

Determinants of Preterm Birth in Kembata Tembaro Zone Public Hospitals, Southern Ethiopia, 2019

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Abstract

Background: Preterm birth is a birth that occurs before 37 weeks of gestational age since the first day of a woman's last menstrual period. In Ethiopia, 10% of babies born preterm each year. Preterm birth is the major cause of neonatal deaths next to pneumonia and it is a substantial cause of long-term problems in survivors. The objective of the study was to identify key determinants of preterm birth in Kembata Tembaro, Southern Ethiopia, 2019.

Method: Institutional unmatched case-control study design was employed on 310 mothers who gave full-term births as control and 104 mothers with preterm births as cases from October 1, 2018, to February 1, 2019. The study participants were selected using a consecutive sampling method. SPSS version 20 was used to analyze the data.

Result: A total of 104 (25.1%) cases and 310 (74.9%) controls were included in the analysis with a 100% response rate. Factors such as rural resident, AOR =2.7; 95% CI [1.3, 5.6], uneducated, AOR= 2.6; 95% CI [1.3, 5.2], ANC visits <4 times, AOR =5.5; 95% CI [2.1, 14.3], substance abuse, AOR =3.5; 95% CI [1.1, 10.5], MUAC <23cm, AOR= 7.2; 95%CI [3.3, 15.7], pregnancy-induced hypertension, AOR =8.9; 95%CI[1.2, 69], history of abortion, AOR =11.1; 95%CI[1.2, 105], FCS ≤21.4, AOR =20.7; 95%CI[10, 42.2], and low birth weight, AOR= 20.2; 95%CI[10.5, 39] were identified as significant determinants of preterm birth.

Conclusion: Education level, rural residence, Poor antenatal care visits, substance abuse, pregnancy-induced hypertension, and history of abortion are the key factors associated with pre-term birth. Community awareness and mobilization should be strengthened through extension programs. Emphasis should be given to strengthening efforts on the availability of basic health services and promoting education on nutrition during pregnancy, especially in rural areas. Further study is recommended regarding the effect of maternal nutrition on preterm birth using a prospective study design.

Introduction

Preterm birth is any birth before 37 completed weeks of gestation or fewer than 259 days since the first day of the woman's last menstrual period ¹. Preterm babies are premature and their organs and systems may not be completely mature or functional, not completely ready for the outside world. Because of this, these "preemies" face an increased immediate and long term health risk². Infants born preterm are known to have a certain added risk of death, disease, disability, as well as longer term motor, cognitive, visual, hearing, behavioural, social, emotional, health, and growth problems compared to normal term infants. The underlying causes of preterm delivery were multiple and poorly understood. It might also include individual level behavioural and psychosocial factors, neighbourhood characteristics, environmental exposures, medical conditions, infertility treatments, biological factors, and genetics³. Preterm is classified as extremely preterm (<28 weeks), very preterm (28 to <32 weeks), and moderate to late preterm (32 to <37 weeks). Likewise, it can be also being categorized on the basis of birth weight as

neonates less than 2500g are classified as low birth weight (LBW), <1500g very low birth weight (VLBW) and <1000g extremely low birth weight (ELBW) ⁴.

Maternal nutrition during pregnancy plays an important role in providing the necessary nutrients for fetal growth. An imbalance in maternal nutrition might be a key factor for preterm birth. Maternal nutrients such as iron and zinc might be associated with low birth weight and preterm birth. However, maternal dietary nutrients, as the main source of nutrition for both mothers and fetus, have been studied less in relation to their association with preterm birth⁵. Micronutrient deficiencies during pregnancy had been shown to have serious implications on the developing fetus ⁶.

Small for gestational age was associated with Pre-pregnancy weight status which is risk for under-weight, over-weight or obesity, short stature, iron, folic acid, Vitamin A and Vitamin D deficiency, nutrition related diseases like hypertension, diabetic mellitus and anaemia⁷. The impact of preterm births falls into short term problems especially in the first few weeks of life such as breathing problems due to under-developed lungs, apnea from respiratory distress syndrome and lung infections are all common, particularly in babies born before 34 weeks¹.

The magnitude of preterm babies was generally the highest in low and increasing in some high income countries such as 11.9% in Africa and 10.6% in North America respectively ⁷. According to national, regional and worldwide estimates of preterm birth rates in the year 2010, Ethiopia ranked as 95th (10.1%) for preterm birth rate, 11th (263,400) for number of preterm birth and 7th (7.8%) for death due to complication of preterm birth⁸. Preterm birth is the leading cause of infant morbidity and mortality throughout the world. It has also considerable health, social, psychological and economic consequences^{9,10}.

Currently, prematurity had been noted to be the commonest cause of under-five mortality worldwide; well above pneumonia and malaria. Furthermore, the earlier in gestation that PTB occurs, the greater the risks of adverse outcomes; however, infants born late preterm (35-36 weeks gestation) still have considerably higher morbidity and mortality compared to their term counterparts ¹¹. Even if, globally several efforts were made on preterm birth prevention, diagnosis, and management as a smart strategy to accelerate achievement of the global goal to end all preventable new-born and child deaths by 2030, neonatal death reduction rate was still low ¹.

Currently, Ethiopia had made impressive progress through achieving many of the national and global health indicators as a result of strong leadership of the Federal Ministry of Health (FMOH), by coordination of efforts and intensive investment in the health system by the government, partners and the community at large¹². The country also achieved MDG 4 target in 2012 three years ahead of 2015 by reducing under-five mortality by two thirds from 1990 level. Whilst celebrating the achievements made through successful implementation of the National Child Survival Strategy (2005 – 2015), Federal ministry of health recognizes that the current under-five and neonatal mortality rates of 64 and 29 per 1,000 live births, respectively, was unacceptably high.

