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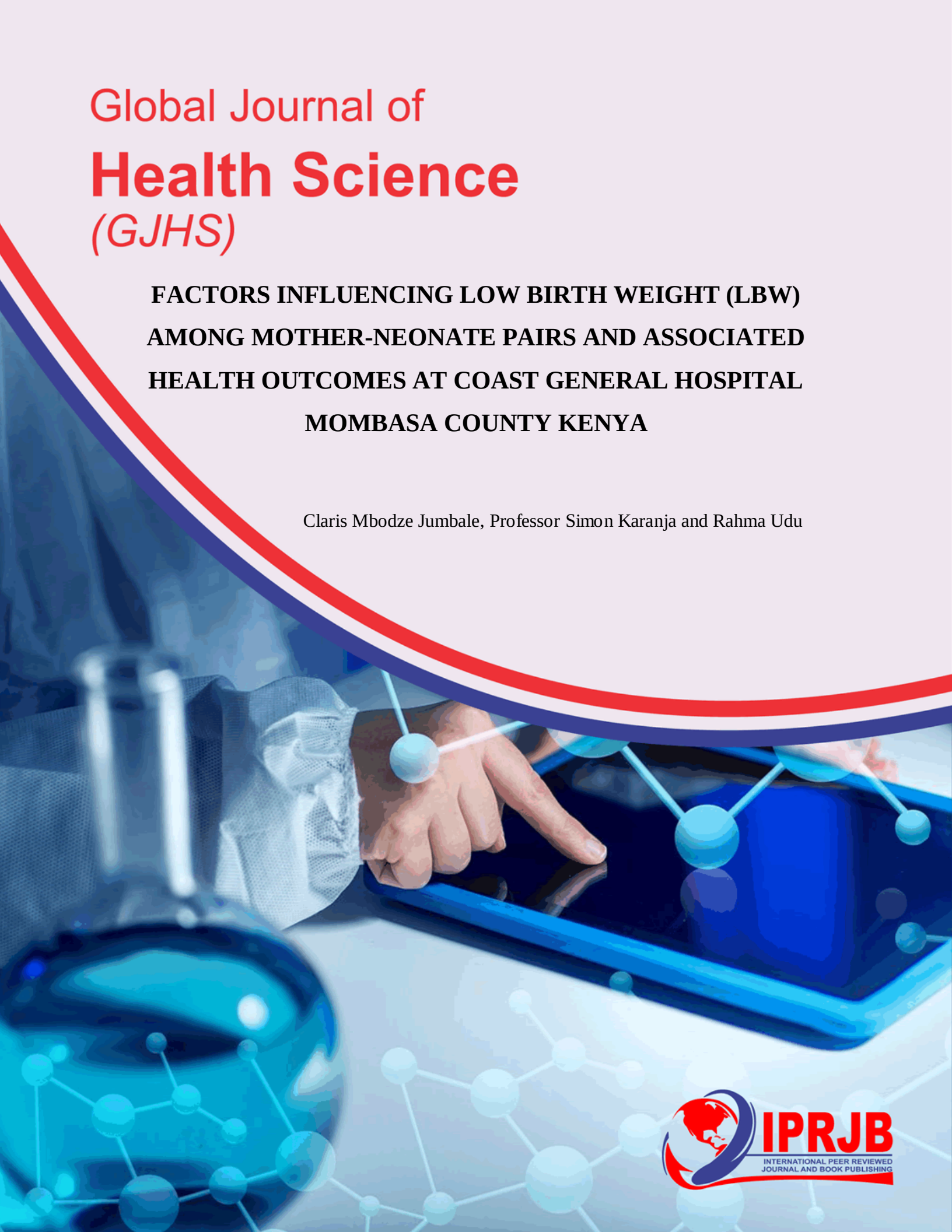
Claris Mbodze Jumbale, Professor Simon Karanja and Rahma Udu



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FACTORS INFLUENCING LOW BIRTH WEIGHT (LBW) AMONG MOTHER-NEONATE PAIRS AND ASSOCIATED HEALTH OUTCOMES AT COAST GENERAL HOSPITAL MOMBASA COUNTY KENYA

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Abstract

Purpose: Low birth weight (LBW) is weight at birth of less than 2500gms regardless of the gestational age. Low birth weight is the leading cause of infants and child mortality. Most neonates / infants spend most of their weeks/ months in hospitals. Globally 20 million LBW babies are born every year throughout the world. Reports indicate that an estimated 14 % of neonates are born with LBW while the burden is estimated to be 16% in Kenya. The Objective of this study was to determine factors influencing low birth weight (LBW) and associated health outcomes associated among Mother-Neonate pairs at Coast General Hospital Mombasa County.

