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ARTICLE

Prevalence and factors associated with low birth weight among neonates in Rwanda: a prospective cross-sectional study

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Abstract

Objective: Low birth weight is a global concern in both developed and developing countries. This problem represents a high proportion in Africa and Asia. In Rwanda, low birth weight is also conspicuous. The main objective of this study is to assess the prevalence of low birth weight and associated factors in Gakoma District Hospital. **Methods:** A cross-sectional research design adopted with quantitative approaches. The study population was 182 mothers delivered in the Gakoma District hospital during July 2019. The researcher used a semi-structured questionnaire known as a structured interview tool. This research tool contained closed-ended questionnaires related to the study objectives and checked the children's card for showing the birth weights. **Results:** The results found that the prevalence of low birth weight was 12.8% in Gakoma District Hospital. The low birth weight in neonates' were associated with partner's employment (adjusted odds ratio (AOR) = 39.5, 95% confidence interval CI: 4.182–373.104), mothers' previous weight status (AOR = 14.5, 95% CI: 4.182–373.104), having malaria during pregnancy (AOR = 113.75, 95% CI: 22.873–565.686), having tuberculosis during pregnancy (AOR = 12.346, 95% CI: 1.885–80.872), suffering from chronic diseases (AOR = 20.357, 95% CI: 5.757–71.987). On the other hand, alcohol consumption during pregnancy (AOR = 0.29, 95% CI: (0.007–0.115)) had preventive effect on low birth weight. **Conclusion:** Low birth weight babies are associated with partners' employment and previous baby birth weight though other socio-demographic factors are no associated. Low birth weight babies is associated with the following health status as suffering from malaria, tuberculosis during pregnancy and chronic diseases.
Key words: Low birth weight, Developing countries, Baby, Socio-demographic factors, Pregnancy

***Abbreviations*:**

LBW, low birth weight; ANC, antenatal care; AOR, adjusted odds ratio; CI, confidence interval.

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***Competing interests*:**

The authors declare that they have no conflict of interest.

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Background

According to the World Health Organization, it estimates that the incidence of low birth weight (LBW) is 15.5%, which means that 95.5% of infants are born each year, about 20.6 million of them in developing countries [1]. Despite several interventions addressed to control LBW babies, their prevalence is going up and remains a challenge. In 2013, the report from the United Nations Children's Fund, estimated that 22 million infants were born with less than 2500 grams and the incidents were around 16% worldwide [2], and most died in the neonatal period [3, 4]. At the regional level, the occurrence of LBW is about 19% in the least developed and developing countries; as Kumar shown in his study, the incidence of LBW around the world was 7% in Pacific and East Asia, 14% in Sub-Saharan Africa, 15% in North and East Africa and 31% in South Asia. Around 75% of LBW is accounted for in Asia followed by 20% in Africa, 7% in developed countries and Latin America (5%) [2, 5]. Around 18 million LBW are born every year; south Asia with 9.3 million followed by Sub-Saharan Africa 3.1 million [1]. According to the World Health Organization, most of the infants born of LBW are in low and middle-income countries [6]. India accounts for the highest incidence of babies born with LBW, with 27% of babies born are LBW, and the mortality rate among them is very high during the first year of life [7]. According to United Nations Children's Fund 2012, it was reported that India accounted itself 40% of all LBW babies in the developing world [8]. About 21% and 14% of LBW babies were reported in Nepal according to DHS 2001 and 2006 respectively [9].

A survey done in 2014–2015 by Rwanda Demographic Health Survey, revealed that among 92 percent of newborns reported, only 6 percent of them were identified to have low weight (i.e., less than 2.5 kg). Considering some factors, there is no large difference between mothers living in urban and rural areas, mother's level of education and their wealth. Children born in rural areas reported lower weight than those born in the urban area, mothers who attended secondary or high school education or who are highest wealth quantile are less likely to deliver LBW babies. The proportion of LBW ranges from 4% to 8% in Kigali and South province respectively. Despite a few numbers of woman who smoke cigarette, different studies show that there is no relation between birth weight and smoking, a woman who smoke are more likely to deliver LBW [10].

In Gisagara District Hospital, LBW has been estimated over the past five years as 258 LBW babies out of 2,063 total babies in 2014, 219 LBW babies out of 3,221 total babies in 2015, 259 LBW babies out of 3,610 total babies in 2016, 280 LBW babies out of 2,849 total babies in 2017, 211 LBW babies out of 1,776 total babies from January to June 2018 [11]. In this study, the general objective of the study was to assess the prevalence and associated factors with LBW among neonatal in Gakoma District Hospital.

Methods

Study design

A cross-sectional study is defined as a group of different participants and different ages studied at the same time with patient' experiences [12]. A cross-sectional study that has used a quantitative research approach to help the researcher in gathering data on LBW among neonates born in Gakoma District Hospital. Birth weights of the neonates were taken within 48 hours after birth to avoid effect on birth weights of post-natal weight loss.

Target population

The research study was comprised of neonates born in Gakoma District Hospital during July 2019. The monthly neonates born in Gakoma District Hospital are encountered to be 182 (established in the facility). The researcher argues that the total number of mothers concerned with the present study was 182, whose deliveries took place in the hospital, and will be included in the study population.

Inclusion criteria

1 Neonates born in Gakoma District Hospital at the time of conducting the research meaning the month of July 2019.
2 Mothers who had a willingness to participate in the study or to provide information related to their neonates.

