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Determinants of Neonatal Low Birth Weight in Hopley, Harare, Zimbabwe

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Abstract: *Low birth weight (LBW) is one of the leading causes of infant mortality, a pivotal indicator of maternal and child health, and a serious public health issue that can cause complications even in adulthood. The study focused on determining the factors that are associated with low birth weight in Hopley farm, Harare. The study participants consisted of 90 cases and 90 controls. Delivery registers were reviewed to obtain participants' physio-demographic, medical, and obstetric data. Phone calls were used to obtain socioeconomic and nutritional data from participants and a structured questionnaire was used to document information. Univariate logistic regression analysis was used to calculate odds ratios and p-values in order to determine the association at 95% confidence interval. Household Dietary Diversity Score (HDDS) was calculated to determine food consumption related indicators. Controls had a higher dietary diversity score than cases. The prevalence of LBW in Hopley was 13%. The study identified getting pregnant at age below 20 years, gravida 1 status, parity, lack of nutritional / counselling education, history of delivering low birth weight infants, affiliation to an African apostolic church, low income less than USD20, vending and eating mound to be significant predictors of LBW. LBW was found to be related to socioeconomic, medical, nutritive, and demographic factors. The study recommends more exploration on the impact of the level of nutritional education on LBW problem in Zimbabwe and the possibility of offering incentives to encourage childbearing women to acquire nutritional education.*

Keywords*: Low Birth Weight (LBW), dietary diversification, dietary diversity, odds ratio, Normal Birth Weight (NBW)*

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1. Introduction

Birth weight is a key factor that influences the growth and development of children worldwide (Axame *et al*., 2022). Worldwide, neonates born with Low Birth weight (LBW) are around 20 million, of which 95% live in developing countries with Africa at 18.3% of Low Birth Weight, which is only preceded by Asia, which accounts for 14.3% (Wardlaw, 2004). Low birth weight (LBW) is defined as babies born before 37 weeks weighing less than 2500 grams (Fraser *et al*., 2003, McCormick, 1985). Low birth weight is considered the single most important risk factor of infant mortality, mainly in deaths that occur within the first 28 days of life (Mulu *et al*., 2020). Low birth weight rate of a population is a good indicator of the public health problems being faced by that population such as long-term maternal malnutrition, poor health care, and ill health (Seid *et al*., 2022).

The 2018 Zimbabwe National Nutrition Survey (NNS) reported that Harare had the highest proportion of babies with LBW (36%, almost 1 in every 4) (MoHCC, 2018), with a 150% rise from the 14% reported, by the Zimbabwe Demographic and Health Survey (ZimStat,2012). LBW deaths in Zimbabwe reached 5433 or 4.32% of total deaths (WHO, 2017). Currently, in Zimbabwe, 46 children per every 1000 die before their 5th birthday, 34 per every 1000 live births die before their 1st birthday while 21 per every 1000 die within 28 days of birth which ranks Zimbabwe number 24 in the world. This reflects a local health disaster, which is not only catastrophic but also a drawback to sustainable development goal (SDG) 3. Maternal malaria and HIV infection are significantly associated with adverse birth outcomes and are the main causes of LBW in Sub Saharan Africa (Axame *et al.*, 2022).

Long-term complications associated with LBW include hypertension, diabetes mellitus, proteinuria, and renal disease in late age, eye problems like deafness, neurologic complications like cerebral palsy, developmental delay with low intelligence (Atitwa, 2015). One of the major observations during the past 20 years has been a general decline of the economy of Zimbabwe (Maphosa *et al.*, 2019). Upsurges in the cost of food normally lead to alterations in the kinds of food and the quantities that are procured. Food choices are usually individual centered, and adjustment of food intake is a composite issue that requires much new research (Vijayalakshmi *et al*., 2019). Economics, flavor, availability, and convenience factors have direct consequences on women of childbearing age (Lee & Lim, 2010). These factors can affect pregnant mothers' ability to nourish the babies and resist disease. If living conditions and poverty become extensive and prolonged, they can act as a brake on child and maternal health goals/outcomes, particularly SGD 3, by increasing the prevalence of LBW babies as well as maternal and child mortality (Cubbin *et al*., 2020).

The Zimbabwe 2018 Zimbabwe National Nutrition Strategy (ZNNS) report gave a recommendation specifically directed to LBW and the recommendation focused only on prenatal care utilization. Understanding the role of these diverse risk factors by area is vital if the objective is to lower LBW occurrence in Zimbabwe. This study attempts to bridge that gap and possibly suggest measures to improve birth weight. This study attempts to generate a striking feature on maternal health and possibly provide possible solutions to reduce the prevalence of LBW.

2. Literature Review

Globally, more than twenty million neonates (an estimated 15.5% of all live births) are delivered with LBW and ninety-five percent of these are in developing countries (Feresu *et al.*, 2015). Three million of these newborns die in the first seven days of life (early neonatal period). The majority of low-birth-weight cases are housed in low- and middle-income countries (Millard *et al.*, 1991). These include 9% in Latin America, 13% in sub-Saharan Africa and 28% in south Asia (Ahmed *et al.*, 2018). Currently, in Zimbabwe, 46 children per every 1000 die before their 5th birthday, 34 per every 1000 live births die before their 1st birthday while 21 per every 1000 die within 28 days of birth (Unicef, 2018).