Methods: A descriptive cross-sectional study was used to collect data on socio-demographic/socioeconomic characteristics, birth weight, and mothers' knowledge as a predictor of health outcomes among neonates. A total of 525 mothers who had delivered at Coast general hospital Mombasa County during the study period of 8months from August 2015 to March 2016 were recruited. Systematic simple random sampling was used to select study participants and a semi-structured questionnaire used to collect data. Data analysis was done by STATA 13·1 (College Station, TX, USA).

Results: The prevalence of low birth weight was 29%, the prevalence was much higher than the estimated prevalence in developing countries of 16% and global prevalence; 15.5% (WHO 2012). There was significant association between low birth weight (LBW) and the following factors; caesarean section birth (adjusted relative risk (ARR) 2.33 (95% CI 1.22 - 4.44), twin birth (ARR 2.85 (95% CI 1.11 - 7.33) and previous low birth weight (ARR 2.42 (95% CI 1.04 - 5.59). Having college education level (ARR 0.41 (95% CI 0.18 - 0.92) and normal hemoglobin concentration (ARR 0.67 (95% CI 0.58 - 0.78) had protective effect on the risk of LBW. Attending ANC during pregnancy for less than 4 times as recommended by WHO was associated with ~3 fold increase in risk of LBW (CRR 2.60 (95% CI 1.69 - 4.02). The prevalence of LBW of 29% is higher than the national burden.

Unique Contribution to Theory, Practice and Policy: There is need for mothers to maintain a healthy weight gain and good nutrition, start antenatal care early, make significant life style changes and pre-exciting medical condition under control to reduce the prevalence.

Key words: *Low Birth Weight, Birth Weight, Preterm, Health Outcomes*

1.0 INTRODUCTION

Low birth weight (LBW) is defined by world health organization (WHO) as weight at birth of less than 2500gms regardless of the gestational age. Low birth weight is the leading cause of infants and child mortality. LBW is a public health problem especially in developing countries. W H O/UNICEF (2012). Prevalence of LBW at the study area was not known. Objective of the study was to determine factors influencing low birth weight (LBW) among Mother-Neonate pairs and associated health outcomes at Coast General Hospital Mombasa County Kenya. No study has been done at the study area despite many babies born at the referral hospital of the Kenyan Coast. Study finding and recommendations made will help to put mitigation measures in place to help reduce problem of Low birth weight.

2.0 METHODS

The study was done in a busy referral hospital for a period of eight months in 2015/2016 in a level five hospital in Mombasa County Kenya. It was a descriptive cross-sectional study. Probability systematic random sampling was used. Sample Size used for the study was 525 mothers. Pretesting of the questionnaire as the study tool was done at Malindi Sub-County hospital. Corrections found were made accordingly for validity and reliability of the data. On inclusion and exclusion criteria and ethical considerations, mothers who had delivered at the hospital and gave an informed consent were interviewed as study respondents while those who did not give an informed consent were left out. A semi structured questionnaire was used to collect data. 525 eligible mothers were recruited by probability systematic random sampling. On the day of the execution of the study the first parameter was selected randomly from the birth register and then the rest selected by systematic random sampling to avoid bias where every 15^{th} member of the population was selected until the desired sample size of 525 individuals was obtained. Raw data collected was sorted for completeness and response return rate, data was entered into Epi Info (version 3.5.4) database. The data was exported to STATA 13·1 (College Station, TX, USA) and analyzed using chi-square test of associations or fisher's exact test, independent t-test or Wilcoxon rank-sum test and log-binomial regression analysis.

Study area and study population

The study was done at a busy referral hospital Coast general in Mvita sub-county Mombasa County at the Kenyan Coast. The area of study is gazette as an urban area according to the Kenyan government. There are many babies who are born in the facility and the prevalence of low birth weight was 29%. The study population was mothers who had delivered at the hospital after giving an informed consent.

