THE EFFECTS OF HOUSEHOLD FOOD PRACTICES AND DISEASES PREVALENCE ON NUTRITIONAL STATUS OF UNDER-FIVE CHILDREN IN RUHANGO DISTRICT, RWANDA

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ABSTRACT

Malnutrition in the Southern province of Rwanda is a significant public health concern. According to the Rwanda Demographic and Health Survey (RDHS) 2010, chronic malnutrition in children under 5 years was widespread 44% children having stunting (insufficient height for age), 11 % underweight (weight for age) and 3% wasting (weight for height). Ruhango district (Southern Rwanda) had the highest malnutrition prevalence (23.5%) in 2009. This study aimed to measure the prevalence of malnutrition among Ruhango children in 2012 and to identify relationship between co-morbidities occurrence, food intake and their nutrition status. A multistage sampling was done across four hierarchical levels: district, sector, cell and village, where households (N=294) with children under five years were purposively selected to form the sampling units in which the survey was conducted. The study showed that Ruhango has improved in prevention of malnutrition as compared to 2010 study. However, stunting was still a problem with those aged between 24 and 35 months being most affected. Wasting did not affect large population of the target group. Better educated household members had less malnourished kids (3%) than those who did not attend school (12%). Co-morbidities occurrence was significantly higher in malnourished children (P = 0.006). Acute Respiratory Tract Infection had the highest occurrence (52%). The children reported to have been sick had significantly lower weight than those who were normal (P<0.05). Food intake (mean dietary diversity of 25%) was not adequate for most households and only few people took protein of high quality like meat and milk. Household food practices were tested at 95% confidence interval and this affected the nutrition status of children (P = 0.02). In households with mean dietary diversity above four food groups, only 2.17 % of children were underweight as compared to 18.18% those from households with mean dietary diversity below three. Thus, interventions to eliminate malnutrition should focus on household food diversification and disease prevention.

Key words: Prevalence, malnutrition, diseases, 24hr recall

INTRODUCTION

Malnutrition among children under five years in Southern Rwanda is high and was of public concern since many years. According to the Rwanda Demographic and Health Survey (Rwanda DHS) 2010, chronic malnutrition in children under 5 years was widespread 44% children having stunting (insuffient height for age), 11 % underweight (weight for age) and 3% wasting (weight for height). Ruhango district (Southern Rwanda) had the highest malnutrition prevalence (23.5%) in 2009 [1]. Each one out of ten children dies before the first birthday, and 52% of the survived are chronically malnourished [2]. Occurrence of malnutrition can be attributed to ignorance, inadequate protein intake, protein mal-absorption, and extreme poverty which hinder access to nutritious food.

According to the UNICEF conceptual framework on the causes of malnutrition, inadequate food intake and disease are immediate causes; underlying causes are household food insecurity, social and care environment, access to health care and the health environment; the basic causes are poor national policies, inadequate formal and informal structures and lack of resources [3].

Under-nutrition in children exhibits in three ways that are most commonly assessed through the measurement of weight and height. A child can be stunted, wasted or underweight. A child who is underweight can also be stunted or wasted or both [4]. According to UNICEF, stunting affects approximately 195 million children under 5 years old in the developing world, or about one in three. Africa and Asia have high stunting rates: 40 percent and 36 percent, respectively, and more than 90 percent of the world's stunted children live in these two continents [4].

Underweight has been described for children aged 0–4 years as low weight-for-age relative to the National Center for Health Statistics/World Health Organization (NCHS/WHO) reference median. The theoretical minimum-risk distribution for this population was equivalent to the Reference population distribution, wherein 2.3% of children have a weight-for-age below -2 standard deviations (SDs) (weight-for-age <-2SDs, or weight-for-age z-score [WAZ] <-2) and are underweight [5, 6]. The Middle Upper-Arm Circumference is an alternative way to measure thinness like weight for height. It is used for children aged between six months and five years [3].