Exclusion criteria

1 All babies born in Gakoma District Hospital before and after July 2019.
2 Mothers of neonates who were unwilling to participate in the study or to provide information related to their neonates were not considered.

Sample design

This section presents how the sample size of the study is calculated or determined in the District Hospital located in Gisagara District. Second, the section provides details on sampling techniques that were adopted by the researcher for selecting the sample population.

Sample size

Kothari defines a sample as a subset of the entire population chosen as a representative of the target population, and these subsets had been chosen and assessed in place of the whole target population due to its capability to serve time, work and financial means [13]. The minimum sample size for mothers delivering

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in Gakoma District Hospital was determined using the Yamane's formula (1967) [14].

$$n = \frac{N}{1 + N * (e)^2}$$

Where e is margin error (0.05) and N is the target population (182).

Therefore, sample, n = 182/(1 + 182 * $(0.05)^2$) = respondents. A minimum of 125 questionnaires were disseminated among the respondents. In this regards, the sample size equaled 125.

Sampling techniques

Convenient sampling techniques were adopted for selecting participants for this study. A convenience sampling technique was defined as a judgment or reasonable sampling technique [15]. The convenience sampling technique helps to get data, which was available and willing to participate in the study. It is also used due to its advantage in selecting those who have relevant information concerning the research topic. A heterogeneous convenience sampling was used in order to afford to look at an event under this study. This helps to select participants with different characteristics for gathering enough information relevant to the study. A mother who has given birth to a live neonate in the hospital and is willing to consent during the study considered for the study.

Data collection methods

This section provides information regarding data collection instruments, the construction and the administration of research instruments during data collection, reliability and validity of these research instruments.

Data collection instrument. The research collects quantitative information. In gathering quantitative information from respondents (mothers who delivered in Gakoma District Hospital), the researcher used a semi-structured questionnaire known as a structured interview tool (Supplementary Material 1–3). This research tool contained closed-ended questionnaires related to the study objectives and checked the children on cards for showing the birth weight of the children.

Questionnaires coded before data collection to make it easy for entry into the computer. A research instrument formulated in both English and Kinyarwanda and administered to mothers in the local language (Kinyarwanda). In addition, other information is collected through observation and examination of medical records. The delivery records, mother and child health booklet, maternal health status, and nutritional status or health-seeking behavior were used to assess obstetrical & gynecological records of the mother, and the trained ANC. This led to establishing complication occurred during giving birth, Gestational age, and birth weight for neonates. These revisions were conducted in the hospital after birth and other most important aspects of mothers delivering at the hospital were scrutinized.

Administration of research instrument. Participation was voluntary and informed consent requested each patient to be involved in the study. The questionnaire attached was informed consent help to record provide information for further analysis. The questionnaires were administered at the hospital and took back the same day. The researcher reads the questionnaire for participants one after another and ticks the right responses accordingly.

Validity and reliability of research instruments. A degree of reliability of the questionnaire in this study was achieved through internal consistency using the Cronbach Alpha coefficient whereby a pilot study was carried on 10 registered patients in Gakoma District Hospital that was not part of the current study to ensure consistency and clarity of the questionnaire.

In simple explanations, validity means to measure what is intended to be measured. The research was assessed whether the questionnaire measured what is intended to measure through support from supervisors and other people who are experienced enough in the field of public health. The questionnaire was formulated taking into account research-specific objectives and re-checked by the supervisor for its consistency, clarity and non-ambiguity of contents.

Data analysis procedures

The questionnaires were checked for exhaustiveness. Therefore, SPSS software was used. All tests were carried out at a priori significance level of 0.05. The researcher grouped data according to the objectives they belong then meaningful information was deducted. A descriptive data analysis consisted of data analysis using a frequency table and the calculation percentages were appropriated. Findings were presented in tables and graphs. Therefore, its objective analyzed clearly stated. Data analysis was conducted in SPSS using a data analysis plan developed prior to data collection and based on the study objectives. Details of analysis approaches were used in each of the three stages of analysis. Therefore, *Chi*-square and *P*-value were very important to analyze the prevalence of LBW and its associated factors. Therefore, bivariate and multivariate analyses were used for data analysis.

Ethical considerations

Prior consent of informants was a condition for involving them in the research and participation was voluntary. For the questionnaire, confidentiality and secrecy about information which was provided by informants were assured. For this sake, an appropriate place was chosen for setting. The participants' identifications were kept anonymous. The approval from Mount Kenya University ethical committee and

authorization from Gakoma District Hospital was presented (Supplementary Material 4).

Results

Socio-demographic characteristic of respondents

Socio-demographic characteristics contain participant's age (years), residence places, marital status education level of mother and her partner, employment mother's status and her partner, mother's age to her firstborn child, how many times she has been pregnant, the pregnancy interval of the previous birth, number of living children, the time taken to attend at health facility and if she has taken alcohol during this pregnancy.

Table 1 indicates that the majority (76.0%) of mothers were between 20 to 29 years old and 16.8% of them were between 30 to 39 years old. Half of the respondents are from the mamba sector, 32% and 17.6% of them are from Musha and Gikonko sectors respectively. The majority of mothers who participated in this study and their partners (67.2% and 56%) have primary education levels. The majority of respondents and their partners (80.0% and 70.8%) are farmers respectively and the majority (67.2%) of them are married/cohabiting and 18.4% are divorced/separated.

