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Determinants of under-nutrition among under-five children in Enugu Metropolis, Southeast Nigeria

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Abstract: *Background:* Malnutrition and infection are among the most frequent causes of morbidity and mortality in infancy, especially in developing countries, where the frequency, severity and duration of the infection are related to the nutritional status of children. Investment in childhood nutrition contributes not only to improving children's current welfare but to enhancing human capacity building in the long term.
Objective: This study aimed to assess the factors that determine the nutritional status of under-five children.
Methods: This was a community based cross sectional study carried out in Enugu Metropolis among children ≤ 5 years of age. A multistage sampling technique was employed. Simple random sampling by balloting was used to choose wards, streets, household and respondents in this study. Questionnaires were administered to parents/caregivers and anthropometric measurements done. Some information sought by the questionnaire include age and educational attainment of the parents/caregiver, immunization history, family income, history of exclusive breast feeding and diarrhea. Binary and multivariate logistic regressions were used to establish determining factors.
Results: Among the 400 children studied, 21 (5.3%) were wasted, 33 (8.3%) were underweight, stunting was found in 38 (9.5%), 36 (9%) were overweight, 11 (2.8%) were obese while the rest had normal nutritional status.
There were statistically significant association between stunting and marital status of parents (p = 0.022), immunization status (p< 0.001), age of mother (p = 0.046), maternal education (p = 0.012) and average family income (p = 0.034). Statistically significant association existed between underweight and number of people in the household (p = 0.027), cases of diarrhea (p = 0.004), exclusive breast feeding (p = 0.008), age of father (p<0.001) and average family income (p<0.001). Wasting was statistically associated with exclusive breast feeding (p = 0.012).
Conclusion: There were significant association between nutritional status and socioeconomic factors of children. Education of women should be given more attention as it has been shown to underlie most other factors contributing to good or poor nutritional status.

Key words: Under-five, Nutritional status, Wasting, Underweight, Stunting, Overweight

Introduction

Nutritional status during childhood is important for human development as it affects every phase of human life. Therefore, investment in childhood nutrition contributes not only to improving children's current welfare but to enhancing human capacity building in the long run.[1,2] The nutritional status of children is a major predictor of child survival.[3]Malnutrition and infection are among the most frequent causes of morbidity and mortality in infancy, especially in developing countries, where the frequency, severity and duration of the infection are related to the nutritional status of children.[3] Children less than five years of age are particularly vulnerable to malnutrition because of their rapid growth rate and susceptibility to infections.[4,5]
Malnutrition is one of the key public health problems of developing countries where resources are limited. At the conclusion of the millennium development goals (MDG), the proportion of underweight children was reported to have declined globally from 25% in 1990 to 15% in 2015.[6,7] However, this decline was not evenly distributed in all regions of the world as nearly 90 percent of all underweight children reside in South East

Asia and sub-Saharan Africa.[8]Also, the number of stunted children had fallen in all regions except sub-Saharan Africa, where the numbers increased by about one third between 1990 and 2013.[6,8] According to the 2015 MDG report, sub-Saharan Africa accounted for 33% of all undernourished under-five children globally – with about 39% stunted, 25% underweight and 10% wasted.[7] These data suggest that despite the global progress that has been achieved, under-nutrition remains unacceptably high in sub-Saharan Africa, where 90% of malnourished under-fives live.[6]

The World Health Organization (WHO) estimates that 150 million children less than 5 years are underweight, 200 million are stunted and additional 55 million wasted with another 26 million having severe acute malnutrition.[9,10] In Nigeria, the trends of stunting and underweight between 1990 and 2013 among under-five children have largely increased despite several measures and attempts at reducing it.[11-13]A research reported by the Nigerian food consumption and nutrition survey between 2001 and 2003 reported 42% stunting, 25% underweight, and 9% wasting.[14] According to the 2013 National Demographic and Health survey, the prevalence of stunting was 37%, while underweight and wasting among the under five children were 29%,and 18% respectively.[11]

