

Research Article

Adequacy of Prenatal Care Utilization and its Effect on postpartum Infant Feeding Behaviors in Northern Ghana

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Submitted: 11 March 2016

Accepted: 20 April 2016

Published: 24 April 2016

ISSN: 2333-6706

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OPEN ACCESS

Keywords

- Postpartum
- Infant feeding index
- Adequate prenatal care utilization
- Nanumba north district
- Ghana

Abstract

Background: Prenatal care service is an important public health intervention in Ghana but its contribution to the adoption of healthy infant feeding behaviours remains unclear. This study was designed to assess the relationship between adequate prenatal care utilization and postpartum infant feeding behaviours.

Methods: We used a cross-sectional design on a sample of 384 postpartum mothers who had delivered a live baby within the past one year prior to the conduct of this study.

Results: Out of the 384 postpartum women interviewed 3.9 % (15) did not attend ANC during their last pregnancy. Of the 369 women who received antenatal care (ANC) services, only 36.9 % (136) initiated ANC during the first trimester of pregnancy. Of the 384 mothers, 69.3 % were considered to have practiced good infant feeding.

Bivariate analyses showed that a greater proportion of women who attended ANC at least four times delivered in a health institution, compared to women who attended ANC less than four times (84.1 % versus 57.9 %) [$\chi^2 = 20.9$, $p < 0.001$]. In logistic regression analysis, the main predictor of good infant feeding was delivery in a health institution. Women who delivered in health institutions were 16 times more likely of providing their infants with good feeding (AOR = 16.16, CI: 8.68 - 30.08), $p < 0.001$. This variable alone accounted for 30 % of the variance in good infant feeding behavior (Nagelkerke R Square = 0.32).

Conclusions: Evidence from this study suggests that there is a strong relationship between prenatal care service utilization and good postpartum infant feeding behavior. Effective focused ANC services may greatly enhance good infant feeding practices.

ABBREVIATIONS

ANC: Ante Natal Care; AOR: Adjusted Odds Ratio; APNCU: Adequacy of Prenatal Care Utilization Index; CFI: Child Feeding Index; CI: Confidence Interval; PNC: Post Natal Care; SBA: Skilled Birth Attendant; SDGs: Sustainable Development Goals; SES: Socio-Economic Status; SP: Sulphadoxine Pyremethamine

INTRODUCTION

Evidence from developing countries have shown that poor breastfeeding and complementary feeding practices are key risk factors of child growth retardation and nutritional deficiency [1] and this together with infectious diseases are major contributors to child mortality [2].

Furthermore, about a third of under-five deaths occur during the neonatal period in Sub-Saharan Africa, peaking at 32 deaths per 1,000 births as of 2012 [3]. This amply demonstrates the urgent need to address neonatal health and nutritional needs if progress is to be achieved in reducing overall child mortality.

In Ghana, neonatal mortality is estimated at 30 /1000 live births and accounts for 60 -70% of infant deaths and 30-40 % of under-five deaths [4]. One key target of Sustainable Development Goal Three (SDG3) is to “end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births by 2030” [5]. To achieve this target, it is important

for mothers to adopt essential newborn care practices such as exclusive breastfeeding, appropriate complementary feeding, environmental and personal hygiene, immunization and attending child welfare clinic.

Prenatal care known commonly as antenatal care (ANC) is one of the most recommended and highly cost effective interventions for promoting healthy behaviors and fostering child survival [6]. ANC has been defined as “care before birth”, and includes education, counseling, screening and treatment to monitor and to promote the well-being of the mother and baby [7]. The potential for ANC services utilization to promote the adoption of essential nutritional actions aimed at reducing neonatal and infant mortality is great [8,9]. Prenatal care services provide information that could improve infant care and nutrition [10] and therefore provide a window of opportunity to avoid many deaths and promote healthy behaviors for the neonate, particularly in developing countries [11-13]. About 6 % of under-five deaths can be prevented particularly in the developing world if optimal complementary feeding is ensured, thereby contributing towards the realization of the SDG3 [2,14,15].

