SPATIAL VARIATION IN THE NUTRITIONAL STATUS OF DIARRHOEA VULNERABLE CHILDREN IN OYO STATE, NIGERIA

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ABSTRACT

The study examined the variation in the nutritional status of diarrhoea vulnerable children in urban, peri- urban and rural areas of Oyo State, Nigeria. Six Local Government Areas were selected for the study, with two Local Government Areas representing each of urban, peri-urban and rural environments. Hospital record of patients from the General Hospital, Ibadan and questionnaire administration were used for the study. A total of three hundred (300) households were sampled using the stratified and systematic random sampling techniques, while anthropometric variables (sex, age, weight and height) were determined using the World Health Organization (WHO) standardized scales. The Analysis of Variance results revealed that significant variations existed in nutritional status of children infected with diarrhoea across the different geographic areas ($p<0.05$). The Pearson's correlation result showed a low positive and significant relationship between body mass index for age and the prevalence of diarrhoea ($r=0.075$; $p<0.05$), underweight ($r=-0.002$; $p<0.05$) and stunting($r=-0.063$; $p<0.05$) negatively correlated with diarrhoea, while wasting had a positive relationship with diarrhoea prevalence($r=0.027$; $p<0.05$). The study recommends hygiene and in-take of balanced diet in order to enhance the immune system of children in the area.

Key words: Anthropometric indicators, Diarrhoea prevalence, Local Government Areas, Nutritional status

INTRODUCTION

Nutrition is a fundamental pillar of human life, health and development across the entire life span. From the earliest stages of foetal development, at birth, and through infancy, childhood, adolescence and adulthood, proper food and good nutrition are essential for survival, physical growth, mental development, performance, productivity, health and well-being. More than half of all child deaths are associated with malnutrition, which weakens the body's resistance to illness (UNICEF, 2008). Poor diet, frequent illness, and inadequate or inattentive care of young children can lead to diarrhoea, and what the child eats or drinks may make diarrhoea worse. Prolonged and recurrent episodes of diarrhoea lead to stunting and growth failure in early childhood. Consequently, malnutrition further predisposes to recurrent episodes of persistent diarrhoea, and a vicious cycle of diarrhoea-malnutrition-diarrhoea follows. The negative nutritional effect of severe diarrhoea is compounded by anorexia, ineffective weaning practices, and food withdrawal by caretakers. Diarrhoea has thus been aptly labelled

as a nutritional disorder, and optimal nutritional therapy is generally considered a cornerstone for its management (UNICEF, 1998).

Diarrhoea is the passage of two or more loose or liquid stools per day or more frequently than is normal by an individual. It is a leading cause of childhood ill health and death in developing countries. Diarrhoea is especially risky for malnourished children who are more likely than adults to become dehydrated quickly, as well as adults who have weakened immune systems (UNICEF, 2008).The median incidence of diarrhoea disease in children under five in developing countries has not changed significantly since the early 1990s, and 3.2 episodes per child occur per year in 2009 compared to 3.5 episodes per child per year in 1993.These episodes are high considering the youthfulness of Nigeria's population. As the global population continues to expand at nearly two percent per year, the population of impoverished children also grows (UNICEF, 2008; Sutariya and Nitiben, 2011).

Diarrhoea is one of the leading causes of death among children in Africa. Estimates suggest that about two million children die before the age of five in Africa (UNICEF, 2008). The United Nations Children's Fund (2014) said that diarrhoea kills about 194,000 children under the age of five every year in Nigeria and that 88 per cent of diarrhoeal deaths could be attributed to unsafe water, poor sanitation and hygiene. Diarrhoea prevalence has been closely linked with high incidence of poverty in the country (NDHS, 2008). Poverty is associated with poor housing, crowding, dirty floors, lack of access to sufficient potable water or to sanitary disposal of faecal waste, cohabitation with domestic animals that may carry human pathogens, and a lack of refrigerated storage for food, all of which increase the frequency of diarrhoea (Smith and Haddad, 2000). According to WHO (1997), human feaces are the primary sources of diarrheal pathogens. The impact of the disease on the poor is exacerbated by the lack of adequate and affordable medical care. Lack of safe water and adequate sanitation in many parts of Oyo State has led to increased cases of diarrhoea among infants and young children. Every year more than five thousand children under five years of age succumb to fluid loss and dehydration associated diarrhoea related illness. Thus, children suffer from continuous exposure to infections and most of these children rarely receive appropriate preventive care, and too often encounter health care system when they are already severely ill. This paper therefore examines variation in the nutritional status of diarrhoea vulnerable children, with the view of establishing the spatial variations and highlighting the underlying factors of influence as well as suggest ways of achieving reduction in diarrhoea prevalence level.