The consequences of malnutrition are factually devastating. And there is a clear dose-response relationship between the degree of malnutrition and mortality, with the risk among those with wasting greater than among those with stunting.[15] Children with the most profound anthropometric defects have an elevated risk of death from a variety of infections and it is estimated that malnutrition contributes to about 45-50% of all under-five deaths annually.[15-18]Every year, 3.5 million children die of malnutrition-related causes in the world.[9,19,20] Most of these deaths occurring in sub-Saharan African countries.[4] Among those who survive, malnutrition predisposes the children to different cognitive deficiencies, delayed physical growth and motor development; low intelligent quotient (IQ), behavioural problems, deficient social skills as well as susceptibility to infection and high incidence rate of some chronic diseases.[21-23]

Most of the work done in Enugu and indeed Nigeria on nutritional status has dwelt on prevalence of malnutrition with few incidental findings on determinants of nutritional status. To the best of the authors' knowledge none has dwelt on which factors affected stunting, wasting or underweight. It has then become very important that we determine what and what affect nutritional status of the under-five children as it gives a guide to the health status of the population. Therefore, this study is aimed to determine the factors associated with the nutritional status of children under-five years.

Methodology

Study design

This was a community-based cross- sectional, observational study carried out among children one to 59 months of age in Enugu North Local Government Area (LGA) between May to July 2018.

Study area

This study was carried out in Enugu North LGA. Enugu North LGA has five wards within it – New Haven, Ogui Township, Onu -Asata, Independence Layout and Udi Siding/Iva Valley wards.

Study population

The study included children whose parents/caregiver gave an informed consent. However, children below one month and children that were seriously ill were not included in the study.

Sample size

Using the formula for descriptive studies involving proportions, $n=z^2pq/d^2$ where, z= 95% confidence level (1.96), p = proportion of children from previous studies that had malnutrition, 50%, q=1-p, d = degree of accuracy desired, taken as 0.05. A total of 400 participants were studied.

Sampling technique

Multi-staged sampling involving stratified and simple random methods was used. Simple random sampling was used to select Enugu North. The streets in each of the wards were listed from which 10 each were selected by balloting. The houses were studied consecutively. In a situation where there are multiple families in a house, a family is selected at random using balloting and that family selected studied. Each ward was allocated 80 participants while each street was allocated 8 participants. How ever if the allocated number of study participants cannot be met, families in the neighboring street were studied to make up.

Data collection

A pretested, interviewer administered questionnaire was used to collect data with regards to demographics, feeding practices, immunization status, family size and income, anthropometric measurements – height and weight, episodes of diarrhea, etc. For each child recruited, the height or length was measured to the nearest centimeter (sensitivity of 0.5 cm) using a Seca stadiometer (Model 786 2021994 Seca GmbH & Co.) or the Infantometer (for those less than 24 months), with the subject barefoot or wearing a pair of socks. The participant's weight was measured using an electronic weighing scale or Bassinet scale with a sensitivity of 0.1 kg. Both the height and weight were measured twice and if

there was disparity, a third measurement was taken and an average of the three measurements used.

Data analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 20. Frequency and descriptive statistics were obtained for all variables. Chi-square test was used for associations between demographics of children and that of parents, immunization status, breast feeding and history of diarrhea with malnutrition. The level of significance was taken as $p \leq 0.05$.

Ethical considerations

The research was approved by the Research and Ethics Committee of University of Nigeria Teaching Hospital Ituku-Ozalla, Enugu. Informed consent, both written and verbal were obtained from each of the parents/caregiver after the main purpose of the research was explained to them in vernacular or English. They were reassured of confidentiality.

Results

Four hundred children were studied. Majority were: males 248 (62.0%), aged 13-16 months (218;54.5%), fully immunized (308;77.0%), had at least an episode of diarrhea (206;51.5%), not exclusively breast fed (221;55.2%) and of Igbo tribe 346 (86.5%). Table 1a.
Most parents were married (344; 86.0%). Majority of the mothers were aged < 36 years (305; 76.3%), had tertiary education (119; 49.8%) and were public servants (181; 45.6%). Most of the fathers were aged < 40 years (238; 59.5%), had tertiary education (243; 60.3%) and were public servants (209; 52.3%). Most families earn 31,000-100,000 Naira ($82.2 - $274.0) per month (204; 51.0%) Table 1b.