Table 2 indicates that above of half (52.8%) of respondents gave their first child between 30 and 39 years old and 39.2% of them had it between 20 to 29 years old. Around a quarter (24.8%) of respondents had been pregnant three times, 36.8 % and 18.4% have been pregnant twice and once respectively. About 43.2% had two years of the pregnancy interval and the previous birth, 32.8% and 9.6% of the respondents had 1 year and under one year of the pregnancy interval and the previous birth. About 8% of the respondents had between one and two children alive, 44% and 14.4% of them had between 3 and 4 children alive and above 5 living children respectively. Around three quarters (74.4%) of respondents took between 1 and 2 hours to attend health facility, 13.6% of them used 2 and 3 hours and 6.4% used more than 4 hours to reach health nearest health facility. Less than a quarter (20%) of the respondents were taking alcohol during the pregnancy. The majority (94%) of respondents had a normal duration of pregnancy (37 weeks and above) and only 4% had a premature baby born (less than 37 weeks) and only 2.4% of them had abortion or miscarriage. The majority of mothers (97.6%) did not respect 2 years of pregnancy interval and the previous birth. About 76% used family planning and 73.6% of them applied modern contraceptive methods, the majority 97.6% of the respondents visited ANC services and 53% of them went to the visit three times before delivering.

Table 1 Socio-demographic characteristics of respondents

Variables	Description	Frequency (n = 125)	Percentage (%)
Age in years	Under 19	4	3.2
	20–29	95	76.0
	30–39	21	16.8
	40 and above	5	4.0
Residence sector	Mamba	63	50.4
	Musha	40	32.0
	Gikonko	22	17.6
Level of education	No formal	7	5.6
	Primary	84	67.2
	Others	34	27.2
Partner's level of education	No formal	22	17.6
	Primary	70	56.0
	Others	33	26.4
Status of employment	Farmer	100	80.0
	Trader	16	12.8
	Employment	8	6.4
	Unemployment	1	0.8
Partner's status of employment	Farmer	88	70.8
	Trader	6	4.8
	Employment	28	22.4
	Unemployment	3	2.4
Marital Status	Single	7	5.6
	Separated/divorced	23	18.4
	Married/cohabiting	84	67.2
	Widower/other	11	8.8

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Table 2 Maternal obstetric life style factors

Variables	Descriptions	Frequency (n = 125)	Percentage (%)
Age of mother when she gave birth to the first child.	Under 19	7	5.6
	20–29 years	49	39.2
	30–39 years	66	52.8
	40 and above	3	2.4
How many times have you been pregnant?	Once	23	18.4
	Twice	46	36.8
	Three	31	24.8
	Four	15	12.0
	Five above	10	8.0
Pregnancy interval with a previous birth.	Under one year	12	9.6
	One and half	41	32.8
	2 years	54	43.2
	3 years	13	10.4
	Above 3 years	-	-
	None	5	4.0
Number of living children.	None	3	2.4
	1 to 2	10	8.0
	3 to 4	55	44
	Above 5	18	14.4
Time taken from home to maternal health facility.	Less than 1 hour	7	5.6
	Between 1 and 2 hours	93	74.4
	Between 2 and 3 hours	17	13.6
	More than 4 hours	8	6.4
Were you taking alcohol during this pregnancy?	Yes	25	20.0
	No	100	80.0
Did you give birth to a premature baby?	Yes	5	4.0
	No	120	96.0
Did you have abortions or miscarriage?	Yes	3	2.4
	No	122	97.6
Respect the pregnancy interval of the previous birth (2 years).	Yes	3	2.4
	No	122	97.6
Did you intend to have the current pregnancy?	Yes	79	63.2
	No	46	36.8
Use of family planning before the pregnancy.	Yes	95	76.0
	No	30	24.0
ANC visit.	Yes	122	97.6
	No	3	2.4

ANC, antenatal care.

Table 3 indicates that during the respondents' pregnancy, 2.4% of them had a sexually transmitted infection, 13.6%, 4% and 20.8% of them suffered from malaria, tuberculosis and chronic diseases respectively. About 22.4% from hypertension, 34.4% cardiac/renal diseases, 26.4% diabetes and 16.8% respiratory diseases. About 13.6% of respondents received iron and folic acid and three-quarters (75.2%) of them received other food supplements during pregnancy. About 69.6% of respondents took meals three to four times per day and 8% and 4% of them obtained their food respectively from the market and from their garden or own land.

Food type consumed during pregnancy. The respondents having consumed animal proteins three times and twice a week 34.4% and 33.6% respectively. The majority (64.8%) consumed plant proteins three times a week. Only 17.6% of respondents consumed fruit daily and 30.4% of them consumed it three times a week. About 35.2% of respondents consumed milk twice a week. A quarter (26.4%) of respondents consumed twice a week food from milk and food from oil respectively during pregnancy.

