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Dietary diversity and nutritional adequacy of under-fives in a fishing community in the central region of Ghana

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Abstract

Background: The irreversible effect of malnutrition on children as a result of micronutrient deficiency is of great public health concern. Micronutrient malnutrition is caused by the chronic lack of vitamins and minerals in diets. Dietary assessment is one of the ways in assessing micronutrient malnutrition. This assessment provides information about the quality of food consumed in terms of nutrient adequacy of children under five years in Ekumfi Narkwa, a fishing community along the Central regional coastline using the dietary diversity assessment method.

Methods: A cross-sectional study involving 250 caregiver-child pairs was conducted. A pre-tested dietary diversity questionnaire was used to collect information on dietary consumption over 7 day period. The caregiver was asked whether the child had eaten foods from the seven (7) main food groups over the past seven days and the number of days they had consumed foods from each of the food groups. The individual dietary diversity score (IDDS) and minimum dietary diversity of the children in the community were calculated independently.

Results: The main food group consumed daily was from flesh foods group 79.8% (namely; meat and fish consumption). Daily fish consumption was 78% (195 of 250), accounting for the high consumption of flesh foods. One-tenth of the children (27 of 250) consumed vitamin A rich foods daily. Almost half (118 of 250) of the children met the minimum dietary requirements with the average dietary diversity score of 2.28 ± 1.33.

Conclusion: The dietary diversity of children under five in Ekumfi Narkwa is low. Though the consumption of flesh foods was very high, that of fruits and vegetables especially Vitamin A rich plant source foods was poor. Health workers need to educate parents on the importance of ensuring their wards consume food from all the various food groups including fruits and vegetables which provide essential vitamins and minerals.

Keywords: Dietary diversity, Food groups, Under-fives

Background

Malnutrition is a public health concern and for that reason adequate nutrition is identified as one of the pillars of public health [1]. Micronutrient malnutrition is one form of malnutrition which poses great risk to children and is referred to as hidden hunger. It is caused by chronic lack of vitamins and minerals as a consequence of nutrient inadequacy [2, 3]. According to the World Health Organization (WHO), one in every two pre-school aged children suffer from hidden hunger [4]. Research has shown that even mild levels of micronutrient malnutrition in children may lead to damage in cognitive development and lower disease resistance [5]. Consequently, over 200 million African children under the age of five suffer from malnutrition and fail to reach their full cognitive potential [6] .

Since malnutrition of all forms are highly preventable, the millions of children who die from malnutrition related causes each year could be saved by putting the right interventions in place [7]. One of the preventive ways of curbing malnutrition is through dietary assessment.

Dietary assessment is an essential component of nutritional adequacy assessment. This tool helps to provide information about the quantity and quality of food consumed in terms of nutrient adequacy and also eating patterns and behaviors of the people [8]. The International Food Policy Research & Institute (IFPRI) defined dietary diversity as the

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number of different foods or food groups eaten over a reference time period not regarding the frequency of consumption [9]. Dietary assessment help determine the risk of deficiency due to low or high intakes of essential nutrients needed for good health [10]. It also serves as a proxy for measurement of the nutritional quality of an individual's diet [1] and in determining whether the child's diet has the important elements needed for growth or not [11]. In addition, it is a useful indicator for growth as it can serve as a qualitative measure of food consumption and reflect household access to a variety of foods [12].

Eating a wide variety of foods is likely to increase nutrient adequacy. A study conducted on South African children showed a strong relationship between dietary diversity and child growth indicators [13]. This was reinforced by a study conducted among the Bangladeshi children on dietary diversity and stunting. Both studies found an association between dietary diversity and the child's nutritional status [14].

Literature reveals that nutrition is relatively poor in fishing communities in spite of the abundance of protein [15, 16]. However, little is known about the nutritional status and health of fishing communities along the coastline of Ghana. The Central region has the longest coastline in Ghana and recorded high rates of under-nutrition (stunting 34%) in the 2008 Demographic and Health Survey (DHS) [17]. It is unclear what other nutritional problems persist along these coastlines. We conducted dietary diversity assessment in children under five years in Ekumfi Narkwa, a fishing community along the Central regional coastline to help identify and develop ways of improving their health.

