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Factors affecting birth interval among mothers in Dabat district, Amhara Regional state, Northwest Ethiopia: A community-based cross-sectional study, 2022

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ABSTRACT

Introduction: Birth interval is the time period from live birth to a successive pregnancy or successive live birth which is the recommended to be at least 2 years or at least 33 months respectively. Both short and long birth intervals are associated with poor health outcomes for both mothers and babies. Therefore, the main objective of this study is to assess the length of birth intervals and its predictors among reproductive-age women in Dabat district.

Methods: community-based cross-sectional survey conducted from December 10/2020 to January 10/2021. This study was done on 1262 multi para women. Five days training was given for the data collectors and supervisors. Bivariable and multivariable ordinal logistic regression analysis were done. Those variables which had *P*-value less than 0.25 in the bi variable analysis were entered to multivariable ordinal logistic regression analysis. An adjusted odds ratio with a 95% confidence interval and *P*-value less than 0.05 was used to determine significant determinants of birth interval.

Result: This study revealed that the magnitude of short and long birth interval was 30.59% and 22.82% respectively. Wealth status (poor: AOR = 0.72, CI: 0.53, 0.97), maternal education

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(Diploma and above: AOR = 2.79, CI: 1.18, 6.56), ANC follow up (having ante natal care: AOR = 2.15, CI: 1.72, 2.69), husband occupation (Employed: AOR = 1.77, CI: 1.03, 3.01) and history of abortion (abortion: AOR = 2.48, CI: 1.08, 5.66) were statistically significant factors.
Conclusion: Higher percentage of mothers have either short or long birth interval. Birth interval is affected by socio demographic characteristics of mothers and husbands.

1. Introduction

World Health Organization (WHO) stated that birth interval is the time period from live birth to a successive pregnancy or from live birth to a successive live birth which is the recommended to be at least 2 years or 33 months respectively [1]. Birth interval can be classified as short, optimum and long. Short birth interval is when the inter birth interval is less than 2 years or birth to pregnancy interval is less than 33 months [2], and long birth interval is when the interval is above 5 years [3] in which both have undesired effects on maternal and child health.

A short birth interval is responsible for the huge number of maternal and perinatal mortality in low-and middle-income countries [4]. Both short and long birth intervals are associated with poor health outcomes for both mothers and babies [5,6]. For example it is associated with poor pregnancy outcomes such as low birth weight, intra-Uterine growth restriction (IUGR), prenatal death, ante partum hemorrhage (APH), neonatal, infant and under five child mortality as well as maternal mortality [6–9]. It has also financial burden, mental, and psychological consequences to the mothers and the family as a whole [10]. Adequate birth intervals on the other hand help women recover from macro- and micronutrient depletion which occurs during pregnancy and lactation [7]. This therefore helps to improve subsequent pregnancies and child health.

As it is evidenced by many literatures birth interval is highly affected by variety of demographic and socio economic characteristics of women such as household wealth status [11,12], residence [11–13], maternal education [14,15], husband education [12,16], contraceptive use [12,17,18], media exposure [19], women health care decision making autonomy [20], religion [10,13,21], maternal occupation [11], breastfeeding duration [21], parity [10,13], and maternal age [22].

The Ethiopian Federal Ministry of Health recommends birth spacing at intervals of 3–5 years as a strategy to promote maternal and child health to reduce maternal, perinatal, and infant mortality by optimizing the fertility rate in the country [23].

Even though, optimal birth spacing is highly associated with to better health outcomes for both mothers and their babies [24], more than half of women in Ethiopia have shorter birth intervals [11]. There is limited evidence on the proportions of birth intervals and factors associated with it in the study area. As the outcome variable is ordinal in nature (short, optimal and long), the current study used ordinal logistic regression model. Therefore, the main objective of this study is to determine the proportion of birth interval (short, optimum and long) and to identify its predictors among reproductive-age women in Dabat district. The finding from this study would help program managers, policy makers and health care practitioners to work on the identified factors to optimize birth spacing.

