Undernutrition in Nigerian under-five children and associated household factors

Israel O. Dada[1], Rasaki A. Sanusi[2], Oluremi O. Keshinro[2], Isaac O. Akinyele[2]

[1]Department of Human Nutrition and Dietetics, College of Medicine and Health Sciences Afe Babalola University, P. M. B. 5454, Ado-Ekiti, Ekiti State, Nigeria.

[2]Department of Human Nutrition and Dietetics, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan, Nigeria.

Corresponding Author: lanredada2006@gmail.com,

ABSTRACT

Background: *Undernutrition in under-five children (U-5) in Nigeria is high. Children's household characteristics influence their nutritional status.*

Objectives: *To determine the prevalence of undernutrition in U-5 and their household characteristics.*

Materials and Methods: *This cross-sectional study involved 531 U-5 randomly sampled through a multi-stage sampling technique in Oyo State. An interviewer-administered questionnaire was used to obtain information on household characteristics. Height and weight of the children were measured to calculate stunting (height-for-age z-score < -2SD), wasting (weight-for-height z-score < -2SD) and underweight (weight-for-age z-score < -2SD). Chi-square test and logistic regression were used to established relationship between household factors and stunting, wasting and underweight at 5% level of significance.*

Results: *The median age of the children was 9.0 months. Stunting, wasting and underweight were found in 21.7%, 11.3% and 7.8% U-5 respectively. Overall, 94.5% households were headed by male, 82.9% had ≤ 6members and 61.8% were monogamous. Fathers were always present in 92.6% households and 96.2% households had 1-2 U-5. Stunting was significantly higher when there were > 6members, >2 U-5 and absence of child's father in the household. Prevalence of wasting and underweight was higher in extended family and female headed households respectively.*

Conclusion: *Stunting, wasting and underweight in U-5 still exist in the study location. Large household size, absence of child's father in the household, large number of U-5, female headship and extended family arrangement were associated with undernutrition in U-5. Household factors should be put into consideration when planning nutrition-related intervention programme.*

Keywords: Stunting, Wasting, Underweight, Under-five children, Household

INTRODUCTION

Malnutrition in the first two years of a child may be irreversible [1] and affects their physical and cognitive development [2,3] with implications for their earnings as adults [1]. About one third of the world's children were malnourished [4,5] and this has been considered to be the underlying cause for more than 50% of deaths of under-five children globally [6].

In Nigeria, the prevalence of undernutrition in

form of stunting, wasting and underweight in children remains high [7,8]. Stunting was observed even among 24% of children less than 6months of age [8]. Recent National surveys [9,10] still showed that the nutritional status of under-five children was yet to improve significantly. Other pocket of studies confirmed high prevalence across the country. In the Southwest, 40% stunting was recorded in a rural area of Oyo State [11]; 28% stunting, 39% wasting and 31% underweight were observed in Benue State [12]; in the South-south, 13% stunting, 9% wasting and 11% underweight were recorded [13].

The household serves as the fundamental unit of production and consumption, as well as the unit on which children depend for their health and well-being [14]. It is hypothesized that nutritional status is a function of the demographic characteristics of the child and socio-economic characteristics of the household from which the child was extracted [15]. Household has been defined as a group of people, related or unrelated, living, cooking and eating together [16]. Changes have been observed in household structure occasioned by migration of household heads and mothers working outside the home due to economic reasons [17], and gradually moving away from traditional position of staying at home to care for children and other household members. Hence, children are left behind to be cared for by grandparents, daycare or others. Furthermore, more mothers are becoming household heads, and grandparents may not be available for care of their grandchildren due to work.

Studies in other countries revealed household factors as determinant of undernutrition in under-five children [18]. Large household size, number of under-five children in the household and extended family were found to be determinants of undernutrition in under-five children in Iraq [19], Mozambique [20], Ethiopia [21,22] and Kenya [23]. The outcome of this current study is expected to reveal the influence of the household characteristics on undernutrition in under-five children in Oyo State. This may bring to reality the need to include household components to nutrition-related intervention programmes in Oyo State. This study was designed to determine the prevalence of undernutrition in under-five children and associated household factors in Oyo State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Oyo State, Nigeria. Oyo State is divided into three senatorial districts with a total of 33 Local Government Areas (LGAs) which are sub-divided into 118 wards in Oyo Central, 134 in Oyo North and 99 wards in Oyo South, making a total of 351 accredited political wards [24]. The State covers a total of 27,249 square kilometers of land mass and with a population of 5,580,894. It has an estimated 1,248,105 households.

