# ENVIRONMENTAL DETERMINANTS OF NUTRITIONAL STATUS OF CHILDREN IN NORTHERN STATES, NIGERIA

**DEBORAH K. MAGAJI**
Government Secondary School, Tudun Jukun, Zaria, Nigeria

## Abstract

*The study assessed the environmental determinants of nutritional status of children under-five in Northern States, Nigeria. The study had one objective, one research question and one hypothesis. Export-factor design method was used for the study. The researcher targeted 400 mother-child-pairs used as the subjects of the study. Data regarding Environmental Quality Indicators (EQI): (household type, structure, toilet and source of drinking water) was collected by using a questionnaire. Personal contact was used for data collection. Weighing scale and infantometer/heightometer were used to measure weight and length/height of children. The Statistical Package for Social Sciences version 23 was used for data analysis. Pearson Product Moment Correlation (PPMC) was used for analysis and was considered significant at 0.05 alpha levels. The result showed that, 194 (49%) children had normal growth rate, 97 (25%) were stunted, 59 (15%) were underweight while 45 (11%) were wasting. The result further revealed that, significant influence existed between EQI and underweight (r=.711; P=<.027), stunting (r=.506; p=<.043) and wasting (r=.611; p=<.0081). The study concluded that, the nutritional status of children in Northern states, Nigeria was poor, and that environmental indicators of source of drinking water and household type significantly influenced the nutritional status of children under-five in Northern States, Nigeria. It was recommended that, government intervention should aim at provision of adequate water supply and promote traditional buildings combined with modern technology to ensure optimal child development in Northern States, Nigeria*.

**Keywords**: Environment, Environmental determinants, Nutritional status

## Introduction

Our built environment (whether structures built by humans as well as the natural environment) has a direct impact on human health and nutritional status in diverse ways. Environmental features such as quality of air, water, buildings, nutrition, refuse disposal to mention a few could positively or negatively influence health and children are particularly the most vulnerable. According to the United Nations Environment Protection Agency-UNEPA (2016) polluted environment causes ecosystem degradation which causes less food production and ultimately food insecurity and malnutrition resulting in significant immune deficiency, infection, compromise health and nutritional statuses. UNICEF/FMOH, (2012) posits that, polluted environment increases the susceptibility to disease and indirectly causes certain types of nutritional problems in humans especially children. Weitz (2012) maintained that, such unhealthy environment poses the greatest dangers to children because of their still growing bodies and weak immune system. The author stressed that, when children put unwelcome things in their mouth while playing could lead to infection and illnesses such as diarrhea which may result to poor nutritional status of children. FAO, (2012) documented that nutritional status is a measure of the health condition of an individual as affected primarily by the intake of food and utilization of nutrients. For the purpose of this study, the Environmental Quality Index (EQI) used was adopted from Vitoria's framework of nutritional status (Victoria, Huttly, Funch & Olinto, 1997). These are type of house, house structure, type of toilet and sources of drinking water.

**Type of House**

Most often, the type of house of an individual is determined by his social class. The conditions within our home and neighbourhoods have great implications on our health. Chemical, air and noise pollutions occur more often in poor neighbourhoods than in wealthier neighbourhoods both because of the cheap rents in neighbourhoods blighted by pollution attracts poor people that lack the money and social influences needed to keep pollution industries and waste dumps out of their neigbourhood (Weitz, 2012). In addition, maintenance of the house especially within a growing family involves constant expenditure which can help to prevent illnesses (Djebbari, 2015). Inadequate, overcrowded and unsafe housing increases the risk of infections and illnesses and thus, influences nutritional status (Bullard, Warren & Johnson, 2011). Children from such homes grow progressively malnourished, develops weak immune system and susceptible to disease (Federal Ministry of Health/Save the child, UNICEF, 2013).

House structure in the context of this study refers to the composition of the family as regard to size of household members. The size of household members is likely to be a great contributory factor to energy requirement. Croll, (2012) wrote that, large household size is risk factor for child poor nutritional status in developing countries. This is because the resources available to large households are often inadequate to prevent children from the problems of competition for limited food due to family size. As such, children from large households are more likely to be wasted. Schneider, Atterberry and Owens (2005) established that, the child's well being is affected by his home environment which is largely influenced by family composition including the structure and relationship to members in the household. In Nigeria, the increased number of children in families placed a heavy burden on the scarce household resources, particularly on finance and food; it also reduces the time and quality of care received by the children (Senbanjo Olayiwole, Afolabi & Senbajo, 2013). While Anyanwu (2013) discover in his study that, large family size progressively increases the probability of being poor in Nigeria, which may result to undermining the nutrition of the family and invariably influencing nutritional status.

