AJFAND ONLINE Formerly AJFNS
Volume 8 No. 2 2008
June 2008
ISSN 1684-5374
AFRICAN JOURNAL OF FOOD AGRICULTURE NUTRITION AND DEVELOPMENT

HOME-BASED PRACTICES OF COMPLEMENTARY FOODS IMPROVEMENT ARE ASSOCIATED WITH BETTER HEIGHT-FOR-AGE Z SCORE IN RURAL BURKINA FASO

HZ Ouédraogo[*1], Nikièma L[1], Somé I[2], Sakandé J[2], Dramaix-Wilmet M[3] and P Donnen[3]

Hermann Ouédraogo

* Corresponding author Email : ouedher68@yahoo.fr

[1]Hermann Ouédraogo & Laeticia Nikièma - Biomedical and Public Health Department, Institute of Research in Health Sciences, 03 BP 7192 Ouagadougou, Burkina Faso, Phone (226) 50 36 32 15, Fax (226) 50 36 03 94,
[2]Issa Somé & Jean Sakandé - University of Ouagadougou, Burkina Faso.
[3]Michèle Dramaix-Wilmet & Philippe Donnen - School of Public Health, Free University of Brussels, Belgium.

AJFAND ONLINE Formerly AJFNS Volume 8 No. 2 2008 June 2008 ISSN 1684-5374
AFRICAN JOURNAL OF FOOD AGRICULTURE NUTRITION AND DEVELOPMENT

ABSTRACT

Repositioning nutrition is central to development. Childcare practices, which include feeding practices, appear in the conceptual framework of malnutrition. The objective of this study was to analyze the nutritional status of young children in relation to feeding practices. This cross-sectional, community-based study was conducted in the rural district of Kongoussi (Burkina Faso). Three hundred ninety nine children (95% of expected 420 children: 30 clusters of 14 children), 6-23 months of age, were recruited by "probability proportionate-to-size" cluster sampling. Items related to the early and current breastfeeding patterns and the mode of complementary feeding were recorded by interview of the mothers. Fortified cereals were defined as home-based improved flours by mixing "soumbala," fishmeal, toasted groundnut, or several of these local foods with cereal. Soumbala is a fermented product from the African bean tree used both as a condiment and as a meat substitute in soups, because it is rich in protein and micronutrients. The height-for-age Z-score (HAZ) and weight-for-height Z-score (WHZ) were computed using height and weight measurements. Adjusted mean HAZ and WHZ were derived from multiple linear regression models and compared using analysis of variance (ANOVA) and *post hoc* t-test with Bonferroni correction.

The prevalence of wasting was 26.3% (95% CI: 21.5% - 30.5%). The mean WHZ (± standard deviation) was –1.39 (± 1.14). The WHZ was associated with the children's age and the mother's nutritional status. The prevalence of stunting was 35.8% (95% CI: 29.4% - 41.1%). The mean HAZ was –1.68 (± 1.15). After adjustment for children, mothers and household characteristics, and for current and past breastfeeding patterns, the HAZ remained associated with the mode of complementary feeding among children 12-23 months of age (p=0.018), but not among children 6-11 months of age (p=0.136). Among children 12-23 months of age, the adjusted mean HAZ (standard error) was –1.33 (0.63), -1.61 (0.30), and –2.11 (0.32) for children using fortified cereals, unfortified cereals, or no complementary feeding, respectively (p=0.018).

These results underline the high frequency of malnutrition in the rural district of Kongoussi, and the great need for nutritional intervention. The prevention of growth impairment in this area could be based on home fortification of complementary foods using locally available foods; this is more sustainable. Thorough research is needed to specify and standardize the procedures of utilisation of the available foods in the prevention of growth impairment.

