# The Influence of dietary diversity on the nutritional status of children between 6 and 23 months of age in Tanzania

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# Abstract

Background Undernutrition poses a serious health challenge in developing countries. Tanzania has the highest undernutrition burdens in East and Southern Africa. Poor infant and young child feeding practices including consumption of undiversified diet are the main cause for undernutrition. There is limited information regarding the association between dietary diversity and undernutrition in Tanzania. The objective of this paper was to examine to what extent the dietary diversity is associated with undernutrition of children of 6 to 23 months in Tanzania.

Methods This is a secondary data analysis from data collected by the Tanzania Demographic and Health Survey of 2015-2016. Stunting, wasting and underweight were calculated from Z-scores based on 2006 WHO standards. A dietary diversity score was created by summing the number of food groups reported for each child by the mother ranging from 0 to 7. Then, a Minimum Dietary Diversity (MDD) indicator was used to assess the diversity of the diet given to children. Bivariate and multivariate logistic regression techniques were used to assess the odds ratios of becoming undernourished.

Results A total of 2,960 children were enrolled in this study. The majority (73.9%) of children did not reach the recommended Minimum Dietary Diversity (MDD). The most commonly consumed types of foods were grains, roots and tubers (91%), and Vitamin A containing fruits and vegetables (65%). Consumption of a diverse diet was significantly associated with a reduction of stunting, wasting and being underweight in children. The likelihood of being stunted, wasted and underweight was found to decrease as the number of food group consumed increased. Children who did not received an MDD diet had a significantly higher likelihood of being stunted (AOR=1.37, 95% CI; 1.13-1.65) and underweight (AOR=1.49, 95% CI; 1.15-1.92), but this was not the case for wasting. Consumption of animal source foods has been found to be associated with reduced stunting among children.

Conclusion Consumption of a diverse diet was associated with a reduction in undernutrition among children of 6 to 23 months in Tanzania. Measures to improve the type of complementary foods in order to meet the energy and nutritional demands of children should be considered in Tanzania.


# Background

Undernutrition poses a serious challenge in developing countries [1]. The World Health Report of 2016 showed about 155 million children under five years of age were estimated to be stunted, and 52 million were wasted [2]. The rates of undernutrition were known to be substantially higher in the Sub-Saharan African (SSA) region [1, 3]. In Tanzania, high prevalence of chronic and acute undernutrition still persist for a long period of time. It was estimated that about 450,000 children in Tanzania are acutely malnourished or wasted, with over 100,000 suffering from the most severe form of acute malnutrition[4]. Tanzania has one of the highest undernutrition burdens in East and Southern Africa, where by, the burden of chronic undernutrition in Tanzania ranks third in SSA after Ethiopia and the Democratic Republic of Congo[5]. The recently released national survey of 2018 reported that 31.8% of children were stunted, 3.6% were wasted and 14% were underweight [6]. The damage caused by undernutrition during the first two years of life may compromise cognitive development of the children and in turn, poor educational achievement, low economic productivity, and is associated with illness and mortality during adulthood [7].

Poor infant and young child feeding practices are the main causes of undernutrition in Tanzania [8, 9] and other developing countries [2]. Maintaining good feeding practices during infancy is critical for the growth, development

and health of a child. From the age of 6 months, breastfeeding is no longer able to meet the energy and micronutrient needs of a growing child, and therefore, the consumption of adequate diversified food is necessary [10]. Globally, however; only less than one-fourth of infants aged 6–23 months meet the recommended criteria for dietary diversity, and only a few of them are receiving a nutritionally adequate diet [2]. The World Health Organization has recommended that an infant should receive a Minimum Dietary Diversity (MDD) of at least four food groups out of seven in order to maintain proper growth and development during this critical period [11], but still many children cannot meet these criteria. In Tanzania forexample, according to the recent report, only 35.1% of the children aged 6 to 23 months had received a MDD diet [12], and only 23.3% in Ethiopia [13]. Receiving an inadequately diversified diet may lead to undernutrition[14], and predispose children to opportunistic infections and severe illnesses [7].

