

Effects of a Traditional Feeding Practice on the Nutritional Status of Mothers and Children: A Case Study of Selected Breastfeeding Mothers and Their Children from Biu LGA of Borno State, Nigeria

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ABSTRACT

Guna (*Citrillus vulgaris*) seed has been reportedly used in different ways by different tribes in Nigeria. The uses of the seeds include for soups, gruels or pap, and snacks. The intents of this study were to assess the use of *guna* pap, the nutrient composition of *guna* pap and the effect of traditional practice of *guna* pap food habit on nutritional status (weight) of lactating women and their children. The study was carried out on selected breastfeeding mothers living in Biu Local Government Area of Borno State, Nigeria, who were visiting the General Hospital Biu for either ante-natal or postnatal care during the study period. A cross sectional hospital-based study design was employed to assess the nutritional status of the breastfeeding mothers and their breast fed children in the study area. The proximate composition of the *guna* pap and the energy value were quantified using the standard methods of analysis. Results indicated that the *guna* pap, which is used in traditional feeding practice by breastfeeding mothers in the Local Government Area, had energy content of about 330 kcal and vitamins B1, B2 and B6 that could meet the recommended intake for breastfeeding mothers. Mothers who consumed the *guna* pap during lactation had higher weight gain than those who did not take the pap. Also, the children of mothers that consumed the pap had highest weight gain than those whose mothers did not take the pap; and the weight for age of those children showed a positive increment. It was concluded that the high energy and micro-nutrient contents of the *guna* pap was responsible for bettering the nutritional status of the breastfeeding mothers and their children, and therefore, the pap was highly recommended for consumption particularly during lactating period.

Keywords: *guna* seed, *guna* pap, Breastfeeding Mothers, Micro-Nutrient, Nutritional Status.

INTRODUCTION

Breast milk is a dynamic and intricate fluid, comprising of over 200 identified substances that can vary in quantity and quality among women and within the same woman at different stages of lactation [1]. The American Academy of Pediatrics (AAP) advocates for exclusive breastfeeding without additional foods or liquids for the initial six months of an infant's life. Furthermore, the AAP suggests continuing breastfeeding for at least the first year and extending it further, as may be desired by both the mother and child [2].

The period of breastfeeding, also known as lactation, is recognized as the most nutritionally intensive phase in a woman's life [3]. The quantity of milk a woman generates and releases, along with its energy content, play a significant role in determining the energy expenditure during lactation [4,5]. The caloric requirements during this period depend on factors such as the woman's basal metabolic rate, age, level of activity, the volume of breast milk produced, and various other considerations [6]. Hence, it is advised that lactating women prioritize obtaining their nutrients through a well-balanced diet rather than relying solely on vitamin and mineral supplements [7]. They should aim at consuming a diverse range of foods for optimal nutrition [8]. Paula [9] suggested that inadequate energy intake often occurred in women attempting weight loss, those with low activity levels or reduced energy needs, or that experiencing food insecurity. Research on undernourished Guatemalan women showed that supplementing their diet with approximately 280 kcal per day led to enhanced milk production and prolonged exclusive breastfeeding [10].

The combination of rapid population growth and limited economic resources in developing nations underscores the need for alternative protein sources. These substitutes should effectively replace animal protein, enhance the nutritional profile of cereal-based foods, and address malnutrition concerns, particularly among breastfeeding mothers [11].

Guna seed, derived from the *Citrullus vulgaris* plant, is a type of melon seed known for its high fat (49%) and protein (36%) contents, making it a valuable source of energy and protein for the body [12]. Referred to as '*guna*' in Hausa, '*egusiito*' in Yoruba, and '*ugbogoro*' in Igbo, this seed is utilized in various ways by different tribes in Nigeria. It is commonly used in soups, breakfast cereals, and snacks among tribes such as the Mbula, Bwatiye, Kilba, and Bura, particularly in Adamawa State

[12]. Additionally, it is processed into pap (*kunu*), a traditional beverage especially favored among lactating women in the Borno-Adamawa region. This practice is believed to contribute to increased breast milk production and thereby enhance the health of both the mother and child (Personal Communication with the inhabitants).