Some children have a naturally slight build and maintain it with a well-balanced diet and physical activity, but true underweight may be a sign of dietary, health or emotional problems [7].

The prevalence of malnutrition of under-five children in Rwanda has been reducing from 2000 up to now. According to Rwanda DHS 2000 the prevalence of chronic malnutrition was 42.6% of stunting, 24.3% of underweight and 6.8% weight-for -height or wasting [8]. According to the 2005 Rwanda DHS the prevalence of chronic malnutrition among under-five population was 45% of stunting, 22% of underweight and 4% weight for height or wasting [9]. Rwanda DHS 2010, 44% children were stunted, 11% under weight and 3% wasted [10]. The prevalence of malnutrition in

Ruhango district was high in 2009-2010 among children under five. The district was one of the most affected by higher occurrence of malnutrition 23.5% in 2009 [1].

Throughout the country, the food and nutrition security have stabilized or improved since 2005. Some geographical areas are more prone to food insecurity and vulnerability than others [11]. The weight of the child is determined by diet and exercise. Children are generally very active and burn off a lot of calories during the day, thus if they do not eat enough, they become underweight [12]. Some children are picky eaters, and many underweight children are not eating enough. Others could be underweight because of diseases like vomiting, diarrhea or thyroid disease. Genetics could cause a child to be underweight [12]. In addition, the increased risk of under nutrition as children reach their second year of life may be due to weaning from the breast and mothers lose their ability to produce enough milk to meet the nutritional demand of the growing infant [13]. The study was conducted to identify the extent to which co-morbidities and food intake contribute to malnutrition among under-five children in Ruhango district of Rwanda.

MATERIAL AND METHODS

Study area
Ruhango district is located in the Southern province of Rwanda, and it has 9 sectors, 59 cells and 533 villages. The district covers 2,626.8 km^2 and the population is 271,807 in 60,809 households with a density of 415/km^2 for 2010. Economic activities are agriculture and livestock. The main crops are cassava, legumes, maize, rice and coffee [14]. Below is the map of Rwanda and Ruhango District, the study site (Figure 1).
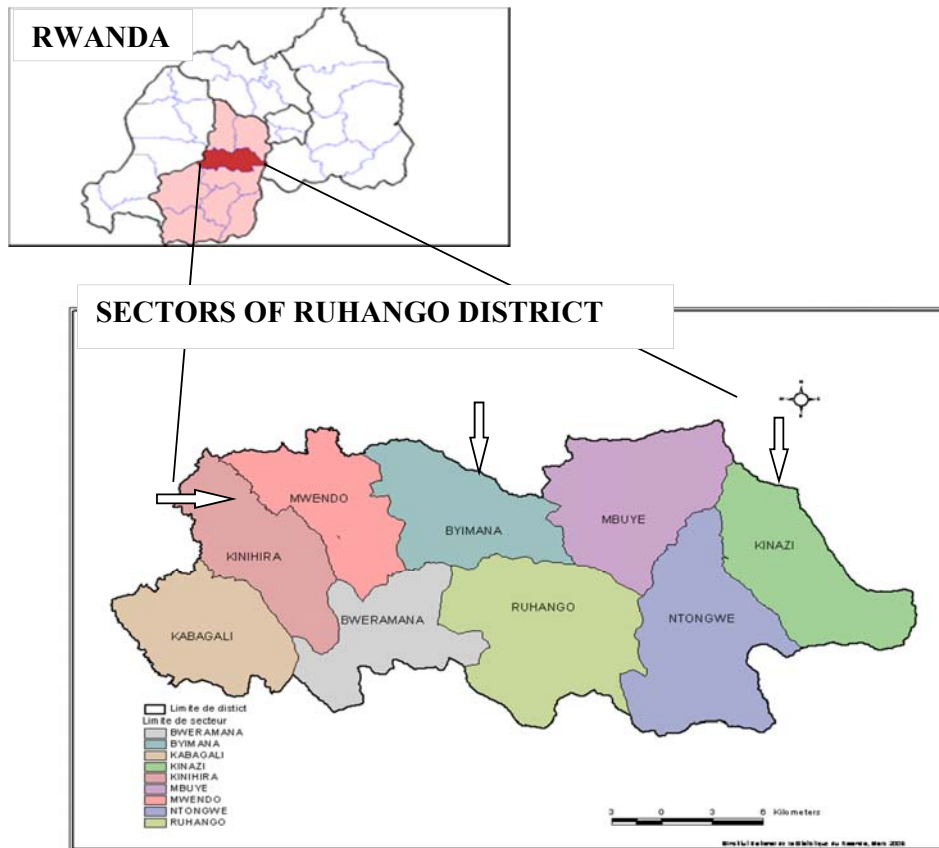
Figure 1: Sectors of Ruhango District. Sources: Southern Province Official Website, 2007 (Ruhango map, 2012)

