

Estimating the rate and determinants of exclusive breastfeeding practices among rural mothers in Southern Ghana.

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Abstract

Background: The health benefits of exclusive breastfeeding practices in both short and long term go beyond the breastfed infant. The benefits of exclusive breastfeeding practices accrue to mothers, families and the society at large. Despite the evidence of these benefits and adoption of various WHO strategies on promotion of exclusive breastfeeding by Ghana, the increase in the rate of exclusive breastfeeding has been very slow in the country. This study aimed to estimate the rate and investigate socioeconomic and demographic determinants of exclusive breastfeeding in two rural districts in Southern Ghana.

Methods: Pregnancy, childbirth, breastfeeding, demographic and socioeconomic information of 1,870 women prospectively registered by the Dodowa Health and Demographic Surveillance System and gave birth between January 1, 2011 and December 31, 2013 was extracted. The rate of exclusive breastfeeding among the study participants was estimated and the relationship between the dependent and the independent variables were explored using logistics regression model at 95% confidence level. All data analyses were done in STATA version 14.2.

Results: The overall exclusive breastfeeding rate in the study is 70.96 %. Mothers aged 25-29 and 30+ years are 93 and 91 % respectively more likely to practice exclusive breastfeeding compared to those aged <20 years (OR:1.93, 95%CI: 1.25-2.99, OR: 1.91, 95%CI: 1.91-3.08). The odds of artisans practicing exclusive breast feeding is 64% less likely compared to those unemployed (OR: 0.64, 95%CI:0.43-0.96). There is a high chance that 45% of mothers with a household size of more than five members to practice exclusive breastfeeding compared to those with household size of less than six (OR:1.45, 95%CI:1.16-1.81). There is reduced odds of 15% for women in fishing districts compared to those from farming districts (OR:0.15, 95%CI: 0.12 -0.20).

Conclusion: There is high rate of exclusive breastfeeding in the study area. Maternal age, type of occupation, household size and district of residence are determinants of exclusive breastfeeding among the study participants.

Key words: Exclusive Breastfeeding, Child Health, Demographic Surveillance, Dodowa, Ghana

Background

The association between child health and development outcomes with appropriate breastfeeding practices such as early initiation at birth, exclusive breastfeeding during the first six months of life, and breastfeeding for at least two years has been established [1, 2]. A baby's diet during the first few months of life has a significant role on the composition and stability of the gut microbiome that is only acquired after birth [3]. These bacteria make digestion of solids easier, thus, preventing gut problems and illnesses at later stage of life [3]. The World Health Organization (WHO) endorsed exclusive breastfeeding as an optimal way to feed infants [4]. Exclusive breastfeeding is defined by WHO as feeding an infant exclusively with breast milk for the first six months of life. During this period, the infant is allowed to take drops of vitamins, minerals and Oral Rehydration Solution, if prescribed [4].

The health benefits of exclusive breastfeeding practices in both short and long term go beyond the breastfed infant. The benefits of exclusive breastfeeding practices accrue to mothers, families and the society at large [5]. Early suckling enhances the release of prolactin, which helps in the production of milk, and oxytocin, which causes the ejection of milk through the let-down reflex [5]. It also causes contraction of the uterus after childbirth, constricting blood vessels and thereby lessening the likelihood of postpartum hemorrhage [5]. An enhanced breastfeeding practice is known to have reduced child morbidity and mortality, improved quality of life, and enriched human capital [1, 2]. Children who are breastfed correctly for a longer period are known to have a reduced risk of allergies, bowel problems, obesity and diabetes later in adult life, have reduced risk of dental malocclusion, and have higher acumen (children and adolescents) than those who are breastfed for shorter period [2, 6]. Breastfeeding is also associated with positive maternal outcomes such as reduced risk of breast and ovarian cancer, diabetes, and increased birth spacing. It also nurtures mother to child attraction which strengthens the bond between mothers and their babies. In countries where child survival and growth are often endangered by infectious diseases and malnutrition, the benefits of enhanced breastfeeding practices cannot be over emphasized [7-10]. Exclusive breastfeeding is known to subdue the mother's return to fertility. These effects are influenced by both the duration and regularity of breastfeeding and the age at which the child receives foods and liquids to complement breast milk [5].

Exclusive breastfeeding practices are influenced by multiple factors. These include health, psychosocial, cultural, social, and economic factors [11, 12]. Studies have shown that the decisions

regarding exclusive breastfeeding in low-income countries are influenced by education, employment, place of delivery, family pressure, and cultural values [13-16].