Among the children studied, with respect to nutritional status using weight for height, 332 (83.0%) were normal, 21 (5.3%) were wasted, 36 (9.0%) overweight and 11 (2.8%) obese. Using height and weight for age, 38 (9.5%) were stunted and 33 (8.3%) underweight respectively using Z score of -2 as reference cut off. Table 2.
There were statistically significant association between stunting and such factors as marital status of parents (p = 0.022), immunization status (p< 0.001), age of mother (p = 0.046), maternal education (p = 0.012) and average family income (p = 0.034). However, the order of birth (p = 0.383), number in the household (p = 0.676), birth weight (p = 0.102), cases of diarrhea (p = 0.223), exclusive breast feeding (p = 0.733), age of father (p= 0.051) and paternal education (p = 0.853) were not statistically associated with stunting. Table 3. On multivariate analysis, those who are married were about 1.2 times (AOR 1.24) and those who are separated/widow were about 2.0 times (AOR 1.97) less likely to be stunted than those who were single. Those not fully immunized were about 4.2 times (AOR 4.21) more likely to be stunted than those fully immunized. Those whose mother were aged 36 years and more were about 2.0 times (AOR 2.02) more likely to be stunted than those whose mother aged < 36 years. Those whose mother had secondary education had about 82% (AOR 0.82) and those whose mother had tertiary education about 78% chances (AOR 0.78) of not being stunted than those with primary education and below. With regards to total family income, those whose family income was ≤ N30,000 monthly had about 64% chances (AOR 0.64) and those whose family earn 31,000-100,000 monthly about 47% chances (AOR 0.47) of being stunted than those whose family earned > 100,000 naira monthly. Table 3.

Table 1a: Socio demographics of participants

	Frequency	Percent %
Age (months)		
≤ 12	71	17.8
13-36	218	54.5
> 36	111	27.8
Sex		
Male	248	62.0
Female	152	38.0
Order of birth		
1-3	298	74.5
4-6	82	20.5
>6	20	5.0
Number in the household		
<6	227	56.8
6-10	145	36.3
>10	28	7.0
Tribe		
Igbo	346	86.5
Hausa	20	5.0
Yoruba	34	8.5
Marital status of parent(s)/ Caregiver		
Single	28	7.0
Married	344	86.0
Others	28	7.0
Fully immunized		
Yes	308	77.0
No	92	23.0
Had case/s of Diarrhoea		
Yes	206	51.5
No	194	48.5
Exclusively Breastfed		
Yes	179	44.8
No	221	55.2

Table 1b: Socio-demographics of parents

Variables	Frequency	Percent %
Age of Mother (years)		
<36	305	76.3
≥36	95	23.8
Age of Father (years)		
<40	238	59.5
≥40	162	40.5
Mother's education		
Primary and below	76	19.0
Secondary	125	31.3
Tertiary	199	49.8
Father's education		
Primary and below	69	17.3
Secondary	88	22.0
Tertiary	243	60.8
Mother's occupation		
Civil/public servant	181	45.3
Trading	47	11.8
Artisan	44	11.0
Farming	21	5.3
Others	107	26.8
Father's occupation		
Civil/public servant	209	52.3
Trading	96	24.0
Artisan	62	15.5
Farming	12	3.0
Others	21	5.3
Average family income (Naira)		
30,000	102	25.5
31, 000-100,000	204	51.0
> 100,000	94	23.5

Table 2: Distribution of Nutritional Status Using Z score of -2 reference cut off

Variables	Frequency	Percent %
Height for Age		
Stunting	38	9.5
Normal	362	90.5
Weight for Age		
Underweight	33	8.3
Normal	367	91.8
Weight for Height		
Normal	332	83.0
Wasting	21	5.3
Overweight	36	9.0
Obese	11	2.8