Methods

Study design, setting and subjects

A cross-sectional study designed was used to assess dietary diversity in under-fives. It was conducted in Ekumfi Narkwa, a sub-district of Ekumfi in the Central region of Ghana. The sample consisted of two hundred and fifty (250) children between six to fifty-nine (6–59) months who had started complementary food and their caregivers. Children were identified from the four (4) suburbs in the community namely Asemasa- Esikado, Ahenbrom, Kokodo and Adukrom. A selection based on proportionate to size was used to select respondents from communities. A minimum of forty-five (45) subjects were selected form each suburb using the modified random walk.

In the modified random walk, key land marks in the community such as private and public schools, churches, mosque, Community- based Health Planning Services (CHPS) compound, community information centre and the taxi rank were listed. One of the major landmarks in the suburb was randomly selected. The first house closest to the landmark was chosen as the first house from which subjects were selected. The selection continued from there in a clockwise direction till the required sample size for the suburb was obtained. For Asemaasa-Esikado, Ahemrom, Kokodo, and Adukrom suburbs the following key landmarks were selected the Methodist church, Ahembrom, the information centre, the child welfare clinic site and the Methodist Primary school respectively.

Caregivers with children under-five years were identified by asking the residents. In a house with several households, one child aged 6–59 months from each of the different households was eligible to participate. The study was explained to the caregivers of these children and they were taken through the consent procedure if they agreed to take part. In households where a mother had two children under-five years, one of the children was randomly select by a simple ballot process using folded pieces of paper with the child's name on it. The child whose name was picked by the mother, was automatically selected to be part of the study.

Participation in the study was based on willingness of the caregiver to give full consent and the availability of the child during the study period.

Assessment of nutrient intake

Data collection was done by trained local field workers with a pre-tested questionnaire in the homes of the subjects. Data collected included; the background characteristics of respondents and children, dietary intake of the children. A pre-tested dietary diversity questionnaire adopted from the Food And Nutrition Technical Assistance (FANTA) project, [18] was used to capture information of dietary consumption over a period of seven (7) days. The reference period was chosen according to Food and Agriculture Organization (FAO) guidelines for measuring household and individual dietary diversity [11]. The caregivers were asked whether; the children had eaten foods from the seven (7) main food groups over the past seven days and the number of days they had consumed foods from each food group. Data gathered were recorded accordingly.

The food groups assessed were;

a. Grains, roots or tubers and plantain
b. Vitamin A-rich plant foods
c. Other fruits and vegetables
d. Flesh foods (Meat, poultry, fish and seafood)
e. Eggs
f. Pulses, legumes or nuts
g. Milk and milk products

Foods consumed from the sugary food group (sweets, pastries and drinks), were also recorded. However, it was excluded from the analysis because they are known to have poor bioavailability of micronutrients [19].

The individual dietary diversity score (IDDS), was calculated for each subject. It was calculated as follows; every

child who had consumed foods from a particular food group for more than five days in the past week was scored 1. The total number of 1 score each child had gotten was added up, as their individual dietary diversity score. The highest dietary diversity score was 7. However, sugary foods were not added to the scoring. The average dietary diversity score of the subjects was also calculated.

The minimum dietary diversity of the children in the community was calculated using the formula

$$\frac{\text{Number of children (6-59 months)who recieved food from four(4) or more food groups in the past seven days}}{\text{Number of children (6-59 months)}} \times 100\%$$

Modified from [20]

The minimum dietary diversity for the various age groups was also calculated. Data collected on demographic characteristics and their general practices were presented in tables as frequencies and percentages.

Results

The mean age of the caregivers was (28.7 ± 9.5) years. Most of them were within the ages of 20–25 years and half of them (55.2%) were traders who dealt in non-fish products. Table 1 gives the background characteristics of the caregivers.

The subjects recruited were evenly distributed by gender (50% for both sexes). The median age group was 24–35 months (187/250). The mean age of the children was 27 months with the highest number recruited being within the ages of 12–23 months. The distribution of the children by age and sex is captured in Table 2.

The main food group consumed daily was foods from flesh foods group (meat, and fish consumption 79.8%). Daily fish consumption was 78% (195 of 250) and accounting for the high consumption of flesh foods daily. About three-quarters (74%) of the children consumed cereals, roots, tubers and plantain on a daily basis. Only 11% of the children (27/250) were reported to have consumed vitamin A rich foods daily. More than half of the children (58.8%) consumed sweets daily though it has very minimal nutritional benefits. Table 3 gives detailed frequency of consumption of the foods, from the food groups over the past seven days.