Despite the wide spread use of prenatal care, the evidence for its effectiveness still remains inconclusive [16]. In particular, our knowledge is incomplete about the degree to which the timing, content and delivery of prenatal care are associated with postpartum care practices such as infant feeding behaviors. As government and partners are implementing public health interventions to improve child survival and growth, the need to evaluate such programmes is vital.

Adequate antenatal care (that is, initiation of ANC in the first trimester and making at least four ANC visits) during pregnancy is an important public health intervention in Ghana but its contribution to the adoption of healthy postpartum infant feeding behaviors remains unclear and therefore warrants further investigation. This study sought to investigate whether adequate prenatal care has an independent effect on feeding practices.

MATERIALS AND METHODS

Study Design, study Population and Sampling

The study was an analytical cross sectional study that was conducted in Nanumba North District of Northern Ghana from September to October 2015.

The study population comprised postpartum mothers who had delivered a live baby within the past 12 months prior to the conduct of the study.

The inclusion criterion was all postpartum mothers who sought postnatal care services and who gave their consent to participate. Women excluded from participation were those with psychiatric problems, deaf and or dumb.

The women were selected from two major health centers; Bimbilla hospital and Makayili health center in the District. In each centre, systematic random sampling was applied to extract the sample. The sampling frame was the list of women contained in the postnatal care (PNC) register. The mothers were arranged in a systematic order at each health centre and then selected at a sampling interval of two with the first selection being at random.

Sample Size Determination and sampling procedure

The sample size was calculated using the Cochran's formula

$$N = Z^2 pq / d^2$$

Where N= sample size

Z = Area under normal curve corresponding to the desired confidence level is 95% (1.96)

P= Population proportion of main outcome variable (which was unknown and so 50%=0.5 was considered)

$$q = 1 - p = 1 - 0.5 = 0.5$$

d= degree of accuracy desired (acceptable error margin) = 5 % (0.05)

$$\text{Therefore } N = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 = 384.16$$

Hence the target sample size was **384** postpartum mothers who have delivered live babies from 0-12 months.

Data Collection

Interviews were conducted using a structured questionnaire to obtain quantitative information including when the women made the first ANC visit, frequency of prenatal care attendance, where and from whom antenatal care was offered, what services were provided, parity, age, and educational level. Prior to data collection, field interviewers were trained carefully on the content of the questionnaire as well as in general interview skills. Five percent of randomly selected forms were re-interviewed by field supervisors to ensure reliability and validity of the information gathered.

Independent variables and Dependent variables

The main dependent variable that was measured in this study was infant feeding index. The independent variables that were measured in the study included timing, frequency and adequacy of prenatal care, a brief description of which is as follows:

Assessment of infant feeding Practices

The study participants were asked questions on the number hours or days after birth breastfeeding was initiated, colostrum feeding, prelacteal feeding, bottle feeding.

Good neonatal feeding practices was defined as if the child was currently breast feeding at the time of the study, initiated breastfeeding within the first one hour after birth, not being fed with prelacteals, fed with colostrum and avoidance of bottle-feeding. A composite infant feeding index was then created from these variables. The index was dichotomized to 'good' if all conditions were met or bad if one or more practices were missing.

Measurement of Prenatal Care Service Utilization Indicators

Prenatal care was assessed on the basis of number of ANC visits, timing of visits and content of services received. The adequacy of prenatal care was measured using the 'Adequacy of Prenatal Care Utilization Index' (APNCU) [17], modified according to the minimum four visits recommend by the World Health Organization (WHO) for developing countries. The WHO

recommends that for normal pregnancies, ANC should consist of at least four visits during the course of the pregnancy, the first of which should occur within the first trimester [18]. Consequently, ANC was considered adequate if the women started ANC within the first trimester and made at least four visits. A woman who initiated ANC later than the first trimester but made at least four visits was thus classified as having inadequate ANC.

The content of antenatal services was also assessed. The content of prenatal care was assessed using eight variables. These included the assessment of whether or not the following procedures were undertaken during the antenatal visits: measurement of blood pressure in the first, second and third trimesters (1 mark for each assessment), height and weight in the first trimester (1 score for each); samples of urine and blood taken (2 marks), tetanus toxoid (TT) injection given at least once (1 mark), woman attended at least three health and nutrition education sessions (1 score), sulphadoxine pyrimethamine (SP) taken in the presence of a health worker (1 score). Omission of a procedure was scored as zero. The maximum score was therefore ten. Scores in the range of 0-5 were classified as "poor content" and, of 6-10, as "good content".