Other studies have shown that mixed feeding is associated with increased diarrhea and pneumonia/respiratory diseases in children [17-21]. Infants who were not exclusively breastfed have a 165% higher risk of suffering from diarrhea and 107% higher risk of pneumonia than children who were exclusively breastfed [18, 21]. Worldwide, mixed feeding is attributed to cause the death of 823,000 children under five years of age and 20,000 deaths due to breast cancer in women each year [2].

Despite the evidence on benefits of exclusive breastfeeding, in 2016 only 43% of infants were exclusively breastfed globally [22]. The rate is lower (37%) in low and middle income countries [2]. Despite high child mortality and malnutrition in Sub Saharan Africa (SSA), only 36% of the infants were exclusively breastfed in 2016 [8, 22, 23].

Although Ghana adopted various WHO strategies to promote exclusive breastfeeding, there has been a slow increase in the rates of exclusive breastfeeding in the country. The 2011 Ghana Multiple Indicator Cluster Survey (MICS) in 2011 reported that less than half (46%) of all infants aged 0–6 months in Ghana were exclusively breastfed [24]. This level is lower than that recommended by WHO/UNICEF.

In Ghana, fifty-two percent of children younger than 6 months were exclusively breastfed in 2014 [5]. According to the 2014 Ghana Demographic and Health Survey (GDHS) the percentage of children 0-5 months who were exclusively breastfed has decreased by 17 percent between 2008 and 2014 [5]. The percentage of children who were bottle fed appears to have increased over the past decade. In 2003 and 2014, 11% and 16% of children under 6 months, respectively, were bottled fed [5]. The 2014 GDHS shows that the country still faces the challenges of high infant mortality of 41 deaths per 1,000 live births and 19% of children were stunted ascribable to malnutrition and infections [5].

Using an open cohort longitudinal population-based dataset, we estimated the rate of exclusive breastfeeding examined socioeconomic and demographic factors influencing exclusive breastfeeding practices in two rural districts in Southern Ghana.

Methods

Study area and data source

This study was conducted in the Shai-Osudoku and Ningo-Prampram districts of the Greater Accra Region of Ghana. The two districts cover a total population of 115,754 individuals living in 380 communities in 23,647 households [25]. A comprehensive description of the study districts and the operations of Dodowa Health and Demographic Surveillance System (DHDSS) can be found elsewhere [26-28]. Health service delivery in the study districts is provided by government hospitals, health centres, clinics, Community-based Health and Planning Services (CHPS) compounds/zones, missions and non-governmental health facilities [25, 26]. Secondary longitudinal population-based data was extracted from the database of the DHDSS. The extracted data was exported to STATA version 14.2 for cleaning, coding and analysis.

Study population

All women resident in the two study districts who were registered in the DHDSS and gave birth between January 1, 2011 and December 31, 2013 were included in the study. Women who were not registered in the DHDSS and those who delivered before 1 January 2011 or after 31 December 2013 were excluded from the study. A total of 1,870 mothers were included.

Variables

Dependent variable

The dependent variable is breastfeeding and it was coded as 1 for exclusive breastfeeding and 0 if otherwise. Exclusive breastfeeding in this study is defined as feeding infants with only breast milk, without supplemental liquids or solids except for liquid medicine and vitamin or mineral supplements for the first six months of life [5]. This is based on UNICEF and WHO recommendation [29].

Independent variables

The independent variables included are maternal age, educational level, marital status, parity, timing of ANC visit, place of delivery, educational level of household head, district of residence and socio-economic status.

The socio-economic status is estimated using weights derived from principal component analysis (PCA) through household social status, ownership of assets, availability of utilities among others [25, 26]. Household socioeconomic status is a proxy measure of a household's long term standard

of living [26]. The proxies from the PCA were divided into five quintiles; poorest, poorer, middle, richer and richest [25, 26].

Statistical methods

A descriptive analysis of socio-demographic characteristics of the participants was carried out. The rate of exclusive breastfeeding among the study participants was estimated and the relationship between the dependent and the independent variables were explored using logistics regression model. The independent variables that were significant at $p < 0.05$ in the crude logistics regression model were entered together into an adjusted model. All data analysis were done using Stata version 14.2 and the results were presented in tables with summary statistics at 95% confidence intervals (CI).

Results

Socio-Demographic Information

Table 1 presents the socio-demographic information of study participants. The mean age was 27.89 years (SD=7.15).