Table 3 Health status and nutritional habit of respondents during pregnancy

Variables	Descriptions	Frequency (n = 125)	Percentage (%)
During the current pregnancy or in labor, did you have a sexually transmitted infection?	Yes	3	2.4
	No	122	97.6
During the current pregnancy or in labor, did you have Malaria?	Yes	17	13.6
	No	108	86.4
During the current pregnancy or in labor, did you do HIV tests?	Yes	94	75.2
	No	31	24.8
During the current pregnancy or in labor did you have Tuberculosis?	Yes	5	4.0
	No	120	96.0
During pregnancy or labor did you have chronic diseases?	Yes	26	20.8
	No	99	79.2
If yes what are they?	Hypertension	28	22.4
	Cardiac/renal disease	43	34.4
	Diabetes mellitus	33	26.4
	Respiratory disease	21	16.8
Did you receive any of the following food supplements during pregnancy?	Iron and Folic acid	17	13.6
	Calcium	6	4.8
	Multivitamin	8	6.4
	Other, specify	94	75.2
What nutritional problems did you during pregnancy?	Nausea and vomiting	2	1.6
	Poor appetite	39	31.2
	Constipation	9	7.2
	Muscle cramps	5	4.0
	Others	19	15.2
	None	51	40.8
Type food from Animal protein during pregnancy.	Daily	18	14.4
	Three a week	43	34.4
	Twice a week	42	33.6
	Once a week	18	14.4
	Once a month	2	1.6
	Sometime	1	0.8
	None	1	0.8
Type food from plant proteins during pregnancy.	Daily	1	0.8
	Three a week	81	64.8
	Twice a week	11	8.8
	Once a week	12	9.6
	Once a month	11	8.8
	Sometime	8	6.4
	None	1	0.8
Type food from Fruits during pregnancy.	Daily	22	17.6
	Three a week	38	30.4
	Twice a week	33	26.4
	Once a week	1	0.8
	Once a month	13	10.4
	Sometime	6	4.8
	None	12	9.6
Type food from Milk during pregnancy.	Daily	11	8.8
	Three a week	36	28.8
	Twice a week	44	35.2
	Once a week	14	11.2
	Once a month	1	0.8
	Sometime	9	7.2
	None	10	8.0

Table 3 Health status and nutritional habit of respondents during pregnancy (*Continued*)

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Variables	Descriptions	Frequency (n = 125)	Percentage (%)
Type food from Oils during pregnancy.	Daily	17	13.6
	Three a week	33	26.4
	Twice a week	27	24.6
	Once a week	25	20.0
	Once a month	18	14.4
	Sometime	3	2.4
	None	2	1.6
How many meals were taking per day during the pregnancy?	Once a day	16	12.8
	Twice a day	22	17.6
	Three to four per day	87	69.6
Where do you obtain food?	Garden or own land	5	4.0
	Market	10	8.0
	Others	110	88

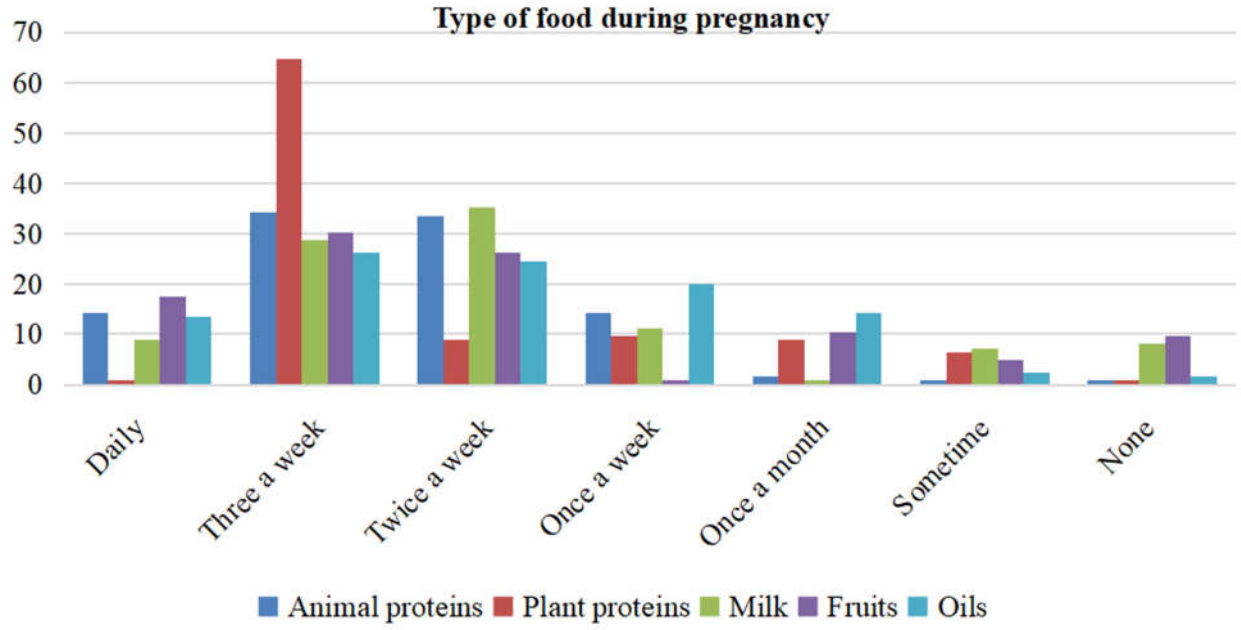


Figure 1 Food type consumed during pregnancy

Presentation of findings based on objectives

The prevalence of LBW among neonates at Gakoma District Hospital. Prevalence calculated by expressing the total number of LBW out of the total of recorded births as a percentage.

