The Effect of Breast Feeding Practices on the Body Composition of Infants and Their Mothers Living in Urban Area Cameroon

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Abstract: The study was aimed to assess the effect of breast feeding practices on the body composition of child-mother and to evaluate the iron status of lactating mothers. Forty six lactating mothers and their children (forty eight) were recruited at the Teaching Hospital Vaccination Centre, Yaounde. Anthropometric measurements including Body Mass Index (BMI) and skinfold thickness were done on children and their mothers. Total Body Water (TBW), Intracellular Water (ICW), Extracellular Water (ECW) and Fat Mass (FM) of mothers were estimated by monofrequency Bioelectrical Impedance Analysis (BIA). The hemoglobin level was determined to assess the iron status of mothers. The results obtained showed that the mean value of mother's BMI irrespective of their age or type of breastfeeding practices was within the overweight limit. However, when separately analysed, 26.1% of mothers recorded normal Body Mass Index against 19.6 and 52.7% who's BMI fell in the obese and overweight categories, respectively. The TBW and FM of mothers varied from 21.7-43.7 and 12.2-46.2 kg, respectively. According to the World Health Organisation criteria for underweight and malnutrition, 73.3% of children mixed breastfed had normal growth pattern whereas only 35.5% of exclusively breastfed children experienced normal growth pattern. About 67.7% of women irrespective of age or socio-economic status practised exclusive breastfeeding whereas 28.3 and 4.3% fed their babies using mixed and artificial breastfeeding, respectively. According to the hemoglobin level, 26.08% of lactating mothers were anemic while 73.92% were normal.

Key words: Breastfeeding, children, mothers, body composition, anthropometry, bioelectrical impedance analysis, hemoglobin

INTRODUCTION

Undernutrition is a major concern of public health worldwide. In 1990, approximatively 20 million children were suffering from undernutrition. In Cameroon, growth retardation affects 32% of children whereas 5% of children under five are stunted. Also, 68% of children under five suffer of iron deficiency while 39% suffer of vitamin A. It was reported that 45% of women are anemic. There is a high prevalence of iron deficiency among children having anemic mother. Breastfeeding is considered to play a major role in the fight against malnutrition of children. The practice of breastfeeding infants in sub-Sahara Africa country is common. Current guidelines for these countries recommend exclusive breastfeeding until the child is at least 6 month old socioeconomic and cultural factors affect the maternal food intake also their decision to supplement human milk is influence (ACC/SCN, 2000).

The present study was conducted at the University Teaching Hospital Centre, Yaounde, Cameroon where researchers could found lactating mother from a different socioeconomic background were recruited. This research was aimed at evaluating the effect of breastfeeding practices on the body composition of children and their mothers.

MATERIALS AND METHODS

Subjects: About 48 mother-infant pairs were recruited from the University Teaching Hospital Centre, Yaounde, Cameroon: the mothers were living in the urban area and aged between 14 and 40 years; the babies, boys (n = 17) and girls (n = 31) were aged between 0.10 and 7.50 months. The study was approved by the ethics committee of Cameroon written informed consent was obtained from each woman before the start of the study (Table 1).

Table 1: General characteristics of breast-fed infants

Characteristics	Mean±SD	Minimum	Maximum
Age (month)	3.2±1.80	0.10	7.5
Body weight (kg)	5.9±1.50	2.60	9.3
Height (cm)	56.2±5.30	45.50	68.0
BMI (kg m^{-2})	18.9±3.90	9.10	28.4
Birth weight (kg)	3.3±0.65	1.70	4.8

n = 48

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Anthropometric measures: Measurements were made by trained personnel using standard procedures (Lohman *et al.*, 1988). Wearing minimal clothes, mothers were weighed to nearest 0.01 kg with an electronic scale (Seca, Hamburg, Germany). Height was measured to the nearest millimeter with a portable gauge (Seca, Hamburg, Germany). The Body Mass Index (BMI) was calculated as weight (kg)/height (m)². The infants were weighed without clothes using a portable electronic baby scale (Seca, Hamburg, Germany) accurate to 0.01 kg. Length was measured using a standardised anthropometer (Seca baby length measures, Hamburg, Germany). Growth and development of infants were assed using WHO child growth standards.

BIA: BIA was performed on the right side of the body using a body composition analyzer (Bodystat®, QuadScan 4000, British Isles) with a tetrapolar electrode placement. The electrodes were placed on the hand, wrist, foot and ankle of each subject according to the standard placement for adults as stated in the manufacturer's guidelines. All metal objects were removed from the subjects before the measurements were made. The subjects were supine on a nonconductive surface with their arms and their thighs apart; the measurements were performed after the subjects had remained in the supine position for at least 15 min. All BIA measurements were performed by the same person.