Socio-economic and demographic factors

Socio-economic and demographic information was collected on mothers' age, marital status, parity and highest level of education attained by the mothers. Household wealth index was used as proxy measure of household socio-economic status (SES). The SES of the sampled households was calculated by considering specific variables such as: source of drinking water, toilet facility, flooring of the house, roofing, walls, and possessions of the household (electricity, bicycle, television, and radio). The household wealth index is a standardized asset-based score that is divided into quintiles [19].

Data Analysis

Data were checked for incompleteness, inconsistency at both field and office levels. The data were then entered, cleaned and analyzed by using SPSS software version 18.0. Standard statistical methods including Chi square test and t-test were used for comparisons between the two groups. Both bivariate analysis and multivariate regression models were used to study the statistical associations between the explanatory and outcome variables.

Some variables (e.g. age and parity, education, occupation, and economic status) might be strongly correlated and technically influence the results of regression analyses that include all available variables. Co linearity was checked to avoid highly correlated independent variables causing spurious results. For example, there was as expected a correlation between place of delivery and the presence of skilled birth attendant during delivery and so only place of delivery was included in the regression model.

Ethical Considerations

The study was also approved by the School of Allied Health Sciences. Personal information of the participants was encrypted and could be accessed only by researchers and data managers.

Written approval was obtained from the local health authorities in the study district. All participants were informed about the purpose of the study and their right to decline participation in the study and verbal consent was obtained from all participants. Data was analyzed and presented anonymously.

RESULTS

Socio-Demographic Characteristics of the Sample

The total number of participants was 384 and there were no refusals or drop outs and so the response rate was 100 %. Out of the 384 respondents that were interviewed, majority 65.4% were Muslims, while few 14.3 % were traditionalist. Majority 303 (78.9 %) of the mothers fell between the ages of 20 and 34 years. About 32.8 % of the respondents were farmers. Table 1 shows the socio-demographic characteristics of the respondents.

Utilization of Prenatal Care

Out of the 384 postpartum women interviewed 3.9 % (15) did not attend ANC during their last pregnancy. Of the 369 women who attended ANC, only 36.9 % (136) initiated ANC during the first trimester of pregnancy. The majority of the ANC attendees 85.2 % (327) made at least four prenatal visits but 34.6 % received adequate ANC care. Table 2 shows the timing, frequency and adequacy of uptake of ANC services.

Content and Quality of ANC Services

The content of ANC is important in assessing the quality of prenatal care services and so women were asked whether specific services including taking of weight and height, measurement of blood pressure, and taking blood or urine samples were carried out for them. For example, 199 (53.9 %) of mothers recalled they received health education sessions at least four times on possible danger signs/complications of pregnancy issues, 491 (95.0 %) had their urine tested whilst 310 (84.0 %) were given tetanus toxoid injection.

A composite index comprising ten of these essential services (Table 3) received during ANC was created by assigning a score of 1 for having received a particular service and zero for not receiving the service. The total score for each woman was then categorized as low (< 7) or high (≥ 7). The bivariate cross tabulation of this ANC content and infant feeding index (IFI) shows low ANC content is a risk factor for poor feeding practices. The prevalence of good infant feeding practices among women who were classified as high ANC content was significantly higher compared to women who received low ANC content (74.4 % versus 61.9 %) (Chi-squared = 4.9, $p = 0.03$). Similarly, women who attended ANC less than 4 times were less likely to practice good infant feeding (50.9 % versus 72.5 %) (Chi-squared = 10.6, $p = 0.001$).

Determinants of Infant Feeding Practices

A composite index of good infant feeding practices comprising breast feeding status, initiating breastfeeding within the first one hour after birth, giving no prelacteal, feeding the child with colostrum and avoidance of bottle-feeding was developed. This composite variable was then dichotomized to good (all practices present) or bad (one or more practices missing). Of the 384

Table 1: Socio-demographic characteristics of respondents.