Participants aged <20 years formed the smallest percentage of the study participants (12.35%), while the 30+ age group contributed the highest percentage (39.14%) followed by the 25-29 and the 20-24 years' groups which accounted for 25.85% and 22.67 % respectively. Majority of the study participants (72.78%) were of the Ga-Dangme ethnic group and 15.35% were Ewes. A large proportion (91.23%) of the participants were of the Christian faith while 6.36% and 1.50% were Moslem and Traditionalist respectively.

A total of 31.76 % of the participants were petty traders, 20.75 % and 16.42 % were unemployed and farmers respectively. Students formed 15.45 % of the study participants. Participants with no formal education and Junior high school level contributed 37.06 % and 35.08 % respectively.

A significant percentage of the study participants (47.86%) were cohabiting with their partners. More than half (60.96%) of the participants' households were headed by males. The mean household size is 6.45 with a standard deviation of 4.33.

Most of the study participants (55.29%) resided in the Ningo-Prampram District.

Participants with parity 3 or more formed 29.25 % of the study population while those with parity 1 and 2 were 27.81, and 22.94 % respectively.

A large percentage of 71.23 of study participants delivered in a health facility. More than half (64.03%) of the study participants initiated antenatal clinic visit in the second trimester of their last pregnancy.

The overall exclusive breastfeeding rate during the study period was 70.96 %.

Table 1: Socio-demographic characteristics of the study participants

Characteristics	Frequency*	Proportion (%)
Age group		
< 20	231	12.35
20-24	424	22.67
25-29	483	25.83
30+	732	39.14
Mean=27.89 (sd=7.15)		
Ethnicity		
Ga-Dangme	1,361	72.78
Akan	102	5.45
Ewe	287	15.35
Northern	106	5.67
Other tribes	14	0.75
Religion		
Christianity	1,706	91.23
Islamic	119	6.36
Traditional	28	1.5
Other religions	17	0.91
Occupation		
Unemployed	388	20.75
Farmer	307	16.42
Artisan	219	11.71
Trader	594	31.76
Civil servant	33	1.76

Student	289	15.45
Others	40	2.14
Level of education		
No education	693	37.06
Primary	284	15.19
Junior high school level	656	35.08
Senior high school level and above	237	12.67
Marital status		
Single	543	29.46
Married	382	20.73
Separated/divorced	36	1.9
Cohabiting	882	47.86
Sex of household head		
Female	730	39.04
Male	1,140	60.96
Household size		
Less than six	956	51.12
More than five	914	48.88
Mean=6.45 (sd=4.33)		
District of Residence		
Shai-Osudoku	836	44.71
Ningo-Prampram	1,034	55.29
Parity		
Parity 1	520	27.81
Parity 2	429	22.94
Parity 3	374	20.00
Parity3+	547	29.25
Delivery place		
Health facility	1,332	71.23
Outside health facility	538	28.77
Timing of ANC initiation		

First trimester	525	28.1
Second trimester	1,196	64.03
Third trimester	147	7.89
Breastfeeding type		
Not exclusive	543	29.04
Exclusive	1,327	70.96
Exclusive breastfeeding rate	70.96%	

n = 1870; *SD* = Standard Deviation ^a number of respondents across some categories may not add up to 1870 due to missing data

Unadjusted and adjusted odds ratio of determinants of exclusive breastfeeding

Table 2 presents the unadjusted and adjusted Odds Ratio (OR) at 95% Confidence Interval (CI) of socioeconomic and demographic determinants of exclusive breastfeeding in the Dodowa Health and Demographic Surveillance site.

In the unadjusted model, maternal age, occupation, place of delivery, parity, household size and sex of household head had statistically significant associations with exclusive breastfeeding.

The odds of mothers aged 20-24 practicing exclusive breastfeeding is 24% more likely compared to those aged <20 years (OR: 1.24, 95%CI: 0.89-1.74). Women aged 25-29 and 30+ years are 53% and 75% more likely to practice exclusive breastfeeding respectively compared to those aged <20 years (OR: 1.53, 95%CI: 1.10-2.13, OR: 1.75, 95%CI: 1.28-2.40). This is statistically significant.

A similar pattern is observed in the adjusted model such that in the presence of other explanatory variables, the odds of mothers practicing exclusive breastfeeding increased with increasing maternal age. Mothers aged 20-24 years were 46% more like to practice exclusive breastfeeding compared to those aged <20 years (OR: 1.46, 95%CI: 0.98-2.15). The odds of mothers aged 25-29 and 30+ years are 93 and 91 % respectively more likely to practice exclusive breastfeeding compared to those aged <20 years (OR:1.93, 95%CI: 1.25-2.99, OR: 1.91, 95%CI: 1.91-3.08). This is statistically significant.