Low birthweight has been defined by the World Health Organization (WHO) as weight at birth of smaller than 2,500 grams (up to and comprising 2499 g) (Muriuki, 2019). A baby's low weight at birth is either the result of preterm birth (PTB) (born before 37 weeks of gestation) or due to restricted fetal growth/intrauterine growth retardation (IUGR) (WHO, 2020). LBW determinants include demographic, social, reproductive, psychological, nutritional, economic, environmental, medical, obstetrical and food choice factors. Prices and incomes are leading determinants of food choices, dietary quality, and household food security (Vijayalakshmi *et al.*, 2019). Less income usually results in a reduction in the quantities of foods consumed and/or the replacement of higher priced foods for cheaper foods which are often of less nutritional value. Changes in dietary practices can have serious and unwanted outcomes on nutrition and health during pregnancy.

LBW is broadly applied as an indicator of neonatal fragility. LBW babies have an increased susceptibility to certain developmental and neurological problems and have difficulties linked to intellectual ability, adaptive talents, scholastic performance, metabolic derangements and even neonatal death ((Rahman *et al.*, 2016, Mericq *et al.*, 2017). LBW is an imperative public health indicator of nutrition, poverty, reproductive health and overall health status of a population and is a forecaster of infant mortality. (Cutland *et al.*, 2017).

LBW is a challenge of maternity care in Zimbabwe, with prevalence ranging from 10.8% to 24.3% (Feresu *et al.*, 2004). The 2018 Zimbabwe National Nutrition Survey (NNS) reported that Harare had the highest proportion of babies with LBW (36%, almost 1 in every 4) (MoHCC, 2018), a 150% rise from 14% reported, 8 years ago, by the Zimbabwe Demographic and Health Survey (ZimStat, 2012). The Zimbabwe 2018 ZNNS report gave a recommendation specifically directed to LBW and the recommendation focused only on prenatal care utilization. The National Health Strategy for Zimbabwe 2016-2020 code-named "leaving no one behind", also recommended Family Planning Focused Antenatal Care (ANC).

3. Methodology

This study was conducted in Hopley, a new settlement situated 17 km south of Zimbabwe's capital city, Harare. According to Harare City Council, Hopley has in excess of 7,500 houses, called residential stands by locals. Hopley currently has one clinic, Tariro Clinic, which caters for the massive 200 000 population (UNFPA, 2018).

To satisfy ethical consideration, the study protocols were sought, reviewed and approved by the Midlands State University Research Ethics Committee (MSU-REC). Permission to conduct the study at the study site was sought and granted by the City of Harare's Health Department. Informed consent was sought from each study participant's parents or guardian before taking part in the study.

The design was matched-pair case-control descriptive study as illustrated in Figure 1. During delivery, the mother's delivery and pregnancy outcome details are entered into the Delivery register which is kept in the maternity wing of the clinic in accordance with City Health standard protocol. This study, therefore, mostly utilized one register (the delivery register) which had sufficient information needed for the research. Birthweight of every infant was recorded in grams using pretested and pre-calibrated weighing machines (Mumbare & Rege, 2011).