Building further upon the established knowledge of the nutritional composition of "*guna*" seed (*Citrullus vulgaris*) as outlined by Penuel [12], this study was aimed at evaluating the utilization of "*guna*" pap, analyze its nutrient composition, and investigate the impact of the traditional consumption of "*guna*" pap on the nutritional status (specifically weight) of lactating women and their children.

MATERIALS AND METHODS

Study Area

The research was carried out in Biu Local Government Area, situated in the southern region of Borno state, located in the northeastern part of Nigeria. Biu is positioned at latitude 10°40'N and longitude 12°5'E [13].

Study Design

The study utilized a cross-sectional hospital-based research design to evaluate the nutritional status of breastfeeding mothers and their breastfed children within the study area.

Study Population

The sample population comprised breastfeeding mothers who were attending antenatal and postnatal care at General Hospital Biu during the data collection phase.

Inclusion Criteria

The study included breastfeeding mothers residing in Biu Local Government Area who visited the General Hospital Health Centre for postnatal and antenatal care during the data collection period. A total of eighty-five (85) mothers were interviewed, with eighty ultimately being selected for sampling.

Exclusion Criteria

Breastfeeding mothers who were critically ill and those having physical deformity during the anthropometric measurements were excluded. Also excluded were mothers with twin babies

and later on, mothers with children over six (6) months old and those with incomplete questionnaires.

Data Collection Procedure

A structured questionnaire, prepared in English, was used to interview the eighty-five (85) respondents. Interviews were conducted in both English and the Bura languages. The questionnaire focused on assessing the nutritional status of breastfeeding mothers and their breastfed children, as well as their awareness of and use of *guna* pap. Trained students from the School of Health Technology, proficient in the Bura language, assisted in administering the questionnaire to mothers who only understood Bura. Additionally, a medical doctor, a nurse, and a hospital attendant from the maternity ward assisted in measuring the weights of both mothers and their children. Before conducting interviews, participants were briefed on the study's objectives, relevance, confidentiality of information, their right to informed consent, and interview techniques. To determine food consumption, a food model was utilized, aiding interviewers in obtaining data through a 24-hour dietary recall. The data collection process was closely monitored throughout the fourteen (14) working days of data collection, with assistance from the medical doctors and hospital attendants.

Anthropometric Measurements

The nutritional status of the breastfeeding mothers and their breastfed children was assessed using the body mass index (Quetelet index). This indicator has been the most frequently used standardized indicator of nutritional status to assess the progressive malnutrition problems in developing countries as reported by James [14]. It is defined as the weight in kilogram divided by the square of the height in meters (kg/m²). The cut-off point suggesting underweight in adults (BMS) and 18.5kg/m² were adopted from International Dietary Energy Consultative Group as described by James [14].

Measurements of weight in kilograms to the nearest 0.1kg for every mother were taken using a weighing scale with an attached height meter provided at the General Hospital in Biu Local Government Area, Borno State. These measurements of height and weight were taken without the mothers' shoes while their babies were undressed and laid on a weighing scale specially designed for babies and their various weights were also recorded on the questionnaire. These measurements were taken for both the breastfeeding mothers and their

breastfed children.

Equipment / Reagents

The equipment used for this study was obtained from the National Agency for Food and Drugs Administration and Control (NAFDAC), Borno State branch.

Proximate Analysis

Proximate composition of the sample was determined using the standard procedures described in Association of Official Analytical Chemists [15] and Nielsen [16]. This included determination of the moisture content, crude protein (using the Kjeldhal method), crude fat (by solvent extraction) and Ash. The carbohydrate content was determined by the difference, as follows: %carbohydrate = 100 – (%moisture + % crude protein + % crude fat + % Ash).

Micronutrient Analysis

The micronutrient contents of the samples were determined as described in AOAC (2006). This includes the determination of minerals such as zinc, sodium, calcium, magnesium and potassium, using the Lamotte Smart Spectrophotometer; while vitamins such as B1, B2 and B6 were determined using a High Performance Liquid Chromatograph (HPLC) system which consists of Shimadzu sil-20AHT auto-sampler, Shimadzu LC-20At liquid chromatography SPD-20A UV-Vis detector.