Table 3: Factors influencing Stunting Using Z score

	Not stunted N (%)	Stunting N (%)	χ^2 (p value)	AOR (95%CI)
Order of birth				
1-3	268 (89.9)	30 (10.1)		
4-6	77 (93.9)	5 (6.1)	1.92 (0.383)	NA
> 6	17 (85.0)	3 (15.0)		
Number in the household				
< 6	208(91.6)	19(8.4)		
6-10	129(89.0)	16(11.0)	0.78 (0.676)	NA
> 10	25(89.3)	3(10.7)		
Birth weight (Kg)				
< 2.5	24(100.0)	0(0.0)	2.68 (0.102)	NA
≥ 2.5	338(89.9)	38(10.1)		
Marital status of parent(s)/Caregiver				
Single	22(78.6)	6(21.4)		1.24 (0.45-3.47)
Married	312(90.7)	32(9.3)	7.59 (0.022)	1.97 (0.33-4.07)
Others	28(100.0)	0(0.0)		1
Fully immunized				
Yes	289(93.8)	19(6.2)	17.28	4.21 (2.07-8.57)
No	73(79.3)	19(20.7)		1
Cases of Diarrhoea				
Yes	190(92.2)	16(7.8)	1.48 (0.223)	NA
No	172(88.7)	22(11.3)		
Exclusively Breastfed				
Yes	161(89.9)	18(10.1)	0.12 (0.733)	NA
No	201(91.0)	20(9.0)		
Age of Mother (years)				
<36	281(92.1)	24(7.9)	3.97 (0.046)	2.02 (0.85-4.80)
≥36	81(85.3)	14(14.7)		1
Age of Father (years)				
<40	221(92.9)	17(7.1)	3.80 (0.051)	NA
≥40	141(87.0)	21(13.0)		
Maternal education				
No formal education/ Primary	62(81.6)	14(18.4)		0.82 (0.26-2.23)
Secon-	117(93.6)	8(6.4)	8.93 (0.012)	0.78 (0.27-3.14)
Tertiary	183(92.0)	16(8.0)		1
Paternal education				
No formal education/ Primary	62(89.9)	7(10.1)		
Secon-	81(92.0)	7(8.0)	0.32 (0.853)	NA
Tertiary	219(90.1)	24(9.9)		
Average family income (Naira)				
30,000 and be-	96 (94.1)	6 (5.9)		0.64 (0.35-1.45)
31,000-	177 (86.8)	27 (13.2)	6.77 (0.034)	0.47 (0.19-7.33)
> 100,000	89 (94.7)	5 (5.3)		1

Underweight

There were also statistically significant association between underweight and number persons in a household (p = 0.027), cases of diarrhea (p = 0.004), exclusive breast feeding (p = 0.008), age of father (p< 0.001) and average family income (p< 0.001) Table 4. Meanwhile there were no statistically significant association between underweight and marital status of parents (p = 0.054), immunization status (p = 0.543), age of mother (p = 0.075), maternal education (p = 0.381), order of birth (p = 0.456), birth weight (p = 0.904), and paternal education (p = 0.345).Multivariate analysis revealed that those families where there are < 6 persons were about 1.2 times (AOR 1.21) and those 6-10 were about 3.2 times (AOR 3.25) less likely to be underweight than in those families where there are > 10 persons, table 4. Also, those children that had diarrhea were about 2.0 times (AOR 2.02) more likely to be underweight than those without diarrhoea. Those that were not exclusively breastfed were about 2.0 times (AOR 1.99) more likely to be underweight than those exclusively breastfed. Those whose father were aged 40 and more were about 1.2 times (AOR 1.21) less likely to be underweight than those whose father aged < 40 years. Those whose family income was N30,000 and below monthly had about 64%

chances (AOR 0.64) and those whose family earn 31,000-100,000 monthly had about 53% chances (AOR 0.53) of being underweight than those whose family earn > N100,000. Table 4.

Wasting

There was statistically significant associations between wasting and exclusively breast feeding (p = 0.012). When subjected to multivariate analysis, those who were exclusively breast fed were about 3.4 times less likely to be wasted than those who were not exclusively breast feed. But there were no significant statistical association between wasting and marital status of parents (p = 0.835), immunization status (p = 0.533), order of birth (p = 0.079), number in the household (p = 0.299), birth weight (p = 0.806), cases of diarrhoea (p = 0.327), age of father (p = 0.818), paternal education (p = 0.363), maternal age (p = 0.295) and education (p = 0.087) and average family income (p = 0.076). Table 5.