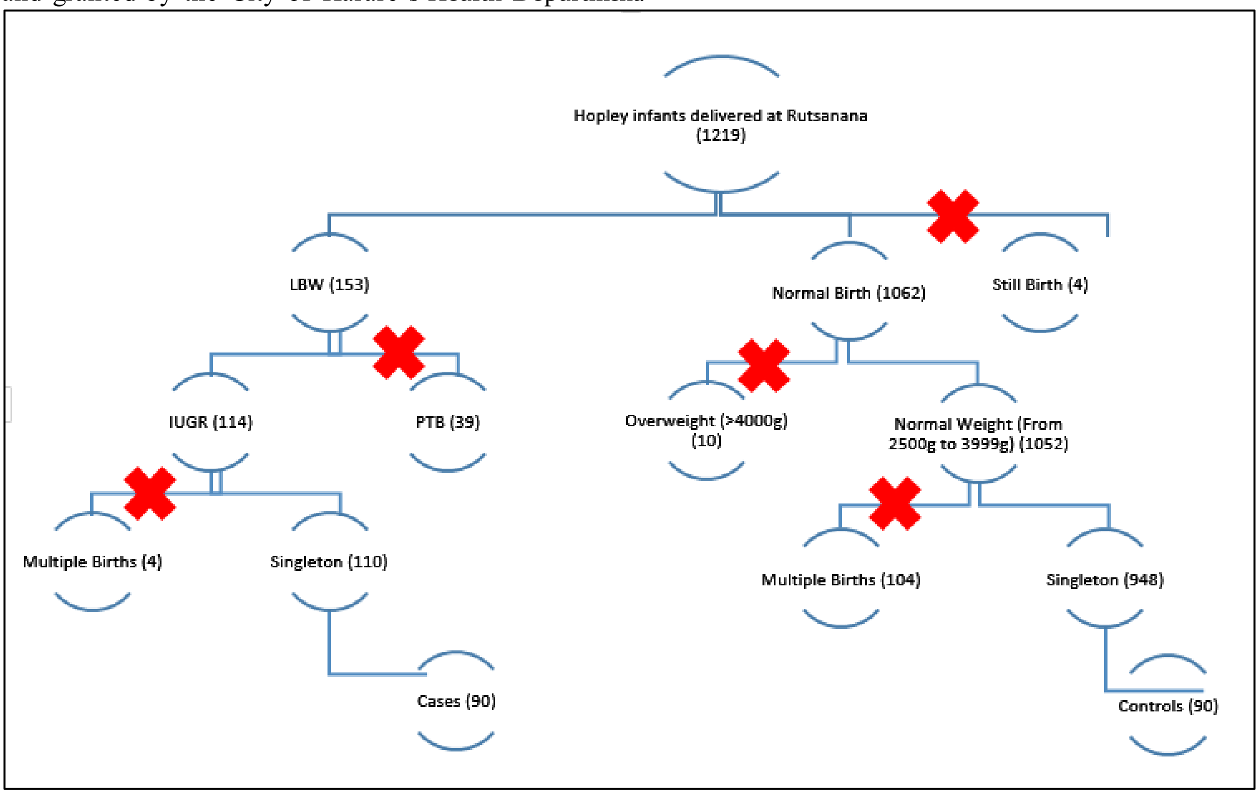

Figure1: The study design indicates how the cases and controls were selected for this study
LBW (Low Birth Weight), IUGR (Intra Uterine Growth Retardation), PTB (Pre-Term Birth)

The maternal information covering the pregnancy and gestation period was collected from delivery registers. The following information was extracted from the records and recorded in Kobo Toolbox on an Android phone: ANC number; age of mother; gestational period/age based on prenatal examination or Last Menstrual Period (LMP); gravida, parity; past obstetric complications; method, time and date of delivery; outcome; birthweight; Apgar score; sex; length of child; head circumference; supplements; and whether or not they received Prevention of Mother to Child Transmission (PMTCT) services. The study included other home deliveries that were reported to Rutsanana Clinic. Major seasonal variations in birthweight were also excluded since the moderate climate variations in Harare were not expected to affect birth weight (Dole *et al*., 1990).

Full-term infants (37+ gestational weeks), live birth infants, singletons, with Low Birth Weight (having birth weight <2500g) from Hopley were defined as cases. Without randomizing, these were selected and recorded in a separate notebook. In this lot, convenience sampling was used where only those that were reachable on the phone were included in the sample. Controls, as well, were selected from full-term (37+ gestational weeks) babies with Normal Birth Weight (having birth weight ≥2500g) adequate for gestational age, born at the same day and being the same sex as cases and the mother being of the same HIV status as the case mother (Dičkutė *et al*., 2004).

All mothers whose infants met the selection criteria were eligible to participate in the interviews. However, mothers of stillborn infants, who delivered multiple infants, or whose infants did not fit the "case" or "control" classifications were excluded from the interviews. The phone numbers and other contact details of the eligible mothers were extracted from the records at the health facility and they were used to conduct interviews by phone call. All Interviews were conducted through phone calls using an interviewer-administered structured questionnaire. The questionnaire was designed by the researcher to match the setting. It was designed to collect demographic, socio-economic, nutrition, and medical information.

The calculated sample size (n_0) for this study (i.e., cases needed for a 1:1 case-control ratio) was 174. Therefore, this study recruited a sample of 90 cases and 90 controls (n = 180).
The study aimed to detect an Odds Ratio (R) of 3, 80% power (T) at 5% level of significance (S), with about 20% (P) of the mothers (controls) exposed to LBW. The sample size was therefore calculated using the following formula:

1. $A = \frac{P*R}{1+P(R-1.0)}$ A= 0.2*3/ (1+0.2*(3-1)) = 0.42857
2. $C = \frac{A+P}{2}$ C= (0.42857+0.2)/2 = 0.314285
3. $D = 1 - C$ D= 1-0.625 = 0.685715
4. $N = \frac{2*C*D*(S+T)^2}{(P-A)(P-A)}$ N= $2*0.31*0.686*(2+0.9)^2 \div (0.2-0.43)(0.2-0.43) = 68.38$
5. ($N_{Adjusted}$) =N *1.25 = 68.38*1.25 = 87 (adjusted to include any 25% allowance for confounding) = 87 (adjusted to include a 25% allowance for confounding)

Where A is the proportion of cases that are exposed
B is the average proportion exposed,
C is a measure of variability between the exposed and non-exposed and
N is the sample size

At a ratio of one case to one control, 87 cases and 87 controls are required. This was consistent with the tables for one control per case (Cousens *et al*., 1988). To allow for loss of power when controlling for confounding factors, one can increase the ratio of cases to controls (Davenpor *et al*., 2002).