Statistical Analysis of the Data

The data were checked, cleaned, and analyzed using SPSS software for Windows version 20. Descriptive statistics, including mean, percentages, frequency distribution, and standard deviation, were employed to identify the determinants of the nutritional status of breastfeeding mothers and their breastfed babies. Additionally, the relationship between the consumption of "*guna*" pap and the nutritional status of breastfeeding mothers and their breastfed babies was examined. Significance tests among means were conducted at a 5% level of significance, following the procedures outlined in Dean et al. [17].

RESULTS AND DISCUSSIONS

The results of the Socio-economic and Anthropometric characteristics of the population are presented in Tables 1 - 7.

Socio-economic Characteristics of the Respondents

Table 1 shows that the age of the breastfeeding mothers ranged from 17 – 46 years. It was observed that the majority of the population, 48 (or 60%), were in the age bracket of 23 and 28 years with a median of 25 years; the majority of this group, 39 (or 45.88%), had completed secondary education. By ethnicity, 33(or 41.30%) of the breastfeeding mothers are Burah by tribe. All of the respondents are married and the majority 29 (or 36.25%) were traders by occupation and 18 (or 22.50%) were civil servants; while 22 (or 27.50%) were unemployed (Table 1).

60kg and only few of the mothers, 1.25%, had a weight range of 71-80kg. Moreover, at the end of the study, the recorded weight of the breastfeeding mothers ranged from 50 -80kg, majority of the mothers, 48 (60.00%), had a weight range of 50-60kg and only 4 (or 5.00%) had a weight range of 71-80kg.

On the other hand, the nutritional status of the breastfed children is presented in Table 3. From the table, it could be observed that the weight of the children at birth ranged from 2.5 – 4.0kg, indicating that none of the children was born preterm or premature (i.e., birth weight of less than 2.5kg). The highest frequency 48 (or 60.00%) of the children had a weight range between 2.6 and 3.0kg and the lowest frequency 5 (or 6.25%) had a weight range of 3.6 and 4.0kg (Table 3).

Nutritional Status of the Breastfeeding Mothers

The nutritional status of the breastfeeding mothers is presented in Table 2. The weight of the mothers ranged from 50 - 90kg with the majority of the mothers 39 (or 48.75%), having a weight range of 61-70kg before delivery and only few of the mothers, 1.25%, had a weight range of 81-90kg. The weight of mothers after delivery ranged from 50 – 80kg, with the majority of them 59 (73.75%), having a weight range of 50-

Furthermore, weight of the breastfed children recorded during the study ranged from 2.8 - 7.5kg with the highest frequency of 38(or 47.5%) of children having a weight range of 3.6-4.5kg and mean weight of 3.72, 4.29, 5.33, 6.41 and 7.00 kg for the 1, 2, 3, 4 and 5 months old children, respectively (Table 3).

Table 1. Socio-economic Characteristics of the Respondents

Variables	Age of respondent		Educational Level			Tribe of the respondent			Employment status			Marital Status		
	Fre- quency (n)	Percentage (%)	Variables	Fre- quency (n)	Percent- age (%)	Variables	Fre- quency (n)	Percent- age (%)	Variables	Fre- quency (n)	Percent- age (%)	Variables	Fre- quency (n)	Percentage (%)
17-22	14	17.5	Primary	11	13.75	Bura	33	41.25	Civil servant	18	22.5	Married	80	100
23-28	48	60	Secondary	36	45	Babur	20	25	Trader	29	36.25	Single	0	0
29-34	14	17.5	Tertiary	19	23.75	Hausa	9	11.25	Farmer	11	13.75	--	--	--
35-40	3	3.75	Non	14	17.5	Fulani	5	6.25	Un-em- ployed	22	27.5	--	--	--
41-46	1	1.25	--	--	--	Margi	3	3.75	--	--	--	--	--	--
--	--	--	--	--	--	Chibok	5	6.25	--	--	--	--	--	--
--	--	--	--	--	--	Lala	3	3.75	--	--	--	--	--	--
--	--	--	--	--	--	Kanuri	1	1.25	--	--	--	--	--	--
--	--	--	--	--	--	Karekare	1	1.25	--	--	--	--	--	--
Total	80	100	Total	80	100	Total	80	100	Total	80	100	Total	80	100