Sample size determination and sampling technique

Fisher et al formula was used to determine the sample size among the mothers who delivered at the study area between August 2016 and March 2016 and a 30% to cater for response return rate. A total of 525mothers were recruited as study participants. Sampling was done by using systematic random sampling**.**

Data Collection

A semi structured questionnaire in two languages English and Kiswahili was used to collect primary data after a pre-testing was done and adjustments made before the actual execution of the study was done. Study participants were explained to risks and benefits of the study, gave an informed consent and the questionnaires were administered with the help of the research assistants. Questionnaires were checked for completeness and kept under key and lock as the process was ongoing till desired sample size was reached.

Data analysis

Data analysis was done by STATA 13·1 (College Station, TX, USA). Raw data which was collected by use of the questionnaire was analyzed by STATA 13·1 (College Station, TX, USA). Analysis involved descriptive statistics such as frequencies and proportions for both numerical and categorical variables. Test of association on low birth weight and the independent variables was done through univariate and multivariate analysis using odds ratio and chi square used to calculate the p-values where univariate analysis showed significant association were entered into a log binominal regression for multivariate analysis. The level of test significance was set at 0.05 as the p-value with a confidence interval at 95%, a p-value of less than 0.05 was considered statistically significant.

3.0 RESULTS

Socio-demographic and socio-economic factors of study participants

The median age (interquartile range-IQR) in years of the mothers was 26 (23 to 29) and was not different between LBW and non-LBW participants (p=0.98). On level of education of the respondents 56% of LBW had primary or no education, 44% with non LBW, secondary education 23% LBW while 77% had non LBW and the respondents who had collage education 10% had LBW and 90% had non LBW. On marital status of the respondents 29% who were married had LBW while 71% had non LBW. Those who were single 31% had LBW and 69% non LBW. ON residence majority of the respondents were urban dwellers 92% while 18% rural dwellers. Out of the urban dwellers 26% had LBW and 74% non LBW. On employment overall 226/496 (47%) mothers were employed; 81 (37%), 44 (20%) and 94 (43%) on permanent basis, as casual laborers and self-employed respectively (Table 1 below).

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Table 1: socio demographic and socioeconomic characteristics

Characteristics*	All participants (N=496)	Birth weight<2500grams (N=145)	Birth weight≥2500grams (N=351)	Univariate p-value
Age in years, Median (IQR)	26 (23 to 29)	25 (23 to 30)	26 (23 to 29)	0.98
Education levels Primary or no education Secondary education College education	 126 (25) 181 (36) 173 (35)	 71 (56) 41 (23) 18 (10)	 55 (44) 140 (77) 155 (90)	 <0.001
Employed	226 (47)	48 (21)	178 (77)	0.002
Religion Christian Muslim	 407 (82) 89 (18)	 110 (27) 35 (39)	 297 (73) 54 (61)	 0.02
Marital status Married Single	 424 (85) 72 (15)	 123 (29) 22 (31)	 301 (71) 50 (69)	 0.50
Urban resident	451 (92)	118 (26)	333 (74)	<0.001

Prevalence of low birth weight

Out of 6,005 live births in the hospital during study period, 525 mothers and their neonates were recruited. Some 29 (5.5%) neonate participants were missing the birth weight and were excluded in the analysis, leaving a total of 496 (Figure 1 below). 145/496 which is 29% neonates were born with low birth weight (LBW) (birth weight <2500 grams) and 71% non LBW; a prevalence of 29% (95% CI 25 to 33) Figure 2 below