Key words: Fortification, Cereals, Stunting, Children, Burkina

AJFAND ONLINE Formerly AJFNS Volume 8 No. 2 2008 June 2008 ISSN 1684-5374
AFRICAN JOURNAL OF FOOD AGRICULTURE NUTRITION AND DEVELOPMENT

INTRODUCTION

More than 10 million children die each year; most children die from preventable causes and the majority of children who die are from poor countries [1]. Adequate nutrition and health during the first several years of life is fundamental to achieving the Millennium Development Goals (MDG) for child survival and the prevention of malnutrition [2]. According to the World Bank, repositioning nutrition is central to development [3]. Investigations into factors associated with malnutrition are important to consider before designing and implementing nutritional interventions. Conceptually, the three underlying causes of malnutrition in children are: 1) inadequate access to food, 2) insufficient health services and an unhealthy environment, and 3) inadequate care for mothers and children [4]. Of these three causes, inadequate care is least likely to be taken into account during nutritional interventions [5]. Six categories of care are recognized: 1) care of women, 2) young child feeding practices, 3) psychosocial care, 4) preparation of meals, 5) hygiene behaviour, and 6) health behaviour [5].

For young child feeding practices, the World Health Organization (WHO) recommends that infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally-adequate and safe complementary foods while breastfeeding continues for up to 2 years of age and beyond [6]. Promotion of exclusive breastfeeding (EBF) and improved complementary feeding (CF) are ranked first and third, respectively, among the most effective preventive actions for reducing mortality in children less than 5 years of age in developing countries [7].

In Burkina Faso, the death rate for children less than 5 years of age reached 184 per 1000 live births, which was amongst the highest death rates in the world [8]. Malnutrition in children was at a high endemic level, particularly in rural areas. In such areas, the prevalence of wasting and stunting among children less than 5 years of age was 19.6% and 41.6% respectively [8]. Before the implementation of a nutritional intervention project in the rural district of Kongoussi, a study was done to gather baseline data and to investigate the main factors contributing to malnutrition. This paper presents the analysis of the nutritional status of young children in relation to feeding practices.

METHODS

Setting. The study was conducted in Kongoussi, a rural district located 115 km north of Ouagadougou, the capital of Burkina Faso. There are 211,551 inhabitants in Kongoussi, distributed in 245 villages. It is a young population, including 17.7% of children less than 5 years of age and 31.3% of children 5-to-14 years of age. The health system involves a reference level, represented by the medical center with a surgical antenna (CMA), and a first recourse level comprised of 26 centers of health and social promotion (CSPS) and 111 primary health posts (PSP). These facilities are manned by teams led by a physician from the CMA, a nurse from the CSPS, and a community health worker from the PSP.

Study design. A cross-sectional study was conducted from January to February 2004. Three hundred ninety nine (399) children, 6-23 months of age, were recruited (95% of an expected

420 children: 30 clusters of 14 children), using "probability proportionate-to-size" cluster sampling [9]. Anthropometric measurements were performed on children and mothers by an experienced nutritionist, in agreement with the WHO recommendations [10]. Weight was measured using an electronic baby scale (SECA®) which was accurate to the nearest 0.01 kg. Recumbent length was measured with a horizontal, locally-made length board, accurate to the nearest 0.1 cm. A questionnaire was administered by the same investigator to the mothers through an oral interview. Records included demographic and socio-economic data, as well as child-feeding practices.

Data collection. The child's age was recorded from his/her health-book or from birth and immunisation registers of the PSP or the CSPS. The following asset variables of the household were recorded and quoted: type of house (cement = 1, roof made with sheet metal = 1, electricity available = 1, and tap water available = 1), type of transport available (bicycle = 1, moped = 2, motorcycle = 3, and car = 4) and domestic equipment present (radio = 1, television = 2, and refrigerator = 3). Agriculture and rearing practices concerned the type of cart used for agriculture (cart with donkey drive = 1, cart with cow drive = 2, and cart with horse or camel drive = 3), and the type of rearing (ovine = 1, and cattle = 2).
Mothers' activities were recorded as income-generating activities or non income-generating. Shop keeping, gardening for marketable products, gold washing, gainful domestic employment, pottery, sewing, weaving, and hairdressing were considered as income-generating activities.

