	,876
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,148	1	,148	3,792	,056
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	1,112	1	1,112	5,118	,027
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	,155	1	,155	1,564	,215
	OTHER FRUITS AND VEGETABLES (M, N))	,082	1	,082	,917	,342
Fehler	GRAINS, ROOTS AND TUBERS A,B)	1,944	70	,028		
	LEGUMES AND NUTS (C,D)	17,772	70	,254		
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	2,727	70	,039		
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	15,207	70	,217		
	EGGS (I)	,000	70	,000		
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	6,956	70	,099		
	OTHER FRUITS AND VEGETABLES (M, N))	6,238	70	,089		
Gesamt	GRAINS, ROOTS AND TUBERS A,B)	70,000	72			
	LEGUMES AND NUTS (C,D)	40,000	72			
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	3,000	72			
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	25,000	72			
	EGGS (I)	,000	72			
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	8,000	72			
	OTHER FRUITS AND VEGETABLES (M, N))	7,000	72			
Korrigierte Gesamtvariation	GRAINS, ROOTS AND TUBERS A,B)	1,944	71			
	LEGUMES AND NUTS (C,D)	17,778	71			

	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	2,875	71			
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	16,319	71			
	EGGS (I)	,000	71			
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	7,111	71			
	OTHER FRUITS AND VEGETABLES (M, N))	6,319	71			

Appendix 19: Anova for meal frequency and district for breastfed children 9-24 months

Tests der Zwischensubjekteffekte

Abhängige Variable: Number of meals

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	3,804	1	3,804	8,351	,004
Konstanter Term	2272,798	1	2272,798	4988,689	,000
District	3,804	1	3,804	8,351	,004
Fehler	210,027	461	,456		
Gesamt	2483,000	463			
Korrigierte Gesamtvariation	213,832	462			

Appendix 20: Manova food groups and district for non-breastfed children 9-24 months

Tests der Zwischensubjekteffekte

Quelle	Abhängige Variable	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	GRAINS, ROOTS AND TUBERS A,B)	,058	1	,058	3,889	,050
	LEGUMES AND NUTS (C,D)	,003	1	,003	,011	,916
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,066	1	,066	2,681	,103
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	,222	1	,222	2,241	,136
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	,907	1	,907	4,929	,028
	OTHER FRUITS AND VEGETABLES (M, N))	,331	1	,331	1,939	,165
Konstanter Term	GRAINS, ROOTS AND TUBERS A,B)	187,672	1	187,672	12634,346	,000

	LEGUMES AND NUTS (C,D)	55,109	1	55,109	219,167	,000
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,147	1	,147	5,976	,015
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	151,978	1	151,978	1533,855	,000
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	112,014	1	112,014	608,353	,000
	OTHER FRUITS AND VEGETABLES (M, N))	117,285	1	117,285	687,153	,000
District	GRAINS, ROOTS AND TUBERS A,B)	,058	1	,058	3,889	,050
	LEGUMES AND NUTS (C,D)	,003	1	,003	,011	,916
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	,066	1	,066	2,681	,103
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	,222	1	,222	2,241	,136
	EGGS (I)	,000	1	,000	.	.
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	,907	1	,907	4,929	,028
	OTHER FRUITS AND VEGETABLES (M, N))	,331	1	,331	1,939	,165
Fehler	GRAINS, ROOTS AND TUBERS A,B)	2,897	195	,015		
	LEGUMES AND NUTS (C,D)	49,033	195	,251		
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	4,807	195	,025		
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	19,321	195	,099		
	EGGS (I)	,000	195	,000		
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	35,905	195	,184		
	OTHER FRUITS AND VEGETABLES (M, N))	33,283	195	,171		
Gesamt	GRAINS, ROOTS AND TUBERS A,B)	194,000	197			
	LEGUMES AND NUTS (C,D)	105,000	197			
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	5,000	197			
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	175,000	197			
	EGGS (I)	,000	197			

	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	148,000	197			
	OTHER FRUITS AND VEGETABLES (M, N))	154,000	197			
Korrigierte Gesamtvariation	GRAINS, ROOTS AND TUBERS A,B)	2,954	196			
	LEGUMES AND NUTS (C,D)	49,036	196			
	DAIRY PRODUCTS (MILK, YOGHURT, CHEESE) (E)	4,873	196			
	FLESH FOODS (MEAT, FISH, POULTRY AND LIVER/ORGAN MEATS) (F,G,H))	19,543	196			
	EGGS (I)	,000	196			
	VITAMIN A RICH FRUITS AND VEGETABLES (J, K, L)	36,812	196			
	OTHER FRUITS AND VEGETABLES (M, N))	33,614	196			

Appendix 21: Manova for food groups and growing vegetables/fruits and owning livestock

Tests der Zwischensubjekteffekte

Abhängige Variable: NUMBER OF FOOD GROUPS

Quelle	Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Sig.
Korrigiertes Modell	15,122	7	2,160	1,834	,077
Konstanter Term	14067,014	1	14067,014	11940,412	,000
Growingvegetables	2,147	1	2,147	1,822	,177
Growingfruits	,196	1	,196	,167	,683
OwingLivestock	1,120	1	1,120	,951	,330
Growingvegetables * Growingfruits	3,765	1	3,765	3,196	,074
Growingvegetables * OwingLivestock	3,936	1	3,936	3,341	,068
Growingfruits * OwingLivestock	,761	1	,761	,646	,422
Growingvegetables * Growingfruits * OwingLivestock	1,939	1	1,939	1,646	,200
Fehler	1764,796	1498	1,178		
Gesamt	29576,000	1506			
Korrigierte Gesamtvariation	1779,918	1505			