Although the link between dietary diversity and the nutritional status of children has already been studied in various countries [14–19]. Studies that use large scale data are scarce particularly in Tanzania. In addition, many previous studies in Tanzania have largely focused on other aspects of childfeeding like micronutrient content[9], complementary feeding practices [9, 20–23], and their determinants [24, 25], but none of them, according to our literature review, has examine the link between child diet diversity and nutritional status. Understanding the influence of the dietary diversity on nutritional status of children could be useful to inform nutrition policy and propose interventions that focus on improving the quality of complementary foods. Findings from this study will also be important to public health experts in Tanzania based on the Sustainable Development Goal–2 (SDG–2) agenda, which aims to end malnutrition in all its forms by 2030 [26]. The present study therefore aimed to examine the role of child dietary diversity on undernutrition in Tanzania by using the large available dataset which is representative of the whole country.

# Methods

## Data source

This is a secondary data analysis from the Tanzania Demographic and Health Survey (TDHS) 2015–2016. TDHS 2015 was implemented by the National Bureau of Statistics in collaboration with other government partners[12]. Data collection procedures have been described and published in the TDHS 2015 report [12]. Briefly, TDHS 2015 was designed to produce representative samples at the national, regional and rural-urban levels. The TDHS of 2015 was part of the worldwide demographic and health survey program in order to assist the countries to collect data to monitor and evaluate the population, health and nutrition programs. The survey employed a two-stage sampling design. In the first-stage, 608 clusters were randomly selected. The second-stage sampling involved systematic sampling of households from the selected clusters. From that, 22 households were selected from each cluster. A total of 13,376 households were included. In this analysis, only data of children aged between 6 to 23 months during the study matched with their mothers were finally selected for further analysis.

We used the Kids file (KR file) and Mother file (MR file) from the TDHS data obtained from online data repository to get information about nutrition status and dietary diversity of children [20]. From 10,233 children of 0–59 months old assessed in the survey, we selected 2,960 younger children aged between 6–23 months living with their mothers—because in TDHS, information on feeding practices was collected only for last child of this age group who lived together with its mothers. Details of the procedure used to select children in this study are described in Figure 1.

## Nutrition status calculation

In this study, stunting, wasting and underweight were calculated from height-for-age z-scores (HAZ), weight-for-height z-scores (WHZ), and weight-for-age z-scores (WAZ); based on 2006 WHO standards [27]. HAZ is used to measure chronic malnutrition due to prolonged food deprivation. WHZ captures undernutrition due to recent food deprivation and malnutrition, and WAZ measures the child's body mass relative to her chronologic age, and is used as a proxy for underweight. Children whose HAZ, WHZ and WAZ below minus two standard deviations (−2 SD) from the median of the reference population were considered short for their age (stunted), wasted and underweight; respectively. We excluded missing values and biologically implausible values such as less than (−6 SD) and greater than (+6 SD) in our study as shown in Figure 1.

## Dietary diversity calculation

To measure dietary diversity, we adopted the WHO's Infant and Young Children Feeding guidelines (IYCF)[11], because they are designed to measure dietary diversity for both breastfed and non-breastfed children. Also, the dataset used in the analysis contains information on the food items that can be used to calculate this indicator. The TDHS survey collected information on food items a child consumed in the previous day. We categorized these food items into seven major food groups based on the WHO's IYCF guidelines. These food groups are: (i) grains, roots, and tubers; (ii) legumes and nuts; (iii) flesh foods (meat, fish, poultry and liver/organ meats); (iv) eggs; (v) vitamin A rich fruits and vegetables; (vi) dairy products (milk, yogurt, cheese); (vii) other fruits and vegetables. If a child consumed at least one food item from a food group, the group was assigned a value of one for that child. The group scores are then summed to obtain the dietary diversity score, which ranges from zero to seven, where zero represents non- consumption of any of the food items and seven represents the highest level of diet diversification. Then, a minimum Dietary Diversity (MDD) was used as an indicator for children dietary diversity in TDHS. This indicator is one of eight IYCF indicator developed by WHO to provide simple, valid and reliable metrics for assessing IYCF practices. MDD diet was attained if a child had consumed four or more food groups (FG≥4) out of seven food groups over the past 24 hours.