Child-feeding practices included prelacteal feeding and breastfeeding patterns in the first 6 months of life. Prelacteal feeding was defined as something given to the child before initiating breastfeeding. Mothers were asked about breastfeeding and feeding with water or something else in the first 6 months of life of the child. Child-feeding practices included current breastfeeding and complementary feeding practices. For complementary feeding, mothers were asked to describe the ingredients usually used to prepare children's complementary foods. Fortified cereals were defined as home-based improved flours by mixing "soumbala," fishmeal, toasted groundnut, or several of these local foods with cereal. Soumbala is a fermented product from the African bean tree used both as a condiment and as a meat substitute in soups, because it is rich in protein and micronutrients [11]. It is referred to as "iru" in Nigeria, "netetou" in The Gambia, "kpalugu" in Ghana, "khinda" in Sierra Leone and "dawadawa" in north-west Africa. No mother reported use of an industrial infant formula. Therefore, the complementary feeding mode was classified as follows: no complementary feeding, use of unfortified cereals, and use of fortified cereals.

Data processing. Data were entered using Epi Info 6.04c, then analysed with Statistical Package for the Social Sciences (SPSS 12.0 for Windows). An equipment index was created by adding quotes related to every asset variable. Thus, the equipment index varied between 0 and 20. Children were regrouped into two approximately equal groups according to the equipment index, using the median value as the cut-off point. Agriculture and rearing index was created by adding quotes related to agriculture and rearing practices. Timely introduction of complementary feeding was defined as the percentage of breastfed infants aged 6-9 months, who received solid/semi-solid food [12]. Predominant breastfeeding was defined as feeding with breast-milk or a combination of breast-milk and water only. The children's

weight and height were compared to the international reference curves of the United States National Center for Health Statistics (NCHS) and expressed as the height-for-age Z-score (HAZ) and the weight-for-height Z-score (WHZ). The –2 cut-off point was used to define stunting (HAZ <-2) and wasting (WHZ <-2) [11]. The mothers' body mass index (BMI) was computed according to the equation "BMI = weight (kg)/height (m)²." Underweight mothers were defined as a BMI <18.5 kg/m².

Statistical methods. Prevalence with confidence intervals of stunting and wasting were determined, taking into account the clustering aspects of sampling [9]. We performed univariate analysis of the HAZ and the WHZ using a t-test, or a one-way analysis of variance (ANOVA) and *post hoc* t-test with Bonferroni correction, to compare means. We established multiple linear regression models (general linear model in SPSS) and computed adjusted means. Only variables with p value <0.10 in univariate analysis were considered for linear regression. ANOVA and *post hoc* t-test with Bonferroni correction were used to compare adjusted means. Residuals and co-linearity analysis served as verification criteria for application conditions. The significance level of all tests was 0.05. The age category was a modifier of the association between the HAZ and the mode of complementary feeding.

Ethics. The study received written ethical approval from the "Comité d'Ethique pour la Recherche en Santé" of the Ministry of Health of Burkina Faso. Informed written consent was obtained from caregivers before children were enrolled. Children with severe wasting during the survey were referred to the nearest health centre of the district for treatment.

RESULTS

Characteristics of children, mothers, and households

The mean age (± standard deviation) of the children was 13.8 (± 4.9) months. The mean age of the mothers was 27.5 (± 6.6) years. The majority of the mothers were uneducated (87.1%). More than one-half of the mothers (55.5%) were involved in income-generating activities. Table 1 presents the characteristics of children, mothers, and households.

Child-feeding practices

Among children, 40% were given prelacteal feeding. Almost all of the children (97.9%) were still breastfed. The proportion of complementary feeding was 75.8% (among those, 17.0% used fortified cereals and 58.8% used unfortified cereals). The proportion of timely introduction of complementary feeding was 50.7%. Child-feeding practices are detailed in Table 2.

Prevalence and risk factors for wasting

The prevalence of wasting was 26.3% (95% CI: 21.5% - 30.5%); 22.5% among children 6-11 months of age and 29.1% among children 12-23 months of age. Figure 1 shows the distributions of the WHZ of the NCHS reference children and Kongoussi children. A left shift of the Kongoussi children's curve was observed. The mean WHZ was –1.39 (± 1.14). The WHZ was associated with the children's age and the mother's nutritional status. The adjusted mean WHZ was lower in children aged 12-23 months than in children aged 6-11 months (-1.37 versus -1.10, p=0.036). Children from underweight mothers had a lower mean

WHZ of –1.46 as compared to –1.02 for children from mothers who were not underweight (p=0.006). The WHZ was not associated with the mode of complementary feeding, independent of other characteristics.