Study design and target population

This is a descriptive cross-sectional study. Children not older than five (5) years were involved in the study. Only the index child (the last under-five child in the households selected) was used for the study.

Sample size and sampling technique

Sample size was calculated at a confidence level of 95% according to FAO [25] as shown below:

$$N = \frac{Z\ \alpha^2}{d^2} \text{ x p x q}$$

Where N = Minimum sample desirable
$Z\alpha$ = Confidence level at 95%
(Standard value of 1.96)
d = Desired precision/margin of error at 5%
p = prevalence of stunting used = 50%
q = 1 – p = 1 – 0.5

$$N = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

$$= \frac{3.8416 \times 0.5 \times 0.5}{0.0025} = 384$$

Giving allowance for attrition a sample of 531 subjects was used for the study.

A multistage sampling technique was used to select 531 households. A total of eleven LGAs were randomly sampled by balloting from the 33 LGAs in the State. In the first sampling stage, one

third of the LGAs in each senatorial district were selected by simple random technique. In the second stage, one third of accredited political wards in each LGA selected were sampled using simple random technique, given a total of 38 wards. For the third stage, the list of settlements in each ward was obtained from the Local Government headquarters [26] and one settlement was then selected by balloting from each sampled ward, given a total of 38 settlements. During the fourth stage, in each settlement, the street names were listed and two streets were randomly selected given a total of 76 streets. In the fifth stage, the housing units and the households were chosen following the approach of Olaogun *et al* [27]. The sample size was divided among the LGAs according to population of households.

Data collection

Socio-demographic and household data were collected using a validated open and closed ended questionnaire [28] with a reliability coefficient value of 0.82.

Anthropometric measurement

Height measurement

A locally adapted height measuring device (stadiometer) was used for the height measurement [29]. For children less than 24 months, recumbent length was measured using graduated horizontal board placed on a level surface. Standing heights of children aged 24-59 months were measured using graduated vertical board placed on a level ground.

Weight measurement

Portable Hana floor bathroom scale (Model BR9011, China) was used for the weight measurement. This was standardized using a known weight at regular interval. Children were weighed standing erect on the scale, wearing light clothes and bare footed. Children who were not able to stand by themselves were weighed while being held in their mother's arms, and then the mother's weight was subtracted from the total weight to give the child's weight. Weight was measured to the nearest 0.5kg. The weighing scale placed on level surface and set at zero each time before taking readings. Special attention was paid to determine the age of the subjects using official documents. Age of the children (in months) were calculated from the date of birth to the date of survey.

Child undernutrition

The child undernutrition was assessed by the three anthropometric indices, namely: height-for-age, weight-for-age and weight-for-height. Using the WHO reference standard for weight and height, undernutrition was classified as z-scores that are -2 standard deviation units below the reference median for the three indices [30].

Ethical consideration

Informed consent was sought at different levels; individual household head's consent was sought at the household level. The research protocol was approved by the Health Research Ethics Committee of the University of Ibadan / University College Hospital, Ibadan.

Data analysis

Both descriptive and inferential statistics were employed. The administered questionnaires were analyzed using statistical package for Social Science (SPSS version 20.0). WHO Anthro plus (2006) was used to analyze the nutritional status of the under-five children. SPSS version 20.0 was used to classify the level of malnutrition among the children based on their z-score. Chi-square test and logistic regression were used to established association between household factors and stunting, wasting and underweight at 5% level of significance.

RESULTS

Characteristics of children

Table 1 shows the children's characteristics. The median age of the children was 9.0 months with 33.5% in the age group less than 6months and a total of 60.5% falling within the age 6-36months. Children financed by both parents were 79.5%. A large proportion (81.0%) of the household heads had some measure of formal education and 2.6% were unemployed. Less than half (35.0%) of the children were exclusively breastfed.