The values used in the calculations were the mean of duplicate measurements. Only the impedance (Z) or resistance (R) data at 5, 50 and 100 kHz were used in the calculations of the present study. The impedance index was calculated as height²/R (cm²/Ω) or height²/Z depending on the explanatory variable used in the equation tested (Liedtke, 1997; Kushner and Schoeller, 1986).

The current is able to pass through cell membranes at high frequencies but not at low frequencies thus enabling the prediction of Extracellular Water (ECW) and TBW independently at 5 and 100 kHz, respectively. Differences in TBW distribution over the intra and extracellular space are reflected by impedance ratios of 5-100 kHz frequencies. The height²/R_5 is assumed to

reflect the ECW volume and the height²/R_{100} is assumed to reflect the TBW volume (Liedtke, 1997; Kushner and Schoeller, 1986).

Biochemical analysis: Whole blood from lactating women was collected in a tube (5 mL). The blood was dissolved in a Drabkins solution. A Miniphotometer MPA was used to determine Hemoglobin (Hb) concentration. The lactating mothers were categorized as having iron deficiency anemia when found with an Hb of <12 g dL^{-1} (Ettyang *et al.*, 2003) (Table 2).

Statistical analysis: Statistical analyses were performed using SPSS 10.1 software (SPSS Inc., USA). Results were expressed as mean±SD. Mean, standard deviations and median were calculated. Independent sample Student's t-test was used to determine the significance differences between the body composition of exclusive breast feeding mother-infants pair, mixed and artificial breast feeding mother-infants pair.

RESULTS AND DISCUSSION

The WHO identifies an Hb level <12 g dL^{-1} as being anemic. Researchers found 26.08% of the lactating mothers anemic by this criterion (Fig. 1). Results showed that 67.4% of women irrespectively of age or socio economic status practised exclusively breastfeeding whereas 28.3 and 4.3% fed their babies using mixed and artificial breastfeeding, respectively. The study population was composed of rich class (6.5% of women), middle class (65.2%) and poor class (28.3%).

Similarly, on the basis of age distribution, the study population was divided into 3 categories: the adolescent mothers whose age was ≤19 years represented 6.5% of the population with a mean age value of 17.3; the adult mothers whose age was comprised between 20 and 30 years represented 64% of the population with a mean

Table 2: General characteristics of lactating women

Characteristics	Mean±SD	Minimum	Maximum
Age (year)	26.6±5.7	14.0	40.0
BMI (kg m^{-2})	26.8±3.7	20.5	38.2
Fat mass (kg)	23.7±8.7	12.2	46.2
Lean mass (kg)	47.4±4.8	41.4	62.8
Total body water (kg)	33.2±3.8	21.7	43.7
Hb (g dL^{-1})	12.9±1.3	10.1	15.8

n = 46
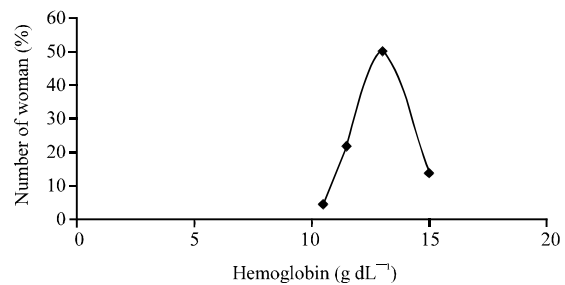

Fig. 1: Distribution of Hemoglobin concentration among lactating women

Table 3: Age distribution of lactating mothers

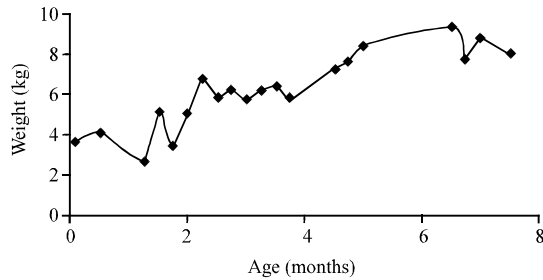| Range	Number	Age (year)	BMI (kg m^{-2})	Fat mass (kg)	Lean mass (kg)	Total body water (kg)
≤19	3	17.3±2.9	24.6±2.6	18.3±6.5	47.6±5.6	29.7±7.7
20-30	29	24.2±2.6	26.3±4.0	21.6±7.8	46.5±4.6	33.4±3.1
≥30	14	33.4±3.8	28.2±3.0	28.5±9.4	49.2±4.9	35.1±3.4