Characteristic	Frequency (n)	Percent (%)
Age of mother (years)		
Less than 20	23	6.0
20-34	303	78.9
≥35	58	15.1
Total	384	100.0
Age of child (months)		
0-5 months	201	52.3
6-8 months	86	22.4
9-11	54	14.1
12-23	43	11.2
Total	384	100.0
Religious background		
Islam	251	65.4
Christianity	78	20.3
Traditionalist	65	14.3
Total	384	100
Marital Status		
Single	29	7.6
Married	354	92.2
Divorced	1	0.3
Total	384	100
Educational background		
None	232	60.4
Primary	38	9.9
JHS	73	19.0
SHS/O' level	22	5.7
Tertiary	19	4.9
Total	384	100
Occupation		
Farmer	126	32.8
Trader	130	33.9
Teacher	15	3.9
None	79	20.6
Seamstress	18	4.7
Hairdresser	4	1.0
Nurse	1	0.3
Health extension worker	6	1.6
Civil servant	2	0.5
student	3	0.8
Total	384	100

mothers, 69.3 % were considered to have practiced adequate neonatal feeding. A bivariate cross tabulation analysis was run to determine whether ANC content, frequency of ANC attendance, place of delivery, presence of special birth attendant and maternal age was associated with good neonatal feeding practice (Table 4).

In logistic regression analysis, the independent predictors of good infant feeding were delivery in a health institution and adequacy of ANC. Potential confounding variables considered in the present analysis included content of ANC services, frequency of ANC visits, place of delivery, presence of special birth attendant and maternal age. Women who delivered in health institution were 16 times more likely of giving good infant feeding to their

babies (AOR = 16.16, CI: 8.68 - 30.08), $p < 0.001$. This variable alone accounted for 30 % of the variance in good infant feeding behavior (Nagelkerke R Square = 0.32). Women who received adequate ANC were 1.8 times more likely of providing adequate infant feeding (AOR = 1.85, CI: 1.03 - 3.30), $p = 0.04$ (Table 5).

DISCUSSION

This study aims primarily to describe the effect of adequate utilization of ANC care services on postnatal infant feeding practices in the Nanumba North District. Almost all previous studies conducted on this subject measured ANC utilization using a single component indicator of ANC, mainly with a focus on the number and timing of first ANC visits. The novelty of the present study lies in the fact that adequacy of ANC was quantified

Table 2: Timing and frequency of ANC attendance.

Factor	Frequency (n)	Percent (%)
Timing of first ANC visit		
First Trimester	136	36.9
Second Trimester	217	58.8
Third Trimester	16	4.3
Total	369	100.0
Frequency of ANC Visits		
0-3 visits	57	14.8
At least 4 visits	327	85.2
Total	384	100.0
Adequacy of ANC attendance		
Yes	133	34.6
No	251	65.4
Total	384	100.0

Table 3: Content of ANC services that were given to pregnant women (N = 369).

Content of ANC given	Frequency (n)	Percentage (%)
Weight Measured (at least 2 times)	366	99.2
Height measured at first ANC visit	363	98.4
Blood pressure checked (3 Times)	365	98.9
Laboratory examination of urine samples at least once	225	61.0
Laboratory examinations of blood samples at least once	296	80.2
Health education given at ANC (At least 4 times)	199	53.9
Tetanus injections received (at least once)	310	84.0
Iron supplements given monthly	47	12.7
Malaria prophylaxis with SP (at least two doses)	285	77.2
Fundal height measurement	351	95.1

Table 4: Predictors of good neonatal feeding (Bivariate analysis).