Mothers who were married were 22% more likely to practice exclusive breastfeeding compared to those who were single (OR: 1.22, 95%CI: 0.91-1.63). Participants who were separated/divorced and cohabiting have a reduced odds of 83% and 94% respectively of practicing exclusive breastfeeding compared to those who were single (OR: 0.83, 95%CI: 0.40-1.70, OR:0.94, 95%CI: 0.74-1.19).

The results further revealed that, the odds of a mother practicing exclusive breast feeding is 81% less likely associated with a mother with primary level of education compared to those with no education (OR:0.81, 95%CI: 0.62-1.05). Again, the odds of women with Junior and senior level of school practicing exclusive breastfeeding is 3% and 8% (respectively) more likely compared to those with no education (OR: 1.03, 95%CI: 0.79-1.34, OR:1.08, 95%CI:0.73-1.61).

Table 2: Unadjusted and adjusted odds ratios of factors of exclusive breastfeeding.

Characteristics	crude		adjusted**	
	OR (95%CI)	P-values	OR(95%CI)	P-values
Age group				
< 20	1.00		1.00	
20-24	1.24(0.89-1.74)	0.205	1.46(0.98-2.15)	0.060
25-29	1.53(1.10-2.13) *	0.012	1.93(1.25-2.99) *	0.003
30+	1.75(1.28-2.40) *	<0.001	1.91(1.91-3.08) *	0.007
Marital status				
Single	1.00			
Married	1.22(0.91-1.63)	0.193		
Separated/divorced	0.83(0.40-1.70)	0.606		
Cohabiting	0.94(0.74-1.19)	0.595		
Education				
No education	1.00			
Primary	0.81(0.62-1.05)	0.110		
Junior school level	1.03(0.79-1.34)	0.844		
SHS and above	1.08(0.73-1.61)	0.694		
Occupation				
Unemployed	1.00		1.00	
Farmer	1.77(1.23-2.55) *	0.002	1.24(0.82-1.87)	0.296
Artisan	0.70(0.49-1.00) *	0.049	0.64(0.43-0.96) *	0.032
Trader	0.91(0.69-1.21)	0.512	1.04(0.76-1.43)	0.805
Civil servant	0.91(0.42-1.97)	0.812	0.66(0.28-1.58)	0.350
Student	0.82(0.59-1.14)	0.242	1.04(0.71-1.53)	0.838

Others	0.73(0.37-1.46)	0.379	0.89(0.42-1.85)	0.750
Delivery place				
Health facility	1.00		1.00	
Outside health facility	1.51(1.20-1.90) *	<0.001	1.13(0.87-1.46)	0.367
Parity				
Parity 1	1.00		1.00	
Parity 2	0.91(0.79-1.36)	0.793	0.91(0.66-1.26)	0.593
Parity 3	1.17(0.88-1.56)	0.285	0.95(0.66-1.38)	0.802
Parity 3+	1.56(1.19-2.04) *	0.001	1.12(0.75-1.66)	0.585
Household size				
Less than six	1.00		1.00	
More than five	1.33(1.09-1.63) *	0.005	1.45(1.16-1.81) *	0.001
Socio economic status				
Poorest	1.00			
Poorer	1.04(0.76-1.43)	0.809		
Poor	1.09(0.79-1.49)	0.611		
Less poor	1.02(0.75-1.40)	0.891		
Least poor	0.95(0.69-1.30)	0.749		
Timing of ANC				
First trimester	1.00			
Second trimester	1.16(0.93-1.45)	0.184		
Third trimester	1.27(0.84-1.91)	0.254		
Sex of household head				
Female	1.00		1.00	
Male	1.44(1.18-1.77) *	<0.001	1.19(0.95-1.49)	0.124
District of Residence				
Shai-Osudoku	1.00		1.00	
Ningo-Prampram	1.16(0.12-0.21) *	<0.001	0.15(0.12-0.20) *	<0.001

CI: Confidence Interval. OR: Odd Ratio, *statistically significant. ** Correct classification rate of the model = 72.78 %