Table 1. Characteristics of children

Characteristics	Frequency (N=531)	Percent
Age (months)		
<6	178	33.5
6-12	172	32.4
13-36	149	28.1
37-59	32	6.0
Gender		
Male	274	51.6
Female	257	48.4
Maternal birth order		
1	150	28.2
2	141	26.6
3	115	21.7
4	83	15.6
5+	42	7.9
Paternal birth order		
1	138	26.0
2	126	23.7
3	97	18.3
4	74	13.9
5+	96	18.1
Person who took financial Responsibility of child		
Both parents	422	79.5
Mother only	66	12.4
Father only	23	4.3
Grandparents	19	3.6
Other relatives	1	0.2
Level of education of Household head		
None	48	9.0
Primary	136	25.6
Secondary	223	42.0
Post-secondary	47	8.9
Tertiary	77	14.5
Occupation		
None	14	2.6
Trading	107	20.2
Farming	64	12.1
Teaching	23	4.3
Civil servant	136	25.6
Artisan	175	33.0
Professional	12	2.3
Child exclusively breastfed		
Yes	186	35.0
No	345	65.0

Child anthropometry

Anthropometry of children (Table 2) reveals that 21.7%, 11.3% and 7.8% of the children were stunted, underweight and wasted respectively.

Household characteristics of the respondents

The household characteristics of the respondents are shown in Table 3. The male household heads accounted for 94.5%. More than half (58.0%) of the households had four to six members and 17.1% of households were made up of more than six members. Monogamy family was predominant (61.8%). In 92.6% households, fathers of the index children slept in the house on daily basis and 52.0% households had high dependency ratio. There were one to two males (58.8%) and one to two females (59.7%) in the households. Overall, 96.2% of the households had one to two under-five children, 39.5% had no older aged (5-17years) children and 78.5% of the households had one to two adults.

Table 2. Child anthropometry

	Frequency (N)	Percent
Height -for-age (Stunting)		
Normal	411	78.3
Stunting	114	21.7
Total	525	
Weight -for-age (Underweight)		
Normal	447	84.2
Underweight	60	11.3
Overweight	24	4.5
Total	531	
Weight -for-height (Wasting)		
Normal	484	92.2
Wasting	41	7.8
Total	525	

Table 3. Child household characteristics

Structure	N (N=531)	%
Gender of head		
Male	507	94.5
Female	29	5.5
Size		
≤ 3	132	24.9
4-6	308	58.0
> 6	91	17.1
Family type		
Monogamy	328	61.8
Polygamy	96	18.1
Extended	107	20.1
Presence of child's father		
Father present always	492	92.6
Father present occasionally	11	2.1
Father absent	28	5.3
Dependency ratio		
Low	105	19.8
Moderate	150	28.2
High	276	52.0
Household composition		
Males		
None	6	1.1
<3	312	58.8
3+	213	40.1
Females		
<3	317	59.7
3+	214	40.3
Number of U -5		
<3	511	96.2
3+	20	3.8
Older children (5 -17years)		
None	210	39.6
<3	227	42.7
3+	94	17.7
Adult (≥18years)		
<3	417	78.5
3+	114	21.5

Child anthropometry and child characteristics

Stunting was significantly higher in older children than those below 12years. It was significantly higher in male than female, and among children that were not exclusively breastfed (Table 4). The prevalence of stunting was higher in households with adolescent head (33.3%), head without former education (29.2%) and heads that were farmers (26.6%).

Factors associated with under-five children anthropometry

In Table 5, household size, number of under-five children and presence of child father in the household were associated with stunting. Family type and gender of household head were associated with wasting and underweight respectively.

Table 4. Child anthropometry and child characteristics

Characteristics	Stunting %	Wasting %	Underweight %
Age (Months)			
≤ 12	18.5*	8.4	10.9
> 12	27.9	6.7	12.2
Gender			
Male	25.7*	6.3	10.6
Female	17.4	9.4	12.1
Exclusively breast fed			
Yes	13.5*	9.2	10.2
No	26.2	7.1	11.9
Age of household head			
<20	33.3	0.0	0.0
20-39	19.6	7.3	12.0
≥40	23.9	8.4	10.6
Household head's level of Education			
None	29.2	4.2	8.3
Primary	21.8	6.7	11.8
Secondary	20.4	9.5	13.5
Tertiary	21.1	7.4	8.1
Occupation			
None	21.4	14.3	7.1
Trading	21.0	10.5	6.5
Farming	26.6	4.7	14.1
Teaching	13.0	8.7	4.3
Civil servant	23.3	11.1	18.4
Artisan	21.3	4.6	9.7
Others	8.3	0.0	0.0