2. Method

2.1. Study design, study area and study period

This is cross sectional study conducted in Dabat district using a project data. The project was a community-based cross-sectional survey conducted from December 10/2020 to January 10/2021 GC in Dabat district. Dabat district is located in the south Gondar zone which is about 76 km way from Gondar town to the North. According to the Dabat woreda health office report, the projected estimate of the population in the district was 189,944 in 2020/2021 GC [25]. There was a total of 44,789 reproductive age women, 25,718 under-five children, and 6401 infants. The Dabat woreda has a total of 36 Kebeles (smallest administrative units in Ethiopia) of which 31 are rural. In the district, there are 6 health centers and 29 health posts [25]. The Dabat demographic and health survey (DHS) is one of the six Health and Demographic Surveillance Systems in Ethiopia. The DHSS consists of 13 Kebeles (9 rural and 4 urban).

2.2. Data collection tools and procedures

This study used data from the DHSS. The DHSS used a structured and pretested questionnaire to collect the data. The questionnaire was developed in English from related literature and translated to Amharic, the local language of the area, and then translated back to English for consistency and analysis. The data were collected through face-to-face interviews of mothers. Supervisors and enumerators from the research center were recruited and to ensure data quality, five-day training was given for Supervisors and enumerators about the study objectives and oriented on the content of the questionnaire and procedure before fieldwork.

2.3. Source and study population

The source population was all women in Dabat woreda who gave birth within two years before the survey. The study population was all women in Dabat demographic and Health Survey sites who gave birth within two years before the survey and who were available in their home during the survey.

2.4. Exclusion criteria

During the project work, women who gave still birth within the last two years and who gave live birth but not alive during the survey were excluded from this study. For this specific study, mothers who gave birth for one child were excluded.

2.5. Sample size and sampling technique

The sample size was initially determined using single population proportion formula considering antenatal care coverage, facility delivery, and post natal care (PNC) utilization from the 2016 Ethiopian Demographic and Health Survey report. In the report, the proportion of ante natal care (ANC), and facility delivery in Amhara Region were 67% and 27% respectively and 17% national level PNC utilization within 48 h [26]. Considering the standard normal distribution, the Z-score at 95% confidence level (1.94), power of 80% and 4%, 3%, and 2% margin of error for ANC, delivery, and PNC services utilization respectively, and 5% non-response rate, the sample size was calculated as follows.

Sample size using proportion of ANC (67%)

$$N = \frac{(Z@/2)^2 * P(1-P)}{d^2}$$

$= (1.94)^2*0.67*0.33/(0.04)^2$
$= 0.8494/0.0016 = 531.$
5% non response rate $= 531*.05 = 26.55.$
$N = 531 + 26.55 = 557.55 = 558.$
Sample size using facility delivery (27%)

$$N = \frac{(Z@/2)^2 * P(1-P)}{d^2}$$

$= (1.94)^2*0.27*0.73/(0.03)^2$
$= 0.742/0.0009 = 824.$
5% non response rate $= 824*0.05 = 41.$
$N = 824 + 41 = 865.$
Sample size using PNC utilization (17%)

$$N = \frac{(Z@/2)^2 * P(1-P)}{d^2}$$

$= (1.94)^2*0.17*0.83/(0.02)^2$
$= 0.53104/0.0004 = 1327.$
5% non response rate $= 1327*0.05 = 66.$
$N = 1327 + 66 = 1393.$

The largest sample size (1393) was considered as a final sample size. However, the total two years extended postpartum women were around the estimated number (1423 post partum women). Hence all women who gave birth within two years before the survey were included (i.e. Census was applied) during the project. But we exclude 161 primi para (mothers who gave birth for only on child). Therefore the final sample size for the current study was 1262 multi para women.

2.6. Sampling procedure

The Dabat Demographic and Health Survey sites (DHSS) are determined by University of Gondar, Institute of Public Health from Dabat district representing each agro-ecological zones of the district. DHSS consists of 13 Kebeles (9 rural and 4 urban). This study applied a census method to identify and select eligible study participants.

2.7. Study variables

2.7.1. Dependent variable

Birth Interval: It is the interval between two successive deliveries and it is measured in months. According to the (WHO recommendation, there should be at least 33 months between two consecutive live births. Inter-birth interval of <33 months is considered a short birth interval, between 33 and 59 months is considered the optimum birth interval and greater than 59 months is long birth interval [27]. It was tri_chotomized as Short birth interval, optimum birth interval and long birth interval using the above recommendation.

2.7.2. Independent variables

Socio-demographic characteristics of the mothers (age, residency, wealth status educational status, occupational, husband occupation and husband education), obstetric and health service-related characteristics of the mother (parity, ANC follow up, unmet need

for family planning, duration of exclusive breast feeding, history of abortion, and history of still birth) were considered as independent variables for this study.