As shown in Figure 1 the kilogram of babies born was measured and the finding revealed that 4% of babies were born with under 2,000 grams and 8.8% were born with 2,000 to 2,499 gram. The prevalence of 12.8% of babies born with LBW (under 2,500 grams) among neonates at Gakoma District Hospital during July 2019. This means among 100 babies born at Gakoma District Hospital, 12.8 of them were born less than 2,500 grams (LBW).

Prevalence of the previous baby born from the same mother. Prevalence is calculated by expressing the total number of LBW out of the total of recorded births as a percentage. The prevalence calculated only for mother who has been delivered for more than once.

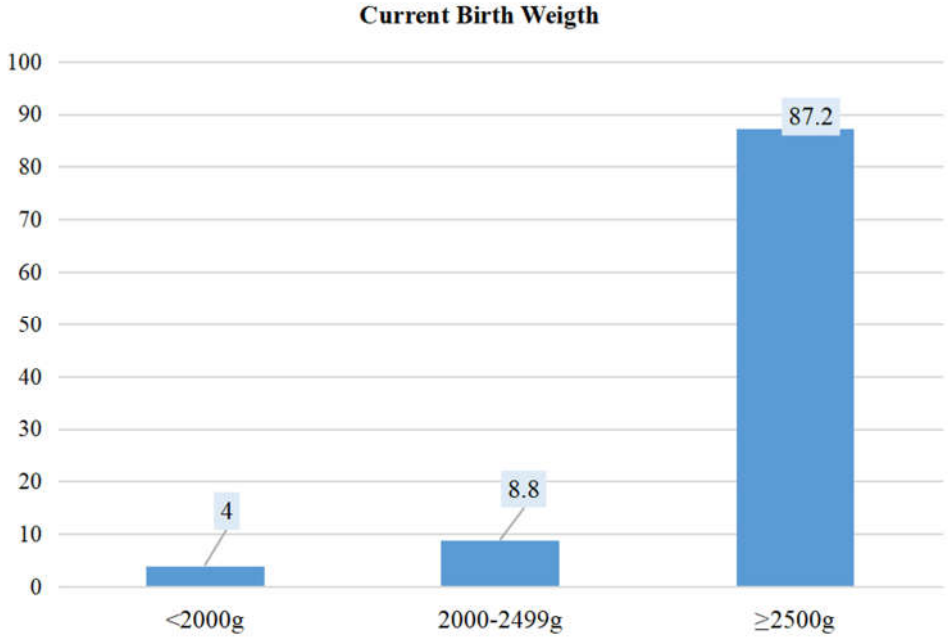
As shown in Figure 2, the prevalence of babies born with LBW is around the same as the currents prevalence in July 2019; 4% of babies born with less than 2,000 grams and 8% of babies born between 2,000 and 2,499 grams. With the prevalence of 12% of LBW.

As shown in Figure 3, the prevalence of babies born with LBW is around the same as the currents prevalence in July 2019; 4% of babies born with less than 2,000 grams and 8% of babies born between 2,000 and 2,499 grams. With the prevalence of 12% of LBW. Therefore those both prevalence were highly correlated which lead to conclude the prevalence of LBW in Gakoma District Hospital equal to 12.8% (Figure 2 & Figure 3).

Association between socio-demographic characteristics and LBW. Table 4 represents the cross-tabulation of association between LBW and socio-demographic factors and it contains frequencies,

percentages, *Chi*-square and *P*-value.

Table 4 shows the result from the study findings, there is statistical significance between LBW and mother education ($P = 0.045$), age of mother during pregnancy ($P < 0.001$), place of residence ($P = 0.009$) partner's employment ($P < 0.001$), marital status ($P < 0.001$), age of the mother when she had her first child ($P < 0.001$). The number of times mother have been pregnant ($P < 0.001$), pregnancy interval ($P < 0.001$), number of living children in the family ($P < 0.001$), time taken to reach health facility ($P = 0.003$), mother taking alcohol during pregnancy ($P < 0.001$) and previous pregnancy ($P < 0.001$) also shown statistical significance with LBW.



.**Figure 2 The prevalence of LBW among neonates at Gakoma District Hospital.** LBW, low birth weight.

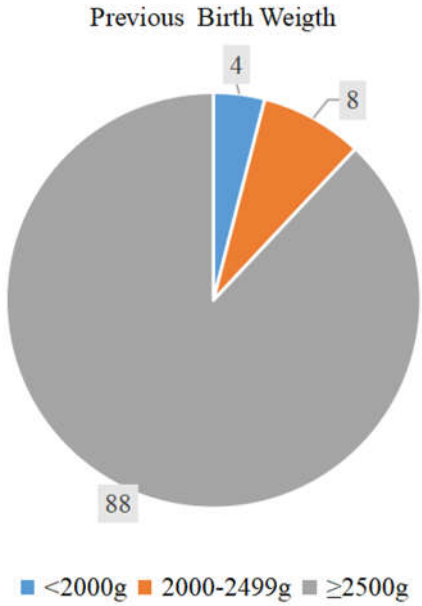


Figure 3 The previous birth weight of the respondents.