The average dietary diversity score for the subjects was 2.39 ± 1.33. Only two (2) of the two hundred and fifty children (250) had a dietary diversity score of seven (7) (See Table 4). The minimum dietary score (children who consumed foods from four or more food groups) was 47.2%. Children aged 6–11 months had the lowest minimum diversity score and children aged 36–47 months had the highest minimum dietary diversity score (See Table 4).

Table 1 Socio-Demographic characteristics of respondents in Ekumfi Narkwa

Variable	Frequency (%) $N = 250$
Age of caregiver (years)	
Below 20	17 (6.8)
20–25	94 (37.6)
26–30	48 (19.2)
31–35	47 (18.8)
36 and above	44 (17.6)
Level of education of caregiver	
No formal education	76 (30.4)
Primary	67 (26.8)
Junior high	97 (38.8)
Senior high	8 (3.2)
Tertiary	2 (0.8)
Primary occupation	
Unemployed	29 (11.6)
Fishmonger	35 (14.0)
Farmer	15 (6.0)
Trader (other than fish products)	138 (55.2)
Artisan	28 (11.2)
Other occupations	5 (2.0)
Head of household	
Mother	37 (14.8)
Father	117 (46.8)
Grandparent	92 (36.8)
Non-relative	4 (1.6)
Migration status	
Permanent resident	154 (61.6)
Migrant	96 (38.4)

Table 2 Distribution of under-fives in Ekumfi Narkwa by age, sex and breastfeeding status

Variable	Sex (frequency)		Total
Age group (months)	Female	Male	
6–11	23	14	37
12–23	30	48	78
24–35	35	37	72
36–47	22	17	39
48–59	14	10	24
Currently Breastfeeding			
Yes	39	51	80
No	85	85	170
Total	124	126	250

Table 3 Frequency of consumption of foods in the previous week by children in Ekumfi Narkwa

	Frequency of Consumption per Week Frequency (%)			
FOOD GROUPS	6–7 times	3–5 times	1–2 times	Never
Foods from cereals, roots tubers and plantain	185 (74)	13 (5.20)	41 (16.4)	11 (4.4)
Vitamin A rich fruits and vegetables	27 (10.8)	57 (22.0)	60 (24.0)	106 (42.4)
Other fruits or vegetables	79 (31.6)	47 (18.8)	90 (36.0)	34 (13.6)
Flesh foods (Meat and fish)	198 (79.8)	16 (6.4)	20 (8.0)	16 (6.4)
Fresh or dried fish or shellfish[a]	195 (78)	19 (7.6)	10 (4)	26 (10.4)
Meat[a]	9 (3.6)	37 (14.8)	60 (24)	142 (56.8)
Eggs	25 (10)	78 (31.2)	61 (24/4)	86 (34.4)
Foods from legumes and nuts	119 (47.6)	52 (20.8)	60 (24.0)	19 (7.6)
Dairy products	25 (10)	61 (24.4)	71 (28.4)	86 (34.4)
Sweets[b]	147 (58.8)	32 (12.8)	42 (16.8)	29 (11.6)

[a]Merged to get the flesh foods group
[b]Food groups not added in dietary diversity score computation

Discussion

In this study, the dietary diversity of children under five years in Ekumfi Narkwa was assessed using a simple scoring system of food groups consumed over a reference period as a means of determining their nutritional status. The individual dietary diversity score gives a reflection and an estimate of nutrient adequacy of one's diet. The average individual dietary diversity score for the children in the study was 2.29 ± 1.33. This is lower than the acceptable recommended dietary diversity score of four (4) or more for children because, a positively strong relationship has been found between food group diversity and diet adequacy of young children [11, 13, 21]. However, these findings are similar to the findings of a study in Kenya on dietary practices of under-fives [22].

Less than half (118 of 250) of the children met their required dietary diversity score. This is an indication that children in the study community are not likely to meet their adequate micronutrient requirement for growth [23]. Children need to be fed a wider variety of foods since an increase in individual dietary diversity score shows a corresponding increase in nutrient intake. Improving food variety may also reflect a high likelihood of meeting daily energy and nutrient requirement which leads to improved nutrition in children under five years [24].