In the study, the age of the mother was defined as the age of the mother at delivery. Gravida was defined as the number of all earlier pregnancies plus stillbirths and abortions (Sutan *et al*., 2014). In this study, hypertension was defined as all hypertensive-related disorders which include pre-eclampsia, eclampsia, essential hypertension, and gestational hypertension. Diabetes mellitus (DM) was defined as either pre-existing DM or gestational DM. Birth weight was the 1st recorded weight of the newborn that was obtained soon after the birth. The 1st recorded weight of the newborn should be measured in the first hour of life as substantial postnatal weight loss can occur (Jafari *et al*., 2010).

Weight was defined as a weight at birth of <2500 grams, whereas very low birth weight (VLBW) was defined as a birth weight of ≤1500 grams. Birth interval was defined as the time space between previous delivery and conception of the next pregnancy (recent conception). The birth interval was calculated in months and was grouped into <24 months and ≥24 months. 'Previous Low Birth weight infants was defined as the maternal history of delivering LBW infants. Infant's gestational age was based on the gestational age written in the medical record. All babies with less than 37 gestational weeks were defined as Preterm Birth and those above 37 gestational weeks were defined as full term. The education level for the mother was put in three categories, i.e., primary and below (those who reached Grade 7 and below), Zimbabwe Junior Certificate (ZJC) and below (those who passed the primary stage but ended at Form 2 level) and Secondary and above (from form 3 to tertiary). A period of one month was allocated to data collection. Data was collected from individuals with the help of a clinical database. Guardians or male spouses were not considered as respondents. Electronic versions of the questionnaires were availed. Data was verified daily, either online (for data collected using an electronic questionnaire) and through email (pictures of the scanned pages of hard copy pages of the questionnaire).

The research results were captured using the Kobo Collect Toolbox version 4.4 Kobo developed by the Harvard Humanitarian Initiative (https://www.kobotoolbox.org). The open-source application was used to design the form and was installed on Android phones through Google Play application store. The data was later exported to a Statistical Package for the Social Sciences (SPSS) 16.0. Statistical analysis was performed by describing the physical, nutritional, social, and economic characteristics of the mother and baby). Univariate linear regression analysis was employed to evaluate the association between the independent variables and LBW (dependent/outcome variable) (Jafari *et al.*, 2010). At 95% confidence interval (CI), logistic regression results were reported as odds ratios along with p- and z-values.

The odds ratios (OR) found using SPSS were verified using the following formula:

OR = (Events $_{treatment}$ / Non-events $_{treatment}$) / (Events $_{control}$ / Non-events $_{control}$)

$$OR = \frac{a/b}{c/d} = \frac{ad}{bc}$$

Where: a is the number of cases exposed; b is the number of controls exposed; c is the number of cases not exposed; d is the number of controls not exposed (Table .1)

Table 1: Computation of the Odds Ratio (OR) variables

	Cases	Controls
Exposed	a	b
Not Exposed	c	d

When: OR>1, mean exposure is associated with higher odds of outcome;

OR<1, mean exposure is associated with lower odds of outcome;

OR=1, it means exposure does not affect the odds of outcome

Household Dietary Diversity Score (HDDS)
Twelve food groups were used to calculate the HDDS indicator. In the dataset, each food group was assigned a score of 0 (not consumed) or 1 (consumed). The score range for a household (equal to the number of food groups eaten) was from 0-12 and was calculated using the following formula:

$$HDDS = A + B + C + D + E + F + G + H + I + J + K + L$$

The average HDDS for the population of the study was calculated as follows:

HDDS of study sample = Sum of HDDS / Total number of households surveyed, 12 food groups used to construct HDDS were A (cereal group), B (root and tubers), C (vegetables), D (Fruits), E (Meat, poultry, offal), F(Eggs), G (Fish and seafood), H (Pulses, Legumes and Nuts), I (Milk and milk products), J (Oils / Fats), K (Sugar/Honey) and L (Miscellaneous)

4. Results and Discussion

A total of 3640 deliveries were recorded in the delivery registers at Rutsanana Clinic. The mean weight for LBW babies was 2228 ± 237.6g which was 12.6% and for NBW was 3041± 366.4 g which was 86.3%. In Hopley, there was 0.3% still birth and 0.8% overweight babies born during the period of research. Table 2 below shows the distribution of low birth weight among participants used for the research.