## Other covariates

Based on the reviewed literature and the objective of this study we considered other characteristics of the child reported by the mother. Child's characteristics included in the study are age, sex, and mother's perceived birth size (size of child as reported subjectively by the respondent), place of birth, presence of fever and diarrhea in the past two weeks before the interview[16, 19].

## Statistical analysis

Categorical variables are presented as proportions, and continuous variables as means and standard deviation (Means±SD). To determine the relationship between dietary diversity and nutrition status outcomes, i.e stunting, wasting and underweight, we first built a series of bivariate logistic regression (for dichotomous outcomes) models. Dietary diversity score, the independent variable of interest, was captured as a continuous variable from the count of the number of food groups from which a child had food in the previous day before the survey. A separate model was created for each anthropometric outcome, with dietary diversity scores as the independent

variable. Also, the same was done for MDD as a categorical indicator. Each food group was entered in a bivariate and multivariate model to test the association with nutrition status of the children. The multivariable models for each outcome were controlled for the child's sex, age, presence of fever (yes/no), and diarrhea (yes/no) in the past two weeks before the survey[16, 19]. Results were considered significant if $p < 0.05$. All analyses were performed using SPSS version 23, and graphically visualized in Excel software.

# Results

## Characteristics of the children

Table 1 presents the general characteristics of the included children. A total of 2,960 children were enrolled in this study. Among them, the majority are female (50.7%) and male children are 49.3%. Their mean (SD) age was 14.2(5.1) months with about 65% and 34% were born at the hospital, and at home respectively. Among the studied children, 31.3% were stunted, 6.05% wasted and 14.3% underweight. Moreover, 95% had normal birth weight of above 2.5 kilograms. About 79% of children had no diarrhea within two weeks before the survey, and 78% had no sign of fever.

## Dietary diversity of 6 to 23 month old children

Figure 2 shows the dietary diversity in terms of food groups consumed by children in the past 24 hours before the survey. This analysis find that the majority (73.9%) of children did not reach the recommended Minimum Dietary Diversity (MDD) of more than 4 food groups. Only 26.01% of them had received diversified diet (Figure 3). The most commonly consumed types of foods were grains, roots and tubers (91%) and Vitamin A containing fruits and vegetables (65%). While the remaining food groups were reported to be consumed by lesser proportion of children including eggs (7%), meat and fish (36%), milk and dairy products (22%), as well as legumes and nuts (35%) and other vegetables (21%).

## Association between dietary diversity and undernutrition

Table 2 presents the association between dietary diversity and stunting, wasting and underweight. Based on this analysis using the dietary diversity score and MDD as independent variables; consumption of a diverse diet was significantly associated with a reduction in stunting, wasting and being underweight for children. The likelihood of suffering from stunting, wasting and underweight was found to decreases as the number of food groups consumed increased. Therefore, both dietary diversity and MDD analysis showed that children who consumed diverse diets are less likely to be undernourished than those who had less diverse diet. In an adjusted model, children who did not received an MDD diet had a significantly higher likelihood of becoming stunted (AOR = 1.37, 95% CI; 1.13–1.65) and underweight (AOR = 1.49, 95% CI; 1.15–1.92) compared to children who received an MDD diet. However; there was no association between the consumption of an MDD diet and wasting in unadjusted (OR = 1.19, 95% CI; 0.83–1.71) and adjusted model (AOR = 1.18, 95% CI; 0.82–1.69).

Table 3 shows an-adjusted and adjusted odds from bivariate and multivariable logistic regression models for the association between specific food groups and stunting, wasting and underweight. Consumption of milk, meat and eggs has been found to be associated with reduced stunting among children. Children who did not consume any milk (AOR = 1.34; 95% CI; 1.09–1.63), meat (AOR = 1.27; 95% CI; 1.07–1.53), and eggs (AOR = 1.46; 95% CI; 1.05–

2.03) have a higher likelihood of becoming stunted in the adjusted model. On the other hand, children who did not consume any grains had a higher likelihood of becoming wasted (AOR = 1.62; 95% CI; 1.02–2.58). Similarly, children who did not consume any legumes and nuts had a higher likelihood of becoming wasted in the un-adjusted model (OR = 1.42; 95% CI; 1.0–1.96).