STUDY AREA

Oyo State is located near the forest-grassland boundary of southwestern Nigeria. It is made up of 11 Local Government Areas (LGAs) of Akinyele, Egbeda, Ibadan North West, Ido, Lagelu, Oluyole, Ona–Ara, Ibadan North East, Ibadan South East, Ibadan South West and Ibadan North (Fig. 1). The region lies between latitudes $7^0$18' and $7^0$34' North of the equator and between longitudes $3^0$49' and $3^0$59' East of the Greenwich Meridian. Its population was 2,550,593 in 2006 with a projected population of about 2,615,000 in 2009 (NPC, 2007). Ibadan urban has a population density of 17,427 per sq.km, while Ibadan rural has 293 per sq.km. Severe poverty appears to be more pronounced in the rural areas of the state. The waste management is very poor as the inhabitants indulge in indiscriminate dumping of refuse. Due to the geologic composition of the area, water is very scarce and in places where it is available, wells, boreholes and rivers serve as the major sources of supply and often times the quality of this water is unsafe for human consumption and these have health

implications on children. Economic activities undertaken by people in Ibadan include trading, public service employment, and agriculture in decreasing order of level of engagement. Majority of the poor live in the rural areas with more than 60% of them depending on agriculture for employment and subsistence.

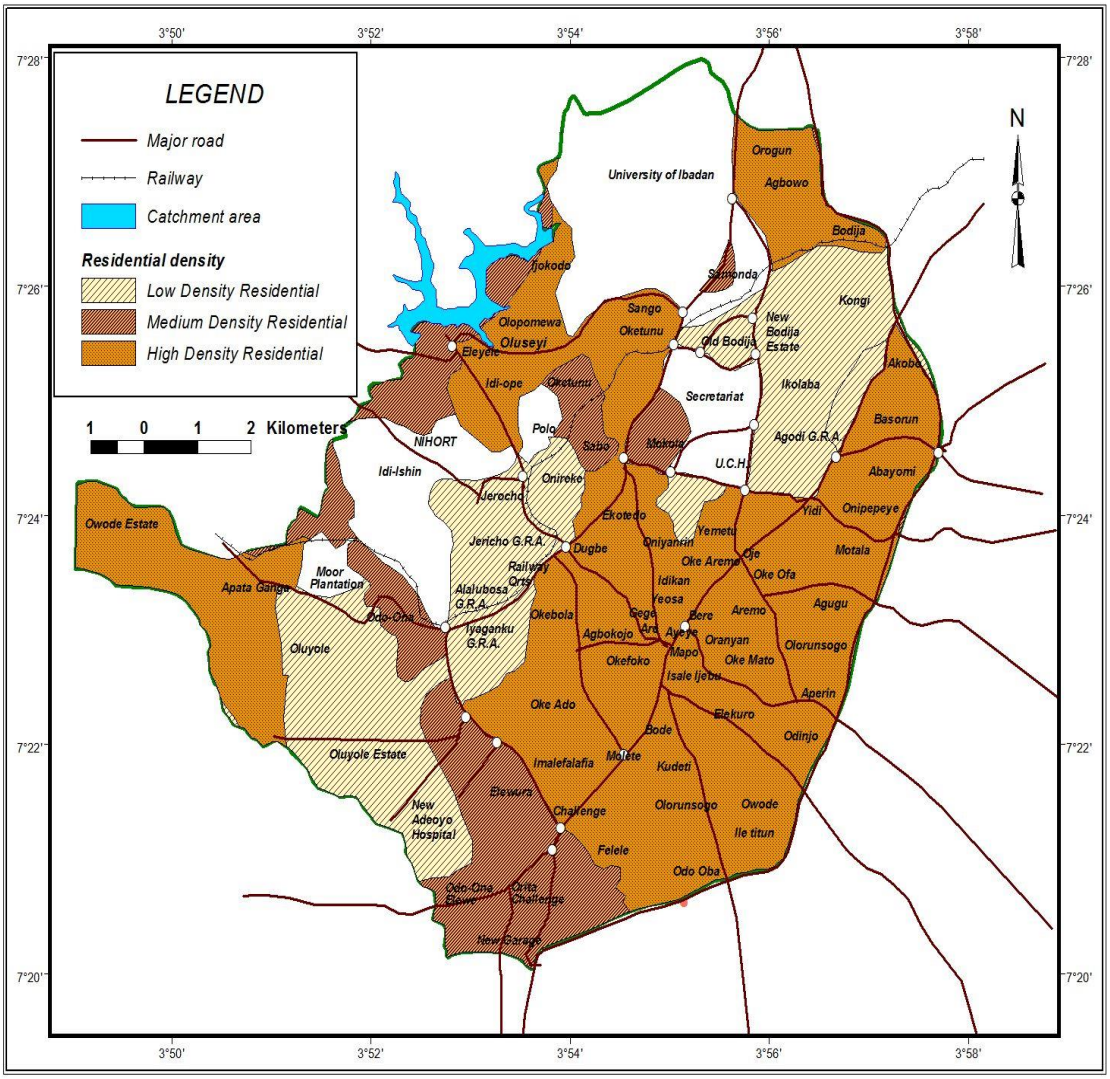

Fig. 1. Ibadan Showing Residential Neighbourhoods

MATERIALS AND METHODS

A cohort-based study of children under 5 years old was conducted in order to determine the prevalence of diarrhoea in relation to their health status. The survey focused on six LGAs selected out of the eleven LGAs within the study area, with two LGAs representing each of urban, peri-urban and rural environments.The selection was stratified in order to have a representation of the three residential categories in the study. Hence, Bodija (Ibadan North) and Molete (Ibadan South West) were selected to represent urban areas because both according to the Local Government ranking are urban. Odo-Ona Elewe (Oluyole) and Ojoo (Akinyele) were selected to represent the peri-urban areas based on their location along the urban fringe. Akufo (Ido) and Egbeda (Egbeda) were selected to depict the rural areas due to their essentially rural nature. Data for diarrhoea prevalence were collected from the hospital