Table 2: Low Birth Weight distribution for Hopley mothers

LBW category	n	% Male	% Female
Preterm Twins	10	2.6	3.9
Preterm Singletons	29	9.2	9.8
IUGR Twins	4	2.0	0.7
IUGR Singletons	110	27.5	44.4

Demographic characteristics of participating mothers

The age of the mother, gravida status, and parity was associated with increased risk of LBW. Marital status was not associated with an increased risk of LBW. Being 20 years and below was highly linked to LBW (OR= 3.27, CI= [1.576, 6.775], p<0.01), whereas the age group 21 to 30 years had a protective effect on LBW (OR=0.42, [0.210, 0.702], p<0.01). Being above 30 years did not affect LBW. Gravida status of 1 was associated with LBW (OR=2, CI = [1.073, 3.762], p<0.05), while the gravida status of 3 or more was associated with NBW (OR=0.52, CI = [0.286, 0.955], p<0.05). Parity of zero significantly increased the risk of LBW (OR=2.1, CI [1.124-3.933]; p<0.01), while parities 1 and 2 were not associated with LBW. Table 3 below shows the physical and demographic characteristics of participants used for the research.

Table 3: Physical and demographic characteristics of the participants

	Factor	n	% Cases	% Controls	Odds Ratio (95 %CI)	95% Confidence Interval	P-value	Z-score
Age of mother (yrs)	***Age ≤ 20***	**45**	**71.1**	**28.9**	**3.3**	**[1.576, 6.775]**	**0.0007**	**3.183**
	20 < age ≤ 30	97	42.2	60.8	0.4	[0.210 , 0.702]	0.0009	3.110
	Age>30	38	22.2	47.4	1.1	[0.558 , 2.340]	0.3575	0.365
Gravida	***Gravida 1***	**62**	**42.2**	**38.7**	**2.0**	**[1.073 , 3.762]**	**0.0146**	**2.181**
	Gravida 2	44	24.4	50.0	1.0	[0.507 , 1.974]	0.5000	0.000
	Gravida ≥ 3	74	33.3	59.5	0.5	[0.286 , 0.955]	0.0174	2.111
Parity	***Parity = 0***	**63**	**43.3**	**38.1**	**2.1**	**[1.124 , 3.933]**	**0.0100**	**2.327**
	Parity =1	45	23.3	53.3	0.8	[0.426 , 1.645]	0.3029	0.516
	Parity≥2	72	33.3	58.3	0.6	[0.313 , 1.044]	0.0345	1.819
Marital status	*Marital Status - Married*	164	87.8	51.8	0.4	[0.141 , 1.270]	0.0625	1.534
	Marital Status - Not Married	16	12.2	31.3	2.4	[0.787 , 7.115]	0.0625	1.534

Medical Characteristics

Booking and Prenatal visits were not associated with LBW (p>0.05). No client reported Diabetes mellitus (DM) either as pre-existing DM or gestational DM. All hypertensive related disorders which include pre-eclampsia, eclampsia, essential hypertension, and gestational hypertension did not have a relationship with LBW (p>0.05) (Table 4).

Table 4: Medical characteristics of the participants

	Factor	n	% Cases	% Controls	Odds Ratio (95 %CI)	95% Confidence Interval	P-value	Z-score
Hypertension	*Yes*	24	50.0	50.0	1.0	[0.423 , 2.362]	0.5000	0.000
Booking	*Unbooked*	22	59.1	40.9	1.5	[0.614 , 3.757]	0.1825	0.906
Complications	*With Past Obstetric Complication*	8	37.5	62.5	0.6	[0.136 , 2.530]	0.2370	0.716
Prenatal Care	*Did not seek prenatal Care*	32	43.8	56.3	0.7	[0.341 , 1.590]	0.2183	0.778
	Sook prenatal Care in First trimester	4	25.0	75.0	0.3	[0.033 , 3.191]	0.1672	0.965
	Sook prenatal Care in Second trimester	82	50.0	50.0	1.0	[0.556 , 1.798]	0.5000	0.000
	Sook prenatal Care in third trimester	62	54.8	45.2	1.4	[0.725 , 2.657]	0.1613	0.989
	Prenatal visits < 4	126	52.4	47.6	1.4	[0.725 , 2.609]	0.1649	0.974
Previous Birth Related issues	***Previous LBW Baby (Yes)***	**14**	**85.7**	**14.3**	**6.8**	**[1.469 , 31.189]**	**0.0071**	**2.454**
	Birth Interval < 24 months	17	70.6	29.4	2.6	[0.881 , 7.760]	0.0416	1.733

Socioeconomic Characteristics

All respondents were from a Christian background. There was an association between LBW and religion as more cases (OR=2.6, CI = [1.391, 4.761], p<0.01) were affiliated to African apostolic churches. Belonging to a mainline church had no relationship with low birth weight (OR=0.2, CI = [0.076, 0.508], p<0.01). Being Pentecostal was not associated with LBW.

Earning less than USD20 (Odds ratio=2.75, CI= [1.474, 5.131], p< 0.01) was highly associated with LBW, while earning between USD20 and USD40 (OR=0.4, CI = [0.242, 0.804], p<0.01) was associated with NBW. With employment status, there was a positive association between LBW and being a vendor/merchant (OR=2.10, CI = [1.201, 4.028]; p<0.01) while being a housewife (OR=0.4, CI = [0.230, 0.767], p<0.01). Education status and formal employment were not related to LBW. None reported cigarette smoking and only one case reported on drinking alcohol during pregnancy. Both elements were found not statistically noteworthy for the occurrence of LBW infants. Table 5 below shows the socioeconomic characteristics of the participants.