Table 5: Factors influencing Wasting using Z-score

Variables	No wasting N (%)	Wasting N (%)	χ^2 (p value)	AOR (95%CI)
Order of Birth				
1-3	278(93.3)	20(6.7)		
4-6	81(98.8)	1(1.2)	5.07 (0.079)	NA
>6	20(100.0)	0(0.0)		
Number in the Household				
<6	216(95.2)	11(4.8)		
6-10	135(93.1)	10(6.9)	2.42 (0.299)	NA
>10	28(100.0)	0(0.0)		
Birth Weight (Kg)				
<.2.5	23(95.8)	1(4.2)	0.06 (0.806)	NA
≥2.5	368(94.7)	20(5.3)		
Marital status of Parent(s)/Caregiver				
Single	26(92.9)	2(7.1)		
Married	326(94.8)	18(5.2)	0.36 (0.835)	NA
Others	27(96.4)	1(3.6)		
Fully Immunized				
Yes	293(95.1)	15(4.9)	0.39 (0.533)	NA
No	86(93.5)	6(6.5)		
Cases of Diarrhea				
Yes	193(93.7)	13(6.3)	0.96 (0.327)	NA
No	186(95.9)	8(4.1)		
Exclusively Breastfed				
Yes	164(91.6)	15(8.4)	6.38 (0.012)	3.44(0.83-16.24)
No	215(97.3)	6(2.7)		1
Age of Mother (years)				
<36	287(94.1)	18(5.9)	1.10 (0.295)	NA
≥36	92(96.8)	3(3.2)		
Age of Father (years)				
<40	225(94.5)	13(5.5)	0.05 (0.818)	NA
≥40	154(95.1)	8(4.9)		
Maternal Education				
No formal education/ Primary	71(93.4)	5(6.6)		
Secondary	123(98.4)	2(1.6)	4.89 (0.087)	NA
Tertiary	185(93.0)	14(7.0)		
Paternal Education				
No formal education/ Primary	65(94.2)	4(5.8)		
Secondary	86(97.7)	2(2.3)	2.03 (0.363)	NA
Tertiary	228(93.8)	15(6.2)		
Average Family income				
30000	101(99.0)	1(1.0)		
31000-100000	191(93.6)	13(6.4)	5.17 (0.076)	NA
>100000	87(92.6)	7(7.4)		

Table 4: Factors influencing Underweight Using Z score

Variables	Not Under-weight N (%)	Under-weight N (%)	χ^2 (p value)	AOR (95% CI)
Order of birth				
1-3	271(90.9)	27(9.1)		
4-6	78(95.1)	4(4.9)	1.57 (0.456)	NA
>6	18(90.0)	2(10.0)		
Number in the household				
<6	214(94.3)	13(5.7)		1.21(0.46-3.23)
6-10	126(86.9)	19 (13.1)	7.23 (0.027)	3.25(0.95-11.18)
>10	27(96.4)	1(3.6)		1
Birth weight (Kg)				
<.2.5	22(91.7)	2(8.3)	0.02 (0.904)	NA
≥2.5	345(91.8)	31(8.2)		
Marital status of parent(s)/caregiver				
Single	28(100.0)	0(0.0)		
Married	311(90.4)	33(9.6)	5.86 (0.054)	NA
Others	28(100.0)	0(0.0)		
Fully immunized				
Yes	284(92.2)	24(7.8)	0.37 (0.543)	NA
No	83(90.2)	9(9.8)		
Cases of Diarrhoea				
Yes	181(87.9)	25 (12.1)	8.47 (0.004)	0.64(0.28-4.80)
No	186(95.9)	8(4.1)		1
Exclusively Breastfed				
Yes	157(87.7)	22 (12.3)	6.99 (0.008)	1.99(0.33-12.08)
No	210(96.0)	11(5.0)		1
Age of Mother (years)				
< 36	284(93.1)	21(6.9)	3.16 (0.075)	NA
≥ 36	83(87.4)	12 (12.6)		
Age of Father (years)				
< 40	228(95.8)	10(4.2)	12.72 (0.000)	1.21(0.64-3.56)
≥ 40	139(85.8)	23 (14.2)		1
Maternal education				
No formal education/ Primary	72(94.7)	4(5.3)		
Secondary	116(92.8)	9(7.2)	1.93 (0.381)	NA
Tertiary	179(89.9)	20 (10.1)		
Paternal education				
No formal education/ Primary	62(89.9)	7(10.1)		
Secondary	84(95.5)	4(4.5)	2.13 (0.345)	NA
Tertiary	221(90.9)	22(9.1)		
Average family income				
≤30000	102(100.0)	0(0.0)		0.64(0.19-2.25)
31000-100000	186(91.2)	18(8.8)	16.64 (0.000)	0.53(0.22-7.54)
>100000	79(84.0)	15 (16.0)		1