Moreover this analysis shows that, children who did not consume any egg or food made from eggs were more likely to be underweight. The likelihood of becoming underweight for children who did not consume any eggs is more than twice as high compared to children who consumed egg products (AOR = 2.1; 95% CI; 1.29–3.69). In addition, the likelihood of becoming underweight for children who did not consume Vitamin A rich fruits and vegetables is higher compared to children who do (AOR = 1.46; 95% CI; 1.17–1.83).

# Discussion

This study aimed to examine the association between dietary diversity and undernutrition of children aged 6 to 23 months in Tanzania. In this study, dietary diversity was found to be a protective factor of stunting (HAZ) wasting (WHZ), and being underweight (WAZ) among children in Tanzania. These results are consistent with results reported from other developing countries like Burkina Faso [17]; Bangladesh [28], Ethiopia [16], and others [14, 19]. Another study by Melaku *et al.,[*,[29] did not show an association between stunting and children dietary diversity. However, Melaku *et al.,,* did not use the age group of 6 to 23 months. Moreover, this study did not find association between wasting and dietary diversity of children using MDD indicator. In contrast to stunting and underweight—wasting refers to acute malnutrition as a result of shorter-term episodes of inadequate feeding or illnesses [30]. Previous study have shown that wasting is more associated with diseases or household food insecurity rather than dietary diversity [16]. In comparison, other studies have not find the association between wasting and dietary diversity of children [17, 31]. This suggesting that stunting and wasting can be affected by dietary diversity. This is supported by the fact that dietary diversity is a good predictor of dietary quality and micronutrient density in children [32, 33]. Therefore, generally, this puts dietary diversity as one of the important factor that policy makers can adopt to improve nutritional status of children in the country.

This study shows that only small proportion (26%) of children of 6 to 23 months old in Tanzania received a minimum dietary diversity. This is similar to the one reported by Ochieng *et al.* which is 26%[25]. Overall, the present study shows that consumption of animal-source foods like meat, milk and eggs were not very common among children of 6–23 months in Tanzania. Similarly, Ochieng *et al.* reported that meat, fish were consumed by less than 10% of the under five years children[25]. This is not suprising and may be explained by seasonal/geographical unavailability of some foods, traditions, or even financial constraints[34]. In this study, children who did not consume any meat were more likely to become stunted. In comparison, a previous survey of 12 to 59 months old children in Cambodia concluded that, the consumption of animal-source foods was a protective factor of stunting and underweight [15]. Animal-sourced foods like meat and poultry have a variety of micronutrients including vitamin A, vitamin B–12, riboflavin, calcium, iron and zinc that are difficult to obtain in adequate quantities from plant sourced foods alone[35]. Thus, insufficient intake of these nutrients, may hinder physically development of a child and results to stunting [2]. Therefore, we recommend that public health officials should educate parents and caregivers on the importance of animal-source foods to their children.

Moreover, our analysis emphasises that the consumption of milk and diary products is very beneficial for growing children. We found that non-consumption of milk products is a predictor of stunting among children. This is obvious due to the fact that, children at this age of 6 to 23 months, apart from breastfeeding, she needs to

consume milk products from complementary foods. Failure to give any milk or dairy product at this critical age may result into protein imbalance and resuts to stunting [2].Milk is one of the basic food which provide proper nutrition to promote child's health [36]. Therefore; health education message related to importance of milk and diary product in complementary foods is a critical public-health intervention in Tanzania.

Another interesting finding in this study was the association of Vitamin A fruits and vegetables with underweight among children. In this study, children who did not consumed Vitamin A containing fruits and vegetables were more likely to become underweight. This finding is similar to finding reported among children in Ghana [19]. Also, previous study had shown a significant association between Vitamin A intake and undernutrition, but not among infant [37]. Vitamin A is known as an essential micronutrient for the growth and immunity. Its deficiency is one of the most important cause of preventable childhood blindness and is a major contributor to morbidity and mortality from infections[37]. Therefore, lack of adequate Vitamin A intake may results to the increase in underweight children in the country. It is therefore important for mothers to increase the inclusion of foods rich in Vitamin A like spinach, mangoes and papaya in complementary foods given to their children. These foods are relatively cheaper and can be easily accessible in both rural and urban areas.