The ministry also acknowledges that neonatal mortality rate was disproportionately high accounting to 44% of under-five deaths. In addition, neonatal and under-five mortality rates were varying across income, gender, and geographical areas. Cognizant of this, Ethiopia had envisioned ending all preventable new born and child deaths by 2035; especially by improving access for quality, basic and comprehensive emergency obstetric and new born care services and Invest in “LINC factor” (lifestyle, infection, nutrition and contraception) programs, integrate preterm birth prevention with other strategies and by fund and report on research to identify and manage risk factors ¹².

Based on, 2016 SNNPR health Bureau annual report, the prevalence of preterm birth was 2.8% of which 1.2% died in their early infant life regionally and 3.5% of preterm birth in Kembata Tembaro Zone which was slightly high as compared to other zones of preterm birth prevalence. Based on the preliminary assessment prior to this study in the zone, majority of women were from rural place of residence, had poor educational status and poor ante natal care follow up. Even if, there was neonatal intensive care unit in two the hospitals providing strong and quality service, much emphasis was given to reduction of under-five and neonatal death as a whole rather than focus on cause and factors of preterm birth. There was also no study about this problem impact in this study area population previously since it was now days the leading cause of under-five death.

The issue of addressing preterm birth is crucial for accelerating progress towards Universal Sustainable Development Goal four ¹³¹⁴. Different reasons were contributing for the deaths of preterm neonate. From which varieties of medical disorders which were diagnosed earlier and missed to be diagnosed were the major causes for this death. So, identifying common factors associated with preterm births in this study might serves as alarm and supporter for the readiness of health facilities so as to make appropriate diagnoses and evaluation of the causes of preterm births and their deaths. Therefore, the aim of this study was to identify determinants of preterm birth in Kembata Tembaro Zone, Southern Ethiopia.

Methods

Study Site

The study was conducted in Kembata Tembaro Zone which is located 357kms south of Addis Ababa, the capital of Ethiopia. During the study period, there were about 31,103 pregnant mothers residing in the zone. There were several health service facilities, including: 1 general hospital, 3 primary hospitals, 31 health canters and 136 health posts. Among the hospitals, only Shenshecho primary and Durame general hospitals have standardized neonatal intensive care unit.

Study Design

Institution based unmatched case control study design was conducted from October 1, 2018 to February1, 2019. Controls represent women who gave live full term births, i.e., births of babies with at least 37weeks and less than 43 weeks of gestational age during this study period in Shenshecho primary and Durame general hospitals in Kembata Tembaro Zone. Whereas the cases represent mothers who

gave live preterm neonates, i.e., births of babies' less than 37 and above 24 weeks of gestational age in the selected hospitals during the study period based on the following criteria (Julie-Anne Quinn, 2016).

The following criteria was used for identifying controls and cases irrespective of mode of delivery; Gestational age of neonates which was determined by LNMP, review of medical records for fundal height or ultra-sound of mothers in second trimester who gave live births were assigned as mothers who gave full term births or controls with pregnancy duration of ≥ 37 weeks and less than 43 weeks irrespective of the neonates weight and as mothers who gave preterm births or cases with pregnancy duration of 25 to less than 37 weeks¹⁵¹⁶.

Small or Large for gestational age with pregnancy duration of 25 to less than 37 weeks were also assigned as mothers who gave preterm births or cases¹⁷. Mothers who were referred to the selected hospitals for this study from nearby hospitals, health centres and health posts and gave live births during the study period assigned as cases and controls corresponding to their location based on the above criteria.

Source Population

All mothers who gave live births during the data collection period in Kembata Tembaro Zone, public hospitals having neonatal intensive care unit in Southern Ethiopia was considered as source population for both case and controls.

Study population

All selected mothers who gave live births during the data collection period at Shenshecho primary and Durame general hospitals were considered as a study population for both case and control.

Inclusion and Exclusion Criteria

Exclusion criteria:

- Mothers who gave live births during the data collection period but referred to other health institution for better service
- Mothers who had postpartum psychosis, unable to hearing and speaking that gave live births during the data collection period
- Mothers who gave more than one live births at a time or multiple pregnancy

Sample size determination

Sample size was estimated based on a previous finding of AOR of 2.22 and 17% of controls exposed for previous history of abortion (p) which were used to assess factors associated with preterm birth¹⁸. So that by using 95% CI, 80% power, 1:3 case to control ratio, and Epi info version 7, a total of 394 mothers who gave live births with 99 cases and 295 controls were calculated as a minimum sample size required

for the study. Finally, by considering 5% of non-response rate, the optimum sample size calculated was 414 mothers with 104 cases and 310 controls (Table 1).