Discussion

Childhood malnutrition is the result of multiple factors including feeding practices, environmental and socio-economic circumstances etc.The results in this study revealed that majority of the subjects were young toddlers who were not exclusively breast fed and are of Igbo extraction. However, it is surprising to note that exclusive breast feeding is not prevalent among majority of the young mothers. This is because of the massive campaign promoting the need and benefits of exclusive breast feeding in Enugu where compliance is thought to exist. However, the worsening economic conditions in Nigeria may be the driving force why most of these mothers had to go out to work to improve the economic conditions of the family, to the detriment of their infants.

The overall prevalence of under-nutrition in this study was 5.3% while over-nutrition is 11.8% using WHO BMI Z-score. The prevalence of both stunting and underweight were 9.5% and 8.3% respectively. The epidemic of overweight and obesity having been escalating over the last two decades in developing countries, Nigeria inclusive.[24] This nutrition transition categorized as a decrease in the prevalence of under-nutrition and increased rates of overweight and obesity has been occurring all over the world.[25] The acute under-nutrition may have been due to the high prevalence of non-exclusively breast fed toddlers as well as worsening economic situation in the country. Whereas this is a community-based study, the prevalence of under-nutrition was higher than the 3.3% reported in same municipality five years ago by Igbokwe *et al* among primary school children.[26]

Stunting is a reflection of accumulated past outcomes and represents chronic malnutrition.[1]The reasons why stunting was significantly associated with marital status may include the fact that the sum total of the earnings of the married being greater and the emotional stability of those in union compared with single parents who may see their child as a burden, with greater propensity of abuse and neglect. The above reasons may however lead to greater food security, encourage healthy eating habit, larger portion per serve, eliminate child neglect, better childrearing environment and living conditions among those in union. Environmental deprivation, emotional abuse and child neglect having been proven causes of malnutrition.[27]Again, those in union are more likely to breast feed exclusively with the support of their partners, attend immunization and seek medical help for common childhood illnesses like malaria, upper respiratory infections (RTI), diarrhea etc which impairs absorption and increase catabolism.[28] This finding agrees with that of Miskir, *et al*[9] in Ethiopia.

Infections including vaccine preventable diseases play a major role in the etiology of under-nutrition because they result in increased need and high energy expenditure, lower appetite, nutrient losses due to vomiting, diarrhea, poor digestion, malabsorption and the utilization of nutrients and disruption of metabolic equilibrium.[9] Those that completed their immunization are most probably more likely to have improved resistant to diseases. In Côte d'Ivoire and India, immunization was found to increase the height of children and reduce stunting and wasting respectively.[15,29,30]Across country studies in the developing world have also shown that child immunization explains the lower prevalence of both wasting and stunting.[17,22,30-34] In the developing countries, childhood immunization is not only said to prevent about 3 million child deaths per year but also has the potential to avert additional 2 million deaths if immunization programmes are expanded and fully implemented.[35-37] Immunization may be able to achieve this feat by preventing childhood under-nutrition.