Description of the study population

This study targeted under-five children in Ruhango District to measure the prevalence of malnutrition and co-morbidities. Households (N=294) with under five children participated in the study provided information on socio-demographic characteristics and food intake in households. Most of the care-givers of the children were females. As compared with other districts in Rwanda, Ruhango came in the 5th position in ranking for the proportion of poor and extreme poor in 2010 [15]; however, it was the first highest in malnutrition.

Survey

1) Sampling

Ruhango district was selected purposively among the districts in Rwanda since it had the highest level of malnutrition. Multistage sampling was then carried out. In the first stage, three sectors were randomly selected from the nine sectors within Ruhango district. In the second stage a cell was selected randomly from each of the three sectors. In the next stage two villages were selected randomly from each of the three cells. Further, household with children under 5 years of age were purposively selected to form

the sampling units in which the survey was conducted. The formula below was used to compute household sample size:

$$n = \frac{(Z_{1/2\alpha} + Z_{(1-12\beta)})^2 \, p(1-p)}{d^2} = \frac{(1.96 + 1.282)^2 \, (0.3)(0.7)}{0.1} = 220.7[16]$$

Proportion of household with children under five was 30% of the households in Ruhango district and the Type I error probability (alpha 0.05 giving 1.96) for estimating proportions with probability (power) of 0.90 (1.282), the proposed sample size was computed to be 221 households for our study. A total of 294 household's care-givers came to the health center where we took anthropometric measurement of one elder child under five per household and thus participated in the study: 95 in Kinazi, 100 in Byimana and 99 in Kinihira. This has been achieved with the help of health workers (sensitization of household members) and records in health centers. By sensitization of household's members the population of study exceeded the computed sample size which increases the accuracy of the results.

A survey was carried out to determine the prevalence of malnutrition, co-morbidities among children under five in Ruhango district and dietary intake in households. The mother or another person (over 18 years) involved in child care was considered as respondent if she/he had a willingness to participate in the survey interview.

2) Data collection
Data collection tools
a) Anthropometry: weight using scales, height using a board, Mid Upper Arm Circumference (MUAC) using tapes. Below are techniques of measurement used. For height a measuring board/stick (±1mm) was used: perfect positioning feet joined, knees extended, head high, lying from 0 to 24 months, standing from 24 months. There was also an assistant to the person taking the measurements. A weighing scale with weight limit of 20 kg was used to obtain the weight of a child wearing an appropriate kit. For determining the age of the child, a birth certificate and or vaccination/health card were used [17]. The MUAC criteria to identify malnutrition of children under five years in the community were highlighted as follows: Severely Malnourished: ≤11.5 cm; Moderately Malnourished: 11.5 cm to 12.4 cm, At risk of malnutrition: 12.5 cm to 13.4 cm [3].

b) Pretested questionnaire: Information about socio-demographic characteristics and diseases was obtained using a questionnaire. A face-to-face interview with the care-giver was conducted.