Comparison of dietary diversity scores within the different age groups revealed that more than half of the children between the ages of 24–35 and 36–47 months had a minimum dietary diversity score of 4 or more (54.2% and 59% respectively). This was higher than that of the other age groups. Therefore, children between the ages of 24–47 months in Ekumfi Narkwa were more likely to meet their nutrient needs than those in the other age groups.

In this study, the highest consumed food groups were those in abundance. A study carried out on primary

Table 4 Individual dietary diversity score of children in Ekumfi Narkwa by age

	Age groups (months)					
Individual Dietary Diversity Score	6–11	12–23	24–35	36–47	48–59	Frequency (%) $N = 250$
0	4	2	0	0	0	6 (2.4)
1	7	2	1	1	0	11 (4.4)
2	9	9	8	1	5	32 (12)
3	8	27	24	14	10	83 (33.2)
4	6	25	25	13	6	75 (30)
5	3	8	7	9	3	30 (12)
6	0	5	6	0	0	11 (4.4)
7	0	0	1	1	0	2 (0.8)
Total	37	78	72	39	24	250
Minimum DDS (%)	24.3	48.7	54.2	59.0	37.5	47.2

school children in Uganda also observed a similar trend. They described dietary diversity in non-urban areas as low and tied to local availability and harvest patterns [19]. The most consumed food group was fleshy foods; mainly fish and followed by staples. About three-quarters (185 of 250) the children were recorded to have consumed staples every day. This reflects a typical African diet due to our high abundance of staples. This reflect eating pattern characteristic of places with high rates of under-nutrition [19]. The high consumption of fish could be attributed to the fact that it is a fishing community. Therefore, the people have easy access to fish and pay little or nothing for it due to its abundance. Also, the presence of fish explains the high intake of non-staples. A study on fish consumption in Nigeria revealed that the presence of fish is likely to increase the intake of non-staples and improve the care for children and women's health [25]. The consumption of fish is a good practice because fish is more nutritious than staple foods. It provides protein, essential fatty acids and micronutrients which help in the growth and development of the child [26]. WHO indicated that almost two-thirds of pre-school aged children living in Africa are anaemic [4]. Since seafood is a good source of iron, a high percentage of children consuming flesh food especially fish and other sea foods are likely to increase their stores of iron and reduce their risk of anaemia.

The daily consumption of Vitamin A rich foods from both plant and animal sources daily was very low (10%). This means that the children lack Vitamin A in their diet. A similar pattern has been observed in other developing countries. It explains why the high number of children (about 2.8 million) in developing countries suffering from Vitamin A deficiency [27]. Lack of clinical vitamin A has been associated with delayed growth and increased risk of morbidity and mortality in children [27].

The daily consumption of fruits and vegetables was generally low; vitamin A rich fruits and vegetables - 11% (27 of 250), other fruits and vegetables- 31% (79 of 250) respectively. Such habits of low consumption of fruits and vegetables have been identified by Bouis et al. as the primary underlying cause of micronutrient malnutrition [5]. Fruits and vegetables are rich sources of minerals and vitamins which are bioavailable.

Though sweets have very limited nutrients that are bioavailable, more than 50% (147 of 250) of the children were recorded to eat sweets on a daily basis. This practice of high sweet consumption affects the health and nutrition of the child. Studies have shown that too much sweet consumption in young children may lead to dental caries [28, 29]. Dental caries have been found to be associated with underweight in children [28]. Therefore, the detrimental effects of high sweet consumption cannot be overlooked. It also has long term effects leading to an increased risk of non-communicable diseases such as diabetes in later stages in life [29].

The information obtained was based on maternal recall of events in the past seven days prior to the study which introduces recall bias however we used laminated pictures of the food groups to help them recall and reduce this bias. The Dietary Diversity Score was constructed using a simple count of the number of food groups consumed. No information on portion sizes and amount of intake was collected. Also, the Dietary Diversity Score used a reference period of the previous 7 days, reflecting diversity in the recent diet.