*Significant at P<0.05

Table 5. Child anthropometry and household characteristics

Household structure	Stunting %	Wasting %	Underweight %
Gender of household head			
Male	21.6	7.7	10.6*
Female	24.1	10.3	24.1
Household size			
1-3	18.5*	10.0	10.7
4-6	20.4	6.2	10.4
> 6	30.0	10.1	15.4
Family type			
Monogamy	20.7	6.2*	10.1
Polygamy	22.3	6.4	8.3
Extended family	24.3	14.2	17.8
No. of U -5			
1-2	21.0*	7.9	11.5
3-4	36.8	5.3	5.3
≥ 5	100.0	0.0	0.0
Presence of father in household			
Father present always	20.9*	6.8	11.1
Father present occasionally	18.2	0.0	9.1
Father absent	53.8	23.1	30.8

*Significant at P < 0.05

The result of the Logistic regression analysis is presented in prose. It shows that children that were less than 12months in age were less likely to be stunted (OR= 0.587, 95% CI:0.357-0.967; p=0.03) compare to those older than 12months. Children whose fathers were absent in the households were significantly more than five times more likely to be stunted (OR=5.570, 95% CI:1.552-19.988; p=0.008) compare to those children whose fathers were present always. Male children were insignificantly about half more likely to be stunted (OR=1.449, 95% CI: 0.925-2.270; P=0.105). Children in households with more than six members were insignificantly twice more likely to be stunted (OR=2.000, 95% CI: 0.880-4.546; p= 0.098) compare to households with three members. Children with wasting were insignificantly two times more likely in extended family (OR=2.151, 95%CI: 0.961-4.811; p= 0.062) compare to monogamy family. Underweight children were insignificantly less likely in male headed household (OR=0.439, 95%CI: 1.164-1.173; p=0.101) compare to female headed households.

DISCUSSION

Undernutrition in form of stunting, underweight and wasting in children still exists in the study area; the prevalence is lower than the overall national figures of 37% stunting and 23% underweight and Oyo State figures of 34.5% stunting and 19% underweight but higher than 3.8% wasting [10]. It is equally lower than other studies [12,21,22,23,31,32]. However, it is higher than the results of other researchers [13,23,33,34]. The low prevalence in this current study might be due to the coverage compare to national survey which covered wider scope. In addition, more than half of the sampled children were below 12months in age and were still being breastfed. At this age, children received adequate care and attention unlike at older age when chronic malnutrition might set in [3]. More so, a greater number was being breast fed compare to national figure of 29% [10]. Poor feeding practices have been observed to contribute to undernutrition of children [6,35].

There were significant disparities of malnutrition by **gender** with males having higher prevalence except for wasting. This concurs with national surveys [9,10] and other studies [1,20,21,32]. In contrary, stunting was higher in female in India and Ghana [36,37]. Higher energy expenditure in boys because of playing more and increased attention being paid to female children [3] probably explain the gender disparity. Barker *et al* [38] however, observed that in India, female children received less care and attention than their male counterpart. This was contrary to the findings of others in India and Thailand [39,40].

The **age-specific pattern** of malnutrition was also observed in this study. Older ages (>12 months) were associated with being stunted and underweight while younger ages (<12 months) were associated with being wasted. This observation is consistent with previous studies in Nigeria [3,9,10,15,35] and other countries [22,23,31,37]. Older children are more likely to be malnourished probably due to reduced care and attention for older and weaned children in an average African household [3,15]. Large number of under-five children in the household can also be a reason [3]. In addition, weaning foods are typically introduced to children in older age (above 6 months), thus increasing exposure to infections and susceptibility to illness which adversely affects nutritional status.

A higher frequency of' 'wasted" in younger ages may be explained by the low proportion of children that were exclusively breastfed. This implies that weaning foods and liquid were introduced to the children early (< 6 months). This predisposes to infection and susceptibility to illness which may adversely affect nutritional status. Studies had shown that duration of exclusive breastfeeding below 6 months was significantly associated to child malnutrition [18,20,22].

Household factors that were found to be significantly associated with child nutritional status include household size, family type, number of under-five children in the household and residence of father in the household. Stunting increased with increasing household size; this agrees with the findings in Solis Valley where children from larger households were found to be shorter and consumed diets of poorer quality [41,42] and Kenya [23], Ethiopia [21,22,31], Mozambique [18,20]. This is contrary to the findings of other studies [43,44]. The dilution model predicts that larger families reduce the amount of available resources (time, energy, money) for each child leading to low calories and less protein consumption [45], thus hindering social and physical development [3]. Large household size is hence associated with increased risk of malnutrition and low socio-economic status.