c) Food intake diversity was determined using 24hr recall: This was administered to 30% of households selected systematically. When taking a 24 recall the interviewers were trained to follow certain procedures to ensure that all foods and beverages consumed are listed [18]. Food and Agriculture Organization (FAO) dietary diversity measurement guidelines were used to score food groups consumed in the household [19]. The dietary diversity scores consisted of a simple count of food groups that a household had consumed over the preceding 24 hours. For the study, a questionnaire was adapted from FANTA Household Dietary Diversity Score Indicator Guide. The

respondent mentioned foods (meals and snacks) eaten or drunk the day before during the day and night starting with the first food or drink of the morning. A total of 12 food groups were scored 1 if the food was eaten and 0 if the food was not eaten. The HDDS variable was calculated for each household by adding scores. The average HDDS indicator was calculated for the sample population (Sum HDDS/Total number of households). The mean dietary diversity was calculated using the sum of scores divided by 12 food groups.

3) Data analysis
Prevalence of under nutrition among under-five children was obtained from the WHO Global Database on Child Growth and Malnutrition, derived from a systematic analysis of raw data sets from 294 children anthropometry.

Frequencies/percentages of respondent sex, age, level of study and number of under five children per household, summary statistics for household members, household dietary diversity and co-morbidities prevalence were obtained using GenStat 14th edition. P-value less than 0.05 were considered to identify variables that contribute significantly to malnutrition as well as mean dietary diversity less than 33% for food intake [20].

RESULTS

A survey was conducted in May among 294 households of Ruhango district in three sectors selected randomly: Kinazi (95 households), Byimana (100) and Kinihira (99) to determine the prevalence of malnutrition, co-morbidities among children under five years and the dietary intake among households in Ruhango District.

1. Social characteristic of the study population
Most (96%) of the respondents were females. This shows that care-givers are females with a small number of males especially when women are sick or absent. A total of 18.7% respondents aged between 20 and 25; 48.3% between 26 and 35; 23.8% between 36 and 45, 5.4% between 46 and 55 and 3.7% were aged over 55 years. Majority of the respondents (71.4%) had primary level education, 11.2% had secondary level and only 0.2% had university education. The rest (16.7%) had not attended school. The size of the household ranged from 2 to 12 members with mean of 5 and a median of 5. Most (64%) of households had one child under five, 32% had 2, and 4% had 3.

2. Prevalence of malnutrition among children under five
Undernutrition indicators are of three types: underweight low weight for age, stunting low height for age and wasted or severely thin low weight for height. The child growth standards applied here are new international growth standards from WHO [6]. The study showed that 37.8% of under-five children were stunted, 8.5% underweight and 3.1% wasted. Ruhango district was one of the most affected by higher incidences of malnutrition [1]. From this study in 2012, the district has improved considerably.

The weight-for-age Z score of WHO standards was compared with survey data for each child using WHO ANTHRO software. An average of 8.5 % of the children was below

-2 Z score (Table 1). These are underweight children who need intervention to gain weight. The same table shows underweight and overweight children using WHO BMI (Weight (kg) /Height (m)²). Some children are naturally small [7]. True underweight cannot be detected in the population of low weight and low height. Only 3.4% of the children of study were underweight using WHO BMI for age cut-offs. The highest prevalence was among children between 12 and 23 months old as shown in Table 1. Obesity counted for 3.7% with the highest prevalence of 14.3% among children of 6 to 11 months [Table 1].

The highest prevalence of underweight was found in Burima at 9.5%, while prevalence in Muhororo and Muyunzwe was 8% and 8.1%, respectively (Table 2). The table shows also stunting in the three clusters. Stunting is determined using height for age and is an indicator of chronic malnutrition, 37.8% of the children were stunted and 11.9% from these were severely stunted. The cluster number 2 (Muhororo) was the most affected with 52%. Stunting was still a problem with those aged between 24 and 35 months being most affected.