Table 2. Weight of Breastfeeding Mothers before and after Delivery and During the Study Period

Weight of Mother (kg)	Before Delivery		After Delivery		In the study	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
50-60	35	43.75	59	73.75	49	61.25
61-70	39	48.75	20	25.00	27	33.75
71-80	5	6.25	1	1.25	4	5.00
81-90	1	1.25	0	0.00	0	0.00
Total	80	100.0	80	100.0	80	100.0

Table 3. Weight of the Breastfed Children

Weight (kg)	Child At Birth		Child in this Study			Age of Child in Months		
	Frequency (n)	Percentage (%)	Weight (kg)	Frequency (n)	Percentage (%)	Months	Frequency (n)	Percentage (%)
2.0-2.5	9	11.25	2.5-3.5	20	25.00	0-1	41	51.25
2.6-3.0	48	60.00	3.6-4.5	38	47.50	2-3	23	28.75
3.1-3.5	19	23.75	4.6-5.5	11	13.75	3-4	4	5.00
3.6-4.0	4	5.00	5.6-6.5	7	8.75	4-5	10	12.50
-	---	--	6.6-7.5	3	3.75	5-6	2	2.50
--	--	--	7.6-8.5	1	1.25	--	--	--
Total	80	100.0	Total	80	100.0	Total	80	100.0

Effects of the Feeding Habits on Health Status of the Breastfeeding Mothers and their Breastfed Children

The effects of feeding habits on the health status of the breastfeeding mothers and their breastfed children are presented in Table 4. It shows that 76 (or 95.0%) of the children were exclusively breastfed and 4 (or 5.0%) of the mothers indicated feeding their children with breast milk and other formula. The frequency of breastfeeding showed that most

of the mothers 79 (or 98.8%) breastfed their children 10 times more, whereas only 1 (or 1.25%) breastfed 10 times less. The mothers in general, perceived themselves and their children as healthy enough. Among the mothers, the highest number 45 (or 56.30%) exclusively consumed "guna" pap, while the lowest frequency 8 (or 10.00%) did not consume "guna" pap at all, and 27 of them (or 33.80%) consumed "guna" pap along with other types (Table 4).

Table 4. Feeding Habits and Perceived Health Status of the Breastfeeding Mothers and their Breastfed Children

Type of food fed to child			Frequency of feeding			Perceived health of mother and child			Guna use*		
Variables	Frequency (n)	Percentage (%)	Variables	Frequency (n)	Percentage (%)	Variables	Frequency (n)	Percentage (%)	Variables	Percentage (%)	Guna use*
Breast milk only.	76	95.00	More than 10 times.	79	98.80	Healthy	80	100.0	Guna pap.	45	56.30
Breast milk and other pap.	4	5.00	Less than 10 times.	1	1.30	Ill	0	0.00	No Guna	8	10.00
--	--	--	--	--	--	--	--	--	Guna and other pap.	27	33.80
Total	80	100.0	Total	80	100.0	Total	80	100.0	Total	80	100.0

*Was obtained from the 24-hour dietary recall of mothers.

When the nutritional status of children and mothers, based on their consumption of "guna" pap or not, was compared, it was observed that children whose mothers consumed "guna" pap had higher weights than those whose mothers did not consume the pap. In addition, the use of "guna" pap and other types of pap appeared to impact the highest mean weight for both mothers and children.