Conclusion

Dietary diversity of children under five in Ekumfi Narkwa was found to be low. Their diets were based on food groups in abundance. Whereas the consumption of flesh foods was high; consumption of fruits and vegetables was low. Though the children might have their protein and iron requirements met by their diets they may lack other essential vitamins and minerals required for proper absorption and function of nutrients in their body. This could affect growth and development of the children. Education on the importance of consuming foods from the various food groups needs to be improved. Also the role of vegetables and fruits in providing essential vitamins and minerals for growth needs to be constantly explained to mothers and caregivers by health workers at child welfare clinics and during home visits. This would urge them, to incorporate them into their children's diets.

Abbreviations

CHPS: Community-based Health Planning and Services; DDS: Dietary diversity score; FANTA: Food and Nutrition Technical Assistance; FAO: Food and Agriculture Organization; IDDS: Individual dietary diversity score; WFP: World Food Program; WHO: World Health Organization

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Availability of data and materials

The data supporting the conclusions of this article are included within the manuscript. Additional data is available on request.

Authors' contributions

DAB and EK – conceived the idea. DAB – conducted the research, did the analyses and wrote the manuscript. EK – reviewed the proposal, results and manuscript and made intellectual inputs. Both authors read and approved the final manuscript.

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DAB has bachelor's degree in Nutrition and Food Science and a Masters in Public Health with a specialization in epidemiology. EK is a medical doctor and has a PhD in Epidemiology and a lecturer at the University Of Ghana School Of Public Health.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Ethical clearance was sought from the Ghana Health Service Ethical Review Board (ID NO: GHS-ERC: 47/02/15). Permission was sort from Health Directorates at the regional and district levels. Community entry was done and the study was explained to the community and its leaders. Informed consent which explained the confidentiality, voluntary participation, withdrawal and risk/benefits of the study were administered to caregivers of the children and they signed before taking part in the study.