Table 4 Socio-demographic factors of respondent's partner

Variables	Description	LBW	X^2 test	*P*-value

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		< 2500 n (%)	≥ 2500 n (%)		
Age in years	Under 19	2 (50)	2 (50)	27.346	< 0.001*
	20–29	9 (9.5)	86 (90.5)	df = 3	
	30–39	1 (4.8)	20 (95.2)		
	40 and above	4 (80)	1 (0.9)		
Residence sector	Mamba	12 (20.6)	50 (79.4)	9.350	0.009*
	Musha	0 (0)	40 (100)	df = 2	
	Gikonko	3 (13.6)	19 (17.4)		
Mather's education	No formal	3 (42.9)	4 (57.1)	6.208	0.045*
	Primary	10 (11.9)	74 (88.1)	df = 2	
	Others	3 (11.9)	31 (91.2)		
Partner's education	No formal	4 (18.2)	18 (81.8)	0.978	0.613
	Primary	9 (12.9)	61 (87.1)	df = 2	
	Others	3 (9.1)	30 (90.9)		
Mother's employment	Farmer	11 (11)	89 (89)	2.571	0.463
	Trader	4 (25)	12 (75)	df = 3	
	Employment	1 (6.3)	7 (87.5)		
	Unemployment	0 (0)	1 (100)		
Partner's employment	Farmer	10 (11.2)	79 (88.8)	33.528	< 0.001*
	Trader	5 (85.3)	1 (16.7)	df = 3	
	Employment	0 (0)	28 (100)		
	Unemployment	1 (50)	1 (50)		
Marital status	Single	4 (57.1)	3 (42.9)	2.571	< 0.001*
	Divorced/separated	7 (30.4)	16 (69.6)	df = 3	
	Married	5 (6)	79 (94)		
	Window	0 (0)	11 (100)		
Age of mother for the first child	Under 19	3 (42.8)	4 (57.1)	23.883	< 0.001*
	20–29	5 (10.2)	44 (89.8)	df = 3	
	30–39	5 (7.6)	61 (92.4)		
	40 and above	3 (100)	0 (0)		
Times have been pregnant	One	4 (17.4)	19 (82.6)	41.536	< 0.001*
	Two	1 (2.2)	45 (97.8)	df = 4	
	Three	0 (0)	31 (100)		
	Four	4 (26.7	11 (73.3)		
	Five and above	7 (12.8)	3 (87.2)		
Pregnancy interval	Under one year	5 (41.7)	7 (58.3)	23.399	< 0.001*
	One and half	5 (12.2)	36 (87.8)	df = 4	
	2 years	3 (5.6)	51 (94.4		
	3 years	0 (0)	13 (100)		
	Above 3	-	-		
	None	3 (60)	2 (40)		
Number of living children	None	3 (100)	0 (0)	33.250	< 0.001*
	One to two	1 (10)	9 (90)	df = 4	
	Three to four	1 (1.8)	54 (98.2)		
	Five to six	6 (33.3)	12 (66.7)		
	7 and above	5 (12.8)	34 (87.2		
Time taken to reach health facility	Less than 1 hour	2 (28.6)	5 (71.4)	14.153	0.003*
	1 hour to 2 hours	7 (7.5)	86 (92.5)	df = 3	
	2 hours to 3 hours	3 (17.6)	14 (82.4)		
	4 hours and more	4 (50)	4 (50)		
Taking alcohol during pregnancy	Yes	13 (52)	12 (48)	43.023	< 0.001*
	No	3 (18)	97 (97)	df = 1	
Previous pregnancy	< 2,000 g	8 (53.3)	7 (46.7)	25.090	< 0.001*
	2,500 g and above	8 (7.3)	102 (92.7)	df = 1	

*Significant at P <0.05.

Multivariate association between socio-demographic characteristics and LBW. Table 5 represents the logistic regression of socio-demographic characteristics that became statistically significant ($P < 0.05$) as shown in Table 4 and their adjusted odds ratio were calculated to determine its statistical association with LBW.

Table 5 shows the results of the multivariable analysis regarding the factors associated with LBW among neonates at Gakoma District Hospital. Compare to mothers aged 40 and above, mothers aged between 20 to 29 and 30 to 39 years old were 0.026 and 0.013 times less likely to give birth to LBW babies respectively (adjusted odds ratio (AOR) = 0.026, 95% confidence interval (CI): 0.003–0.26) at $P = 0.002$ and (AOR= 0.013, 95% CI: 0.001–0.244) at $P = 0.004$. Having a partner who is a trader was 39.5 more times likely to deliver LBW babies than mothers who had farmers partner employment (AOR = 39.4, 95% CI: 4.182–373.1) at $P = 0.001$. Mothers who are married were 0.048 times less likely to give birth to LBW babies than those who are single (AOR = 0.048, 95% CI: 0.008–0.273) with $P = 0.001$. Mother who gave birth their first child aged between 20–29 years old and 30–39 years old were 0.152 and 0.109 less likely to give birth to LBW babies respectively than those who deliver at under 19 years aged (AOR = 0.152, 95% CI: 0.026–0.88) at $P = 0.036$ and (AOR= 0.109, 95% CI: 0.019–0.631) at $P = 0.013$. Mothers who have been pregnant five times were 0.156 times less likely times to deliver LBW babies than mothers who has been pregnant once (AOR= 0.036, 95% CI: 0.027–0.916) at $P = 0.04$. Taking alcohol during pregnancy were 0.29 times less likely to give birth to LBW babies than those who were not taken it (AOR = 0.29, 95% CI: 0.007–0.115) with $P < 0.001$. Mothers who deliver LBW baby during the previous pregnancy were 14.571 times more likely to deliver LBW baby that those who delivered a normal baby (AOR = 14.571, 95%CI: 4.201–50.54 with $P < 0.001$).