Wasting cannot be considered as problem of health, for the population of study, the prevalence of wasted was 3%. However, low weight against low height lead to normal output even if it is severe. The Middle Upper-Arm Circumference is an alternative way to measure thinness like weight for height. It is used for children aged between six months and five years [3]. It is used for rapid screening of assessment of malnutrition. Only 4.4% were moderately malnourished. This can be confirmed by the wasting of 3% as MUAC is an alternative way of measuring weight for height [Table 2].

Considering the education background, it was observed that better educated household members had less malnourished kids (3%) than those who did not attend school (12%).

3. Dietary intake in households
The most commonly consumed food in Ruhango were fresh cassava, cassava dough made from cassava flour, sweet potatoes, potatoes, taro, bananas, rice, maize, beans, peanuts, soybeans, milk, fish, vegetables especially amaranths, eggplants, cassava leaves and green beans, and avocado as fruits. Cassava was boiled with beans; vegetables were fried with small fish and peanut and eaten with cassava dough or rice.

About half of the households in Ruhango District, 44.3% did not take breakfast. Out of 55.7% households who took breakfast, 22.8% took porridge and 33% took reheated food remaining from last night especially cassava with beans. About one tenth (8.9%) of households did not take lunch. Households, which had lunch, were 91.2%. Among those, 13.9% ate sweet potatoes with beans, 10.1% sweet potatoes plus beans and vegetables, 10.1% cassava dough plus beans and vegetables, 10.1% cassava fresh with beans, 3.8% potatoes with beans, 2.5% bananas with beans, and other recipes that varied by household. None of the households skipped dinner. Snacking was not common, only 7.6% of the households ate between lunch and supper and 1.3% household took juice and water between meals.

Caloric and protein adequacy was determined using the Household Dietary Diversity Scores. A more diversified diet is highly correlated with caloric and protein adequacy, and percentage of protein from animal sources with high quality protein. Twelve food groups were considered as recommended by FAO [19]: 1 Cereals, 2 White roots and tubers, 3 Vegetables, 4 Fruits, 5 Meat, 6 Eggs, 7 Fish and other sea food, 8 Pulses, legumes and nuts, 9 Milk and milk products, 10 Oil and fats, 11 Sweets and 12 Spices, condiments and beverages. Average Household Dietary Diversity Scores (HDDS) for mean number of food groups used within past the 24 hours was 3.8. and could be obtained using the formula: Sum HDDS/Total number of households. The median was 4, the minimum was 2, the maximum was 8 and the sum of scores was 304. Table 3 shows the proportion of respondents consuming a range of foods and 69.7% consumed 1-4 food items and 30.4% consumed between 5 and 8 different food varieties. No one consumed the foods in more than 8 groups [Table 3].

The mean dietary diversity was calculated using this formula: Sum/12. The sum of scores 304 was divided by 12 food groups and a mean of 25 dietary diversity was obtained which is less than the upper tercile of diversity of the 33 percent of households with the highest diversity [19].

Percentages of households consuming each food group were computed using GenStat 14th edition as shown in Table 4. The highest consumed food groups were white roots and tubers, and pulses, legumes and nuts with 97.5% of households in Ruhango district. Animal protein was rare in the diet of the study population. Only 11.4% had eaten small fish, 8.9 % had drunk milk and no one had eaten meat and eggs the day before the survey [Table 4].

Household food practices were tested at 95% confidence interval to show how inadequate food intake threatens the nutrition status of under five children (P = 0.02). The relationship between household dietary practices and malnutrition is shown in the Table 5. For households with mean dietary diversity above four only 2.17 % of children were underweight while households which have mean dietary diversity below three 18.18% of their children were underweight.

4. Co-morbidities among the children
During the survey 40.1% of the children had been sick in the previous two weeks. Of the children who had been sick 83% of the parents had sought medical assistance while 16% did not seek any assistance. Nearly half of those who sought assistance went to hospitals (49.5%). An additional 24.2% went to herbalists, 19.2% to pharmacies and the rest used home remedies (9.1%) or sought assistance from relatives (2.0%). Most (61.6%) sought assistance after 24 hours. The majority of those who did not seek for assistance did not look serious (68.4%) or lacked money (31.6%).