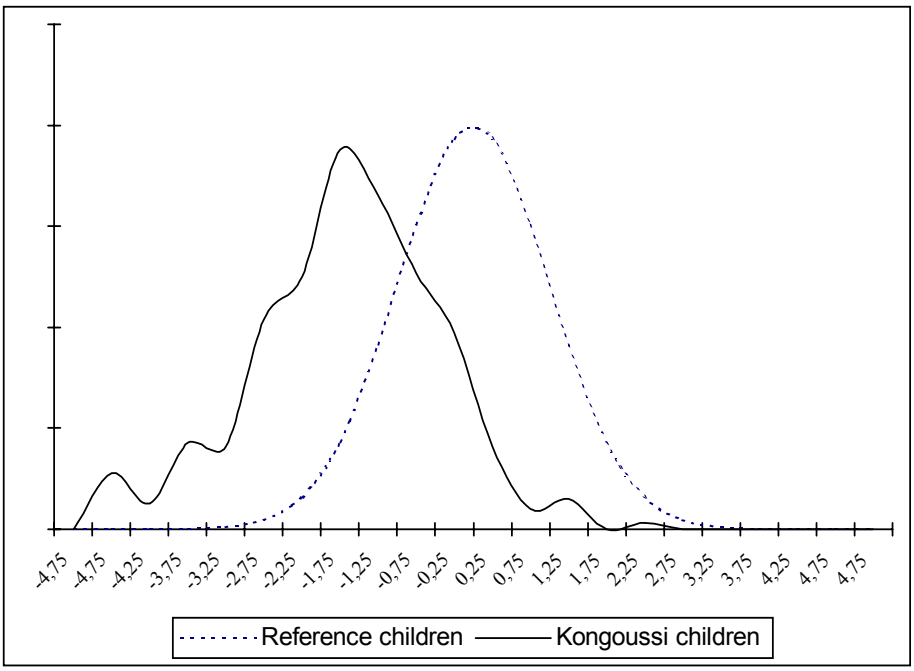

Figure 1: Distribution of the children's height-for-age Z-score

Prevalence and risk factors for stunting

The prevalence of stunting was 35.8% (95% CI: 29.4% - 41.1%). It was 18.3% for children 6-11 months of age and 48.7% for children 12-23 months of age (p<0.001). Figure 2 shows the distribution of the HAZ, and the left shift of the Kongoussi children's curve compared to the NCHS reference curve. The mean HAZ was –1.68 (± 1.15).