2.7.3. Data management and analysis

We used Stata software for data management and analysis. Descriptive analysis was performed to see the frequency and proportion of dependent and socio-demographic variables. Bivariable and multivariable ordinal logistic regression analysis were done to check the presence of an association between dependent and independent variables. Those variables which had *P*-value less than 0.25 in the bi variable analysis were entered to multivariable ordinal logistic regression analysis. In multivariable ordinal logistic regression analysis, variables with *P*-value less than 0.05 were considered significant. An adjusted odds ratio with a 95% confidence interval was used to determine significant association.

3. Results

3.1. Socio demographic characteristics

Three hundred sixty four (28.84%) mothers were between 30 and 34 years old. Majority of the mothers (65.13%) were rural residents. About 98% of mothers were married. Seven hundred eighty eight (62.44%) mothers and more than half (57.13%) of husbands had no formal education. Nearly 87% of mothers were house wife. More than three fourth (76.47%) of husbands were farmers and nearly 41% of mothers were from poor household **(Table 1).**

3.2. Obstetrical characteristics of mothers

Out of 1, 262 study participants, 1115 (88.35%) of them are multipara. More than half of mothers (56.81%) had ante natal care (ANC) follow up. When we see duration of exclusive breast feeding, 873 (69.18%) of mothers had it for less six months. Only 1.9% and

Table 1
Socio demographic characteristics of Mothers in Dabat demographic and health survey site (DHSS), 2022.

Variables	Categories	Frequency (%)
Maternal Age	15–19	2 (0.16)
	20–24	108 (8.56)
	25–29	363 (28.76)
	30–34	364 (28.84)
	35–39	307 (24.33)
	40–44	85 (6.74)
	45–49	33 (2.61)
Husbands age	≤29	61 (4.83)
	30–34	255 (20.21)
	35–39	323 (25.59)
	40–44	324 (25.67)
	≥45	299 (23.69)
Residence	Urban	440 (34.87)
	Rural	822 (65.13)
Marital status	Married	1231 (97.54)
	Divorced	22 (1.74)
	Widowed	9 (0.71)
Wealth status	Poor	510 (40.41)
	Middle	255 (20.21)
	Rich	497 (39.38)
Maternal Education	No formal education	788 (62.44)
	Primary education	249 (19.73)
	Secondary education	132 (10.46)
	Diploma and above	93 (7.37)
Husband education	No formal education	721 (57.13)
	Primary education	310 (24.56)
	Secondary education	132 (10.46)
	Diploma and above	99 (7.84)
Maternal Occupation	Housewife	1095 (86.77)
	Farmer	13 (1.03)
	Merchant	24 (1.90)
	Employed	92 (7.29)
	Other**	38 (3.01)
Husband occupation	Farmer	965 (76.47)
	Merchant	46 (3.65)
	Employed	152 (12.04)
	Others**	99 (7.84)

Other** = daily laborer and private vocational work.

2.46% of mothers had history of abortion and still birth respectively. Nearly sixty percent (57.77%) of mothers have unmet need for family planning **(Table 2).**

3.3. Birth interval

This study revealed that the magnitude of short inter birth interval was 30.59%. About 46.59% of mothers had optimum inter birth interval and 22.82% of mothers had long inter birth interval.

3.4. Factors associated with birth interval

Five variables (Wealth status, maternal education, ANC follow up, history of abortion and husband occupation) were statistically significant factors which would affect the inter birth interval. For mothers who were from poor household, the odds of having longer birth interval (optimum and long interval versus short interval) was reduced by 28% **(poor: AOR = .72, CI: 0.53, 0.97**) compared to mothers from rich household. For mothers who had educated to diploma and above, the odds of having longer birth interval (optimum and long interval versus short interval) was 2.79 (**Diploma and above: AOR = 2.79, CI: 1.18, 6.56)** times that of the mothers who didn't attend formal education. For mothers who had ANC follow up, the odds of having longer birth interval (optimum and long interval versus short interval) was 2.15 (**having ANC: AOR = 2.15, CI: 1.72, 2.69**) times that of the mothers who didn't have ANC follow up. For mothers whose husband was employed, the odds of having longer birth interval (optimum and long interval versus short interval) was 1.77 (**Employed: AOR = 1.77, CI: 1.03, 3.01**) times that of the mothers whose husband was farmer. For mothers who had history of abortion, the odds of having longer birth interval (optimum and long interval versus short interval) were 2.48 **(abortion: AOR = 2.48, CI: 1.08, 5.66**) times that of the mothers who had no history of abortion (Table 3).