As shown in the Table 6, the result from the study findings, there is statistical significance between LBW and giving birth to a premature baby ($P < 0.001$), using family planning ($P < 0.001$), visited antenatal care (ANC) ($P < 0.001$), receiving food supplement ($P < 0.001$), having nutritional problem during pregnancy or in labor ($P < 0.001$), origin of food ($P = 0.002$) having a sexual infection, malaria, HIV, tuberculosis and non-communicable diseases during pregnancy or in labor ($P < 0.001$).

Table 5 Logistic regression to examine the association between LBW and socio-demographic characteristic of the respondent

Variables	Description	AOR	95% CI		*P*-value
			Lower	Upper	
Age in years	Under 19	0.25	0.013	4.729	0.355
	20–29	0.026	0.003	0.26	0.002*
	30–39	0.013	0.001	0.244	0.004*
	40 and above	Ref			
Residence sector	Mamba	1.647	0.422	6.428	0.473
	Musha				
	Gikonko	Ref			
Mother's education	No formal	7.750	1.148	52.297	0.081
	Primary	1.396	0.360	5.422	0.036*
	Others	Ref			
Partner's employment	Farmer	Ref			
	Trader	39.5	4.182	373.104	0.001*
	Employment				
	Unemployment	7.9	0.458	136.41	0.155
Marital status	Single	Ref			
	Divorced/separated	0.328	0.058	1.871	0.21
	Married	0.048	0.008	0.273	0.001*
	Window				
Age of mother for the first child	Under 19	Ref			
	20–29	0.152	0.026	0.88	0.036*
	30–39	0.109	0.019	0.631	0.013
	40 and above				
Time have been pregnant	One	Ref			
	Two	0.09	0.16	0.509	0.006*
	Three	0.01	0.001	0.105	<0.001*
	Four				0.998
	Five and above	0.156	0.027	0.916	0.04*

Table 5 Logistic regression to examine the association between LBW and socio-demographic characteristic of the respondent (*Continued*)

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Variables	Description	AOR	95% CI		*P*-value
			Lower	Upper	
Pregnancy interval	Under one year	0.476	0.057	3.99	0.494
	One and half	0.093	0.012	0.697	0.021*
	2 years	0.039	0.005	0.332	0.003*
	3 years				
	Above 3	Ref			
Number of living children	None	Ref			
	One to two			.	
	Three to four	1.324	0.137	12.802	0.809
	Five to six	7.941	0.0889	70.92	0.064
	7 and above	0.294	0.096	1.143	0.077
Time taken to reach health facility	Less than 1 hour	0.4	0.047	3.424	0.403
	1 hour to 2 hours	0.081	0.017	0.397	0.002
	2 hours to 3 hours	0.214	0.033	1.382	0.105
	4 hours and more	Ref			
Taking alcohol during pregnancy	Yes	0.29	0.007	0.115	< 0.001*
	No	Ref			
Previous pregnancy	< 2,500	14.571	4.201	50.54	<0.001*
	2,500 and above	Ref			

Source: primary data; *Significant at *P* <0.05; LBW, low birth weight; Ref, reference; AOR, adjusted odds ratio; CI, confidence interval.

Table 6 Health Factors associated with LBW

Variables	Descriptions	LBW		*P*-value
		< 2,500 n (%)	≥ 2,500 n(%)	
Did you give birth to a premature baby?	Yes	5 (100)	0 (0.0)	< 0.001*
	No	11 (9.2)	109 (90.8)	
Did you have abortions or miscarriage?	Yes	0 (0.0)	3 (100)	0.502
	No	16 (13.1)	106 (86.9)	
Did you respect the pregnancy interval of the previous birth? (2 years)	Yes	0 (0.0)	3 (100)	0.502
	No	16 (13.1)	106 (86.9)	
Did you intend to have the current pregnancy?	Yes	8 (10.1)	71 (89.9)	0.241
	No	8 (50.0)	38 (82.6)	
Did you use family planning before the pregnancy?	Yes	5 (5.3)	90 (94.7)	< 0.001*
	No	11 (36.7)	19 (63.3)	
ANC visit.	Yes	16 (13.1)	106 (86.9)	0.502
	No	0 (0.0)	3 (100)	
During the current pregnancy or in labor, did you have a sexually transmitted infection?	Yes	3 (100)	0 (0.0)	< 0.001*
	No	13 (10.7)	109 (89.3)	
During the current pregnancy or in labor, did you have Malaria?	Yes	13 (76.5)	4 (23.4)	< 0.001*
	No	3 (2.3)	105 (97.2)	
During the current pregnancy or in labor, did you do HIV tests?	Yes	5 (5.3)	89 (94.7)	< 0.001*
	No	11 (35.5)	20 (64.5)	
During the current pregnancy or in labor did you have Tuberculosis?	Yes	3 (60.0)	2 (40.0)	0.001*
	No	13 (10.8)	107 (89.2)	
During pregnancy or labor did you have chronic diseases?	Yes	12 (46.2)	14 (53.8)	< 0.001*
	No	4 (4.0)	95 (96.0)	
Did you receive any of the following food supplements during pregnancy?	Iron and folic acid	6 (35.3)	11 (64.1)	0.002*
	Calcium			
	Multivitamin	2 (33.3)	4 (66.7)	
	Other, specify	2 (25.0)	6 (75.0)	
		6 (6.4)	88 (93.6)	

Table 6 Health Factors associated with LBW (*Continued*)