Table 1: Sample size calculation of the study conducted in Kembata Tembaro Zone, Southern Ethiopia

| S/ N | Risk factors For PTB | | Preterm % | Full term % | Confidenc e level (CL) | Study power | Case to Control ratio | AOR | Cases | Controls | Total |
|---------|-------------------------|------------|--------------|----------------|------------------------------|----------------|--------------------------|-------|-------|----------|-------|
| 1 | Substance abuse | Yes | 23(40.3) | 42(27.8) | 95% | 80 | 1:3 | 0.282 | 59 | 176 | 235 |
| | | No | 34(59.7) | 109(72.2) | | | | | | | |
| 2 | MUAC | <24 cm | 12(17) | 43(9) | 95% | 80 | 1:3 | 2.67 | 98 | 292 | 390 |
| | | >=24 cm | 58(83) | 435(91) | | | | | | | |
| 3 | History of abortion | Yes | 21(25) | 80(17) | 95% | 80 | 1:3 | 2.22 | 99 | 295 | 394 |
| | | No | 64(75) | 398(83) | | | | | | | |
| 4 | Residence | Rural | 31(54) | 64(42) | 95% | 80 | 1:3 | 2.281 | 69 | 207 | 276 |
| | | Urban | 26(46) | 87(58) | | | | | | | |
| 5 | Education | Illiterate | 28(49) | 44(29.1) | 95% | 80 | 1:3 | 0.169 | 37 | 111 | 148 |
| | | Literate | 29(51) | 107(70.9) | | | | | | | |

Sampling Method

Durame General and Shenshecho Primary Hospitals which had the neonatal intensive care unit were purposively selected. Based on total live births of the hospitals over the past four months from review of delivery registry book we allocated the sample size for both selected hospitals by proportional allocation based on number of births in each hospital. Then, mothers who gave live preterm births (cases) and mothers who gave live full term births (controls) were included in the study, three controls for one case were consecutively included till the desired sample size of each hospital was attained. Total mothers who had live births over four months in both hospitals were 1312 of which 864 were in Durame General and 448 in Shenshecho Primary Hospitals (Figure 1).

Data Collectors

Data was collected by trained BSc nurses who were fluent speakers of Amharic language. They were given training on methods of data collection and pretest was done for consecutive five days prior to actual data collection.

Data Collection tools

Data was collected by using structured and pretested questionnaire from the selected mothers and checklists were used to collect data from medical records of preterm neonates. The questionnaires were first developed in English and then translated to Amharic language. The Amharic version was then back translated into English by another language expert to check for consistency of two versions. The

questionnaires were adapted from EDHS 2011 and FAO that was developed for DHS project to reflect the population and health issues relevant to Ethiopia¹⁹.

Anthropometric measurement

Mid upper arm circumference (MUAC) of mothers who gave live births was also taken with level of accuracy nearer to 0.1cm. Maternal body mass index (BMI) was calculated from measurements of height and weight with the accuracy nearer to 0.1cm and 0.1Kg, respectively after delivery. Height and weight of neonates were taken immediately after birth with new born measuring scale. Duplicate measurements were performed with the same measuring instrument and measurer with calibration of measurement instrument in order to enhance precision and accuracy of required value.

Food frequency questions

Dietary habit of the mothers was assessed using food frequency questionnaire. The food frequency questions were developed based on the studied population dietary intake habit and commonly consumed food items with respect to their culture. Thirty-four food items were included in the questionnaire and aggregated them into nine food groups; 1) cereals and tubers; 2) pulses; 3) organ vegetables; 4) Organ fruits; 5) meat and fish; 6) poultry and eggs; 7) milk and milk products; 8) other fruits and 9) other vegetables.

These were collected from mothers who gave live births during the study period about their past twelve months' dietary frequency intake. Recall bias was tried to overcome by using corresponding food pictures included their products as much as possible while data collecting. Then, this was converting to the standard seven days dietary frequency intake by using conversion factors and summed up ²⁰²¹. Next, by using standard food groups' weight for each, we calculated respondents' household food consumption score ²¹. Finally, based on food consumption score threshold as poor (0-21.4), borderline (21.5-35) and acceptable (>35), we measured the association of preterm birth with caloric intake and dietary quality using logistic regression (Table 2).

Table 2: Food groups and their weight for food consumption score, Kembata Tembaro Zone Public hospitals, 2019.

| Food Groups | Food Items belonging to group | weights |
|------------------------|--|----------------|
| Cereals & Tubers | Rice, pasta, bread / cake and / or sorghum, maize etc... | 2 |
| | potato, yam, cassava, sweet potato, taro and / or other tubers | |
| Pulses | Beans, cowpeas, peanuts, lentils, nut, soy, pigeon pea etc... | 3 |
| Organ vegetables | carrot, red pepper, pumpkin, orange sweet potatoes | 1 |
| | spinach, broccoli, amaranth and / or others green leafy vegetables | |
| Organ fruits | mango, papaya, apricot, peach | 1 |
| Meat and fish | goat, beef, chicken, pork (meat in large quantities and not as a condiment) | 4 |
| | fish, including canned tuna, escargot, and / or other seafood (fish in large quantities and not as a condiment) | |
| Poultry and eggs | | 4 |
| Milk and milk products | fresh milk / sour, yogurt, cheese, other dairy products (Exclude margarine / butter or small amounts of milk for tea / coffee) | 4 |
| Other fruits | banana, apple, lemon, tangerine | 1 |
| Other vegetables | onion, tomatoes, cucumber, radishes, green beans, peas, lettuce, etc. | 1 |

Adopted from food security indicator for integrating nutrition and food security programming for emergency response workshop ²¹.

Estimation of gestational age (GA)

Estimation of gestational age could be carried out based on different methods such as menstrual periods, date of conception, fetal ultra-sound and physical parameters using the new Ballard score ¹⁶. According to this study almost 87% of gestational ages of live births were determined by using normal last menstrual period and aiding local events in order to increase recall ability of mothers in addition to review medical records. Eleven percent of live births gestational ages were estimated assisted by first or second try-minister pregnancy fetal ultra-sound. The rest 2% were determined by new methods of Ballard score for neonates of mothers who had no ultra-sound and couldn't recall their last normal menstrual period by any means. The Ballard score is based on the neonate's physical and neuromuscular maturity and can be used up to 4 days after birth (in practice, the Ballard score is usually used within 24 hours after delivery). The neuromuscular components are more consistent over time because the physical components mature quickly after birth. However, the neuromuscular components can be affected by

illness and drugs such as magnesium sulfate given during labor. Because the Ballard score is accurate only within plus or minus 2 weeks, it should be used to assign gestational age only when there is no reliable obstetrical information.