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References

1. Elmadfa I, Meyer A. Importance of food composition data to nutrition and public health. Eur J Clin Nutr. 2010;64:S4–7.
2. Ruel MT, Deitchler M, Arimond M. Developing Simple Measures of Women ' s Diet Quality in Developing Countries : Overview 1, 2. J Nutr. 2010;140(11): 2048S–50S. Available from: EURRECA-Evidence-based methodology for deriving micronutrient recommendations. doi:10.3945/jn.110.123695J.
3. Wieser S, Plessow R, Eichler K, Malek O, Capanzana MV, Agdeppa I. Burden of micronutrient deficiencies by socio-economic strata in children aged 6 months to 5 years in the Philippines. BMC Public Health. 2013;13:1–15.
4. McLean E, Cogwell M, Egil I, Wojdyla D, De Benoist B. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993-2005. Public Health Nutr. 2008;12:444–54.
5. Bouis H, Erick B-G, Meenakshi J V. Micronutrient Malnutrition: Prevalence, Consequences, and Interventions. In: Bruulsema TW, Hefer P, Welch RM, Cakmak I, Moran K, editors. Fertilizing Crops to Improve Human Health: a Scientific Review. Paris: Norcross; 2012. p. 29.
6. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. The lancet. 2007;369(9555):60–70.
7. Daelmans B, Mangasaryan N, Martines J, Saadeh R, Casanovas C, Arabi M, editors. Strengthening actions to improve feeding and young children 6 to 23 months of age: Summary of a recent World Health Organisation/UNICEF technical meeting. Geneva: WHO; 2009.
8. Maqbool A, Olsen IE, Stallings, VA. Clinical Assessment of Nutritional Status. Nutrition in Pediatrics. 4th ed. Hamiliton: BC Decker Inc; 2008. p 5-12.
9. Wiesmann D, Bassett L, Benson T, Hoddinott J, Validation of the World Food Programme's Food Consumption Score and Alternative Indicators of Household Food Security. International Food Policy Research & Institute (IFPRI). 2009. http://www.indiaenvironmentportal.org.in/files/validation-wfp.pdf. Accessed 15 Apr 2015
10. Castro-Quezada I, BR-VaLS-M. The Mediterranean diet and nutritional adequacy: a review. Nutrients. 2014;6:231–48.
11. Sealey-Potts C, Potts A. An Assessment of Dietary Diversity and Nutritional Status of Preschool Children. Austin J Nutr Food Sci. 2014;2(7):1040. Available from: http://austinpublishinggroup.com/nutrition-food-sciences/fulltext/ajnfs-v2-id1040.php.
12. Food and Agriculture Organization of the United Nations (FAO). Guidelines for measuring household and individual dietary diversity. Kennedy G, Ballard T, Dop M, editors. Rome: FAO; 2011. p.53.
13. Steyn N, Nel JH, Natel G, Kennedy G, Labadarios D. Food variety and dietary diversity scores in children : are they good indicators of dietary adequacy ? Public Health Nutr. 2006;9:644–50.
14. Rah JH, Akhter N, Semba RD, Pee SD, Bloem MW, Campbell AA, et al. Low dietary diversity is a predictor of child stunting in rural Bangladesh. Eur J Clin Nutr. 2010;64:1393–8.
15. FAO Fisheries and Aquaculture. Nutrition and food security. 2014. http://www.fao.org/fishery/topic/16603/en Accessed 20 June 2015
16. Baker-french, SR. Food Security and Nutritional Status in Fishing Communities in Bolivia's Northern Amazon. The University of British Columbia. 2013. https://open.library.ubc.ca/clRcle/collections/ubctheses/24/items/1.0165736 Accessed on 18 Apr 2015
17. Ghana Statistical Service (GSS), Ghana Health Service(GHS), & ICF Macro. Ghana Demographic and Health Survey 2008. Accra. 2009. pp 171–83.
18. Bilinsky P, Swindale A. Household dietary diversity score (HDDS) for measurement of household food access : indicator guide version 2 anne swindale household dietary diversity score (HDDS) for measurement of household food access : indicator guide version 2, (2006). http://www.fantaproject.org/sites/default/files/resources/HDDS_v2_Sep06_0.pdf Accessed 15 Sept 2016
19. Acham H, Tumuhimbise GA, Kikafunda JK. Simple food group diversity as a proxy indicator for iron and vitamin a status of rural primary school children in Uganda. Food Nutr Sci. 2013;4:1271–80.
20. CARE. Infant and Young Child Feeding Practices: Collecting and Using Data: A Step-by- Step Guide. Cooperative for Assistance and Relief Everywhere, Inc. 2010. http://nutritioncluster.net/wp-content/uploads/sites/4/2013/12/final-iycf-guide-iycf-practices_eng.pdf Accessed 20 June 2015
21. Food and Nutrition Technical Assistance Project (FANTA) FHI 360. Working Group on Infant and Young Child Feeding Indicators. Developing and Validating Simple Indicators of Dietary Quality and Energy Intake of Infants and Young Children in Developing Countries: Summary of findings from analysis of 10 data sets. 2006. Washingston, D.C. Chege PM,
22. Kimiywe JO, Ndungu ZW. Influence of culture on dietary practices of children under five years among Maasai pastoralists in Kajiado, Kenya. Int J Behav Nutr Phys Act. 2015;12:1–6.
23. World Health Organisation. Indicators for assessing infant and young child feeding practices, Geneva (2010). Retrieved from http://apps.who.int/iris/bitstream/10665/44306/1/9789241599290_eng.pdf. Accessed 20 June, 2015
24. Nti CA, Lartey A. Effect of caregiver feeding behaviours on child nutritional status in rural Ghana. International Journal of Consumer Studies - Wiley Online Library. 2006;31:303–9.
25. Gomna A, Rana K. Inter-household and intra-household patterns of fish and meat consumption in fishing communities in two states in Nigeria. Br J Nutr. 2007;97:145–52.
26. Kawarazuka N. The contribution of fish intake, aquaculture, and small-scale fisheries to improving nutrition: A literature review, Working Papers. 2010. p. 44.
27. Bhutta ZA, Salam RA, Das JK. Meeting the challenges of micronutrient malnutrition in the developing world. Br Med Bull. 2013;106:7–17.
28. Duijster D, Sheiham A, Hobdell MH, Itchon G, Monse B. Associations between oral health-related impacts and rate of weight gain after extraction of pulpally involved teeth in underweight preschool Filipino children. BMC Public Health. 2013;13:533.
29. Naidoo S. Oral health and nutrition for children under five years of age: A paediatric food-based dietary guideline. South African Journal of Clinical Nutrition. 2013;26:S150–5.