Variables	Descriptions	LBW	*P*-value

		< 2,500 n (%)	≥ 2,500 n(%)	
What nutritional problems did you during pregnancy?	Nausea and vomiting	1 (50.0)	1 (50.0)	< 0.001*
	Poor appetite	14 (35.9)	25 (64.1)	
	Constipation	1 (11.1)	8 (88.9)	
	Muscle cramps	0 (0.0)	5 (100)	
	Others	0 (0.0)	19 (100)	
	None	0 (0.0)	51 (100)	
How many meals were taking per day during the pregnancy?	one per day	13 (81.3)	3 (18.8)	< 0.001*
	Two per day	3 (13.6)	19 (86.4)	
	Three to four/day	0(0.0)	87 (100)	
Where do you obtain food?	Garden or own land	0 (0.0)	43 (100)	0.002*
	Market			
	Others	10 (25.6)	29 (74.4)	
		6 (14.0)	37 (86.0)	

*Significant at P <0.05; LBW, low birth weight; ANC, antenatal care.

Discussion

This study had the objectives of determining the prevalence and factors (socio-demographic and health status and nutritional habit of respondents during pregnancy) associated with LBW in Gakoma District Hospital. This section is meant to discuss the finding from the analysis of data collected from 125 respondents who gave birth in Gakoma District Hospital. It will also illustrate the relevance of these finding and relation with other carried studies.

The prevalence of LBW in this study was 12.8% which is not similar to the study was done in Adwa General Hospital, Northern Ethiopia by Gebregzabiherher with the prevalence of 10% [16] and in rural Wardha, Central India by Kumar, with the prevalence of 33% [17] and 14.6% value at Muhima referral hospital [18]. The finding of this study is also similar to 12% [19] reported by Oladeinde et al. in the University of Ilorin Teaching Hospital, Nigeria and 12.3% [20] reported by Muchemi et al. among neonates born at Olkalou District Hospital, Kenya. The prevalence of 12.8% was three times higher than the Rwanda statistic which shows the total prevalence of 3.6% all over the country; 3.1% in health centers, 4.4% in district hospitals, 4% in provincial hospitals and 5.2% in referral hospital [21] and study in Malawi [22] with a prevalence of 6.0 percent.

This can be explained by the fact that mothers attending Gakoma District Hospital come from rural areas where the prevalence is higher than the prevalence in urban areas. Also, this might be determined by the fact that the national and regional estimates are pooled estimates whereas the 12.8% is from a selected population attending Gakoma District Hospital. The prevalence was lower than the 14.6% estimated at Muhima referral hospital, Kigali [18], but it was lower than 9.9% estimate at Kenyatta National Hospital [20]. This difference in prevalence may be explained by variation in biological and environmental factors. Although there are no documented cutoff values of public health significance for LBW in Rwanda by region or internationally.

The finding from this study showed that LBW babies are associated with partner's employment which similar to the study carried out in Nigeria where the women and their partners had the similar job [19] but in contrast study done in Northwest Ethiopia revealed that occupation of the respondent and the partner are not associated to the LBW [23]. This result should be due to the fact that the majority of the respondents are from rural area and the main economic activities in the area are farming and agriculture.

The finding showed that LBW is associated with previous birth weight babies. This was similar to other studies carried in Kenya among neonates born at Olkalou District Hospital, Central Region, Kenya where mothers who had delivered a LBW baby in their previous pregnancy were almost 5 times more likely to give birth to an LBW baby compared to those who had given birth to a normal weight baby [20]. It implies that having delivered a LBW baby in a previous pregnancy is the single most important predictor of LBW in the hospital.

The finding of this study showed that malaria during pregnancy was significantly associated with LBW. In line with a study carried out in Zahedan, the Islamic Republic of Iran [24] and in Nigeria revealed that having malaria during pregnancy was found to be a risk for LBW [25]. This might be due to that the parasite has affinity for decidua's vessel and involve the placenta and decrease nutrient and oxygen transmitted to the fetus [26]. The study was done in Uganda among teenage mothers in New Mulago Hospital revealed the opposite result of this study [27].

The finding of this study showed that mothers suffering from tuberculosis during pregnancy were associated with LBW babies' delivery. In line with this result, the study carried out in Tanzania showed malaria

and tuberculosis are associated with LBW [28]. This might be due to some complications such as intrauterine growth retardation, suboptimal weight gain in pregnancy and preterm labor [29].

This study showed LBW was associated with mothers suffering from chronic diseases. In line with the result from the present study, a survey carried out in Ethiopia revealed that a history of chronic medical illnesses during their current pregnancy was found to have a greater chance to deliver LBW baby than mothers with no chronic illnesses condition [30, 31]. A study was done by Awoleke, showed that a hypertensive pregnancy disorder (pre-eclampsia) was also observed to significantly increase the risk of LBW [32]. However, it is contrary to findings from a hospital-based setting in Northern Ethiopia, which shows that maternal history of chronic diabetes was found to have a negative relationship with LBW [33].

The finding of this study showed that respondents receiving food supplements during pregnancy were associated with LBW babies. This is in line with the result from the present study, a survey carried in Central Hospitals in Vientiane, Lao revealed that Mothers with inadequate nutritional practices were more prone to deliver LBW babies [34]. A study done in Kenya revealed that maternal nutritional status is strongly associated with premature baby, size of the baby and caesarian section [35].

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