The findings of the proximate analysis of "guna" pap are summarized in Table 5. The moisture content of "guna" pap is 50.05% on a wet-weight basis and 4.95% on a dry weight basis. This moisture content is comparatively lower than that reported for legumes by [18] which typically ranged between 7.0-10% on a dry weight basis. Regarding crude protein, "guna" pap contains 27.01% on a dry weight basis, which compares favorably with protein-rich foods such as pumpkin

and watermelon seeds, and other melon varieties, which are reported to range from 25.80% to 38.10% [19]. The ash content of "guna" pap is also comparable to the ash content observed in "egusi" melon [20]. However, the carbohydrate content of

"guna" pap is relatively low at 0.46% on a wet weight basis, compared to the values reported for other varieties of melon seeds, such as "egusi" melon (10.6%) and *Colocynthus citrillus* (5.1%) [19].

Table 5. The Proximate Composition of *Guna* Pap (g/ 100g)

Contents	On Wet-Weight Basis*	On Dry-Weight Basis*
Moisture	50.05±5.70	4.95±7.10
Fat	29.12±5.70	38.23±2.30
Protein	16.46±0.03	27.01±0.70
Ash	4.01±0.10	3.74±0.70
Carbohydrate	0.46±5.70	26.06±0.60
Energy (kcal)	329.76	558.51

*Values are means ± standard deviations of triplicate determinations.

On the other hand, the mineral analysis results for "guna" pap are presented in Table 6. Sodium content has the highest value of 205mg / 100g, which falls below the recommended intake for breastfeeding mothers by the Institute of Medicine (IOM). However, this value is notably higher than that recorded in "egusi" melon (13.0mg/100g) [21]. The calcium content of "guna" pap is lower than that of other legume seeds such as Lime bean (68mg/100g), pigeon pea (124mg/100g), and jack bean (132mg/100g) as also reported [21], but higher than "egusi" melon (28.2mg/100g) [20].

The magnesium content of "guna" pap is 80.00mg/100g, which is lower than the range of 140mg/100g to 190mg/100g

reported in some legumes [21]. Magnesium plays a crucial role in bone calcium metabolism, circulatory disease prevention, blood pressure regulation, and insulin release [22]. The Recommended Dietary Allowance (RDA) of magnesium for breastfeeding mothers [5], is 310/320 mg/day, a value which "guna" pap falls short of.

Similarly, the zinc content of "guna" pap exceeds that of "egusi" melon (1.2mg/100g) [20]. FAO/WHO recommends 4.3 – 17.5mg zinc, and the zinc content of "guna" pap surpasses this level, indicating that it is adequate for breastfeeding mothers (Table 6).

Table 6. Mineral Composition of *Guna* Pap (mg/100g)

Mineral	Values (mg/100g)*
Sodium (Na)	205.00±0.01
Magnesium (Mg)	80.00±0.07
Zinc (Zn)	47.50±7.07
Calcium (Ca)	30.00±0.07
Potassium (K)	2.25±0.07

*Values are means ± standard deviations of three trials.

Finally, Table 7 presents the concentrations of vitamin B1, B2, and B6 recorded in the "guna" pap. The vitamin B1 content in "guna" pap can exceed the required amount (1.4 - 1.5mg) recommended for breastfeeding mothers by FAO/WHO [5] if only 10ml is consumed by the mother. Similarly, the vitamin

B2 and B6 contents in "guna" pap can help meet the FAO/WHO recommended intake of 1.6mg and 2.0mg, respectively, for breastfeeding mothers by consuming only 10ml of the pap (Table 7).

Table 7. The Comparison of Vitamin B1, B2 and B6 of *Guna* pap and the Recommended Nutrient Intake for Breastfeeding Mothers

Nutrients*	Institute of Medicine	WHO/FAO	In This Study (mg/ml)
B1 (Thiamin)mg	1.4	1.5	0.2328
B2 (Riboflavin)mg	1.6	1.6	0.3112
B6 (Pyridoxine)mg	2.0	2.0	0.2364

*Source: Institute of Medicine (2011)

CONCLUSION

This study concludes that “*guna*” pap has high energy content and essential micronutrients, which appear to positively affect the weight gain of both breastfeeding mothers and their breastfed children when compared with those mothers who do not consume pap during the lactating period. As a result, it is highly recommended for breastfeeding mothers of all age groups and their children.

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CONFLICT OF INTEREST

The authors have declared no conflict of interest regarding this study.

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