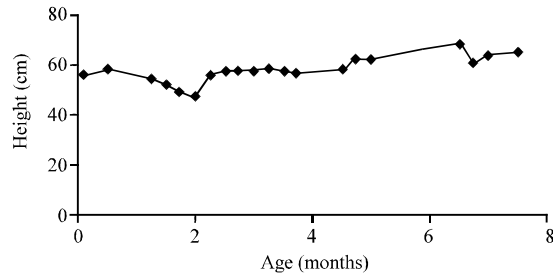Fig. 2: Weight variation with age of children

Fig. 3: Height variation with age of children

age value of 24.2; the older adult mothers whose age was ≤30 years represented 30.4% of the study population with a mean age value of 33.4. On the other hand, women from poor and middle classes had greater preference for exclusive breastfeeding (92.3 and 63.3%, respectively). All the mothers from the rich class (100%) practised mixed breastfeeding. The mean value of mother's BMI irrespective of their age or type of breastfeeding practices was within the overweight limit. However, when separately analysed, 26.1% of mothers recorded normal Body Mass Index against 19.6 and 52.7% whose BMI fell in the obese and overweight categories, respectively. The mean BMI, mean fat mass, mean lean mass and mean total body water did not significantly vary among different breastfeeding practices with the exception of lean mass, results also showed that the mean values of BMI, FM and TBW increased with age as shown in Table 3.

Generally, most mothers registered normal level of haemoglobin (73.9%) against 26.1% of those with haemoglobin level <12 g dL^{-1}. However, averagely the mean haemoglobin level of mothers did not significantly vary with breastfeeding practices. This study revealed that there were more girls (64.6%) than boys (35.4%). However, more boys (58.8%) presented a normal

Table 4: Characteristics of mothers depending on the type of breastfeeding practices

Type of breastfeeding	No. of mothers	BMI (kg m^{-2})	Fat mass (kg)	Lean mass (kg)	Total body water (kg)	Hb (g dL^{-1})
Exclusive	31	27.0±4.1	24.2±9.9	47.3±4.8	33.1±3.9	12.9±1.5
Mixed	13	26.3±3.1	22.1±5.9	47.3±4.9	33.3±3.7	13.1±1.3
Artificial	02	26.4±0.2	25.5±0.4	48.3±7.3	33.6±4.7	12.8±1.3

growth pattern than girls (48.4%). Results also show that the socio-economic status did not have effect on the growth pattern of children. In Fig. 2 and 3 researchers observed that generally the growth pattern of children did not follow the normal curve as defined by the WHO child growth standard (WHO, 2006).

The higher preference for exclusive breastfeeding by mothers (67.4%) may be due to the sensitization campaign during prenatal period on the benefits mother's milk provides children in terms of protection against infectious diseases (Picaud, 2008).

This is in accordance with the WHO's recommendations requesting mothers to exclusively breastfed their children from at least 6 months. In addition, traditionally exclusive breastfeeding is a common practice in Africa. Noticeably, exclusive breastfeeding was mostly practised by women from middle and poor classes compared to the rich class (100% of them mix breastfed their children). This may be explained by the fact that rich women have means to buy artificial milk. Only two mothers (4.3%) practised artificial breastfeeding. Artificial breastfeeding is not common in Africa and it is not part of the tradition. This option is chosen only when the mother fails to produce milk or when she is HIV positive.

The mean value of Body Mass Index (BMI), Fat Mass (FM), Lean Mass (LM) and Total Body Water (TBW) revealed that the body composition of lactating mothers who participated in the study did not vary significantly with respect to breastfeeding practices (Table 4). The finding confirmed the result of Janney *et al.* (1997) who showed that there was no correlation between breastfeeding and the body composition of lactating mothers.