Moreover, we also found that, children who did not consume any food made from grains or legumes were more likely to become wasted. In many countries including Tanzania, grains and cereals including maize, sorghum, millets and rice; are among the first foods that are introduced at the beginning of the complementary feeding period [9, 20, 21, 38]. These are very beneficial for the children because they are excellent source of energy, vitamins and minerals[38]. Therefore, to reduce the prevalence of undernutrition, mothers should provide adequate foods that would provide adequate energy and all nutrients to their children.

However, it is important to mention some important limitation of this study. We only consider the dietary diversity which is the indicator of quality of food intake. This study did not take into account the quantity of the foods consumed, and therefore, the diversity doesn't meat adequate dietary intake. Also, due to the cross-sectional nature of this study, we have to interpreate these findings with cautions because it does not justify the causal-effect relationship. Moreover, some indicators of nutrition status like stunting represent a long-term cumulative process, whereas the dietary information available in the TDHS reflects only the previous 24 hours. In addition, the responses given by mothers/caregivers are sometime based on their ability to recall types of foods which is some time not the actual food given to a child. In spite of mentioned limitations, this present study, we hope, has shed ample light on the how dietary diversity influences the development of undernutrition in Tanzania. Future large scale studies are needed to justify the causal relationship of children in Tanzania.

# Conclusions

This study shows that consumption of a diverse diet is associated with a reduction in undernutrition among children among children of 6 to 23 months of age in Tanzania. In addition to dietary diversity, animal-source foods like meat, milk and eggs can prevent stunting for children. Consumption of milk products is very important in order to reduce the stunting among children. Measures to improve the type of complementary foods to meet the energy and nutrients demands of children should be considered in the country. Moreover, strong commitment by the government and public health officials is needed to ensure adequate foods are available.

# Declarations

## Ethical consideration

The permission to do this study was given by DHS program. Since we only used secondary data, personal consents was not required, as well as no any personal identity was being identified from the data files. The data were completely anonymous.


## Author Acknowledgements

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## Conflict of Interest

The authors declare that there is no any conflict of interest

## Contributions

AGK analysed the data and wrote the first draft. AWM reviewed and revised the first draft. JEN and KK improved the final draft of the manuscript.

## Consent for publication

Not applicable for this study

## Availability of data and material

Data for this study are freely available upon request from the DHS portal (www.dhsprogram.com).


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# Tables

**TABLE 1**: Descriptive charatceristics of the included children 6-23 months from TDHS 2015-2016

| **Variables** | **Total (N=2,960)** |
|---|---|
| | ***Mean (SD)*** |
| | **Frequency (%)** |
| | |
| *Age of Children (months)* | *14.2(5.1)* |
| | |
| Prevalence of undernutrition | |
| Stunting(HAZ <-2SD) | 927(31.3) |
| Wasting(WHZ <-2SD) | 179(6.05) |
| Underweight (WAZ <-2SD) | 423(14.3) |
| Gender | |
| Male | 1459(49.3) |
| Female | 1501(50.7) |
| Place of Birth | |
| Health facility | 1913(64.4) |
| At home | 1001(33.8) |
| Other places | 46(1.6) |
| Size at Birth | |
| Above 2.5 | 1801(60.8) |
| Below 2.5 | 100(3.4) |
| Not reported | 1059(35.8) |
| Presence of Diarrhoea | |
| YES | 625(21.1) |
| NO | 2335(789) |
| Presence of Fever | |
| YES | 651(22) |
| NO | 2309(78) |