**Type of Toilet**

The proper place to dispose faeces is the toilet or latrine. Without toilets, excreting in just any place can lead to many problems of health and pollution. Many variations of toilet exist (pit toilet, ventilated improved pit-VIP, and water system). The basic principle of using toilet is that waste is controlled and decomposed into harmless by-products (Obassalmah, 2012). Poor disposal and management of human waste or excreta put children at increased risk of illness, which affects their nutritional status (YAN Li, 2012). In Nigeria, illegal dumping of excreta into water bodies still exists, and contamination of surface and ground water remains a big challenge (NPC, 2009). The multiple indicator cluster survey (MICS) found that 56 percent of rural households in Nigeria did not have sanitary means of excreta disposal (UNAIDS, 2012). UNICEF/FMOH, (2012) found that 40 percent of households resorted to open field defecation. Many households (46 percent) also do not allow their children to use latrines, mainly out of fear that children may fall into the pit (60 percent) or mess up the latrine (52 percent). The 2008 NDHS indicates that about one-third of rural

household have no toilet facilities at all and as a result make use of the bush and rivers (NPC, 2009).

## Sources of Drinking Water

Households' water supply takes place in different forms. This could be by drawing from ponds, streams and rivers, wells and in a more modern form from boreholes as well as from pipe system. The main problem with all kinds of supply lies in the extraction and distribution of water. Waste water is predominantly returned into the hydrological cycle by the population in a way and at any place (Woldermariam & Timotiows, 2012). A clean water supply is one means of preventing water-borne diseases. Diarrhoea diseases including dysentery and cholera occur when individuals ingest contaminated water or foods (Weitz, 2012). Diarrhoea causes dehydration and electrolytic imbalance. It also leads to malnutrition when affected children not only eat less but also absorb fewer nutrients from the food they do eat. In turn, malnutrition leaves children susceptible to other fatal illnesses (Cutler & Miller, 2015). Therefore, clean water supply must to be provided as this is necessary for the health of the family. Using WHO estimates reports, at least 1 billion people lack access to improved water supplies, and even more lack access to truly safe water. The number of persons without safe water is greatest in Asia, whereas the percentage of those without safe water is highest in sub-Saharan Africa (WHO/UNICEF, 2014). WHO estimates showed that diarrhoea diseases kill more than 2 million children yearly, accounting for 27% of all child deaths (WHO, 2015). A comparative study in Jimma, Ethiopia showed that unprotected water source was associated with low child stature and that stunting was highest among children with recent diarrhoea (Woldermariam & Timotiows, 2012). In developing nations, diarrhoea diseases can be fatal, especially among children under age two (Awoyemi, Odozi & Ogunniyi, 2012). Nigeria's infrastructure for providing piped water is weak (ORIE/WINNN, 2013). Overall, only 49% of the Nigerian population currently has access to improved drinking water sources, with the situation in the Northern States being considerably worse than in the South. In total, 49% of Nigerians are currently living in households using improved water and sanitation facilities (National Bureau of Statistics, 2014). Another study in Nigeria revealed that drinking unsafe water has a significant link with wasting. A higher proportion of wasted children are found when not consuming treated water compared to their counterpart (Onimawo, Amanbangwu & Eluwa, 2016). Because of the situation, the researcher intends to investigate the relationship between environment and nutritional status of children under-five in Northern States, Nigeria.

## Research question

The study is guided by one research question.

What is the relationship between environment and nutritional status of children under-five in Northern States, Nigeria?

## Research Hypothesis

The study is guided by one hypothesis

There is no significant relationship between environment and nutritional status of children under-five in Northern States.

## Methodology

The ex-post facto research design was employed in this study. Multi-stage sampling procedures of stratified random, proportionate and purposive sampling procedures were further used to sample 400 subjects (mother-child-pairs) of the study. Data regarding Environmental Quality Indicators of the subjects was collected by using a validated questionnaire. A total of 400 copies of questionnaire were purposively distributed to the respondents for the study out of which, 395 (98.8%) copies were adequately filled and returned for analysis. Weighing scale and infantometer/heightometer were used to measure weight and length/height of children. The Statistical Package for Social Sciences version 23 was used for data analysis. Descriptive statistics of frequencies and percentage, mean and standard deviation (SD) were used to describe data on demographic characteristics of respondents and to answer the research question. Inferential statistics of Pearson Product Moment Correlation (PPMC) was used for analysis and was considered significant at 0.05 alpha levels.