4. Discussion

The main purpose of this study was to assess birth intervals and its determinants among women of reproductive age in Dabat district. As a result, about 30.60% of mothers had short birth interval (SBI) (95% CI: 28.10, 33.20). This finding was much lower than findings from Uganda (52.4%) [28], north west Ethiopia (43.4%) [12] and rural India (51%) [29]. This magnitude was also higher than findings from northern Ethiopia (23.3%) [30] and Tanzania (22%). In this study we have also assessed the duration of long birth interval and it revealed that about 23% of mothers had long birth interval (95% CI: 20.58, 25.22). This finding was higher than findings from rural India (13%) [29] and lower than finding from Zimbabwe (27.0%) [31]. Generally more than halve of mothers in this study had unfavorable birth spacing (Both SBI and long birth interval) which in turn increases the risk of adverse pregnancy and delivery consequences.

This study also assessed predictors of birth interval. Of those factors wealth status was one. Mothers from poor house hold are more likely to have short birth interval. This finding was consistent with findings from rural India [29], Saudi Arabia [32], Northern Ethiopia [33] and Southern Ethiopia [11]. This may be due to the fact that mothers from rich household had enough money and had greater access to health care information's such as postnatal consultations about healthy timing and spacing of pregnancy, family planning techniques for keeping adequate birth interval and afford health care services and materials. On the contrary, the poorer mothers are more likely to be less educated and unemployed which intern affects the accessibility and affordability of health care services [29].

Maternal education is also another predictor of birth interval. Mothers who are educated to higher level had higher odds of longer birth interval. This evidence was supported by findings from Pakistan [34], India [35], Saudi Arabia [36], Ethiopia [19] and Democratic republic of Congo [37]. This could be due to the fact that women who are more educated are more knowledgeable about family planning programmes, have higher chance of using birth controllers such as modern family planning methods and limit their reproductive years as well as their number of children [38].

This study also identified husband occupation as important determinant of birth interval. It revealed that, mother whose husband had employed have higher odds of longer birth interval than mothers who had farmer husband. This evidence is supported by findings

Table 2
Obstetric and health service-related characteristics of Mothers in Dabat demographic and health survey site (DHSS), 2022.

Variables	Categories	Frequency (%)
Parity	Multipara	1115 (88.35)
	Grand Multipara	147 (11.65)
ANC	Yes	717 (56.81)
	No	545 (43.19)
Unmet need for family planning	Yes	729 (57.77)
	No	533 (42.23)
Duration of exclusive breast feeding	<six month	873 (69.18)
	>=six month	389 (30.82)
History Abortion	Yes	24 (1.90)
	No	1238 (98.10)
History of still birth	Yes	31 (2.46)
	No	1231 (97.54)

Table 3
Bi variable and multi variable ordinal logistic regression result.

Variables	Categories	COR (95% CI)	AOR (95% CI)
Residence	Urban	2.00 (1.60, 2.49)	1.27 (.97, 1.65)
	Rural	1	1
Marital status	Married	1	1
	Divorced	2.26 (1.01, 5.05)	2.47 (.98, 6.21)
	Widowed	1.24 (.38, 4.08)	.76 (.25, 2.27)
Wealth status	Poor	.49 (.39,.61)	**.72 (.53, .97)**
	Middle	.53 (.40, .69)	.80 (.60, 1.07)
	Rich	1	1
Maternal Education	No formal education	1	1
	Primary education	1.48 (1.13,1.94)	1.08 (.80,1.44)
	Secondary education	2.14 (1.50, 3.05)	1.19 (.77,1.84)
	Diploma and above	3.90 (2.59,5.88)	**2.79 (1.18,6.56)***
Husband education	No formal education	1	1
	Primary education	1.29 (1.01, 1.66)	1.03 (.79, 1.32)
	Secondary education	2.29 (1.61, 3.26)	1.13 (.73, 1.74)
	Diploma and above	2.94 (1.96, 4.39)	.97 (.53, 1.75)
Maternal Occupation	Housewife	1	1
	Farmer	.46 (.16, 1.36)	. 35 (.10, 1.02)
	Merchant	3.20 (1.51, 6.74)	1.48 (.73, 3.01)
	Employed	2.76 (1.85, 4.10)	.85 (.44, 1.64)
	Other**	2.57 (1.39, 4.73)	1.02 (.50, 2.08)
Husband Occupation	Farmer	1	1
	Merchant	1.91 (1.11, 3.27)	1.14 (.61, 2.13)
	Employed	3.46 (2.55, 4.69)	**1.87 (1.03, 3.38)***
	Other**	2.58 (1.76, 3.78)	1.59 (.98, 2.59)
Parity	Multipara	1	1
	Grand Multipara	.69 (.50, .96)	.93 (.69, 1.26)
ANC	Yes	2.56 (2.07, 3.18)	**2.15 (1.72, 2.69)****
	No	1	1
Unmet need for family planning	No	1	1
	Yes	.82 (.67, .99)	1.03 (.81,1.32)
Duration Exclusive breast feeding	<six month	1	1
	>=six month	.63 (.51, .79)	1.04 (.83, 1.31)
History Abortion	Yes	2.73 (1.27, 5.94)	**2.48 (1.08, 5.66)***
	No	1	1
History of still birth	Yes	1.57 (.81, 3.02)	.99 (.51, 1.90)
	No	1	1