**TABLE 2**: Crude and adjusted odds of association between dietary diversity and stunting, wasting and underweight

| | Stunting (HAZ <-2SD) | | | Wasting (WHZ <-2SD) | | | Underweight (WAZ <-2SD) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **Crude** | **Model[a]** | **n** | **Crude** | **Model[a]** | **n** | **Crude** | **Model[a]** |
| Diversity score | | **OR (95 % CI)** | **AOR (95 % CI)** | | **OR (95 % CI)** | **AOR (95 % CI)** | | **OR (95 % CI)** | **AOR (95 % CI)** |
| | | | | | | | | | |
| **0** | 18 | Ref. | Ref. | 8 | Ref. | Ref. | 11 | Ref. | Ref. |
| **1** | 93 | 0.8(0.43-1.47) | 0.65(0.35-1.23) | 29 | 0.56(0.24-1.3) | 0.5(0.21-1.18) | 54 | 0.7(0.37-1.6) | 0.67(0.32-1.39) |
| **2** | 285 | 0.94(0.53-1.69) | 0.57(0.31-1.05) | 50 | 0.34(0.15-0.76)** | 0.3(0.13-0.7)** | 134 | 0.69(0.35-1.38) | 0.52(0.26-1.06) |
| **3** | 311 | 1.08(0.61-1.94) | 0.61(0.33-1.12) | 51 | 0.35(0.15-0.78)* | 0.32(0.14-0.73)** | 136 | 0.71(0.35-1.41) | 0.52(0.26-1.05) |
| **4** | 166 | 0.91(0.5-1.64) | 0.49(0.26-0.91)* | 31 | 0.35(0.15-0.82)* | 0.32(0.13-0.76)* | 67 | 0.56(0.27-1.14) | 0.4(0.19-0.83)* |
| **5** | 46 | 0.68(0.35-1.31) | 0.36(0.18-0.72)** | 9 | 0.3(0.11-0.82)* | 0.26(0.09-0.74)* | 19 | 0.46(0.20-1.04) | 0.32(0.14-0.74)** |
| **6** | 6 | 0.44(1.55-1.25) | 0.25(0.85-0.72)* | 1 | 0.17(0.02-1.49) | 0.16(0.19-1.38) | 1 | 0.12(0.01-0.98)* | 0.09(0.01-0.74)* |
| **7** | 2 | 0.51(0.9-2.67) | 0.26(0.05-1.38) | 0 | - | - | 1 | 0.44(0.51-3.88) | 0.31(0.03-2.7) |
| Minimum Dietary Diversity (MDD) | | | | | | | | | |
| **YES (≥4 food groups)** | | Ref. | Ref. | | Ref. | Ref. | | Ref. | Ref. |
| **NO (<4 food groups)** | | 1.19(0.99-1.42) | 1.37(1.13-1.65)** | | 1.19(0.83-1.71) | 1.18(0.82-1.69) | | 1.4(1.08-1.79)** | 1.49(1.15-1.92)** |

**$P < .01$, *$P < .05$; [a]Adjusted for age, gender, diarrhoea and fever; CI=confidence interval; OR=Odds ratio, AOR=Adjusted Odds ratio; Ref=reference category. Both models fit the data equally well (all P > 0.10 in likelihood ratio test).

**TABLE 3**: Crude and adjusted odds of association between food groups and stunting, wasting and underweight

| Variable | Stunting (HAZ <-2SD) | | Wasting (WHZ <-2SD) | | Underweight (WAZ <-2SD) | |
|---|---|---|---|---|---|---|
| | Crude | Model[a] | Crude | Model[a] | Crude | Model[a] |
| | OR (95 % CI) | AOR (95 % CI) | OR (95 % CI) | AOR (95 % CI) | OR (95 % CI) | AOR (95 % CI) |
| FOOD GROUPS | | | | | | |
| Grains roots and tubers | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 0.89(0.67-1.17) | 1.05(0.78-1.41) | 1.59(1.01-2.52)* | 1.62(1.02-2.58)* | 1.22(0.86-1.72) | 1.34(0.94-1.90) |
| Legumes and nuts | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 0.9(0.77-1.06) | 0.96(0.81-1.14) | 1.4(1.0-1.96)* | 1.38(0.98-1.94) | 1.1(0.87-1.35) | 1.1(0.89-1.39) |
| Milk and Dairy products | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 1.38(1.13-1.67)** | 1.34(1.09-1.63)** | 1.26(0.85-1.86) | 1.24(0.83-1.83) | 1.26(0.97-1.64) | 1.22(0.94-1.59) |
| Meat and flesh | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 1.07(0.91-1.26) | 1.27(1.07-1.53)** | 1.0(0.73-1.38) | 0.97(0.7-1.34) | 0.98(0.79-1.22) | 1.04(0.89-1.3) |
| Eggs | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 1.37(0.99-1.89) | 1.46(1.05-2.03)* | 1.92(0.89-4.15) | 1.95(0.9-4.23) | 2.1(1.24-3.52)** | 2.1(1.29-3.69)** |
| Vitamin A rich fruits and vegetables | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 0.93(0.79-1.1) | 1.18(0.99-1.41) | 1.29(0.95-1.76) | 1.29(0.94-1.78) | 1.29(1.04-1.59)* | 1.46(1.17-1.83)** |
| Other fruits and vegetables | | | | | | |
| YES | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| NO | 1.01(0.83-1.22) | 1.07(0.88-1.31) | 0.88(0.61-1.26) | 0.9(0.63-1.29) | 1.06(0.82-1.37) | 1.11(0.86-1.44) |