Study variables

Dependent Variable

- Preterm birth

Independent Variables

- Identification of the preterm birth:
- Maternal socio-demographic characteristics:
- Gynaecologic-obstetric related factors:
- Medical disorders & infection in mother:
- Maternal physical factors:
- Nutrition and life style factors

Data Quality Control

The adopted and developed tool was evaluated by experienced researchers. Pretest was employed on 5% of the sample size with structured questionnaire in Durame General Hospital two weeks prior to the actual study to check quality of data collector, questioner and usually recorded variables on the patient's folder. Daily evaluation of the data for completeness and encountered difficulties on the time of data collection was attended accordingly.

Data processing and analysis

Completeness of the questionnaire was rechecked preceding data entry. Following this, data were coded, entered, cleaned, recoded and analysis was accomplished by using IBM SPSS version 20. Chi-square test and bivariate logistic regression analysis was done after dichotomizing the dependent variables by coding with '0' for full term birth and '1' for preterm birth to measure association of independent variables with outcome variable. After checking associations of the variables, those with $p < 0.25$ in the bivariate model were selected for multivariate logistic regression analysis using enter method to control for confounding factors in the process of evaluating the strength of association. P-value of < 0.05 was used to declare statistical significance of the variables. Text, table of frequency and graphs were used to present result of the study.

Results

Socio-demographic and economic characteristics of respondents

All the selected study participants were participated in the study which included 104 (25.1%) mothers who gave live preterm neonates (cases) and 310 (74.9%) mothers who gave live term neonates (controls). About 36 (34.6%) cases and 54(17.4%) of controls were uneducated while 18(17.3%) of cases and 23(7.4%) controls were single in marital status. Economically, 50(48.1%) of cases and 62(20.0%) of controls had had less than 2869 Ethiopian birr monthly household income (Table 3).

Table 3: Distribution of socio-demographic and economic characteristics among mothers who gave live birth in selected public hospitals of Kembata Tembaro Zone, SNNPR, Ethiopia, 2019

| Variables | | Case N (%) | Control N (%) | X ² |
|--------------------|------------|------------|---------------|----------------|
| Residence | Rural | 73(70.2) | 153(49.4) | 13.6* |
| | Urban | 31(29.8) | 157(50.6) | |
| Occupation | Student | 11(10.6) | 9(2.9) | 13.2* |
| | House wife | 62(59.6) | 194(62.6) | |
| | Unemployed | 14(13.5) | 68(21.9) | |
| | Gov./NGOs | 17(16.3) | 39(12.6) | |
| Educational status | Uneducated | 36(34.6) | 54(17.4) | 13.5* |
| | Literate | 68(65.4) | 256(82.6) | |
| Marital status | Single | 18(17.3) | 23(7.4) | 8.5* |
| | Married | 86(82.7) | 287(92.6) | |
| Monthly income | <2869 | 50(48.1) | 62(20.0) | 32.7* |
| | 2869-4949 | 29(27.9) | 159(51.3) | |
| | >=4950 | 25(24.0) | 89(28.7) | |

*x² indicate significant at p value <0.05 & 0(.0%) cells have expected less than five

The average (\pm SD) age of mothers was 27 \pm (4.7) years for cases and 28 \pm (4.1) years for controls. There was a significant difference between cases and controls in their average BMI of 22.9 (\pm 4) kg/m² for case and 24.1 (\pm 3) kg/m² for controls. The mean food consumption score was 25.8(\pm 15.8) for cases and 63.8(\pm 33) for controls (Table 4).

Table 4: Independent sample test for comparison of cases and controls based on mean distribution of background variables in Kembata Tembaro Zone, Southern Ethiopia, 2019

| Variable | Statistics | Control (n=310) | Case (n=104) | P value |
|--------------------------|------------|------------------|--------------|---------|
| Age of mothers(years) | Mean | 28.25 | 26.86 | 0.156 |
| | Sd. | 4.06 | 4.70 | |
| Monthly income(ETB) | Mean | 4063.55 | 3609.90 | 0.016* |
| | Sd. | 1424.15 | 2168.94 | |
| Gravidity | Mean | 2.81 | 2.63 | 0.322 |
| | Sd. | 1.59 | 1.77 | |
| APGAR score | Mean | 7.98 | 6.91 | 0.405 |
| | Sd. | 1.06 | .98 | |
| Weight of neonate(gm) | Mean | 3089.35 | 2005.77 | <0.001* |
| | Sd. | 625.39 | 512.72 | |
| Height of mother (meter) | Mean | 1.64 | 1.62 | 0.002* |
| | Sd. | .06 | .07 | |
| Weight of mother(kg) | Mean | 64.49 | 59.70 | 0.151 |
| | Sd. | 8.12 | 8.71 | |
| BMI | Mean | 24.05 | 22.95 | 0.003* |
| | Sd. | 3.08 | 3.86 | |
| FCS | Mean | 63.79 | 25.87 | <0.001* |
| | Sd. | 33.95 | 15.89 | |

*p depicts significant difference between means at <0.05 level of significant

Maternal Obstetrics, Medical and Physical conditions

The study showed that 10(9.6%) cases and 119(38.4%) controls had at least four ANC visits whereas 18(17.3%) of cases and 22(7.2%) controls had no ante natal care follow up. In the current study, 84 (80.8%) cases and 248 (80.0%) controls gave birth by spontaneous vagina delivery while 16(15.4%) and 45(14.7%) of cases and controls by caesarean section, respectively (Table 5). Regarding medical problems, 78(75%) of cases and 45(14.5%) controls had pregnancy related medical health problems during the current pregnancy. For instance, pregnancy induced hypertension was reported as a major problem by 23(29.5%) cases and 19(42.2%) controls (table 5).