records of patients from the General Hospital, Ibadan. A total of 300 households were visited and the same proportion of questionnaire were distributed to mothers of children under 5 years of age. Then systematic random sampling was adopted for the survey due to the poor numbering of houses. This was such that every fifth household was visited and in cases where there were no children under the age of five years in a paticular household, the next household was visited. However, in a household where there were twins or triplets, only one child was sampled.

In order to determine the various categories of nutritional status (anthropometric variables) of children under five years of age, antropometric measures such as sex, age, weight, and height were used (World Health Organisation, 1997). Heights of children were measured using height stadiometer. The Standardized Bathroom Scale and measuring board were used to determine the weight of children, and children's ages were confirmed by their mothers or care-givers. These anthropometric variables were further subjected to Z-score statistic for the determination of wasting, stunting, and under weight as well as body mass index of the cohorts. Wasting was calculated as weight for height, stunting was determined based on height for age, under weight was measured using weight for age, while body mass index was derived from weight and height of the children. This afforded the categorisation of the children from the various neighbourhoods into severely, moderate and low wasted and stunted categories as well as under weight and low body mass categories. One-Way Analysis of variance (ANOVA) was used to determine if there were significant variations in the nutritional status of the children, while Pearson's Product Moment Correlation analysis was used to determine the relationship between the nutritional status of children and the prevalence of diarrhoea. The results are discussed below.