**$P < .01$, *$P < .05$; [a]Adjusted for age, gender, diarrhoea and fever; CI=confidence interval; OR=Odds ratio, AOR=Adjusted Odds ratio; Ref=reference category

# Figures

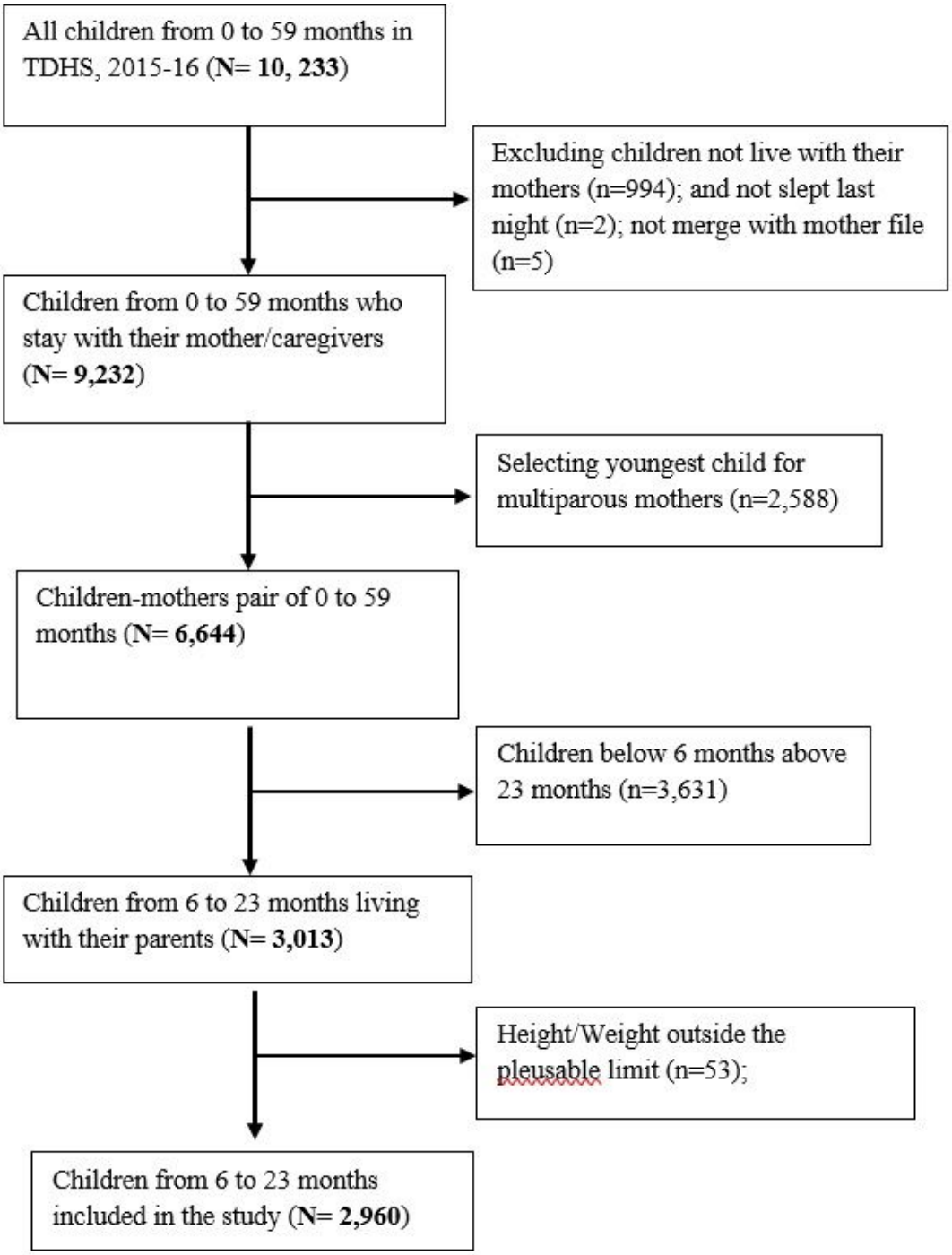


**Figure 1**

Selection of children of 6 to 23 months from TDHS 2015-16