Bold: significant variables.
Other** = daily laborer and private vocational work.
* = significant at p value < 0.05.
** = significant at p value < 0.001.

from Saudi Arabia [32] and Ethiopia [18,39] which revealed that mothers who had influential husbands have longer birth interval. This can be explained by the fact that employed husbands are educated and those husbands can influence on the spacing of their children and may support contraceptive use as well as other interventions which promote adequate birth intervals.

Another important predictor of birth interval was ANC follow up. Mothers who had ANC follow up had higher odds of longer birth interval. This finding is in agreement with evidences generated from South Gondar, Ethiopia [40] and Farta woreda [41] which showed that, Women who had a history of ANC follow-up were more likely to have longer birth interval practice than women who didn't have ANC follow-up. This might be due to the fact that, mothers get adequate information about adverse pregnancy outcomes of short birth interval and family planning use during ANC counseling by health care providers.

5. Conclusion

Optimal inter birth interval has significant role in reducing fertility and maternal and child mortality. However, Only 46.59% of mothers have optimum duration of birth interval. Higher percentage of mothers have either short or long birth interval. Birth interval is affected by socio demographic characteristics of mothers and husbands. Wealth status, women's education, husband occupation, ANC follow up and abortion history were the significant predictors of birth interval. Therefore, the Ethiopian Ministry of Health together with the ministry of education and other stakeholders should strengthen the existing strategies of providing information, education, and communication focusing on women and their husbands to advance their awareness on the importance of ANC follow up and optimal birth spacing. Policy makers should also design new strategies to empower women on their education and economic status.

6. Strength and limitations of the study

This study employed census method of sampling technique and it uses sufficient sample size. So it can be inferred to any other area which has similar socio demographic characteristics. It also used ordinal logistic regression model to account the three levels of birth interval (short, optimum and long). On the other hand, we used secondary source of data and some important variables such as socio cultural variables were missed.

Ethical approval and consent to participate

This study was reviewed and approved by Ethical review board of the University of Gondar (reference number O/V/P/RCS/05/473/2015). Their name and other forms of personal identification were not recorded into the data collection format to maintain confidentiality.

Consent for publication

Not applicable.

Availability of data and materials

All relevant data used for this analysis are from the corresponding author.

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Author contribution statement

Abebaw Addis Gelagay, Abebaw Gebeyehu Worku, Debrework Tesgera Bashah, Nigusie Birhan Tebeje, Mignote Hailu Gebrie, Hedija Yenus Yeshita, Endeshaw Adimasu Cherkose, and Birhanu Abera Ayana conceived and designed the study; performed the study.

Ayenew Molla Lakew: Desale Bihonegn Asmamaw, Wubshet Debebe Negash, Tadele Biresaw Belachew, and Elsa Awoke Fentie: Contributed analysis tools and analyzed and interpreted the data.

Desalegn Anmut Bitew - Contributed analysis tools, analyzed and interpreted the data; and wrote the manuscript.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors have declared that no competing interests exist.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e17046.

Abbreviations

ANC	Ante natal care
AOR	Adjusted Odds ratio
CI	Confidence Interval
COR	Crude Odds Ratio
DHSS	Dabat demographic and health survey site (DHSS)
PNC	post natal care

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