## Results and Findings

### Research Question

What is the relationship between environment and nutritional status of children under-five in Northern States, Nigeria?

The results used to answer research question one is as presented in the Table

**Table 1: Environmental Quality Indicators (EQI)**

| S/N | Items | Mean | Std. Dev |
|---|---|---|---|
| 1 | The main source of my drinking water is the tap | *2.6278 | 0.98503 |
| 2 | The main source of my drinking water is well | *2.8759 | 1.06980 |
| 3 | The type of toilet I use in my house is pit latrine | 2.3722 | 1.14694 |
| 4 | The type of toilet I use in my house is water system | 2.3139 | 0.82639 |
| 5 | My house is made of cement | 2.4405 | 0.80189 |
| 6 | My house is made of mud | *2.7772 | 0.69515 |
| 7 | The roof of my house is made of thatched | 2.2937 | 0.65674 |
| 8 | The roof of my house is made of zinc | 2.2785 | 0.66334 |
| 9 | The number of my family members are more than | 2.2481 | 0.80872 |

| | |
|---|---|
| six (6) | |
| Grand mean | 2.5000 |

Decision mean=2.500

Looking carefully at Table 1.1 reveals the mean score of mother's response on environmental quality. The mean scores (2.6278; 2.8759; 2.7772) indicates that, tap, well were the main sources of drinking water, while majority of the houses were built with mud respectively. This implies that the environmental quality of majority of the respondents is poor as most households have access to well than tap, and also mud as their building material.

**Research Hypothesis**

There is no significant relationship between environment and nutritional status of children under-five in Northern States.

**Table 2: Pearson Product Moment Correlation Coefficient of Environment and Nutritional Status of Children Under-five**

| Variables | R | P-value |
|---|---|---|
| Environment | .743 | .001 |
| Nutritional status (Normal) | | |
| Environment | .711 | .027 |
| Nutritional status (Underweight) | | |
| Environment | .506 | .043 |
| Nutritional status (Stunted) | | |
| Environment | .611 | .0081 |
| Nutritional status (Wasting) | | |

r=.743, .711, .506, .611; $p<0.05$

An observation of Table 1.2 shows that environment is a determinant of the nutritional status of children under–five in Northern States, Nigeria. This is because the p values of 0.001, .027, .043 and .0081 obtained from the nutrition indicator (normal, underweight, stunted, wasting respectively) were lower than the 0.05 level of significance at a correlation index level (r=.743, normal growth rate); (r=.711, underweight); (r=.506, stunting) and (r=.611 wasting). Therefore, the null hypothesis which stated that environment has no significant influence on the nutritional status of children under–five in Northern States, Nigeria, is hereby rejected.

**Discussion**

The finding of this study is in line with the findings of Aliyu, Oguntunde, Dahiru and Raji, (2012) which found the rates of (26%, 15.6%, and 3.7%) as stunted, underweight and wasted in Northern Nigeria. NPC, (2013) reported the prevalence rates of (29% underweight, 18% wasting, and 37% stunting). In contrast to rates obtained in this study, Turkey, had (10.9%, 4.8%, and 8.2%) children stunted, underweight and wasted respectively (Ergin, Atasoylu & Beser, 2013). In Ghana, (20% and 22.4%) were stunted [Nti & Lartey, (2011) and UNICEF, (2008)] respectively. Akorede and Abiola (2013) overall assessment of children nutritional status in Akure Ondo State, Nigeria shows that, 12.5%, 8.5% and 14.8% were stunted, wasted and underweight respectively. These values are lower than the ones found in this study. The high rates obtained in this study could be attributed to the security challenges experienced within the northern region, which affected a lot of economic activities of most families coupled with the economic recession presently experienced in the country resulting in a sharp increase in poverty level and food price crises might have in one way or the other played a major role especially in affecting the quality of complementary feeding of children.