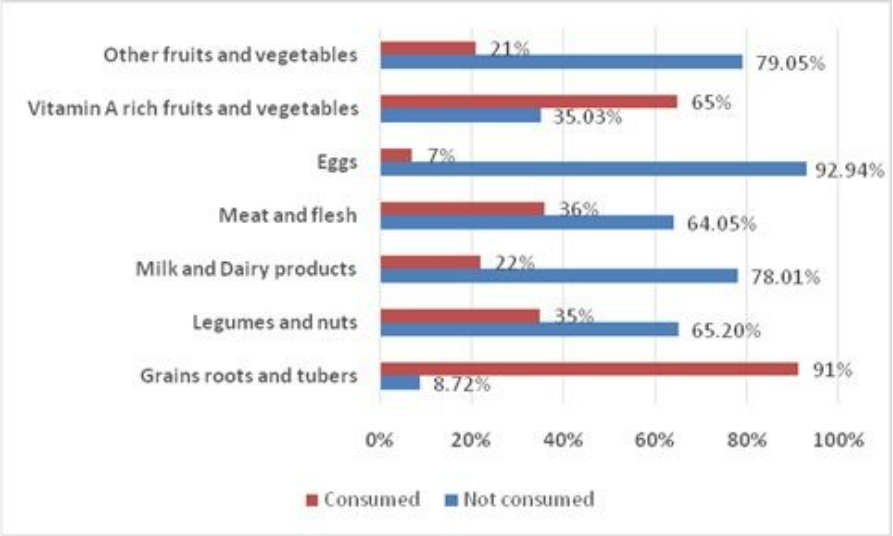


**Figure 2**

Percentage consumption of food groups for children

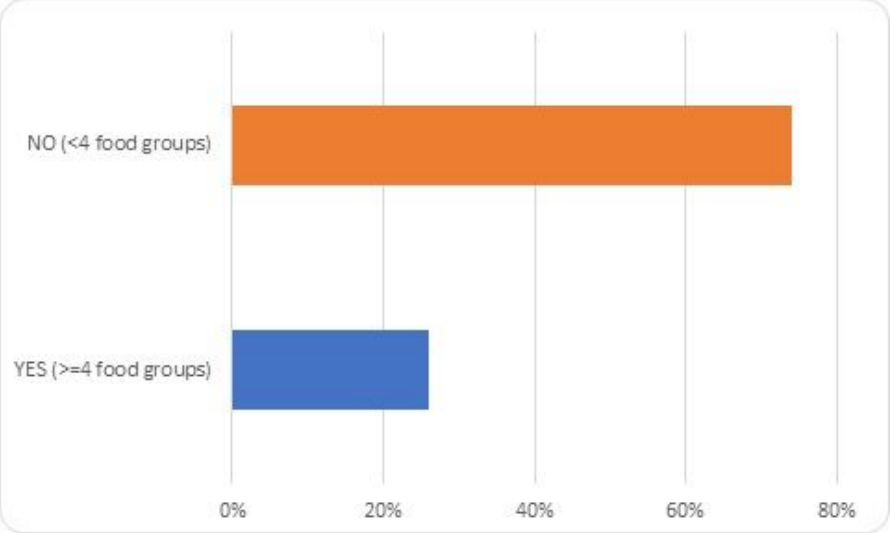


**Figure 3**

Proportion of children reaching the recommended Minimum Dietary Diversity (MDD)