Table 5: Maternal Obstetrics, Medical and Physical characteristics among mothers who gave live birth in public hospitals of Kembata Tembaro Zone, SNNPR, Ethiopia, 2019

| Variables | | Case N (%) | Control N (%) | X ² |
|-------------------------------|--------------------|------------|---------------|----------------|
| Mode of delivery | Spontaneous normal | 84(80.8) | 248(80.0) | 0.5 |
| | Cesarean section | 16(15.4) | 45(14.5) | |
| | Instrumental | 4(3.8) | 17(5.5) | |
| Birth spacing | <24 months | 46(67.6) | 135(57.0) | 2.5 |
| | >=24 months | 22(32.4) | 102(43.0) | |
| Gravida | Multigravida | 68(65.4) | 236(76.1) | 4.6* |
| | Primigravida | 36(34.6) | 74(23.9) | |
| Parity | Multipara | 65(62.5) | 229(73.9) | 4.8* |
| | Primipara | 39(37.5) | 81(26.1) | |
| Outcome of Previous pregnancy | Preterm birth | 6(8.8) | 12(5.1) | 13.7* |
| | Abortion | 13(19.1) | 14(5.9) | |
| | Still birth | 6(8.8) | 32(13.5) | |
| | Normal | 43.2 (63) | 179(75.5) | |
| Domestic violence | Yes | 29(27.9) | 21(6.8) | 32.7* |
| | No | 75(72.1) | 289(93.2) | |

*x² indicate significant at p value <0.05 & 0(.0%) cells have expected less than five

Maternal Nutrition, Life Style and Fetal conditions

Nineteen (18.3%) cases and six (1.9%) controls were under-weight (BMI <18.5kg/m²) and 28 (26.9%) cases and 81(26.1%) controls were over-weight (BMI of 25-29.9 kg/m²) and 5(4.8%) cases and 11(3.5%) controls were obese (BMI >=30 kg/m²). Among preterm neonate's majority of 32(30.8%) had gestational age of 36 weeks, only 3(2.9%) had gestational age of 28 weeks and the rest 69(66.3%) were in between 29-35 weeks of gestational age of which 16(15.4%) had gestational age of 32 weeks. More than half of preterm neonates 84(80.8%) and 13 (4.2%) of term neonates had a birth weight of < 2.5 kg of which only 20(19.2%) of cases were very low birth weight (Table 6).

Table 6: Maternal nutrition, life styles and fetal conditions of mothers who gave live births in public hospitals of Kembata Tembaro Zone, SNNPR, Ethiopia, 2019

| Variables | | Case N (%) | Control N (%) | X ² |
|-------------------|------------|------------|---------------|----------------|
| MUAC | <23 cm | 51(49%) | 43(13.9%) | 54.8* |
| | >=23 cm | 53(51%) | 267(86.1%) | |
| Height of mother | <=1.50m | 9(8.7) | 8(2.6) | 5.8* |
| | >1.50m | 95(91.3) | 302(97.4) | |
| FCS | <=21.4 | 40(38.5) | 18(5.8) | 101.9* |
| | 21.5-35 | 41(39.4) | 67(21.6) | |
| | >35 | 23(22.1) | 225(72.6) | |
| Substance abuse | Yes | 28(26.9) | 16(5.2) | 38.8* |
| | No | 76(73.1) | 294(94.8) | |
| Sex of neonate | Male | 59(56.7) | 123(39.7) | 9.2* |
| | Female | 45(43.3) | 187(60.3) | |
| Weight of neonate | <2500g | 84(80.8) | 13(4.2) | 127.7* |
| | 2500-4000g | 20(19.2) | 297(95.8) | |
| APGAR score | 4-6 | 31(29.8) | 20(6.5) | 39.3* |
| | >=7 | 73(70.2) | 290(93.5) | |

*x² indicate significant at p value <0.05 & 0(.0%) cells have expected less than five

Determinants of preterm births

Uneducated mothers were 2.6 times more likely to give preterm birth than those who were literate [AOR= 2.6; 95% CI (1.3, 5.2)]. Compared to urban residents, the odds of preterm births were 2.7 times higher among mothers in rural residents [AOR= 2.7; 95% CI (1.3, 5.6)]. The chance of preterm birth was over thirteen [AOR= 13.5; 95% CI (3.7, 48.7)] and over five [AOR= 5.5; 95% CI (2.1, 14.3)] folds higher for mothers who had no ANC visits or had less than four ANC visits than mothers who had at least four ANC visits, respectively. Mothers who had a previous pregnancy outcome of abortion were eleven times more risk of giving live preterm birth in subsequent pregnancy as compare to those who had normal previous pregnancy outcome [AOR= 11.1; 95% CI: (1.2, 105)]. As compared to mothers who had MUAC of >=23 cm, mothers who had MUAC of <23 cm were seven times more risk to have preterm birth [AOR= 7.2; 95% CI: (3.3, 15.7)] (Table 7).