In agreement with the findings on environmental indicators of this study, Sunday and Adebambo (2014) established that, more than 50% of the building in both Iloko-Ijesa and Ijeda-Ijesa towns were built with mud. Furthermore, significant relationship existed between building type and residents' health in Iloko-Ijesa than in Ijeda-Ijesa, Osun State Nigeria. Further inferences could be drawn from the finding of Akinbamiro (2012) which found a significant relationship between health status of residents and housing quality measured in terms of type of walling materials (mud) in Odi-Olowo residential district, Osogbo, Osun State Nigeria.

In support of findings on household structure Unaeze and Ibe (2013) found that, majority of the family size was 4 to 5 in a rural area of Ikuano, Umuahia Abia State, Nigeria. The NDHS (2008) documented that majority of the family size for rural and urban areas were (4.6 person and 4.1 person) respectively. Although not statistically significant, it shows that majority of the children were from a sizeable families. This could be a suitable home that can support the well-being of children and likely a condition to achieving food security. In contrast to finding of this study, Ezeama, Adogu, Ibeh and Adinma (2015) reported an average household size for rural and urban areas as (6.05 people and 5.3 people) respectively in Anambra state, Nigeria. These values are higher than the average household sizes obtained in this study. Duru, Oluoha, Uwakwe, Kelvin, Diwe, Merenu, Chigozie, and Iwu (2015) study revealed that having more children was a significant predictor for childhood malnutrition in Imo State, Nigeria. A similar finding was reported in studies done in Malaysia and Pakistan (Khattak & Ali 2010); and Vietnam (Hien & Kam, 2008).

The result on the type of toilet of this study is in contrast with Akinbamiro (2012) that found significant relationship between health status of residents and type of toilet and the use of toilet in Odi-Olowo residential district, Osogbo Osun State, Nigeria. Most of the toilet facilities were not well developed in the study areas thereby residents preferred defeacating in the bush or open space around their houses. Akorede and Abiola (2013) further established that, 29.9% of the children used toilet, 7% of the children stool were always thrown outside, 0.6% stool was buried in the compound

while 56.9% used potty, pampers in Akure South Local Government, Ondo State Nigeria. Both cases have negative implications for the health of the residents. United Nations Environment Programmes- UNEP (2016) that observed that, Ascaris and Trichuris infections dropped 30 and 50% respectively after water supplies and latrines were installed. The growth of children was significantly better in the improved areas. Lawal and Samuel, (2010) discover that, the predominant toilet facilities were pit latrine and bush in Oyo State, Nigeria. Gobotswang (2012) found that the nutritional status of the preschool children had a strong positive correlation with access to a latrine ($r = 0.52$).

The observed influence on sources of water on children nutritional status agrees with the studies of Lawal et al, (2010) that, dug wells were the most common source of drinking water while in contrast none of the households had access to a public tap in Oyo State, Nigeria. Aschalew, (2000) established that, only a relatively small percentage of Nigerian households have access to improved sources of drinking water and sanitation. Tomkins and Williamson (2008) revealed that, high incidence of Protein-energy malnutrition (PEM) was found in a community survey of pre-school children in a rural Northern Nigeria. Wasting (<80%) weight-for-height was common (37.9%) among those with scanty, unprotected supplies than in those with protected water (10.2%). Samuel, Cole and Oldewage-theron (2008) found a significant association between environmental inadequacy of sources of water and stunting ($r=-0.152$, $p=0.20$) and underweight ($r=-0.491$, $p=0.000$).

## Conclusion

Based on the findings of this study, it was concluded that, inadequate environmental quality index of sources of water and building material (mud) significantly influenced children's nutritional status in Northern States, Nigeria.

## Recommendations

On the basis of the findings, the study recommended that, government intervention should aim at provision of adequate water supply and promote traditional buildings combined with modern technology to ensure optimal child development in Northern States, Nigeria. Furthermore, government should encourage parents to maintain their current family structure and the different types of toilet used if the findings of this study are to be maintained.

## References

Akinbamiro, O. B. (2012), Urbanization and Social Economic Position Analysis-An Approach to Housing and Health Relationship in Residential Districts of Nigerian Cities. *The Built and Human Environment Review,* **5**: 2012

Akorede, Q. J. and Abiola, O. M. (2013). Assessment of Nutritional Status of Under-five Children in Akure South LGA, Ondo State, Nigeria. *IJRRAS*, **14** (3): 133.

Aliyu, A. A.; Oguntunde, O.; Dahiru, T. and Raji, T. (2012). Prevalence and Determinants of Malnutrition among Pre-school Children in Northern Nigeria. *Pakistan Journal of Nutrition*, **11**(11): 1092-1095.