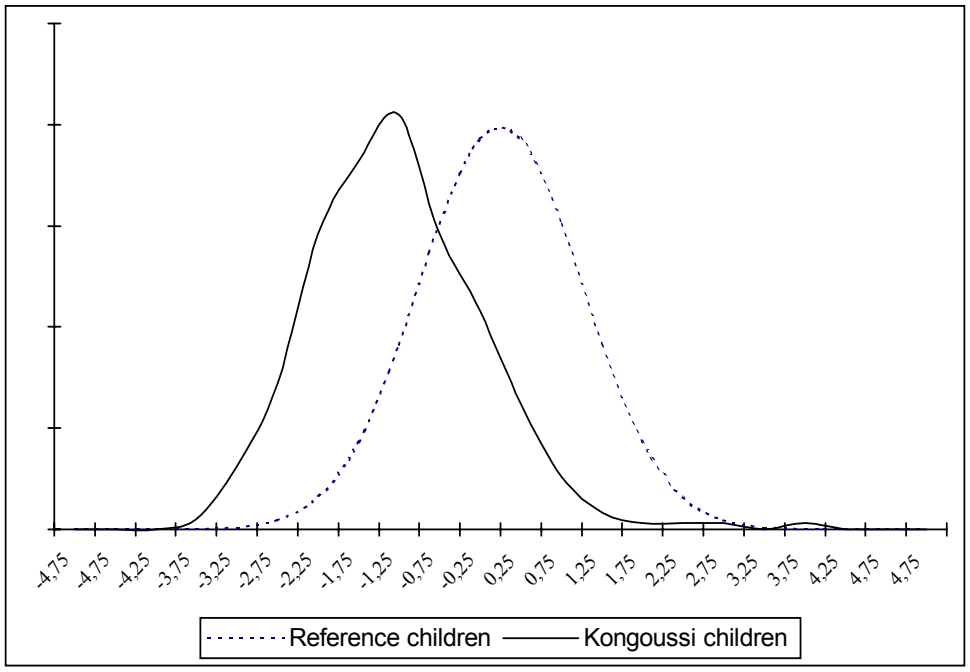

Figure 2: Distribution of the children's weight for height z-score

Table 3 presents the adjusted means of HAZ. After adjustment for children, mothers and household characteristics, and for current and past breastfeeding patterns, the HAZ remained associated with the mode of complementary feeding among children 12-23 months of age (p=0.018), but not among children 6-11 months of age (p=0.136). Among children 12-23 months of age, the adjusted mean HAZ (standard error) was –1.33 (0.63), -1.61 (0.30), and –2.11 (0.32) for children using fortified cereals, unfortified cereals, or no complementary feeding respectively (p=0.018). A *post hoc* comparison showed significant difference in the mean HAZ between children using unfortified cereals and no complementary feeding (Δ=0.50, p=0.020). The difference in the mean HAZ between children using fortified cereals and no complementary feeding was higher but not significant due to the low number of cases in the former category (Δ=0.78, p=0.558). The mother's income-generating activity was a significant determinant of the HAZ among children 6-11 months of age. The mean HAZ (standard error) was –1.49 (0.34) in children from mothers without income-generating activity and –1.88 (0.35) in children from mothers with income-generating activity (p=0.017).

DISCUSSION

The HAZ was associated with the mode of complementary feeding among children 12-23 months of age. Compared to children without complementary feeding, children whose mothers made use of complementary feeding were more likely to have a higher HAZ. The use of fortified cereals for complementary feeding was associated with the highest HAZ. These results highlight the crucial need of the timely introduction of complementary feeding

and underline the importance of complementary food fortification to reduce malnutrition. The fortification with soumbala, fishmeal, or toasted groundnuts probably contributed to the increase in HAZ by increasing the gruel's nutrients, such as protein and micronutrients.

In Ghana, Lartey *et al.* reported the importance of fortified complementary foods [13]. She conducted a community-based intervention with Weanimix®, consisting of a mix of 75% maize, 15% soybeans, and 10% groundnut, and other fortified foods (Winimix® + vitamins and mineral, Winimix® + fish powder, and local gruel + fish powder). Fortification with fish powder consisted of adding fish powder at 20% by weight. The addition of fish powder effectively increased the protein, calcium, iron, zinc, phosphorus, and vitamin B12 contents. In the Ghana study, children in whom there was intervention were compared to children fed traditional food and in whom there was no intervention. The HAZ and the Weight-for-age Z-score of children who had intervention were higher than those of children without intervention. However, the between group comparison of the children with intervention did not show any improvement in growth. The hypothetical explanation of this observation was that the control food, Winimix®, along with frequent breastfeeding, was nutritionally adequate. A further explanation was that either the micronutrient deficiencies in this population were not severe enough to impair growth, or that the growth response to micronutrient supplementation was constrained by other factors, such as frequent infection.

In the district of Kongoussi, fortification of complementary foods with soumbala, groundnuts and fishmeal was associated with better nutritional status. It is important to note that in this district, the home-based fortification of complementary foods using local foods involved only 17% of young children. This strategy should be encouraged through nutrition education, as soumbala and groundnuts are available and affordable throughout the year. Thorough studies are needed to elucidate the nutritional value of home-based fortified foods and their contribution to improve child nutritional status. The present study did not quantify the number of complementary feeds. Furthermore, morbidity, which is an important determinant of child nutritional status, was not considered [14]. Although morbidity was not accounted for, variables considered in the regression model accounted for approximately three-fourths of the variation of the HAZ among children 12-23 months of age (R^2=0.77).