Table 7: Factors associated with preterm birth among mothers who gave live birth in Durame public hospitals Southern area of Ethiopia, 2019

| Variables | | Case (%) n=104 | Control (%) n=310 | COR[95%CI] | AOR[95%CI] |
|-------------------------------|---------------|-------------------|----------------------|----------------|-------------------|
| Residence | Rural | 73(70.2) | 153(49.4) | 2.4[1.5, 3.9] | 2.7[1.3, 5.6]* |
| | Urban | 31(29.8) | 157(50.6) | 1.0 | 1.0 |
| Educational status | Uneducated | 36(34.6) | 54(17.4) | 2.5[1.5, 4.1] | 2.6[1.3, 5.2]* |
| | Literate | 68(65.4) | 256(82.6) | 1.0 | 1.0 |
| Marital status | Single | 18(17.3) | 23(7.4) | 2.6[1.3, 5.1] | 1.9[0.8, 4.6] |
| | Married | 86(82.7) | 287(92.6) | 1.0 | 1.0 |
| Monthly income (ETB) | <2869 | 50(48.1) | 62(20.0) | 2.8[1.6, 5.1] | 1.4[0.6, 3.2] |
| | 2869-4949 | 29(27.9) | 159(51.3) | 0.6[0.3, 1.1] | 0.4[0.5, 1.2] |
| | >=4950 | 25(24.0) | 89(28.7) | 1.0 | 1.0 |
| Number of ANC visits | None | 18(17.3) | 22(7.1) | 9.7[3.9, 23.8] | 13.5[3.7, 48.7]** |
| | <4 times | 76(73.1) | 169(54.5) | 5.4[2.7, 10.8] | 5.5[2.1, 14.3]* |
| | >=4 times | 10(9.6) | 119(38.4) | 1.0 | 1.0 |
| Gravida | Multigravida | 68(65.4) | 236(76.1) | 0.6[0.4, 0.9] | 1.0[0.2, 4.3] |
| | Primigravida | 36(34.6) | 74(23.9) | 1.0 | 1.0 |
| Parity | Multipara | 65(62.5) | 229(73.9) | 0.5[0.3, 0.9] | 0.4[0.1, 1.8] |
| | Primipara | 39(37.5) | 81(26.1) | 1.0 | 1.0 |
| Domestic violence | Yes | 29(27.9) | 21(6.8) | 5.3[2.9, 9.9] | 2.5[0.9, 7.2] |
| | No | 75(72.1) | 289(93.2) | 1.0 | 1.0 |
| Substance abuse | Yes | 28(26.9) | 16(5.2) | 6.7[3.5, 13.2] | 3.5[1.1, 10.5]* |
| | No | 76(73.1) | 294(94.8) | 1.0 | 1.0 |
| MUAC | <23 cm | 51(49) | 43(13.9) | 5.9[3.6, 9.8] | 7.2[3.3, 15.7]** |
| | >=23 cm | 53(51) | 267(86.1) | 1.0 | 1.0 |
| Height of mothers | <=1.50m | 9(8.7) | 8(2.6) | 3.6[1.3, 9.5] | 6.5[1.4, 30.6]* |
| | >1.50m | 95(91.3) | 302(97.4) | 1.0 | 1.0 |
| BMI (kg/m2) | <18.5 | 19(18.3) | 6(1.9) | 12.9[4.9, 34] | 9.3[2.6, 32.5]* |
| | 18.5-24.95 | 52(50.0) | 212(68.4) | 1.0 | 1.0 |
| | 25-29.95 | 28(26.9) | 81(26.1) | 1.4[0.8, 2.4] | 3[1.5, 6.1]* |
| | >=30 | 5(4.8) | 11(3.5) | | |
| FCS | <=21.4 | 40(38.5) | 18(5.8) | 21.7[10.8, 44] | 20.7[10, 42.2]** |
| | 21.5-35 | 41(39.4) | 67(21.6) | 5.9[3.4, 10.7] | 5.2[2.9, 9.6]* |
| | >35 | 23(22.1) | 225(72.6) | 1.0 | 1.0 |
| Weight of neonate | <2.5kg | 84(80.8) | 13(4.2) | 17.1[9.8, 30] | 20.2[10.5, 39]** |
| | 2.5-4kg | 20(19.2) | 297(95.8) | 1.0 | 1.0 |
| Medical problems | HTN | 23(29.5) | 19(42.3) | 3.6[0.6, 20.1] | 8.9[1.2, 69]* |
| | HIV | 2(2.6) | 6(13.3) | 1.0 | 1.0 |
| | DM | 3(3.8) | 2(4.4) | 4.5[0.4, 49.6] | 2[0.9, 49] |
| | PROM | 32(41) | 15(33.3) | 6.4[1.2, 35.5] | 4.8[0.6, 39] |
| | APH | 18(23.1) | 3(6.7) | 18[2.4, 135] | 13.4[1.3, 135]* |
| Outcome of previous pregnancy | Preterm birth | 6(8.8) | 12(5.1) | 2[0.7, 5.8] | 2.8[0.4, 20.3] |
| | Abortion | 13(19.1) | 14(5.9) | 3.8[1.7, 8.8] | 11.1[1.2, 105]* |
| Pregnancy | Still birth | 6(8.8) | 32(13.5) | | |
| | Normal | 43.2 (63) | 179(75.5) | 1.0 | 1.0 |
| Previous mode of delivery | Instrumental | 5(7.4) | 10(4.2) | 2.1[0.7, 6.5] | 1.9[0.3, 13.9] |
| | C/S | 18(26.5) | 37(15.6) | 2[1.1, 3.9] | 1.2[0.4, 4.1] |
| Birth spacing | SVD | 45(66.2) | 190(80.2) | 1.0 | 1.0 |
| | <24 months | 46(67.6) | 135(57.0) | 1.6[0.9, 2.8] | 1.8[0.6, 5.4] |
| | >=24 months | 22(32.4) | 102(43.0) | 1.0 | 1.0 |

* P value <0.05 and **p value <=0.000 significant value; C/S-caesarean section, SVD-spontaneous vaginal delivery, APH- ante partum hemorrhage, ANC-ante natal care, FCS-food consumption score

Discussion

The present study aimed to assess determinants of preterm birth, in order to contribute to tackling morbidity and mortality related to preterm babies by incorporating as many risk factors as possible. The current study illustrated numerous maternal and fetal factors which were significantly associated with preterm birth such as place of residence, educational status, pregnancy induced hypertension, APH, previous history of abortion, substance abuse, BMI, height of mothers, FCS, sex and weight of neonate.