Wasting was observed in extended family than other types. This result is consistent with the findings in other countries [19,20,36,40]. Worse nutritional status in extended family was associated to socio-economic factors. Nutritional resources are spread more thinly among dependents in a large extended family. Hence, family type was a strong determinant of child nutritional status. The prevalence of stunting increased with increasing number of under-five children. In Kenya [23] and Mozambique [20] more than one under five child in the household is a risk factor of underweight and stunting respectively. A large number of children in a family suggests that there is more competition for available resources [44,46] and mothers devote less time to child care [44].

This study shows that the prevalence of all the three indices of child undernutrition was higher when fathers were absent, and the association was significant for stunting. This agrees with finding in Gambia [47]. Presence of father in the household is expected to improve food security. Iyangbe and Orewa [45] observed that male consume more protein than female therefore improve protein consumption by the households. The presence of father and his input in child care complement the stronger role mother plays in child health outcomes as the caretaker and decision maker in respect to the nutrition of the

child. The prevalence of underweight was higher in female-headed households. This concurs with the finding of Haider and Kogi-Makau [48]. They observed that the nutrient intake in male-headed households was better than the female-headed households. Male-household heads have the advantages of being involved in various income generating activities away from their homestead that probably affords them better opportunities to access better food consumption [44].

CONCLUSION AND RECOMMENDATIONS

This study reveals high prevalence of undernutrition in under-five children in the study location and the influence of household factors. Female headship, large household size, extended family arrangement, large number of under-five children in the household and absence of fathers in the households were found to be associated with undernutrition in under-five children. Hence, Policy makers at all levels of government should be encouraged to entrench nutritional issues of under-five children to national demographic, educational, health, economic and employment policies. For instance, consideration may be given to female household heads for employment since higher prevalence of stunting, wasting and underweight was observed in female headed households. Nutrition-related intervention programmes for under-five children should consider the influence of household factors in prioritizing vulnerable groups.

Study Limitation

The under-five children studied were only the index children in the selected households and not all the under-five children in the households.

Acknowledgment

The contributions of the households that participated in the study are recognized and appreciated.

Competing interest

There is no competing interest

REFERENCES

1. Adewumi, M.O., Babatunde, R.O., Ayodele, O. (2010). The anthropometric status of farming household in Kogi State, Nigeria. Poster presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economist Association of South African (AEASA) Conference, Cape Town, South Africa. 19-23rd September 2010. 1-17. Retrieved Dec. 30, 2011, from htt://puri.umn.edu/96798.
2. Nzala, S.H., Siziya, S., Babaniyi, O., Songolo, P., *et al*. (2011). Demographic, cultural and environmental factors associated with frequency and severity of malnutrition among Zambian children less than 5years of age. *J. of Public Health and Epidemiology*, 3(8): 362 – 370.
3. Babatunde, R.O., Olagunju, F.I., Fakayode, S.B., Sola-Ojo, F.E. (2011). Prevalence and determinants of malnutrition among under-five children of farming households in Kwara State, Nigeria. *J. of Agricultural Science*, 3(3): 173-181.
4. Anderson, A.K., Bignell, W., Winful, S., Soyiri, I., *et al*. (2010). Risk factors for malnutrition among children 5years and younger in the Akuapim-North district in the Eastern Region of Ghana. *Current Research Journal of Biological Sciences*, 2(3): 183-188.
5. FAO. (2017). The state of food security and nutrition in the world. The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security. Rome, FAO.
6. Deribew, A., Alemseged, F., Tessema, F., Sena, L., *et al*. (2010). Malaria and undernutrition: a community based among under-five children at risk of malaria, South West Ethiopia. PloS ONE, 5(5): 1-6. Retrieved 30/12/2019 from, www.plosone.org.
7. National Population Commission, Abuja