RESULTS AND DISCUSSION

Prevalence of Diarrhoea among Children under Five Years

The prevalence of diarrhoea data among children under 5 years (as revealed by hospital record) in the selected LGAs shows that in the year 2008, Ibadan Southwest had the highest cases (24) of diarrhoea with blood, while the least was recorded in Ido (1). Similarly, in 2009 and 2010, Ibadan Southwest LGA also recorded the highest diarrhoea prevalence with cases 53 and 40 cases respectively. This high levels of reported cases might be attributed to lack of access to health care services. The least reported cases of diarrhoea with blood over the years under review in Ido LGA can be attributed to the rural nature of the area. Diarrhoea infection without blood had higher prevalence rates in Ibadan North over the years. In 2008 for instance, 686 cases were reported, in 2009, 536 cases were confirmed, while in 2010, the number of infections reduced to 461. The least prevalence of diarrhea was in 2008, with only 9 cases recorded in Ibadan Southwest. The number of children infected increased to 148 cases in 2009, and declined rapidly to 96 cases in 2010. These trends and variations on the prevalence of the disease among children may be largely attributed to changes in the nutritional status of children as a result of improvement in household income.

In order to confirm the health data from the hospital, a prevalence survey through the administration of questionnaire was conducted and the results are presented in Table 1 showing the prevalence of diarrhoea among children under 5 years old. 47.3 percent of the nursing mothers stated that their children had not experienced diarrhoea, while 52.7 percent confirmed that their children have had diarrhoea. The result shows clearly that the number of children who had experienced diarrhoea were more than those who had not experienced the condition with the highest number of cases in the peri-urban area, while the least was

recorded in the urban area. This is evident as the peri-urban area is characterized by poor environmental sanitation and hygiene, lack of access to economic security and low nutritional status whereas the core area is characterized by improved socio-economic status of mothers, high maternal education, access to safe water, improved domestic and environmental sanitation (Zere and Mclntyre, 2003).

Table 1: Types and Spatial Pattern of Diarrhoea Prevalence

Diarrhoea Prevalence	Frequency	Percentage
Those who had not experienceddiarrhoea	142	47.3
Those who had diarrhoea	158	52.7
Total	**300**	**100.0**
Location	**Diarrhoea with blood (%)**	**Diarrhoea without blood (%)**
Ojoo (Akinyele LGA)	11.9	31.0
Egbeda (Egbeda LGA)	19.0	14.7
Bodija (Ibadan North LGA)	19.0	7.8
Molete (Ibadan South west LGA)	9.52	12.9
Akufo (Ido LGA)	21.4	22.4
Odo-ona elewe (LGA)	19.0	11.2
Total	**100.0**	**100.0**

Source: Author's Fieldwork, 2011

The prevalence of diarrhoea without blood was higher than diarrhoea with blood. Diarrhoea without blood was high in the peri-urban areas with prevalent rate of 11.2 percent and 31.0 percent as confirmed by nursing mothers. The prevalence rate of diarrhea without blood among children in the rural areas accounted for 22.4 percent and 14.7 percent, while children from the urban environment experienced less diarrhea without blood and accounted for 7.8 percent and 12.9 percent of the cases. In the category of diarrhoea with blood, children in the rural areas had the highest prevalence of 21.4 percent and 19.0 percent, while urban and peri-urban areas such as Ojoo, Odo-ona elewe, Molete and Bodija had almost the same proportion of prevalence as shown in Table 1, with the least prevalence rate of 9.5 percent recorded in Molete.

The seemingly slight variations in diarrhoea episodes may be due to disparities in settlement patterns, income, education, occupation, and dietary patterns of the people. The dietary habits and nutritional status of a people have been objectively tallied to historical, geographical and socio economic circumstances and by extension of disease profile. Smith (2008) noted that nutritional status and the frequency of disease follow very closely the pattern of food availabillity, social customs and economic conditions in different areas of the world.