The present study revealed rural resident and poor educational status as a significant risk factor for preterm births. This was in line with the study conducted in China, India, Uganda and also some parts of Ethiopia⁵²²²³²⁴²⁵¹⁸. The study also identified that, mothers with less than four ANC visits had an increased risk of delivering preterm babies compared to those who attended a minimum of four ANC visits. This might be attributed to poor nutritional counselling and screening, poor immunization service, lack of early detection of pregnancy related complications and unaware on need for skilled delivery care which is provided on timely and accurate antenatal screening throughout the pregnancy.

Similar to a study conducted in Tigray region and Debreabor²⁶¹⁸, mothers who had history of abortion were eleven folds more at risk to give preterm births as compared to outcome of previous normal birth in this study. This is mainly due to the fact that; previous medical abortion increases the risk of preterm birth by causing complication of placenta.

The present study showed that, the chance of giving preterm birth was higher among mothers with pregnancy-induced hypertension than those who had no such problems during the current pregnancy. Pregnancy induced hypertension reduces placental blood flow which would affect the exchange of nutrients and oxygen between the mother and fetus. In turn it would result in decreased fetal growth and increase the risk of abnormal pregnancy outcomes including preterm birth. If pregnancy induced hypertension is complicated, it leads to placenta abruption and pre-eclampsia in turn results in surgical operations and preterm birth.

Regarding to maternal nutritional status, under-weight (BMI of <18.5 kg/m²) and over-weight (BMI of 25-29.95 kg/m²) mothers had higher odds of giving preterm birth relative to mothers who were normal (BMI of 18.5-24.95 kg/m²) in present study. This result was supported by studies conducted in different countries²⁷²⁸²⁹³⁰³¹³²³³. This was, because over-weight and high body mass index is a measure of absolute body fat and is positively associated with intrauterine infections, systemic inflammation, dyslipidemia and hyper insulinemia in turn may increase risk of preterm birth and under-weight may be exposed to under-nutrition and poor weight gain during pregnancy.

We found that strong association between short stature (≤ 1.5 meters) and preterm birth relative to mothers who had height of >1.5 meters. This was consistent with the study done in Swedish¹⁴²³³⁴³⁵. One possible biological mechanism linking short stature directly to preterm birth is low uterine volume and or small pelvic size. Small uterine volume is considered to restrict fetal growth and hypothesized that earlier filling of the pelvis which could lead to early spontaneous labour.

The chance of delivering preterm birth were 7.2 times higher in mothers who had MUAC of <23 cm than mothers with MUAC of ≥ 23 cm in the present finding and it was agreed with the findings from Bangladesh and Ethiopia³⁶¹⁸. This is due to poor maternal nutrition status which leads to reduce uterine blood flow, direct effect on placental size, fetus and strength of the membrane including maternal immunity.

The present study revealed that, the odds of delivering live preterm birth was higher in mothers who were exposed to substance abuse specific to alcohol, cigarette smoking and khat either before or during the current pregnancy as compared to mothers who had no exposure for it. This was in line with the findings from Pelotas, Brazil ³⁷³⁸. The mechanism of substance abuses either combined or independently as for risk of giving preterm birth was unclear. However, in some literatures it may severely impair an individual's functioning as apparent, spouse or partner, and trigger gender-based and domestic violence, thus significantly affecting the birth outcome and lead to preterm birth (WHO,2014). It also risk to have preterm birth since developing babies were lack of the ability to process substance abuse during pregnancy³⁹.

Conclusion

This study identified rural place of residence, poor educational status, poor ANC visit, history of abortion, history of substance abuse, MUAC (<23 cm), height (<1.50 cm), BMI, low food consumption score, sex of neonate, low birth weight, pregnancy induce hypertension and ante-partum haemorrhage were identified as the most determinant of preterm birth. Therefore, early detection and treatment of diseases or disorders among pregnant women as well as improving health care quality delivered to pregnant women may reduce risk factors for preterm delivery. Since over half of mothers had less than four ante natal care visits and 17% of mothers who had preterm neonates had no ante natal care during the current pregnancy, community awareness and mobilization should be strengthen through extension program. Emphasis should be given in strengthening efforts on availability of basic health services and promoting education on nutrition during pregnancy especially at rural areas. Finally, further study is recommended regarding the effect of maternal nutrition on preterm birth using prospective study design.