Table 5: Socioeconomic Characteristics of the participants

	Factor	n	% Cases	% Controls	Odds Ratio (95 %CI)	95% Confidence Interval	P-value	Z-score
Religion	***African Apostolic***	**108**	**59.3**	**40.7**	**2.6**	**[1.391, 4.761]**	**0.0013**	**3.011**
	Main Line	30	20.0	80.0	0.2	[0.076 , 0.508]	0.0004	3.354
	Pentecostal	42	47.6	52.4	0.9	[0.442 , 1.763]	0.3623	0.352
Education	*Education ≤ primary*	10	70.0	30.0	2.4	[0.612 , 9.776]	0.1029	1.265
	Education ≤ ZJC	34	58.8	41.2	1.6	[0.728 , 3.304]	0.1277	1.138
	Education ≥ Secondary	136	46.3	53.7	0.5	[0.271 , 1.088]	0.0425	1.722
Employment	*Formally Employed*	6	66.7	33.3	2.0	[0.365 , 11.465]	0.2077	0.815
	Merchant/Vendor	**75**	**61.3**	**38.7**	**2.1**	**[1.201 , 4.028]**	**0.0054**	**2.552**
	Housewife	99	40.4	59.6	0.4	[0.230 , 0.767]	0.0024	2.824
Income	*income ≤ 20 USD*	69	65.2	34.8	2.8	[1.474 , 5.131]	0.0007	3.179
	20USD <income ≤ 40 USD	82	39.0	61.0	0.4	[0.242 , 0.804]	0.0037	2.675
	income > 40 USD	29	44.8	55.2	0.8	[0.351 , 1.735]	0.2718	0.607

Nutritional Characteristics

Lack of nutrition counseling (OR=2.3, CI = [1.153, 4.637], p<0.01) and eating Termite Mound (OR=2.60, CI = [1.439-4.867], p<0.001) showed a high association with LBW as more cases were in these categories (Table 6). Taking traditional medicines and lack of iron/folate supplementation were not linked to LBW.

Table 6: Nutritional characteristics of the participants

	Factor	n	% Cases	% Controls	Odds Ratio (95 %CI)	95% Confidence Interval	P-value	Z-score
Use of Traditional substances	***Eating Mound (Yes)***	**77**	**63.6**	**36.4**	**2.6**	**[1.439 , 4.867]**	**0.0009**	**3.130**
	Taking Traditional Medicines (Yes)	50	46.0	54.0	1.5	[0.725 , 2.996]	0.1418	1.072
Counseling	***nutrition counseling (No)***	**134**	**55.2**	**44.8**	**2.3**	**[1.153 , 4.637]**	**0.0091**	**2.362**
Supplementation	*Iron and Folate Suplementation (No)*	20	60.0	40.0	1.6	[0.612 , 4.064]	0.1729	0.943

24-hour dietary recall

Table 7 looks at consumption during the past 24 hours. Eating tsunga (OR=4.9, [0.135, 17.827], p<0.01) was associated with LBW, while eating Sugar had a protective effect on birth weight (OR=0.2, [0.074, 0.731], p<0.05). Cereals, mainly sadza and porridge, made from maize were consumed daily by 98.9% of the respondents. No consumption of small grains was reported. Milk and milk products were not consumed. Eggs, meat, and meat products were not regularly consumed (20% cases and 21% control) by most respondents in accordance with the dietary guidelines by the MoHCC. Some respondents (28% cases and 39% controls) substituted meat with healthy exchanges like soya chunks, kapenta, and beans. Vegetable consumption was very high (99% cases and 89% control) while fruit consumption was very poor (2% cases and 4% control).

Table 7: Foods eaten by respondents in the previous 24 hours (24-hr Recall)

Category	Food eaten	n	Cases (%)	Control (%)	Odds Ratio (95 %CI)	*95% Confidence Interval*	*P-value*	*Z-score*
Cereals and Tubers	*sadza*	178	50.0	50.0	1.0	[0.062, 16.238]	0.5000	0.000
	rice	34	50.0	50.0	1.0	[0.474, 2.109]	0.5500	0.000
	pasta	3	0.0	100.0	0.0	0	0.0000	0.000
	bread	33	39.4	60.6	0.6	[0.274, 1.276]	0.0902	1.340
	chimodho	24	50.0	50.0	1.0	[0.423, 2.362]	0.5000	0.000
	potato	4	75.0	25.0	3.1	[0.313, 30.076]	0.1678	0.963
	white sweet potato	21	38.1	61.9	0.6	[0.227, 1.471]	0.1249	1.151
	other	8	75.0	25.0	3.1	[0.617, 16.009]	0.0840	1.379
Legumes/Nuts/peanuts	*beans*	12	33.3	66.7	0.5	[0.138, 1.644]	0.1204	1.173
	cow peas	1	0.0	100.0	0.0	0	0.0000	0.000
	soya chunks	47	44.7	55.3	0.7	[0.384, 1.461]	0.1984	0.847
Flesh/Organ Meat/fish/Egss	*beef*	5	40.0	60.0	0.7	[0.136, 7.176]	0.4955	0.011
	pork	2	100.0	0.0	0.0	0	0.0000	0.000
	chicken	12	50.0	50.0	1.0	[0.310, 3.226]	0.5000	0.000
	matumbu	2	50.0	50.0	1.0	[0.062, 16.238]	0.5000	0.000
	fish	1	0.0	100.0	0.0	0	0.0000	0.000