Although it was not significant, children 6-11 months of age without complementary feeding were more likely to have better HAZ than children with complementary feeding. The trend was reversed in children 12-23 months of age. This may be due to the fact that the introduction of complementary feeding in children 6-11 month of age leads to lower breastfeeding frequency and breast-milk intake that can be detrimental for infants.

The role of income-generating activities in child nutritional status should be mentioned. Children whose mothers had income-generating activities had lower HAZ than children whose mothers had no income-generating activities, especially in children 12-23 months of age. Lack of time caused by these activities may have affected the household environment and food availability, and consequently affected childcare and nutrition. Gold-washing mobilizes mothers during the whole day to gold sites, while the elder brothers or sisters have the task to care for the young child. This is the same for other income-generating activities, like gardening for marketable products, shop-keeping, hairdressing, sewing and pottery

making. Time is one of the main resources for childcare. In the Accra observational study, mothers of children with better growth spent less time in income-generating activities than mothers of poorly growing children [15].

Among children 12-23 months of age, those who were no longer breastfed unexpectedly had a higher HAZ than those who were still breastfed. The relationship between prolonged breastfeeding and nutritional status has been controversial. The prospective study by Fawzi *et al.* concluded that the inverse association often observed is not causal, but may be explained by poorer complementary feeding among breastfed compared to weaned children [16].

In the district of Kongoussi, child health status is affected by a high prevalence of malnutrition. The 2003 Demographic and Health Survey (DHS) for a national representative sample reported that stunting was 10.6% among 6-11 month-old children, and 31.7% among 12-23 month-old children [8]. The prevalence of wasting was 20.2% among 6-11 month-old children, and 26.4% among 12-23 month-old children [8]. There was a difference from our results with respect to stunting, which was more frequent in this rural area of Kongoussi.

CONCLUSION

These results underline the high frequency of malnutrition in the rural district of Kongoussi, and the great need for nutritional intervention. Complementary feeding, especially those using home-based improved flours, is a key factor in child growth. However, such practices of flour improvement involved less than one-fifth of children. The prevention of growth impairment in this area could be based on home fortification of complementary foods using locally available foods as this is more sustainable. Thorough research is needed to specify and standardize the procedures of utilisation of the available food in the prevention of growth impairment.

ACKNOWLEDGMENTS

To the “Fonds pour la Recherche Scientifique Médicale” of Belgium, for funding this study (convention n° 3.4534.03).

Table 1: Characteristics of children, mothers, and households

Characteristics	n	%
Children		
Age (months)		
6-11	168	42.3
12-23	229	57.7
Sex		
Girls	203	51.1
Boys	194	48.9
Rank		
1	86	23.0
> 1	288	77.0
Mothers		
Age (years)		
< 35	303	81.7
≥ 35	68	18.3
Underweight		
No (body mass index ≥ 18.5 kg/m²)	326	85.1
Yes (body mass index < 18.5 kg/m²)	57	14.9
Education status		
Attended school	48	12.9
Never attended school	324	87.1

Table 1 : (continued)

Income-generating activity		
Yes	206	55.5
No	165	44.5
Households		
Presence of latrines		
Yes	148	39.6
No	226	60.4
Agriculture and rearing index		
High	205	54.5
Low	171	45.5
Equipment index		
High	220	59.6
Low	149	40.4

Table 2: Distribution of child feeding practices

Child feeding practices	n	%
Prelacteal feeds used		
Yes	150	40.0
No	226	60.0
Predominant breastfeeding when child was 0-6 month-old		
Yes	351	93.4
No	25	6.6
Still breastfeeding		
Yes	368	97.9
No	8	2.1
Complementary feeding mode		
Use of fortified cereals	64	17.0
Use of unfortified cereals	221	58.8
No complementary feeding	91	24.2

Table 3: Adjusted means of height-for-age Z-score according to child feeding practices, by age category, derived from multiple linear regression