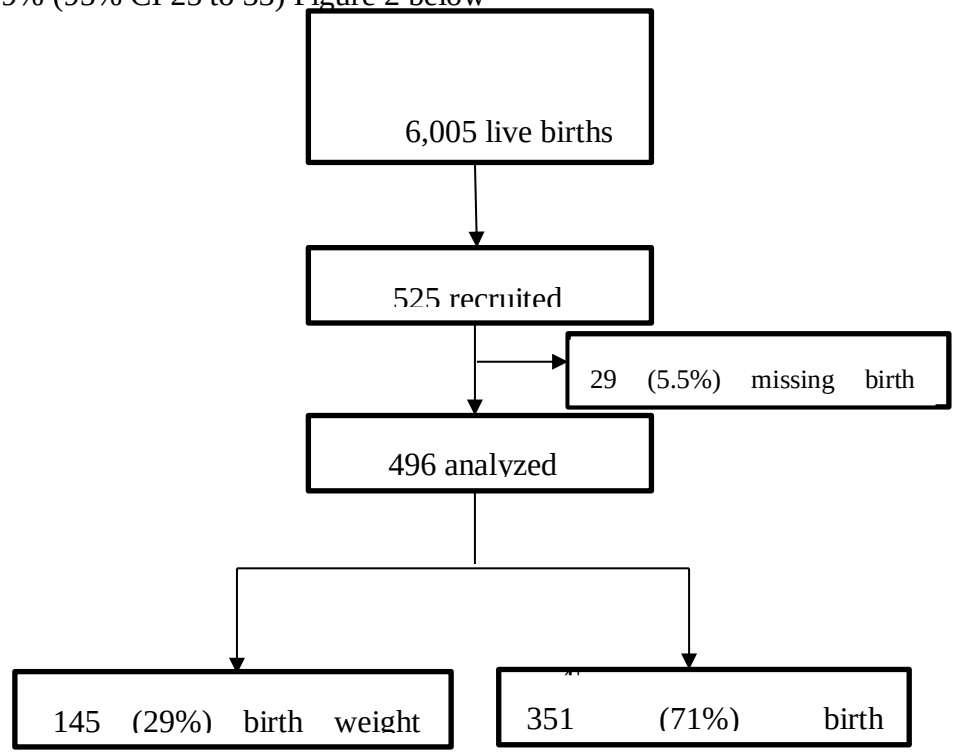

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Figure 1: Study participant's flow chart.

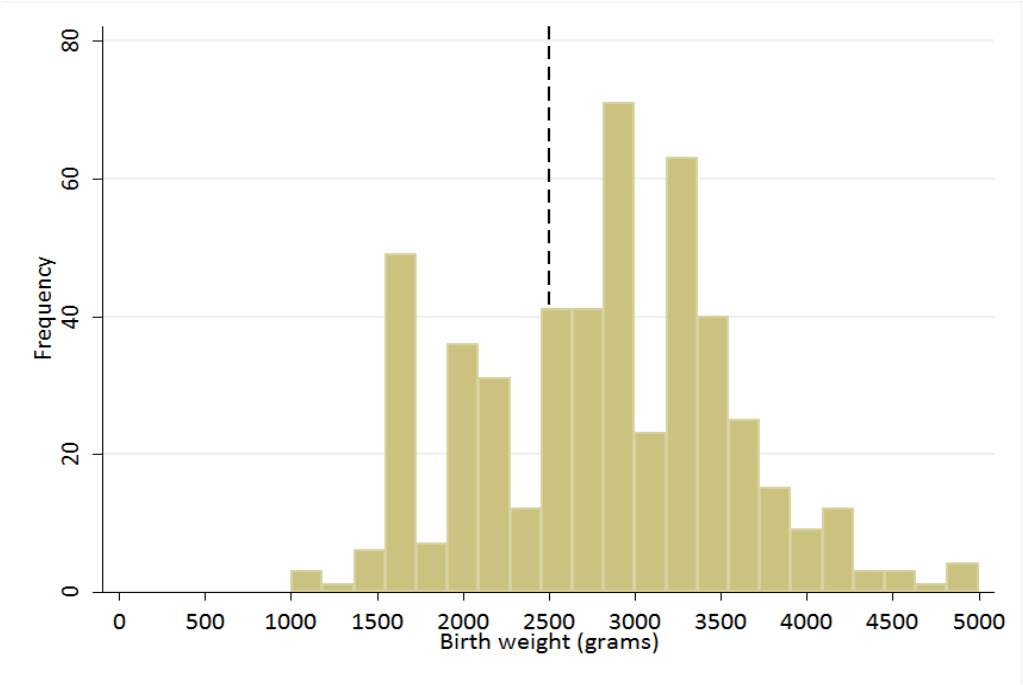

Figure 2: Distribution of birth weights (grams).