Nigeria and ORC/MACRO. (2004). Nigeria Demographic and Health Survey-2003 Calverton, Maryland.
8. National Population Commission, Abuja Nigeria and ICF International. (2014). Nigeria Demographic and Health Survey 2013.
9. National Bureau of Statistic. (2018). Report on the nutrition and health situation of Nigeria June 2018. National Nutrition and Health Survey (NNHS).
10. National Population Commission and ICF International. (2019). Nigeria Demographic and Health Survey 2018.
11. Bamisaye, O.B., Adepoju, O.T. (2018). Association between stunting and obesity among underfive children in urban and rural areas of Oyo State, Nigeria. Mal J Nutr., 24(1): 25-34.
12. Kpurkpur, T., Abubakar, M.S., Ucheh, B.I., Achadu, A.E., et al. (2017). Nutritional Status of Preschool Children in Semi-urban Area of Benue State, Nigeria. Afr. J. Biomed. Res., 20: 145- 149.
13. Okari, T.G., Nte, A.R., Frank-Briggs, A.I. (2019). Prevalence of malnutrition among under-fives in Okrika Town, Nigeria. Journal of Dental and Medical Sciences, 18(1): 40-45.
14. Berman, P., Kendall, C., Bhattacharyya, K. (1994). The household production of health: integrating social science perspectives on micro-level health determinants. Soc. Sci. Med., 38(2): 205-215.
15. Ojiako, I.A., Manyong, V.M., Ikpi, A.E. (2009). Determinants of nutritional status of preschool children from rural households in Kaduna and Kano States, Nigeria. Pakistan Journal of Nutrition, 8(9): 1497 – 1505.
16. Wamani, H., Tylleskar, T., Astrom, A.N., Tumwine, J.K., et al. (2004). Mother's education but not father's education, household assets or land ownership is the best predictor of child health inequalities in rural Uganda. International J. for Equity in Health, 3(9): 1-3. www.equityhealthj.com.
17. Reyes, H., Perez-Cuevas, R., Sandora, A., Satos, J.L., et al. (2004). The family as a determinant of stunting in Children living in conditions of extreme poverty: a case-control study. BMC Public Health, 4:57 doi:10.1186/1471-2458-4-57
18. Kalu, R.E., Etim, K.D. (2018). Factors associated with malnutrition among underfive children in developing countries: a review. Global Journal of Pure and Applied Sciences, 24: 69-74.
19. Abdulla, M.M. (2016). Assessment and determinants of nutritional status in a sample of under five-year-old Iraqi children. European Journal of Biology and Medical Science Research, 4(4): 1-24.
20. Cruz, L.M.G., Azpeitia, G.G., Súarez, D.R., Rodríguez, A.S., et al. (2017). Factors Associated with Stunting among Children Aged 0 to 59 Months from the Central Region of Mozambique. Nutrients, 9, 491; doi:10.3390/nu9050491
21. Berhanu, G., Mekonnen, S., Sisay, M. (2018). Prevalence of stunting and associated factors among preschool children: A community based comparative cross sectional study in Ethiopia. BMC Nutrition, 4:28
https://doi.org/10.1186/s40795-018-0236-9
22. Woldeamanuel, B.T., Tesfaye, T.T. (2019). Multivariate Analysis of Correlates of Under Five Children Malnutrition in Tigray Region, Ethiopia. Mathematical Modelling and Applications, 4(4): 49-63.
23. Guyatt, H., Muiruri, F., Mburu, P., Robins, A. (2019). Prevalence and predictors of underweight and stunting among children under 2 years of age in Eastern Kenya. Public Health Nutrition.
doi:10.1017/S1368980019003793
24. Oyo State Independent Electoral Commission. Accredited political wards 2009. Retrieved July 5, 2009 from, Oyo State Independent Electoral Commission