List Of Abbreviations

ACOG American College of Obstetrics and Gynaecology

ANC Antenatal Care

AOR Adjusted Odd Ratio

APGAR Appearance, Pulse, Grimace, Activity and Respiration

APH Ante partum haemorrhage

BMI Body Mass Index

CI Confidence Interval

CL Confidence Level

CM Centimetre

DHS Demographic Health Survey

EDHS Ethiopian Demographic Health Survey

ELBW Extremely Low Birth Weight

FAO Food and Agricultural Organization

FCS Food Consumption Score

FMOH Federal Minister of Health

G.C Gregorian Calendar

GA Gestational Age

HIV Human Immuno-Deficiency Virus

Kg Kilogram

LBW Low Birth Weight

LGA Large for Gestational Age

LINC Life style, Infection, Nutrition and Contraceptive

LNMP Last Normal Menstruation Period

MCH Maternal and Child Health

MDG Millennium Development Goal

MUAC Mid Upper Arm Circumference

NICU Neonatal Intensive Care Unit

PROM Premature Rapture of Membrane

PTB Preterm Birth

SNNPR South Nation Nationality People of Region

SPSS Statistical package for the social science

VLBW Very Low Birth Weight

WFP World Food Program

Declarations

Authors Contributions:

SD designed the study, conducted data management and analysis, drafted and revised the manuscript. HH participated in the designing of the study, prepared and revised the manuscript. DK (Dr) participated in designing the study and commenting on the draft manuscript. DT participated in commenting on the manuscript.

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Ethical approval and consent to participate

Approval of the research was given by Hawassa University Institutional Review Board (IRB). Prior to data collection the district administrators were contacted with a description of the study and purposes and consent was taken. The nature of the study was fully explained to the respondent and informed consent was taken from all participants ahead of the interview. The authors also confirm that, all methods were performed in accordance with the relevant guidelines and regulations.

Consent for publications

Not applicable for this section

Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding Author on reasonable request.

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Figures

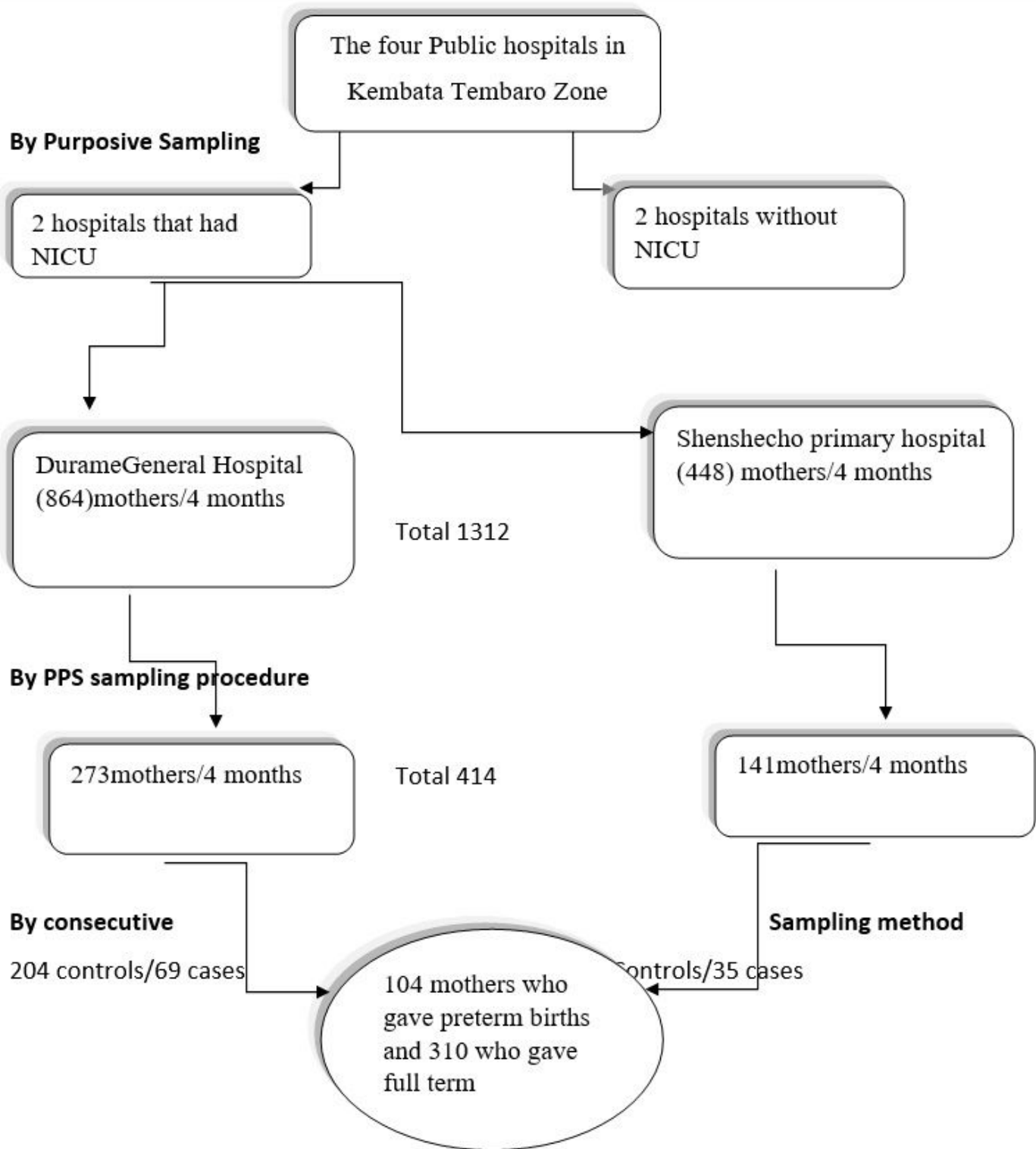


Figure 1

Schematic presentation of sampling procedure for study on determinants of preterm birth from October1, 2018 to February1, 2019 in Kembata Tembaro Zone Public Hospitals, 2019