Maternal education, age and family income were other factors that affected stunting. The role of maternal education in reducing under-nutrition cannot be overemphasized. Maternal education enhances mother's knowledge and practice towards child feeding practice, better food choices, health seeking attitude, participation in family decision making and empowers them to be better in economic status by being gainfully employed, diversify and amplify the means of household income than their less educated counterpart, with direct impact on child malnutrition. This agrees with other studies in Nigeria and other parts of African that found that maternal education was a statistically significant predictor of stunting.[6,17,26,38] However, these findings is at variance with that of Kamiya and Kabeta, *et al*.[1,33] Increases in family income ensures provision of adequate amount of nutritious food items in the house as more money is allotted to feeding, ensure food security and prompt treatment of ailments like malaria, diarrhea and RTI that cause fever, vomiting and loss of appetite ultimately leading to stunting. The finding in this study is similar to previous works that have demonstrated that the monthly family income was a noteworthy determinant of stunting.[6,17,39,40]

Those mothers aged < 36 years were more likely to have a better nutritional status and less likely to have developed metabolic diseases like hypertension and obesity which ultimately affects birth weight. Though birth weight was not associated with stunting in this study as was in Ojofeitimi *et al* in Ile-Ife[34], other studies have noted that birth weight, mother's BMI were major factors associated with stunting among children.[6,22]
Underweight is an index of both acute and chronic under-nutrition and therefore represents neither chronic nor acute malnutrition.[1,15,41] The fact in this study is that children in those families with ≤ 6 persons were less likely to be underweight than in those families where there were more. The reasons most probably, could be due to the fact that the care and serving portion per person is reduced significantly. Again money spent per person in feeding and health care in the household is also markedly reduced. This study finding is consistent with other studies.[9,17,42]

Children who have diarrhea at least once a year were twice more likely to be underweight compared with those who did not. This is because with each episode of diarrhea, there is a decreased intake, an increased nutrient loss from vomiting and less nutrient absorption while the gut is infected and inflamed, and some of the energy a child would otherwise use for growth and development is diverted to fight off the infection. Because of these reasons, a child with borderline nutritional status needs more energy and calories to fight off the infection and recover while an undernourished child who has fewer energy reserve falls even further behind and is more susceptible to the next bout of diarrhea. Consistently, this finding also agrees with other studies.[6,9,22]

The fact that breastfeeding protects against infections in the newborns and infants and is associated with low levels of morbidity and mortality explains the finding that those children who were exclusively breast fed were twice less likely to be underweight compared with those not exclusively breast fed.[43-45] This protection can substantially decrease when a child is fed other than maternal milk, including water. This is because the child not exclusively breastfed receives less protection factors from the maternal milk, besides receiving food or water that are frequently contaminated.[43]This finding also agrees with studies in other countries of Africa, India and Banglandesh.[46-48]

The average family income is also significantly associated with underweight. Just as it is with stunting, increases in family income will lead to more money allotted to feeding and prompt treatment of common infection and enhance improvement in nutritional status. This also agrees with other studies which have found household income as a critical and significant determinant of malnutrition.[17,26,49]Paternal age was surprisingly found to be associated with underweight. This may be a reflection of employment pattern in Nigeria due to the high unemployment rates.

Wasting which is represented by weight-for-height z-score is a shorter-time index of nutritional deficiency and indicates acute under-nutrition. Wasting is usually caused by a recent nutritional deficiency and results from rapid weight loss or a failure to gain weight.[1]In this study, wasting was associated with exclusive breast feeding. This must have stemmed from the protection offered by breast feeding against infections and calories supplied which prevents abrupt weight loss. Acute malnutrition usually being the result of a combination of inadequate dietary intake and infection. This finding is also agreeing with that of other studies.[9]

Conclusion

Malnutrition is still prevalent and rising among under-five children in Enugu Municipality. Marital status of the parents, age and educational status of the mother, family income and immunization status of the child all predict stunting while exclusive breastfeeding, diarrheal disease, number of persons in the household, age of father as well as family income determine underweight. Wasting is determined by exclusive breastfeeding.

Authors contribution
EEA, ECA and NDU conceived the research, designed the questionnaire, collected data and literature search. ECA analysed data while NDU directed data analysis. AN and CCO collected data, literature search. All authors wrote and read the manuscript.
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