Variable	N	Good infant feeding?		Test statistic
		No n (%)	Yes n (%)	
Age (years)				
Under 20 years	23	11 (47.8)	12 (52.2)	Chi-square (χ^2) = 6.6, p = 0.037
20-34 years	303	84 (27.7)	219 (72.3)	
At least 35 years	58	23(39.7)	35 (60.3)	
Total	384	118 (30.7)	266 (69.3)	
Presence of skilled birth attendant (SBA)				
No	77	61 (79.2)	16 (20.8)	$\chi^2 = 105.1$, p < 0.001
Yes	304	57 (18.8)	247 (81.3)	
Place of delivery				
Hospital	308	58 (18.8)	250 (81.2)	$\chi^2 = 103.1$, p < 0.001
Home	76	60 (78.9)	16 (21.1)	
Frequency of ANC visits				
0-3	57	28 (49.1)	29 (50.9)	$\chi^2 = 10.6$, p = 0.001
≥ 4	327	90 (27.5)	237 (72.5)	
ANC Content				
Low	84	32 (38.1)	52 (61.9)	$\chi^2 = 4.9$, p = 0.026
High	285	73 (25.6)	212 (74.4)	
Adequacy of ANC				
No	90	44 (48.9)	46 (51.1)	$\chi^2 = 18.2$, p < 0.001
Yes	294	74 (25.2)	220 (74.8)	

Table 5: Predictors of adequate/good infant feeding practices (Multivariate analysis).

	Wald	Sig.	Exp(β)	95% C.I. for EXP(B)	
				Lower	Upper
Adequate ANC	4.25	0.04	1.85	1.03	3.30
Institutional delivery	68.87	<0.001	14.36	7.65	26.94
Constant	24.44	0.000	0.19		

using a composite index comprising both the timely initiation and frequency of ANC. Studies that have measured overall ANC adequacy using combined indicators are rare [20-22]. Furthermore, a composite index of infant feeding practices was used to measure infant feeding behavior.

Utilization of ANC Services among Postnatal Mothers

The results from our study showed that 96 % of postpartum women interviewed attended ANC at least once during their last pregnancy and more than 85.0 % of attendees made at least four prenatal visits. However, less than 40 % initiated ANC during the first trimester of pregnancy. The high ANC coverage level may be due to the increase education and sensitization of the importance of ANC in the District. The findings are consistent with similar studies undertaken by other researchers in Ghana and elsewhere where by majority of women initiate ANC visits after trimester (12 weeks) [23-26]. In our study we also found out that, majority of the ANC attendees made atleast four prenatal visits. This results also agree with that of Collen and colleagues which shows

that women in develop countries typically attend regular ANC visits, usually 7-11 times per pregnancy [27].

The study also assessed the adequacy of ANC attendance among the respondents and found that; majority (65.4%) had inadequate antenatal care. This high proportion of women not meeting adequate antenatal care attendance criteria was mainly due to late initiation of ANC. A similar study conducted in Vietnam also found out that adequacy of ANC was particularly low in the rural areas at 15.2 % [28].

Relationship between Adequacy of ANC and Infant Feeding Behaviours

Many studies have been conducted to find the association between prenatal care utilization and infant feeding practices. Most of these studies however, concentrated on some components of maternal health care utilization (e.g., timing of antenatal care visit, number of antenatal visits) and infant feeding practices such as clostrum feeding, breastfeeding initiation, prelacteal feeding and continued breastfeeding.

This has made strict comparisons between these studies

a bit difficult due to the varying ways adequate antenatal care utilization was quantified and the outcome measures used.

In the present study composite indices were used to measure antenatal care utilization and the outcome measure. Good infant feeding was quantified as a composite index which comprised breast feeding at the time of the study, initiated breastfeeding within the first one hour after birth, not being fed with prelacteals, fed with colostrum and avoidance of bottle-feeding. This composite variable was then dichotomized to good if all practices were present or bad if one or more practices missing. These composite indices used in this study give a better reflection of antenatal service utilization and infant feeding practices because assessing the situation using single practice indicators could be misleading.

Multiple logistic regression analyses showed that the main determinants of good infant feeding were woman delivering in a health institution and adequate ANC utilization. Women who delivered in health institutions were 16 times more likely of providing good infant feeding to their babies and this variable alone accounted for 30 % of the variance in good infant feeding behavior. The association was even stronger among women who had inadequate ANC, where institutional delivery accounted for 58 % of the variance in adequate infant feeding behavior.