Mother –level factors

A total of 494 participants attend ANC at least once; 108 (76%) and 346 (99%) among LBW and non-LBW participants respectively (p <0.001). During the ANC visits, 222 (45%), 213 (43%), 209 (42%) and 144 (29%) reported to have received examinations, investigations, Immunization/drugs and counseling respectively. 190 (38%) mothers had health problems during pregnancy; 83 (57%) and 107 (30%) among the LBW and non-LBW participants respectively, P <0.001 (Table 2). Mothers with LBW neonates and those with non-LBW neonates reported varying knowledge of causes, prevention and management of LBW (Table 2). Overall, 124/496 (25%) reported that LBW can be prevented by attending the ANC; 16 (11%) and 108 (31%) among mothers with LBW and non-LBW respectively (P<0.001). Use of ant-malarial during pregnancy was more prevalence among non-LBW mothers (p<0.001) but LBW mothers reported have had more health problems during the pregnancy (Table 2). The health problems reported during the pregnancy were; fever infection, hypertension, multi pregnancies complications and preterm labour reported by 106 (21%), 25 (5.1%), 15 (3.1) and 1 (0.2%) respectively. Non-LBW participants' mothers were more satisfied with hospital reception and nursing care but the LBW participants' mothers appreciated postnatal care more (Table 2).

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Table 2: ANC experiences and LBW knowledge

Variable*	LBW	Non-LBW	P-value
Knows what LBW is	48 (33)	140 (40)	0.16
Knows how a LBW baby looks like	42 (30)	139 (40)	0.04
What causes LBW?			
Multiple pregnancies/infections	29 (20)	9 (2.6)	<0.001
Maternal age	12 (8.3)	1 (0.3)	<0.001
Poor nutrition	11 (7.6)	113 (32)	<0.001
All the above	22 (15)	24 (6.8)	0.004
How can LBW be managed?			
Ensure breathing	2 (1.4)	0	0.09
Ensure warmth	8 (5.5)	6 (1.7)	0.02
Feeding	9 (6.2)	125 (36)	<0.001
Care of infections	2 (1.4)	2 (0.6)	0.58
All the above	29 (20)	16 (4.6)	<0.001
How can LBW be prevented?			
Provision of information	2 (1.4)	12 (3.4)	0.17
Educate the mothers	6 (4.1)	8 (2.3)	0.26
Counseling	10 (6.9)	5 (1.4)	0.001
Antenatal care visits	16 (11)	108 (31)	<0.001
All the above	20 (14)	25 (7.1)	0.02
Previous LBW	26 (18)	17 (4.8)	<0.001
History of LBW in the family	15 (10)	58 (17)	0.08
History of twin births in the family	46 (32)	121 (35)	0.56
History of fever during pregnancy	34 (23)	94 (27)	0.43
Use of ant-malarial during pregnancy	54 (37)	212 (60)	<0.001
Use of antibiotics for infection during pregnancy	24 (17)	92 (26)	0.03
Any health problems during pregnancy	83 (57)	107 (30)	<0.001
Satisfied/extremely satisfied with;			
Reception	82 (57)	304 (87)	<0.001
Nursing care	88 (61)	307 (87)	<0.001
Delivery process	86 (59)	227 (65)	0.65
Postnatal care	134 (92)	313 (89)	0.02
Satisfied/extremely satisfied with;			
Immunization	124 (86)	314 (89)	0.78
Family support	124 (86)	309 (88)	0.86
Food intake	89 (61)	306 (87)	<0.001
Counseling	76 (52)	246 (70)	0.02
* All the results are N (%)			

Risk factors associated with low birth weight

The following (table 3 below) factors were associated with increased risk of LBW; caesarean section birth (ARR 2.33 (95% CI 1.22 to 4.44), twin birth (ARR 2.85 (95% CI 1.11 to 7.33) and previous low birth weight (ARR 2.42 (95% CI 1.04 to 5.59) from the multivariable analysis (Table 3). Having college education level (ARR 0.41 (95% CI 0.18 to 0.92) and an increase of hemoglobin per g/dl (ARR 0.67 (95% CI 0.58 to 0.78) were associated with protective effect on risk of LBW. Attending ANC during pregnancy for less than 4 times as recommended by WHO was associated with ~3fold increase in risk of LBW (CRR 2.60 (95% CI 1.69 to 4.02) in the univariable analysis but the effect attenuated in the multivariable analysis. Preterm birth (gestation age <37 weeks) was also associated with ~7fold increase in the risk of LBW (CRR 6.74 (95% CI 4.74 to 9.59) in the univariable analysis but was excluded in the multivariable analysis because it was considered to be on the casual pathway.