To further examine the relationship between health status of children and prevalence of diarrhoea in the area, the Pearson's correlation test was performed. The result shows that the prevalence of underweight is negatively correlated with diarrhoea prevalence ($r = -0.002$, $p<0.05$). In other words, there is an inverse relationship between underweight and diarrhoea. The result also shows a positive and significant significant association between body mass

index for age and the prevalence of diarrhea($r=0.075$; $p<0.05$), while the prevalence of stunting is negatively correlated with diarrhoea prevalence ($r=-0.063$, $p<0.05$). Wasting is positively correlated with diarrhoea prevalence($r=0.027$; $p<0.05$). This indicates that as wasting increases, the prevalence of diarrhoea also increases in the area. In other words, there is a direct relationship between wasting and prevalence of diarrhoea. Hence, the more wasted a child is, the more the susceptibility of that child to diarrhoea.

Aspects of Nutritional Status of Children Under Five Years

Anthropometric measures were used in the analysis of aspects of the nutritional status of children under five years of age. These included sex, age, weight, and height. These variables were used to determine the various categories of health using the WHO (2005) standard. Anthropometric measures and the Z-score weight for height (wasting), height for age (stunting), and weight for age (under weight) as well as body mass index were obtained and discussed below. Age of children is an important variable to studies relating to nutritional status and prevalence of diarrhea. For the male children, the highest mean ages of 2.2 and 1.9 were recorded in the rural areas of Egbeda and Akufo, this was closely followed by peri-urban Ojoo and Odo-ona Elewe with mean ages of 2.0 and 1.7, while the urban area (Bodija and Molete) had the least mean ages of 1.7 and 1.4 respectively.This variation was due to the differences in ages of the children studied (the age ranged from 0- 5 years).

On the other hand, for the females, Bodija and Molete representing the urban environment recorded the highest mean age of 2.5 and1.5 respectively, the rural area consisting of Egbeda and Akufo had a mean age of 2.2 and 1.6, while the peri-urban area comprising of Ojoo and Odo ona elewe had 1.6 and 1.5 respectively. The implication of this result is that children under five years are more prone to diarrhoea despite parental socio-economic conditions which determine where they live and their nutritional status. Zere and Diene (2003) noted that early childhood diarrhea during periods of critical post natal development may have long-term effects on linear growth, physical and cognitive functions.

The weight of a child is influenced by the height of that child. The anthropometric index weight for age represents body mass relative to age. Table 2 shows the weight and height of children under five years of age. For the weight, the result indicated that 7.3 percent of the children weighed between 2.5-5.4 kg, 52.3 per cent of the children representing weighed between 5.5 - 8.4 kg, 29 percent of them weighed 8.5 -11.4kg, while 11.3 percent of the children weighed between 11.5 -14.4 kg. Ahmed and Islam (1984) observed that in the absence of wasting, both weights for age and height for age reflect the long term nutrition and health experience of the individual or population.

The anthropometric index of height for age reflects linear growth achieved during pre and post natal with its deficits indicating long term, cummulative effects of inadequate nutrition for health. Shortness in height refers to low height for age that may reflect either normal variation in growth or deficit in growth. The assessment done on height of children further revealed that the highest height of the children measured 66-75cm representing 36.3 per cent of the children, this was closely followed by those with a height range of 56cm-65cm which constituted26.3 per cent of the children. Similarly, 10 per cent of the children were between the heights of 46cm and 55cm, whereas 8 per cent were between the ages of 86cm and 95cm, and only 0.6 per cent of the children had a height of above 96cm. This result implies that the ages of children influence their height. UNICEF (2009) reported that height for age is a function of nutrition, stunting therefore represents a long term effect of malnutrition in a

population. The prevalence of stunting in the area can therefore be attributed to lack of adequate nutrition over a long period of time and is also affected by chronic or recurrent illness especially among the peri-urban and rural dwellers.