However, the conclusion of the finding cannot be authoritative given the fact that this present study was not a longitudinal one which usually takes in account important parameters such as duration of lactation, mothers who smoke and those with low birth weighed children. These are key factors that strongly affect the maternal nutrition and lactation (Kramer *et al.*, 2007). For example, they pointed out that mothers who breastfed for 6-11 months had lower measurement of body fat than those with shorter or larger duration. On the contrary with

Table 5: Age distribution of children and type of breastfeeding

Range	Number	Age (month)	Height (cm)	Weight (kg)	Arm circumference (cm)
Exclusive breastfed children					
0-3 month	21	1.67±0.75	54.20±4.90	4.88±1.18	12.10±1.80
3-6 month	9	3.75±0.83	57.27±3.54	6.87±1.27	14.22±1.11
Mixed breastfed children					
0-3 month	3	2.25±0.25	55.16±7.42	5.21±0.62	12.3±0.65
3-6 month	7	4.39±0.55	56.85±4.05	6.68±0.94	14.05±1.04
>6 month	5	7.05±0.44	64.5±3.20	8.28±0.73	14.92±0.63
Artificial breastfed children					
0-3 month	1	1.5±0	52±0	5.8±0	13±0
3-6 month	1	3.75±0	56.5±0	5.8±0	13±0

the exception of LM the mean values of BMI, FM and TBW increased with age group as one moved from the adolescent mothers to old adult mothers (Table 5). This result is in accordance with the finding of Valeggia and Ellison (2003) who concluded that the pattern of change in post partum body composition varied with maternal age. However, the hemoglobin level of lactating mothers did not significantly vary with breastfeeding practices or mother's age group distribution through the haemoglobin level of adolescent mothers was very closed to that of the adult mothers.

This may be due to that fact that the iron requirement of adolescent females is similar to that of non menopauses adult women (Dubost and Schneider, 2000). However, these two groups are the most susceptible to iron deficiency as a result of menstruation and other physiological factors.

The individual iron requirement is the most determining factor of iron absorption: the more is needed, the more it is absorbed by the body. Therefore, the lack of significant variation of haemoglobin levels of lactating mothers irrespective of their breastfeeding practices may just be attributed to the fact that these women may have quite similar diet.

Generally, according to Fig. 2 and 3, the growth pattern of children did not follow a normal curve as is defined by the WHO child growth standard (WHO, 2006). On the other hand, more male babies (58.8%) presented normal growth than baby girl (48.4%).

No obvious reason was found to explain this difference. It should also be noted that the effect of lactation on maternal body composition has been a controversial issues while some studies demonstrated that breastfeeding affect maternal weight others did not find any correlation between the two parameters (Butte and Hopkinson, 1998).

CONCLUSION

The breastfeeding practices have an effect on the body composition of children; no significant effect was found on their mothers. Most of the lactating mothers were overweighed and obese. The hemoglobin level of lactating mothers did not significantly vary with breastfeeding practices.

REFERENCES

ACC/SCN, 2000. Fourth report on the world nutrition situation: Nutrition throughout the life cycle. International Food Policy Research Institute. http://www.unsystem.org/scn/archives/rwns04/index.htm.

Butte, N.F. and J.M. Hopkinson, 1998. Body composition changes during lactation are highly variable among women. J. Nutr., 128: 381S-385S.

Dubost, M. and W.H. Schneider, 2000. La Nutrition. 2nd Edn., McGraw-Hill, Montreal-Toronto, Canada, pp: 147-149.

Ettyang, G.A., W.D.V.M. Lichtenbelt, A. Oloo and W.H.M. Saris, 2003. Serum retinol, iron status and body composition of lactating women in Nandia, Kenya. Ann. Nutr. Metab., 47: 276-283.

Janney, C.A., D. Zhang and M.F. Showers, 1997. Lactation and weight reduction. Am. J. Clin. Nutr., 66: 1116-1124.

Kramer, M.S., L. Matush, I. Vanilovich, R.W. Platt and N. Bogdanovich *et al.*, 2007. Effect of prolonged and exclusive breastfeeding on child height, weight, adiposity and blood pressure at age 6.5 Y: Evidence from randomized trial. Am. J. Clin. Nutr., 86: 1717-1721.

Kushner, R.F. and D.A. Schoeller, 1986. Estimation of total body water by bioelectrical impedance analysis. Am. J. Clin. Nutr., 44: 417-424.

Liedtke, R.J., 1997. Principles of bioelectric impedance analysis. Tech. Rep.

Lohman, T.G., A.F. Roche and R. Martorell, 1988. Anthropometric Standardization Reference Manual. Human Kinetics Books Inc., Champaign, IL.

Picaud, J.C., 2008. Breastfeeding and human milk: What benefits for neonates and infants. Nutrition Clinique et Metabolisme 2008.

Valeggia, C.R. and P.T. Ellison, 2003. Impact of breastfeeding on anthropometric changes in peri-urban Toba women (Argentina). Am. J. Hum. Biol., 15: 717-724.

WHO, 2006. Who child growth standards: Length/height-forage, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. Methods and Development. http://www.who.int/childgrowth/standards/.