Figure 2 shows the different co-morbidities affecting the children in Ruhango District which included Acute Respiratory Tract Infection 52%, intestinal parasites 13% and watery diarrhea 7% among others.
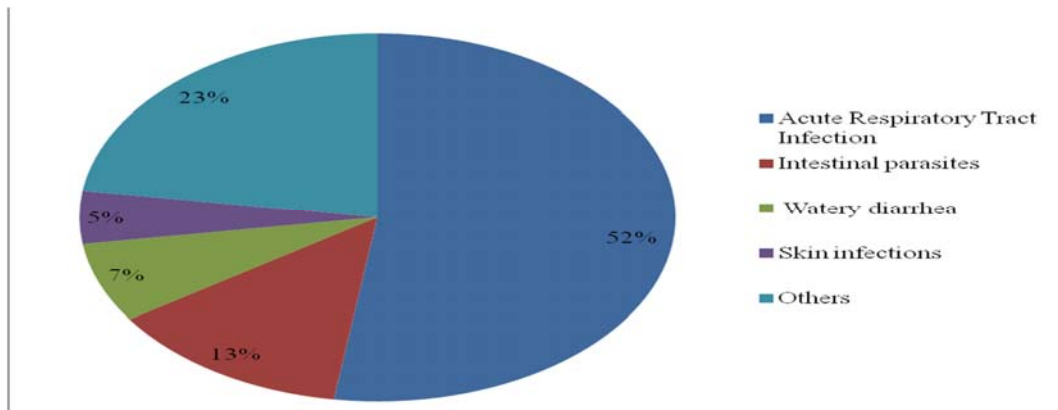
Figure 2: Co-morbidities among children under five years in Ruhango District

One way ANOVA was used to test the significance of co-morbidities on weight of the underfives at 95% confidence interval. The weight of the children was significantly affected by sickness (P = 0.006). Those children were reported to have been sick had significantly lower weight than those who were normal. Table 5 shows children sick and malnourished 10.2% against 7.4% not sick malnourished. Among children who were underweight 10.4% was suffering from Acute Respiratory Tract Infection against 7% not sick, 11.8% had Intestinal parasites against 8.3% who were not sick. [Table 5].

DISCUSSIONS

5.1. Prevalence of malnutrition
The Rwanda Demographic Health Survey 2010 showed 11% of children underweight, 44% stunted, 3% wasted and Ruhango was the one of highest prevalence of malnutrition with 23.5% [1]. The study show that Ruhango has improved with 8.5% of underweight compared to 2010 situation [9]. The most affected group was aged between 12 and 23 months and can be attributed to the period during which the children are not used to eat, are choosy in the food they eat and sometimes are anxious [12]. If a particular attention is not given to those children they get easily malnourished. Stunting has reduced from 44% (in 2010) to 37.8% (in the study, 2012) but the prevalence is still high and this shows chronic malnutrition [10]. Wasting has not changed from the 3% and it seems to not be a problem because the weight for height fitting well due to low weight for low height of a short person [7].

Among causes of malnutrition, the study showed variables that contribute the most to malnutrition as co-morbidities (P = 0.006) and inadequate food intake as the mean dietary diversity was 25 which is less than the average diversity of the 33 percent of household with the highest diversity [18]. This is confirmed by UNICEF conceptual framework on the immediate causes of malnutrition [3].

Ignorance of food practices contributes to high level of malnutrition according to background in education, 3% of malnourished children are recorded in households

attended school against 12% of malnourished children for those who did not attend school.

5.2. Food intake

Few people took high quality protein (meat, milk, eggs, fish and soybean), and this is important to fight malnutrition in this area. The main source of protein was beans but animal sources of protein are needed also for good health. In Ruhango, 97% consumed roots and tubers the previous day of the survey but cereals were not enough. Energy can be satisfied but when protein is missing for a long time in the diet, this leads to malnutrition especially kwashiorkor. Household diversity practices significantly affected nutrition status of under five children living in those household was tested at 95% confidence interval and was significant (P = 0.02).