(OYSIEC).htm.
25. FAO. (1990). Conducting small-scale nutrition surveys: a field manual. Nutrition in Agriculture, 5. 186pp.
26. Babatunde, R.O., Qaim, M. (2010). Impact of off-farm income on food security and nutrition in Nigeria. Food Policy, 35(2): 303-311.
27. Olaogun, A.A.E., Brieger, W.R., Ayoola, A.B., Obianjuwa, P.O., et al. (2006). Mother-father concordance on treatment choices in the care of sick children under-five years of age in Osun State, Nigeria. International Quarterly of Community Health Education, 25(3): 283 – 293.
28. Rathnayake, I.M., Weerahewa, J. (2005). Maternal employment and income affect dietary calorie adequacy in households in Sri Lanka. Food and Nutrition Bulletin, 26(2): 1-10.
29. FANTA. (2003). Anthropometric indicators measurement guide. Food & Nutrition Technical Assistance 2003. Retrieved Aug. 15, 2007 from, http://www.fantaproject.org/publications/anthropom.shtml.
30. WHO. (2006). WHO Child Growth Standards: Methods and development. WHO Multicentre Growth Reference study Group, WHO, Geneva, Switzerland. Retrieved May 9, 2010 from, http://www.who.int/childgrowth/standards/technical_report/en/Index.html.
31. Endris, N., Asefa, H., Dube, L. (2017). Prevalence of malnutrition and associated factors among children in rural Ethiopia. BioMed Research International, Article ID 6587853, 6 pages https://doi.org/10.1155/2017/6587853
32. Adepoju, O.T., Ayodele, A.A. (2019). Evaluation of dietary diversity, nutrient adequacy and nutritional status of pre-school children in three Local Government Areas of Ibadan, Nigeria. *Journal of Health Science*, 7 (2019): 283-294
33. Jimoh, A.O., Anyiam, J.O., Yakubu, A.M. (2018). Relationship between child development and nutritional status of under-five Nigerian children. *South African Journal of Clinical Nutrition*, 31(3):50–54.
34. Ali, Z., Abu, N., Ankamah, I.A., Gyinde, E.A., *et al*. (2018). A Nutritional status and dietary diversity of orphan and non – orphan children under five years: a comparative study in the Brong Ahafo region of Ghana. *BMC Nutrition*, 4:32 https://doi.org/10.1186/s40795-018-0240-0
35. National Population Commission, Abuja Nigeria and ICF Macro. (2009). Nigeria Demographic and Health Survey-2008, Abuja, Nigeria.
36. Parihar, A., Acharya, A. (2009). "Household structure and nutritional status of children and women: India and comparison between Kerala and Orissa." Causes of Child Mortality-iussp 2009. Retrieved Dec. 30, 2017, from iussp2009.princeton.edu/papers/92091.
37. Boah, M., Azupogo, F., Amporfro, D.A., Abada, L.A. (2019). The epidemiology of undernutrition and its determinants in children under five years in Ghana. *PLoS ONE*, 14(7): e0219665. https://doi.org/10.1371/journal.pone.0219665
38. Barker, M., Chorghade, G., Crozier, S., Leary, S., *et al*. (2006). Gender differences in BMI in rural India are determined by socio-economic factors and lifestyle. *The Journal of Nutrition*, 136: 3062-3068.
39. Kshatriya, G.K., Ghosh, A. (2008). Undernutrition among the tribal children in India: tribes of Coastal, Himalayan and Desert ecology. *Anthropol. Anz.*, 66: 355-363.
40. Cameron, M., Lim, S. (2007). Household resources, household composition, and

child nutritional outcomes. Paper presented at the Australian Agricultural and Resource Economics Society Conference, Queenstown.13-16th February, 2007.

41. Olaniyan, O. (2002). The effects of household resources and community factors on child health: evidence from Nigeria. Paper presented at the CSAE conference on "Understanding Poverty and Growth in sub-Saharan held at St. Catherine's College, Oxford 18-19 March, 2002.
42. Pelto, G., Urgello, J., Allen, L., Chavez, A., *et al*. (2009). Household size, food intake and anthropometric status of school-age children in a highland Mexican area. *Social Science and Medicine*, 33(10): 1135-1140.
43. Chindime, C.C., Ubomba-Jaswa, S. (2006). Household headship and nutritional status of Toddlers: An examination of Malawian data. *African Population Studies*, 2: 45-73.
44. Hien, N.N., Hoa, N.N. (2009). Nutritional status and determinants of malnutrition in children under three years of age in Naghean, Vietnam. *Pakistan Journal of Nutrition*, 8(7): 958 – 964.
45. Iyangbe, C.O., Orewa, S.I. (2009). Determinants of daily protein intake among rural and low-income urban household in Nigeria. *American-Eurasian Journal of Scientific Research*, 4(4): 290-301.
46. Cunningham, S.A. (2011). Household structure and children's obesity risks. Paper submitted for the 2011 meeting of the Population Association of America, 1-14. Retrieved March 20, 2012 from, paa2011.princeton.edu/papers/111883.
47. Oyekale, A.S., Oyekale, T.O. (2009). Do mothers' educational levels matter in child malnutrition and health outcomes in Gambia and Niger? *The Social Sciences*, 4(1): 118-127.
48. Haidar, J., Kogi-Maku, W. (2009). Gender differences in the household-headship and nutritional status of pre-school children. *East African Medical Journal*, 86(2): 69-73.