Similar findings had been reported from Ghana, Ethiopia and south India where mothers who had given birth at health institution were more likely initiate breast feeding and complementary food timely than mothers who had gave birth at home [29-31]. The fact that health facility delivery was a strong predictor of infant feeding could be attributed to the education on feeding practices given to women who delivered in health facilities,

In Ethiopia, a cross-sectional study in the Raya Kobo District found that mothers who delivered at home were seven times more likely to offer prelacteal feeds compared to those who had institutional deliveries [32].

Similarly, in Bangladesh women who delivered in clinics had lower odds of prelacteal feeding compared to home deliveries after adjusting for socio-demographic variables [33].

Evidence from this study shows that, adequate ANC utilization is an independent contributory factor to good infant feeding practices. The findings of an earlier study conducted in Northern Ghana where the present was conducted showed that good neonatal feeding practices were commonly adopted among women who initiated ANC early. In that study, women who initiated ANC early in the first trimester were two times more likely of giving good neonatal feeding to their babies, compared to women who initiated their first ANC late [34].

Studies conducted in India have established similar relationship between maternal health service use and newborn care practices [35,36]. This finding is also consistent with that of Nielsen et al., [37] who reported that women who attended antenatal clinic four to six times were more likely to feed their newborn infants with colostrum as compared to women who attended none or had three visits. There is a greater chance of providing adequate infant feeding practice among the postnatal

mothers who have achieved adequate ANC because such women would have received more health and nutrition education on baby care [3]

A study from rural China that explored infant care practices and their relation to prenatal care utilization reported significant associations between the timing of antenatal care initiation and some infant care practices [11]. The same study showed that participants with no antenatal care visits were more likely to introduce infant formula to their offspring when they were less than four months old.

In Bangladesh, findings from a study found that ANC attendance protected infants from being fed prelacteal foods [33] and evidence from Nepal suggests that more than three antenatal care visits were associated with higher odds of breastfeeding within an hour after birth [38]. Other studies in Nepal, India and Sri Lanka have reported of similar findings were inadequate antenatal care was associated with inappropriate complementary feeding [39-41].

On the contrary, results of some other studies showed no significant relationship between adequate ANC attendance and infant feeding practices [42-44]. Using data from the 2008 Ghana Demographic and Health Survey (GDHS), it was shown that infant feeding practices were partly determined by maternal health care utilization during pregnancy [31]. In particular, women with non-institutional delivery were less likely to initiate breastfeeding ≤ 1 hour after birth. However, the timing of ANC and number of ANC visits were not significantly associated with breastfeeding initiation ≤ 1 hour after birth. There was also no significant difference in the timing of ANC visits and prelacteal feeding.

The impact of adequate ANC service utilization on proper infant feeding practices has been studied but these have focused on single outcome indicators such as clostrum feeding, timely initiation of breast feeding, appropriate complementary feeding and avoidance prelacteal and bottle feeding [42,45].

CONCLUSION AND RECOMMENDATION

The prevalence of adequate infant feeding was 69.3 % and the main determinants were women delivering in a health institutions and the provision of adequate ANC service. Evidence from this study suggests that there is a relationship between adequate prenatal care utilization and good postpartum child feeding behaviour. Effective focused ANC services may therefore greatly enhance good infant feeding.

LIMITATIONS OF THE STUDY

Data collection was through face to face interviews and cannot be without recall bias from the participants. Furthermore, since it was facility based study, the findings may not be generalized. The study design was also cross sectional and so cause and effect relationship could not be established. So a cohort study design is recommended to establish the cause and effect relationship between adequate ANC and infant feeding practice.

POLICY IMPLICATIONS OF THE STUDY

Despite the above-mentioned limitations, our study has obtained important information about antenatal care and infant feeding practices. This information may be useful in planning

public health interventions to change bad infant feeding behaviors.

AUTHORS' CONTRIBUTIONS

MS, KE and IF conceived the study, participated in its design and contributed significantly to the acquisition of data. MS and KE did the analysis and interpretation of data and were deeply involved in drafting the manuscript and revising it critically for important intellectual content. All the authors read and approved the final draft.

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Cite this article

Saaka M, Emmanuel K, Farruza I (2016) Adequacy of Prenatal Care Utilization and its Effect on postpartum Infant Feeding Behaviors in Northern Ghana. *J Hum Nutr Food Sci* 4(2): 1082.