There was a statistically significant association between occupation and women practicing exclusive breastfeeding. The odds of a farmer practicing exclusive breastfeeding is 77% more

likely compared to those unemployed (OR: 1.77, 95%CI: 1.23-2.55). Women artisans were 70% less likely to practice exclusive breastfeeding compared to those unemployed (OR: 0.70, 95%CI: 0.49-1.00). Mothers who were traders, civil servants and students were 91%, 91% and 82% respectively less likely to practice exclusive breastfeeding compared to those unemployed (OR:0.91, 95%CI:0.69-1.21, OR:0.91, 95%CI:0.42-1.97, OR: 0.82, 95%CI: 0.59-1.14). In the adjusted model, farmers, traders and students are 24%, 4% and 4% more likely to feed their babies exclusively with breast milk compared to women unemployed (OR: 1.24, 95%CI: 0.82-1.87, OR: 1.04, 95%CI: 0.76-1.43, OR:1.04, 95%CI: 0.71-1.53). The odds of female artisans and civil servants to practice exclusive breast feeding is less likely compared to those unemployed (OR: 0.64, 95%CI:0.43-0.96, OR:0.66, 95%CI:0.28-1.58).

In the unadjusted model, the place of delivery was significantly associated with mothers practicing exclusive breastfeeding such that, the odds of women who delivered outside health facility to practice exclusive breastfeeding is 51% more likely compared to those who delivered in a health facility (OR:1.51, 95%CI: 1.20-1.90). This association was not statistically significant (OR:1.13, 95%CI: 0.87-1.46) in the adjusted model.

In the crude model, the odds of women with parities 2 to practice exclusive breastfeeding compared to those with parity 1 was 0.91 (OR: 0.91, 95%CI: 0.79-1.36). There was an increased odds of 17% and 56% of mothers with parities 3 and more (OR: 1.17, 95%CI: 0.88-1.56, OR:1.56, 95%CI: 1.19-2.04). In the presence of other variables (Age, Occupation, Place of delivery, Household size, Sex of household head and District of residence), while there was reduced odds of 91% and 95% of women with parities 2 and 3 respectively to practice exclusive breastfeeding (OR:0.91, 95%CI:0.66-1.26, OR:0.95, 95%CI:0.66-1.38), there was increased odds of 12% for mothers with parity more than 3 (OR:1.12, 95%CI: 0.75-1.66) in the adjusted model.

There is an increased odds of 33% and 45% in the crude and adjusted model respective of mothers with household size more than five members to practice exclusive breastfeeding compared to those with household size of less than six (OR: 1.33, 95%CI:1.09-1.63, OR:1.45, 95%CI:1.16-1.81). This was also statistically significant.

In the crude analysis, participants who belong to poorer, poor and less poor socioeconomic categories were 4%, 9% and 2% respectively more likely to practice exclusive breastfeeding compared to those in poorest category.

There was increased odds of 16% and 27% for participants who initiated antenatal visit in the second and third trimesters respectively to practice exclusive breastfeeding compared to those who initiated theirs in the first trimester (OR: 1.16, 95%CI:0.93-1.45, OR:1.27, 95%CI:0.84-1.91). The crude analysis showed a significant association of women whose households were headed by males being 44% more likely to practice exclusive breastfeeding compared to those in female headed households (OR: 1.44, 95%CI: 1.18-1.77).

The district of residence of participant is statistically significantly associated with practicing exclusive breastfeeding; there was an increased odds of 16% for women from Ningo-Prampram district compared to those from Shai-Osudoku district in the unadjusted analysis. The odds ratio rather reduced with the adjusted model to 0.15 ((OR:1.16, 95%CI: 0.12-0.21, unadjusted) (OR:0.15, 95%CI: 0.12-0.20, adjusted)). This is statistically significant.

Discussion.

The aim of this study was to estimate the rate and examine socioeconomic and demographic determinants of exclusive breastfeeding in two rural districts (Ningo-Prampram and Shai-Osudoku Districts) of Southern Ghana.

The exclusive breastfeeding rate among the study participants in this study is 70.96%. This rate is higher than 52% reported by 2014 GDHS [5] but lower than 84.3% report by another Ghanaian study [30].

Maternal age, type of occupation, household size and district of residence appear to be strong determinants of exclusive breastfeeding practices after adjusting for other variables.

Older women were more likely to practice exclusive breastfeeding compared to younger mothers. This result is consistent with studies in other settings which showed that, younger mothers are at an increased risk of early cessation of exclusive breastfeeding[31-35]. Our finding is also similar to a study conducted in Tanzania where participants who were younger were less likely to practice exclusive breastfeeding [36].

Although maternal level of education and socioeconomic status were found elsewhere to be significantly associated with breastfeeding practices in other studies [37], the current study has not found a statistically significant association between maternal education, socioeconomic status and exclusive breastfeeding.