Table 3: Univariable and multivariable analysis of factors associated with low birth weight.

	CRR (95% CI)	Crude p-value	ARR (95% CI)	Adjusted P-value
Age in years	1.01 (0.97-1.05)	0.68	0.98 (0.91-1.04)	0.46
Education levels				
Primary/no education	1.0		1.0	
Secondary education	0.40 (0.27-0.59)	<0.001	0.60 (0.30-1.17)	0.13
College education	0.18 (0.11-0.31)	<0.001	0.41 (0.18-0.92)	0.03
Employed	0.62 (0.44-0.88)	0.008	1.16 (0.64-2.09)	0.63
Religion				
Christian	1.0		1.0	
Muslims	1.46 (0.99-2.13)	0.06	0.80 (0.41-1.55)	0.50
Marital status				
Married	1.0			
Single	1.05 (0.67-1.66)	0.82		
Rural residence	2.29 (1.48-3.56)	<0.001	1.83 (0.80-4.19)	0.16
Preterm (gestation age<37 weeks)	6.74 (4.74-9.59)	<0.001		
Less than 4 ANC visits	2.60 (1.69-4.02)	<0.001	1.97 (0.98-3.99)	0.06
Hemoglobin per g/dl	0.68 (0.63-0.73)	<0.001	0.67 (0.58-0.78)	<0.001
HIV positive	1.28 (0.32-5.21)	0.73		
Hospital delivery	0.49 (0.24-0.99)	0.05	2.64 (0.31-22.48)	0.38
Neonate gender-female	0.76 (0.54-1.06)	0.11		
Deliver mode				
Spontaneous vertex delivery	1.0		1.0	
Caesarean section	2.23 (1.51-3.28)	<0.001	2.33 (1.22-4.44)	0.01
First born	1.26 (0.90-1.76)	0.19		
Twin birth	2.81 (1.64-4.80)	<0.001	2.85 (1.11-7.33)	0.03
Previous low birth weight	2.30 (1.51-3.52)	<0.001	2.42 (1.04-5.59)	0.04
Any health problem during pregnancy	4.50 (2.90-6.99)	<0.001	1.77 (0.96-3.26)	0.07
CRR-crude risk ratios, ARR-adjusted risk ratios, ANC-Antenatal Clinics				

Neonatal health outcomes

On the neonatal health outcomes among the LBW the 496 neonates, 237 (48%) were males and 259 were females (52%) respectively. 103 (71%) of the LBW neonates were not discharged to postnatal ward after delivery while all the non-LBW neonates were discharged (P <0.001). In total, 39 (27%), 36 (25%) and 10 (6.9%) of the LBW neonates had respiratory distress syndrome (RDS), premature conditions requiring them to be hospitalized in the nursery or new born unit and birth asphyxia respectively that made them not be discharged to postnatal ward. Two LBW neonates were also not discharged to postnatal because they had signs jaundice and pneumonia. However, although 71% of the LBW neonates were not discharged to postnatal ward on delivery, 130 (97%) and 344 (99%) of the LBW and non-LBW neonates were alive and well during the interview respectively (P=0.10).

Discussion

In this study, which was conducted in a regional referral hospital; Coast general hospital (CGH) at the coast of Kenya, the prevalence of LBW was 29%. This prevalence was much higher than the estimated prevalence in developing countries of 15.9% and global prevalence; 15.5% (WHO 2012) and did not concur with most of studies done as in available literature. However, in a very busy maternity hospital serving resident of slums in Nairobi, Kenya, the prevalence of LBW was 32.8% (2004). The prevalence in the study and that from Nairobi, Kenya was higher than the estimated prevalence for developing countries partly because these studies represent different populations. While the study and the one in Nairobi, Kenya were hospital based representing only pregnant women who seek services in hospital, the developing countries estimate study used data from the community via Demographic Health surveys (DHS) which included women who delivery in the community. There was also room for selection bias in the developing countries estimate, because it excluded children with missing birth weight and children born as twins or multiple births. Since these were reported birth weights, this is expected missing more birth weights among the community based surveys than hospital based studies.