5.3. Co-morbidities

The study showed that co-morbidities were the main cause of malnutrition [3]. Acute Respiratory Tract Infection had the highest prevalence among 15 diseases recorded followed by intestinal parasites and watery diarrhea. In the month of May in which the survey was done, many people were suffering from flu. However, studies done before had showed that Acute Respiratory Tract Infection had the highest prevalence among co-morbidities of under five and 10.4% were underweight against 7% not sick [1,10]. Finally, under nutrition increases risk of morbidity and this lead to a circle of malnutrition-diseases [1].

CONCLUSION

The study showed that in 2012, Ruhango has improved in combating malnutrition compared to the 2010 period situation. However stunting was still a problem with those aged between 24 and 35 months being most affected. Wasting did not affect large population of the target group but can still be considered a nutritional problem although not a significant one. P-value less than 0.05 and mean dietary diversity less than 33% upper tercile diversity were considered to identify variables that contribute significantly to malnutrition. Co-morbidities were the most contributing (P = 0.006), followed by food intake where the mean dietary diversity was 25% (P = 0.02).

Food intake was not adequate for most households and only few people took protein of high quality like meat and milk but most of them consumed roots and tubers. This could explain the high level of malnutrition prevalent in Ruhango district. Co-morbidities were the main cause of malnutrition with Acute Respiratory Tract Infection taking the highest percentage for the co-morbidities recorded in the survey.

RECOMMENDATIONS

Strategies should be taken by the Ministry of Health to reduce Acute Respiratory Tract Infection as they did for intestinal parasites.

Utilization of inexpensive foods rich protein such as soybean can be promoted to combat malnutrition.

Interventions to eliminate malnutrition should focus on household food diversifications and diseases prevention.

Table 1: Prevalence of malnutrition among study children by age groups

Age groups	N	Weight-for-age (%)		BMI-for-age (%)		
(Months)		<-3SD	<-2SD	< -3SD	< -2SD	>+3SD
(6-11)	7	0	0	0	0	14.3
(12-23)	65	1.5	9.2	6.2	9.2	6.2
(24-35)	66	0	9.1	0	3	4.5
(36-47)	77	0	9.1	0	0	3.9
(48-60)	79	1.3	7.6	1.3	2.5	0
Total:	294	0.7	8.5	1.7	3.4	3.7

Table 2: Prevalence of malnutrition among study children sex combined by cluster

Cluster	N	Weight-for-age %		Length/height-for-age %	
		< -3SD	< -2SD	< -3SD	< -2SD
Burima	95	1.1	9.5	11.6	34.7
Muhororo	100	1	8	17	52
Muyunzwe	99	0	8.1	7.1	26.3
Total	294	0.7	8.5	11.9	37.8

Table 3: Household Dietary Diversity in Ruhango district

Household Dietary Diversity Scores	%	Cumulative %
2	12.7	12.7
3	29.1	41.8
4	27.9	69.7
5	25.3	95
6	2.5	97.5
7	1.3	98.7
8	1.3	100

Table 4: Frequency for households who had consumed each food group the previous day in Ruhango District

Food groups	% of household consuming
Cereals	44.3
White roots and tubers	97.5
Vegetables	70.9
Fruits	2.5
Meat	0.0
Eggs	0.0
Fish and other sea food	11.4
Pulses, legumes and nuts	97.5
Milk and milk products	8.9
Oil and fat	45.6
Sweets	2.5
Spices, condiments and beverages	3.8

Table 5: Relationship between food intake in household, diseases prevalence and nutrition status

	Normal weight	Underweight	P	Food intake status
≥4 food groups	97.83	2.17		
≤3 food groups	81.82	18.18	0.02	
Sickness status				
Not sick	92.60	7.40		
Sick	89.80	10.20	0.006	

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