Anyanwu, J. C. (2013). Marital Status, Household Size and Poverty in Nigeria. Evidence from the 2009/2010 Survey Data. *African Development Bank Group Working Paper* 180. September 2013.

Aschalew. G. (2012). Determinants of Nutritional Status of Children in Amhara Region: A Case Study of Misrak, Gojjam and SemenWello Zones. *MSc. Thesis.* DTRC/IDR, AAU.

Awoyemi, T. T.; Odozi, J. C. and Ogunniyi, A. A. (2012). Environmental and Socioeconomic Correlates of Child Malnutrition in Iseyin Area of Oyo State, Nigeria. *Food and Public Health 2012,* **2** (4): 92-98 DOI: 10.5923/j.fph.20120204.02.

Bullard, R. D.; Warren, R. C. and Johnson, G. S. (2011). Health Issues in the Black Community. 2nd ed. San Francisco: Jossey-Bass.

Croll, E. (2012). Endangered Daughters: Discrimination and Development in Asia. Routledge, London.

Cutler, D. And Miller, G. (2015). "The Role of Public Health Improvement in Health Advances: The twentieth-century, United States.

Djebbari, H. (2015). *Impact on Nutrition of the Intra-Household Distribution of Power.* Institute for the Study of Labor (IZA) *Discussion Pape*r 1701, Bonn, Germany, IZA.

Duru, C. B.; Oluoha, U. R.; Uwakwe, K. A.; Kelvin, C.; Diwe, K. C.; Merenu, I. A.; Chigozie, I. O. and Iwu, A. C. (2015). Prevalence and Sociodemographic Determinants of Malnutrition among Under-Five Children in Rural Communities in Imo State, Nigeria. *American Journal of Public Health Research*, **3** (6): 199-206. doi: 10.12691/ajphr-3-6-1 | Research Article http://pubs.sciepub.com/ajphr/3/6/1

Ergin, F. O. P.; Atasoylu, G. and Beser, E. (2013). Nutritional Status and Risk Factors of Chronic Malnutrition in Children Under-five Years of Age in Aydin. A Western City of Turkey. *Turkey. Journal. Paediatrics*, **49** (3): 283-9.

Ezeama, N. N.; Adogu, P. O. U.; Ibeh, C. C. and Adinma, E. D. (2015), Comparative Analysis of Nutritional Status of Under-five Children and their Mothers' in Rural and Yrban Areas of Anambra State, Nigeria. *European Journal of Nutrition and Food Safety*, **5** (3): 190-201.

FAO (2012). Mapping Under-nutrition 5 Year Later. Proceedings of the Poster for the World *Food,* June m10-13, 2002. *Food and Agricultural Organization of the United Nations*, Rome, Italy.

FMOH/Save the Child UK/UNICEF (2013). *Report of the Nutrition Assessment of the North West Millet and Sesame Livelihood Zone of Northern Nigeria.* Abuja, Nigeria.

Gobotswang, K. (2012). Determinants of the Nutritional Status of Children in a Rural African Setting: The Case of Chobe District, Botswana. *Food Nutrition Bulletin,* **19** (1): 42-45. UNU Press.

Hien N.N, Kam S (2008). Nutritional Status and the Characteristics Related to Malnutrition in Children Under-Five Years of Age in Ngheen, Vietnam. *J Prev Med Public Health*, **41**: 232-240.

Khattak, M, and Ali, S. (2011) Malnutrition and Associated Risk Factors in Pre-School Children (2 – 5 years) in District Swabi (NWFP)–*Pakistan Journal of Medical Science*, **10**: 34-39.

Lawal, B. O. and Samuel, F. O. (2011). Determinants of Nutritional Status of Children in Farming Households in Oyo State, Nigeria. *AJFAND Journal*, **10**(10): ISSN:1684-5374.

NBS-National Bureau of Statistics (2009). Social Statistics in Nigeria. Federal Republic of Nigeria, Abuja. Nigeria.

NPC (2009). *Demographic and Health Survey. Nigeria.* USAID, UNFPA-ICF Macro 2009. C'alverton, Maryland, USA. http://wwwmeasuredhs.com/pubs/pdf;FR222.pdf.

Nti, C. A. and Lartey, A. (2012). Young Children Feeding Practices and Child Nutritional Status in Rural Ghana. *International Journal of Consumer Studies*, **31** (4): 326-332.

Obassalmah, S. (2012). The problem of malnutrition among Nigerian children. **30** (4): 12.