Caesarean section birth, twin births, previous low birth weight, education level and the mother's hemoglobin level were associated with risk of LBW in the study. Pregnant women with low education level were at greater risk of LBW, this finding is consistent with previous studies. This could be because learned women are likely to be well informed about the risks of LBW and take caution during pregnancy to avoid such risks. Mothers who deliver through caesarean section are likely to be mothers with complications during pregnancy and in most cases, end up delivering prematurely to save the baby. This could explain why caesarean section birth was associated with higher risk of LBW. Attending ANC during pregnancy for <4 times as recommended by WHO was associated with elevated risk of LBW in the univariable analysis but the effect attenuated in the multivariable analysis. The association of inadequate ANC attendance with risk of LBW confirms findings from other studies and specifically the pooled analysis of countries in developing countries Mogire (2013). Mothers with LBW neonates reported poor adherence to ANC attendance and were less satisfied with ANC services, this suggests although its effect attenuated in the multivariable model, ANC could have played a key role. LBW is caused by

restricted fetal growth or preterm birth (<37weeks of gestation) (WHO). Poor fetal growth is associated with mother's poor nutrition and health, in this study marked by low hemoglobin levels. LBW is a marker of susceptibility; mortality is reported to be as high as 100-fold higher and increases with decreasing birth weight. In this study, LBW neonates spent more time in hospital (New born unit ward) and were treated for respiratory distress syndrome (RDS), birth asphyxia, premature conditions requiring them to be hospitalized in the new born unit. Therefore, these are infants who are highly susceptible to infections causing deaths, that require extra clinical care and follow up in the community even after discharge to ensure their catch up with babies born with weight >2500grams.

Further research is needed to understand the long-term effects of LBW on growth and health of the child and the role of adherence to WHO guidelines on ANC on reducing risk of LBW. In this study and previous ones, the mother nutrition status has been found to be associated with birth weight. Research on best approach to improve pregnant women nutrition as an intervention to avert LBW is required especially in resource poor countries in Sub-Saharan Africa and Asia where prevalence of LBW is high.

Strength and limitations of the study

The strengths of the study were its systematic collection of data especially the birth weight and targeting a very vulnerable population that is rarely studied. The proportion of neonate missing birth weight was very low (~5%) and thus maintaining the statistical power to answer the study questions. The main limitation of the study was that it was hospital based; our results can only be generalized to population of hospitalized children. Coast general hospital (CGH) is a coast regional referral hospital, meaning most of the patients treated are referrals from lower level hospitals in the region, therefore, our LBW prevalence and risk factors could be specific to patients with severe conditions requiring referral to a regional hospital. This was a cross-sectional study that collected data on neonate birth weight and outcome simultaneously without a long-term observation in the hospital or after discharge. The implication of such study design is that it could have missed the discharge outcome of the neonates and their health status immediately after hospital discharge. Therefore, the health outcome could be an under estimation of the effects of LBW on neonate health outcome.

Conclusions

The study findings of the study showed that factors like low education level, low hemoglobin level, poor clinic attendance, history of previous low birth weight, caesarian births, twin pregnancy, fevers, hypertension are some of the factors influencing LBW. The prevalence of LBW was 29% as the proportion of LBW deliveries during the study period at the study area. On health outcomes LBW neonates, in total, 39 (27%), 36 (25%) and 10 (6.9%) of the LBW had respiratory distress syndrome (RDS), premature conditions and birth asphyxia which made them to be admitted to the new born unit and not discharged with their mothers. All individuals should have higher education to be able to take control of their own life in relation to health. There is need for health education to create awareness and understanding on prenatal clinic attendance as recommended by WHO as this will enhance the individual attitude and perception. Proper

prenatal screening and care to detect complications associated with pregnancy early. There is need for proper nutrition during adolescence to enter healthy in pregnancy so that women have a high hemoglobin level to avoid LBW. A further research needs to be done to determine the long term outcome of these babies born with LBW with a proportion of 29%.

Recommendations

1. Longitudinal follow up of these children is needed

2. Need of adequate clinical care for the children with LBW because they are very susceptible to infections

3. Pregnant mothers should be encouraged to follow the ANC national and WHO guidelines

4. Health education through information, education and communication to achieve universal health care.

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