This supports the finding of an earlier study [38] which suggested that educational attainment of mothers was not associated with exclusive breastfeeding. Nonetheless, the finding of this current study contradicts the results of studies in Nigeria [39, 40], Tanzania [36], India [41, 42], Brazil [38] and in Ghana [24] which reported that the level of educational attainment of mothers was positively associated with exclusive breastfeeding practice. Due to the education provided to pregnant women at highly patronized antenatal care (87%) [5], the issue of exclusive breastfeeding has become a universal knowledge hence it is not preserved for only educated women in the study area.

The high rate of exclusive breastfeeding among the study participants can also be attributed to education from Reproductive and Child Health (RCH) Centers of the Ghana Health Service in the study area where pregnant women receive antenatal care services with education on breastfeeding practices as shown in other study [30].

The findings show that, mothers who are self-employed artisans are more likely to practice exclusive breastfeeding. This finding is in line with earlier studies that found self-employed mothers to be more likely to practice exclusive breastfeeding [43]. This study found that mothers whose households were headed by males were more likely to practice exclusive breastfeeding but this relationship is not statistically significant after adjusting for other explanatory variables. This result is similar to the findings of other studies in Ghana [43] and Malawi [44] where the decision of exclusive breastfeeding is influenced by spouses and family members.

The relationship between household size and exclusive breastfeeding as found in this study has also been established in another study [45]. Mothers with family size of 4 and less were more likely to practice exclusive breastfeeding as compared those with family size above 4 [45].

It was also very intriguing to find that the district of residence is significantly associated with exclusive breastfeeding practice among the study participants. Women from Ningo-Prampram District are 15% less likely to practice exclusive breast feeding compared to those from Shai-Osudoku District. This can be ascribed to the introduction of pregnancy schools in health facilities in Shai-Osudoku District where expectant mothers are educated on how to handle themselves and their babies and the importance of exclusive breastfeeding among others. The effective RCH in Shai-Osudoku District where pregnant women receive antenatal care services with education on breastfeeding practices could be another contributing factor to the high likelihood of exclusive breast feeding practice in the Shai-Osudoku District.

Strength and limitations of the study

Despite the advantage of large sample and use of population based data, this study has a number of limitations. First, the outcome was measured based on self-report; recall bias may have been underestimated or overestimated the association between the outcome of interest and the explanation variables. Social desirability bias could also be a limitation to the study as some women might have withheld what they thought to be negative aspects of their breastfeeding practices. The study did not explore other factors such as knowledge, initiation, duration and cultural determinants of exclusive breastfeeding which might have some influence on the outcome of interest. This is primarily due to the limited information in the secondary data used. The study was also limited to only two districts in the Greater Accra Region of Ghana hence, limits the generalizability of the findings.

Conclusions

Majority of the study participants practiced exclusive breastfeeding. Maternal age, type of occupation, household size and district of residence are strong determinants of exclusive breastfeeding practices.

Maintaining access to information on appropriate breastfeeding practices and promotion of exclusive breastfeeding especially among young mothers in the study area is highly recommended. To further understand other factors influencing the practice of exclusive breastfeeding and to design a suitable evidence-based intervention targeting young mothers, we recommend further qualitative study in this area.

Abbreviations

ANC: Antenatal Care; CI: Confidence Intervals; DHDSS: Dodowa Health and Demographic Surveillance System; DHRC: Dodowa Health Research Centre; GDHS: Ghana Demographic Health Survey; JHS: Junior High school; OR: Odd Ratio; PCA: Principal component analysis; RCH: Reproductive and Child Health; WHO: World Health Organization

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Availability of data and materials

All relevant data supporting the conclusions of this article are included within the article.

Authors' contributions

AKM conceptualized, designed, conducted data extraction and the statistical analysis for the study. He also led the drafting of the paper. AA, RAE and DEA contributed to the initial design of the study, literature review and drafting of the paper. JW and MG refined the study design and critically reviewed the paper. All authors read and approved the manuscript.

Consent to participate and Ethics approval

At the beginning of each data collection round, Dodowa Health Research Centre sought verbal consent from household heads and all individual participants as shown in earlier studies [25, 26]. The Ethical Committee of Ghana Health Service and the Institutional Review Board of Dodowa Health Research Centre approved the operations, data collection procedure and quality assurance of the DHDSS [25, 26]. The management of Dodowa Health Research Centre sanctioned the use of data for this study on a condition that the participants' identity remains anonymous.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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