Onimawo, I. A.; Amanbangwu, K. E. and Eluwa, M. A. (2016). Nutritional Status of School Age Children Assessed by Anthropometric and Dietary Methods. Nigeria. *J. Nutr. Sci.*, **27** (1 & 2): 27-34.

ORIE/WINNN (2013). Nutritional Status in Northern Nigeria, Prevalence and Determinants: A Review of Evidence. *ORIE Nutrition Research Summary in Northern Nigeria* heart resources.org/about#orie Econlit; IBSS; Web of Knowledge; Wiley's Online Library; JSTOR; (PubMed).

Samuel, F. O.; Cole, A. H.; and Oldewage-theron, W. H. (2008). Undernutrition and Household Environmental Quality among Urban and Rural Children in Nigeria. Pakistan Journal of Nutrition, **7** (1): 44-49. ISSN 1680-5194.

Schneider, B. A.; Atterberry, A.; and Owens, S. (2005). 'Family Matters: Family Structure and Children's Success: A comparison of Widowed and Divorced Single Mother Families'. *Journal of Marriage and Family,* **62** (2): 533-548.

Senbanjo, I. O.; Olayiwola, I. O.; Afolabi, W. A. and Senbanjo, O. C. (2013). Maternal and Child under Nutrition in Rural and Urban Communities of Lagos state, Nigeria: The Relationship and Risk Factors BMC Research Notes 6: 286. http://www.biomedcentral.com/1756- 0500/6/286. Accessed 21:01:2014Management.

Sunday, O. D. and Adebambo, A. S. (2014). Housing Condition and Health Relationships in Ijeda Ijesu and Iloko-Ijesu, Osun State, Nigeria. *Global Journal of Human Social Science, Geography, Geo-Sciences, Environmental Disaster*, **14** (7): ISSN: 2249-460x.

Tomkins, A. M. and Williamson, W. A. (2008). Water Supply and Nutritional Status in Rural Northern Nigeria. Transaction of the Royal Society of Tropical Medicine and Hygiene. **72** (3): 239-243. https://doi.org/10.1016/0035-9203(78)90201-8 .

Unaeze, H. H. and Ibe, L. (2013). Effects of Family Structure on Nutritional Status of Pre-school Children (2-5 Years) in a Rural Nigerian Population. *Journal of Biology, Agriculture and Healthcare*, **3** (18): ISSN 2224-3208.

UNAIDS (2012). Epi Fact Sheet by Country- Updates 2002. FMOH, Abuja Nigeria.

UNICEF/FMOH (2012). Multiple Indicators Cluster Survey, Nigeria. Abuja, Nigeria. www.childnfo.org.

UNICEF (2008). The State of the World's Children. Oxford University Press. WHO. Report of the 48th World Health Assembly, Geneva.

United Nation Environmental Protection Agency-UNEPA (2016), Environmental Sanitation, Infection and Nutritional Status of Infants in Rural Lucia, West Indies. Human Health and Environment. *Transaction of the Royal Society of Tropical Medicine and Hygiene*. **75** (4): 507 513. https://doi.org/10.1016/0035-9203(81)90187-5

Victoria, C. G.; Huttly, S. R,; Funch, S. C. and Olinto, M. T. (1997). The role of conceptual frameworks in epidemiology analysis: A hierarchical approach. *International Journal of Epidemiology*, **26** (1): 224-227.

Weitz, R. (2012). The Sociology of Health, Illness and Health Care: A Critical Approach. Wadsworth Cengage Learning. USA-Boston.

WHO (2015). The World Health Report 2015-May the Every Mother and Child Count. World Health Report Policy Briefs. www.whoint/whr/2015/en/pdf

WHO/UNICEF (2014). Complementary Feeding of Young Children in Developing Countries. WHO/NUT/98.1 Geneva. http://www.who.int/child-adolescent-health/publicatios/

Woldermariam, G. and Timotiows, G. (2012). Determinants of the Nutritional Status of Mothers and Children in Ethiopia. ORC macro. Ethiopia Health and Nutrition Research Institute, Addis Ababa, Ethiopia. Calverton, Maryland, U.S.A.

YAN, Li. and GUANGPING, Guo (2012). Prevalence and Correlates of Malnutrition among Children in Rural Minority Areas of China. *Paediatrics International* **41** (5): 549-556. Doi:10.1046/j. 1442-200x. 01103.