	Children's age					
	6-11 months			12-23 months		
	n	Mean (SE*)	p	n	Mean (SE*)	p
Children's Rank			0.056			0.057
1	33	-1.86 (0.34)		47	-1.87 (0.36)	
> 1	115	-1.41 (0.28)		159	-1.51 (0.33)	
Mothers' body mass index			0.045			0.667
≥ 18.5	129	-1.34 (0.30)		173	-1.64 (0.33)	
< 18.5	19	-1.93 (0.35)		33	-1.73 (0.38)	
Income-generating activity			0.410			0.017
Yes	81	-1.71 (0.30)		114	-1.88 (0.35)	
No	67	-1.55 (0.31)		92	-1.49 (0.34)	
Prelacteal feeds used			0.653			0.254
Yes	61	-1.59 (0.31)		84	-1.60 (0.35)	
No	87	-1.68 (0.30)		122	-1.78 (0.35)	
Predominant breastfeeding			0.412			0.894
Yes	143	-1.41 (0.16)		188	-1.67 (0.32)	
No	5	-1.85 (0.53		18	-1.70 (0.40)	
Still breastfeeding						0.071
Yes	148	-1.63 (0.29)		200	-2.11 (0.24)	
No	0	-		6	-1.26 (0.53)	

Table 3: (continued)

Complementary feeding mode			0.161		0.018
Use of fortified cereals	58	-1.69 (0.32)	4	-1.33 (0.63)	
Use of unfortified cereals	63	-1.86 (0.30)	146	-1.61 (0.30)	
No complementary feeding	27	-1.35 (0.35)	56	-2.11 (0.32)	
R^2		0.52		0.77	

*Standard error

REFERENCES

1. **Black RE, Morris SS and J Bryce** Where and why are 10 million children dying every year? *Lancet* 2003; **361**: 2226-2234.
2. **Lutter C** Meeting the challenge to improve complementary feeding. *SCN News* 2003; **27**: 4-9.
3. **World Bank.** Repositioning nutrition as central to development. A strategy for large-scale action. Washington, D.C.: The World Bank, 2006.
4. **UNICEF.** Strategy for improved nutrition of children and women in developing countries. New York: UNICEF policy review, 1990.
5. **Martin-Prevel Y** Soins et nutrition publique. *Sante* 2002; **12**: 86-93.
6. **WHO.** Global strategy for infant and young child feeding practices. Geneva: WHO, 2003.
7. **Jones G** How many child deaths can we prevent this year? *Lancet* 2003; **362**: 65-71.
8. **Institut National de la Statistique et de la Démographie** Enquête Démographique et de Santé (EDSBFIII, 2003). Washington, D.C.: Measuredhs, 2004.
9. **Lemeshow S and D Robinson** Surveys to measure programme coverage and impact: a review of a methodology used by the expanded programme on immunisation. *World Health Statist. Quart.* 1985; **38**: 65-75.
10. **WHO.** Physical status: the use and interpretation of anthropometry. *WHO Techn. Rep. Ser.* 1995; **854**: 1-459.
11. **Ndir B, Lognay G, Whatelet B, Cornelius C, Marlier M and P Thonart** Composition chimique du nététu, condiment alimentaire produit par fermentation des graines du caroubier Africain *Parkia biglobosa* (Jacq.) Benth. *Biotechnol. Agron. Soc. Environ.* 2004; **4**: 101-105.
12. **WHO.** Report of informal meeting to review and develop indicators for complementary feeding. Geneva: WHO / DCAHD, 2002.
13. **Lartey A, Manu A, Brown KH, Peerson JM and KG Dewey** A randomised, community-based trial of the effects of improved, centrally processed complementary foods on growth and micronutrient status of Ghanaian infants from 6 to 12 months. *Am. J. Clin. Nutr.* 1999; **70**: 391-404.
14. **Stephenson CB** Burden of infection on growth failure. *J. Nutr.* 1999; **129**: 534S-538S.
15. **Arimond M and MT Ruel** Assessing care: progress toward the measurement of selected childcare and feeding practices, and implications for programs. Washington, D.C.: FANTA project, Academy for Educational Development, 2002.
16. **Fawzi WW, Herrera MG, Nestel P, El Amin A and KA Mohamed** A longitudinal study of prolonged breastfeeding in relation to child undernutrition. *Int. J. Epidemiol.* 1998; **27**: 255-260.