Table 2: Weight and Height of Children Under Five Years

Children's Weight(kg)	Frequency	Percentage(%)
2.5 -5.4	22	7.3
5.5 – 8.4	157	52.3.
8.5 – 11.4	87	29.0
11 .5 -14.4	34	11.3
Total	300	100
Children's Height		
36 - 45	6	2.0
46 – 55	30	10.0
56 – 65	79	26.3
66 – 75	109	36.3
76 – 85	50	16.7
86 – 95	24	8.0
Above 95	2	0.6
Total	300	100.0

Source: Author's Fieldwork, 2011

Stunting Category Children under Five Years

Stunting refers to shortness that is a deficit or linear growth that has failed to reach genetic potential as a result of poor diet and disease. Children with the normal heights for their ages according to WHO standard are termed normal, while those whose heights do not correspond with their ages are classified as moderately and severely stunted. Children who suffer from growth retardation as a result of poor diets or recurrent infections tend to be at greater risk of diarrhoea. The study shows differentials in stunting among under-five children in selected areas of Oyo State.

The analysis also reveals that the highest number of moderately stunted children was recorded in the rural areas of Akufo and Egbeda (8-20 per cent), followed by the peri-urban (Ojoo and Odo-ona elewe)with4-10%, the urban area (Bodija and Molete) had the least moderately stunted children with 6 per cent.The overall result on the pattern of stunting showed that the rural area had the highest number of moderately stunted children, next was children from the peri-urban, while children from the urban area were least stunted. The result implies that diarrhoea prevalence often leads to stunting in children due to its association with poor nutrient absorption and appetite loss. The risk of stunting in young children has been shown to increase significantly with each episode of diarrhoea, particularly in the first six months of life (National Center for Health Statistics [NCHS], 1977; UNICEF, 1998).

Under Weight Category Children under Five Years

The antropometric indicators affirm that 10 percent of the children are underweight and this depicts low prevalence, 10-19 percent indicates medium prevalence, between 20-29 percent shows high prevalence, while 30 percent depicts very high prevalence (Table 3). Hence, the

spatial distribution of underweight children further reveals that there is a high prevalence of underweight children in Ojoo (peri-urban), and low prevalence existed in the rural and urban areas (Egbeda, Akufo and Odo-ona elewe respectively). This finding corroborates earlier studies by National Center for Health Statistics (1977) and Sutariya and Nitiben (2011) where the mortality risk of children who are mildly underweight increased in slum areas, with severely underweight children even greater risk. For the moderately underweight, medium prevalence existed in Egbeda and Ojoo, while in the four other neighbourhoods, the prevalence was low. The high number of underweight children in the peri-urban may be largely due to high level of poverty among the people, constrained access to economic resources and malnutrition. This lends support to the findings of Bateman and McGahey (2001) that malnutrition affects the survival, health and education of children and substantially raises the risk of infant and child deaths increasing their vulnerability to a variety of diseases later in life which impairs cognitive ability and lowers school performance.

Wasting Category Children under Five Years

Wasting in children is a symptom of acute under nutrition, usually as a consequence of insufficient food intake or high incidence of infectious diseases, especially diarrhoea. Children with normal weight for their ages are categorised as adequate, while others are categorised as moderate and severe wasting. The study reveals the differentials in the prevalence of severely and moderately wasted children. The peri-urban and urban areas had the highest number of severely wasted children, while Odo-ona Elewe had the least with no cases of wasted children. Severe wasting in Ojoo accounted for 20 percent, followed by children in Bodija with 16 percent, Molete and Akufo had 10 percent respectively, while Egbeda had only 8 percent of severely wasted children.