Category	Food eaten	n	Cases (%)	Control (%)	Odds Ratio (95 %CI)	*95% Confidence Interval*	*P-value*	*Z-score*
Flesh/Organ Meat/fish/Egss	*matemba*	11	0.0	0.0	0.8	[0.242, 2.802]	0.3780	0.311
	egg	3	0.0	0.0	2.0	[0.180, 22.713]	0.2840	0.571
	other meat	1	0.0	0.0	0.0	0	0.0000	0.000
Orange and Green leafy vegetables/fruits	*carrot*	2	0.0	0.0	0.0	0	0.0000	0.000
	pumpkin	2	0.0	0.0	0.0	0	0.0000	0.000
	tomato	106	0.0	0.0	1.3	[0.727, 2.390]	0.1819	0.908
	spinach	1	0.0	0.0	0.0	0	0.0000	0.000
	tsunga	16	0.0	0.0	**4.9**	**[0.135, 17.827]**	**0.0080**	2.409
	covo	121	0.0	0.0	1.4	[0.762, 2.664]	0.1336	1.110
	rape	12	0.0	0.0	0.7	[0.213, 2.285]	0.2759	0.595
	other dark green leaf vegs	11	0.0	0.0	1.8	[0.512, 6.424]	0.1782	0.922
	banana	2	0.0	0.0	0.0	0	0.0000	0.000
	orange	1	0.0	0.0	0.0	0	0.0000	0.000
	lemon	1	0.0	0.0	0.0	0	0.0000	0.000
	other fruit	2	0.0	0.0	0.0	0	0.0000	0.000
Oil/Fats	*Veg Oil*	32	0.0	0.0	0.5	[0.206, 1.016]	0.0274	1.921
	Margarine	1	0.0	0.0	0.0	0	0.0000	0.000

	other oils/fat	3	0.0	0.0	0.5	[0.044, 5.551]	0.2840	0.571
	sugar	19	0.0	0.0	**0.2**	**[0.074, 0.731]**	**0.0063**	2.496
Sugar/Honey/Sweet	*cake*	1	0.0	0.0	0.0	0	0.0000	0.000
	other sweet/sugary drink	1	0.0	0.0	0.0	0	0.0000	0.000
	tea	83	0.0	0.0	0.6	[0.338, 1.101]	0.0505	1.641
Miscellaneous (Condiments and spices)	*coffee*	3	0.0	0.0	0.0	0	0.0000	0.000
	salt	178	0.0	0.0	0.0	0	0.0000	0.000
	other spices	5	0.0	0.0	4.1	[0.454, 37.782]	0.1040	1.259

The mean weight for Low-Birth-Weight infants (2228 ± 237.6g) and for Normal Birth Weight infants (3041± 366.4 g) reported in this study were consistent with previous findings of a study conducted in Zimbabwe where the LBW was 2213 ± 367 g and the mean NBW was 3263 ± 431 kg (Yaya *et al*., 2017). The prevalence of LBW in Rutsanana (13%) was slightly higher than the 10% reported in 2007 (Mbuya *et al*., 2010), but lower than the 36% reported in the National Nutrition Survey of 2018 (MoHCC,2018). However, the LBW prevalence at Hopley was consistent with previous studies done and the national prevalence of 12.8% at the national level in research conducted in Zimbabwe (Yaya *et al*., 2017). LBW prevalence rate temporarily rose from just above 10% (Mbuya *et al*., 2010)., to 14% in 2010/11(Takarinda *et al*., 2016), and a frequency rate for LBW of 16.7% at Harare Maternity Hospital (Feresu *et al*., 2015).

The sample included 180 women within the age group of 15–49 years (Table 3). There was a clear link between those under the age of 21 years and delivering a LBW infant. The study indicated that 31 cases were in the age group ≤20 years had delivered LBW babies. This is probably due to the fact that younger mothers are characteristically lighter and smaller than their older, biologically more developed counterparts and hence their neonates are usually smaller than those of adult gravida (Ogbonna *et al*., 2007).

Gravida 1 (OR=2, CI [1.073, 3.762]; p<0.05) and Parity 0 (OR=2.1, CI [1.124, 3.933]; p< 0.01) were associated with LBW (Table 3). There is usually a gradual rise in average birthweight as parity increases (*Dole et al*., 1990). In a study conducted in Zimbabwe, mothers who gave birth more than once showed a one- third decrease in the risk of having infants with LBW when likened to those having babies for the first time (Yaya *et al*., 2017).