For moderately wasted children, the peri-urban still accounted for the highest cases, while the rural areas (Egbeda and Akufo) and the urban (Bodija and Molete) had less moderately wasted children. Tables 2 and 3 depict WHO specification of anthropometric indicators. According to World Health Organization (1995), wasting interval of less than 5 percent is classified as acceptable, between 5-9 percent is poor, 10-14 percent is regarded as serious, while 15 percent and above is termed as critical. There is critical wasting in Ojoo and Bodija and this may be attributed to the type of food given to children, while for Molete and Akufo, wasting is a serious issue. In Egbeda, the proportion shows that wasting is poor and may be probably due to the socio-economic conditions of parents.Wasting in the study area, represents failure to receive adequate nutrition in the period immediately preceeding the survey and largely the result of inadequate food intake, or recent episodes of illness, causing loss of weight and the onset of malnutrition. A similar observation was made by Bhuiya, Zimicki and D'Sonza (1986) in Bangladash.

Table 3: Antropometric Indicators of Nutritioncut-off Values for Public Health Significance

Indicator	Prevalence cut-off values for public health significance
Underweight	< 10%: Low prevalence 10-19%: Medium prevalence 20-29%: High prevalence = 30%: Very high prevalence
Stunting	< 20%: Low prevalence 20-29%: Medium prevalence 30-39%: High prevalence = 40%: Very high prevalence
Wasting	< 5%: Acceptable 5-9%: Poor 10-14%: Serious = 15%: Critical

Source: World Health Organisation, 1995.

The result of analysis in Table 4 shows that the Fisher's (F) value between groups which are 3.82, 8.63, 11.02, and 4.47 are significant at 0.05 (95 percent) confidence level, thus, suggesting that there is a significant variation in the health status of children in the study area. The results also shows a significant difference within-groups means between wasting category, stunting category, under weight category, and body mass index category, reflecting the existing variation in the nutritional status as indicated by the anthropometric measures in the study area. The result corresponds with the report of Smith (2008), where levels of health and diseases varied between places and over time, thus variability in the spatial patterns of health problems.

Table 4: Analysis of Variance between Nutritional Indicators

		Sum of Squares	df	Mean Square	F-Value	Sig
Wasting Category	Between Groups	7.707	5	1.541	3.825	.002
	Within Groups	118.480	294	.403		
	Total	126.187	299			
Stunting Category	Between Groups	33.987	5	6.797	8.630	.000
	Within Groups	231.560	294	.788		
	Total	265.547	299			
Underweight Category	Between Groups	12.910	5	2.582	11.024	.000
	Within Groups	68.860	294	.234		
	Total	81.770	299			
Body Mass Index Category	Between Groups	8.976	5	1.795	4.471	.001
	Within Groups	116.829	291	.401		
	Total	125.805	296			

Source: Author's Fieldwork, 2011

CONCLUSION

The study shows that there is a significant variation in the nutritional status of children in the study area. The study identifies sex, age, height and weight to be related to the prevalence of diarrhoea among children in different neighborhoods. Cases of diarrhoea without blood are more prevalent than diarrhoea with blood among children in the study area. On the whole, diarrhea shows a higher prevalence in the peri-urban areas (Odo-Ona Elewe and Ojoo) and rural area (Akufo and Egbade) and low prevalence in the urban (Bodija and Molete) area. The spatial distribution of underweight children shows a high prevalence of underweight children in peri-urban areas while, low prevalence exists in the rural and urban areas. The spatial pattern of stunting shows that the rural area have the highest number of moderately stunted children than the urban. Wasting, stunting, and underweight in children vary spatially and are essential in explaining the pattern of diarrhoea prevalence in the area.

The study confirms that the prevalence of diarrhea among children under-five cuts across all socio-economic strata from the urban, through the peri-urban to rural areas, although with varying rates. The study therefore recommends the consumption of balanced diets, improvement in hygiene practices, availability of potable water, and the enlightenment of mothers on the causes, consequences, prevention, and first aid management of diarrhoea. Furthermore, the importance of seeking and receiving urgent medical care during disease episode, in the treatment and prevention of unpleasant health outcome cannot be over emphasised. In other words, the reduction of the prevalence of childhood diarrhoea requires interventions that make children healthier and less likely to develop infections.

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