For all mothers in the sample, 12% (14.4% cases; 10% controls) were not booked with an Odds ratio of 1.5 (Table 4), and this was consistent with results of a study done at Harare Hospital (Fawcus *et al*., 1992). The most common explanations given by the respondents were that the women either assumed it was too early to book or they did not have adequate money to book. Less utilization of prenatal care in sub-Saharan Africa has been linked to the worsening economic situation, poor access to care facilities, women's lack of consciousness about the best time to start care (Galvan, 2001). Among the factors already mentioned for not seeking prenatal care, the other factor, consistent with (Galvan, 2001), was the fright of exposure to rude and disrespectful health workers. Given this reason and others, a total, of 70% (73.3% cases; 66.7% controls, Odds ratio=1.40) of all mothers had less than the recommended four (4) prenatal visits before delivery.

In contrast to a study conducted in Bangladesh where religion was an insignificant contributor to LBW (Khatun & Rahman, 2008., there was an association between LBW and affiliation to an African apostolic church. Apostolic sects like Johane Marange do not believe in any medication at all, they indicated that they believed in the water that has been prayed for at their churches (Musevenzi, 2017). Long hours spent by the mother at the shrines at different days of the week can introduce poor maternal consumption habits and hence LBW. Polygamy can obstruct intrahousehold food distribution due to many family members.

Similar to other studies, income had an influence on birth weight as those earning USD 20 were at risk of giving birth to neonates below 2500g (Table 5). Price and income are the leading determinants of food choice, dietary quality, and household food security (Vijayalakshmi, 2019). The effect of aggregate fluctuations, macroeconomic shocks as well as economic crises on the welfare of the household, from undeviating effects on employment, income, and poverty, to extended consequences on health (including LBW), human capital investment and psychological well-being have been well documented (Cruces *et al*., 2012). Regarding wealth/income status, 99.4% (100% cases and 98.9 controls) were living below the Zimbabwe March 2020 poverty datum line, thus there is a relationship between being young income and LBW. Marital status had no relationship with LBW in contrast to one study where being unmarried was significantly associated with LBW delivery (Masho *et al*., 2010). There was an association between LBW and being a vendor/merchant. Most women reported a very high mobility as they sell commodities from places like Mbudzi Traffic Circle to Harare CBD. Little gestational weight gain either due to excess expenditure of much-needed calories (hard work) or inadequate dietary intake, poor maternal nutritional status just before or during conception, and short maternal stature are also risk factors of LBW particularly being born small for gestational age (SGA) (Ahmed *et al*., 2018). Spending the whole day in the street affects cooking and eating practices and it is money to buy a meal that is not guaranteed. Of the vendors, 25 cases earned USD20 and below, while only 12 controls of the same trade earned as much (Table 5). This shows the relationship between vending, income obtained and LBW. Inclusive prenatal services that consist of parental counseling, education, screening services, nutritional services, and home visitation can be an effective policy tool to prevent low birth weight births, the gathered data showed that an association between lack of nutrition education and/or counseling and LBW (Lee & Lim, 2010).

The average Household Dietary Diversity Score (HDDS) for respondents was 4.5 (4 for cases and 5 for controls) (Table 7). This indicates poor consumption in both cases and controls but particularly in the cases. Absence of dietary diversity is a predominant challenge in most poor populations in developing countries as they are chiefly centered on starchy foods (Rathnayake *et al*., 2012). Milk and milk products were hardly consumed also due to the pricing and few respondents relied on non-nutritious creamers as substitutes for milk. Vegetable consumption was very acceptable according to the Zimbabwe Food and Nutrition Council's 'Healthy harvest' guidelines (FNC, 2015). Some respondents (20%) indicated that they grew their own vegetables in their backyards while the rest indicated that this was the cheapest relish on the market. Market prices for vegetables were favorable and clients easily accessed through local farmers or markets. Fruit consumption was very poor (2% cases and 4% control). The recommended number of fruit servings per day (>2) (WHO, 2019). were far from being achieved as respondents highlighted that they did not make enough money to afford the fruits and mainly due to attitudes and beliefs that they were luxurious foods.

5. Conclusion and Recommendations

5.1 Conclusion

The study concluded that low birth weight in Hopley depends on socioeconomic, medical, nutritive, and demographic factors. The research concludes that the frequency of LBW is consistent with other areas in Harare; that age, gravida status, parity, nutrition, education/counselling, history of LBW, type of church affiliated to, employment status, income, eating mound) mujuru are significant predictors of LBW in this population of Hopley mothers. The level of education and birth interval needs more exploitation given the high odds ratios. Factors like marital status, hypertension, prenatal booking, past obstetric complications and education, iron, and folate supplementation were not related to Low Birth Weight.

5.2 Recommendation

There is need to explore more on the impact of level of education and birth intervals on Low-Birth-Weight problem among reproductive women in Zimbabwe. Women need adequate nourishment before and during pregnancy to minimize the problem of Low-Birthweight. Incentives are needed to encourage childbearing mothers to acquire education on nutrition and supplementary feeding.

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