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Research Article

Determinants of Low Birth Weight in Dire-Dawa City Public Health Facility Eastern Ethiopia

Mustaf Mahdi Badal*

Department of Biotechnology, College of Health Science Kebridahar, Kebridahar University, Kebri Dehar, Ethiopia

ABSTRACT

Background: Low Birth Weight (LBW) is one of the leading public health problems in developing countries including Ethiopia. Worldwide, more than 20 million infants born low birth weight every year. Of which about 13% to 15% occur in Sub-Saharan Africa. Thus, knowing clear picture of the risk factors of LBW in the study area is essential. Therefore, this study was conducted to identify determinants of LBW in all public health facilities in dire dawa city administration eastern Ethiopia.

Methods: Unmatched case-control study was employed from 1 June to 1 August the data were collected using structured and pretested interviewer administered questionnaire in all public health facilities in study areas. Consecutive sampling technique was used to select cases and controls respectively. Data were entered in to Epi-data software in version 3:1 and exported to SPSS version 23. Variables having with P-Value<0.25 in the binary logistic regression were entered in to multivariate logistic regression model. Statistical significance was considered at P-Value<0.05.

Results: A total of 292 mothers with their respective newborns (73 cases and 219 controls) were included the study, mothers not having nutritional counseling (AOR=3.13, 1.59~6.16), not consuming additional meal (AOR=2.37, 1.26~4.44), not having iron supplementation (AOR=2.21, 1.14~4.29), mothers being anemic (AOR=3.51, 1.64~7.53), and undernourished mothers (AOR=4.83, 2.49~9.38) were significantly associated with the low birth weight in this study.

Conclusion: Poor nutrition related activities interims of nutritional counseling, iron supplementation, maternal feeding especially during pregnancy and others were the main problems identified in this study. Therefore, Government and non-governmental NGOs would work together to reduce LBW by establishing appropriate intervention, awareness creation and Behaviors Change Communication (BCC) and development of effective strategy and policy to improve maternal nutritional status and prevent maternal anemia are curtail. In addition, a large scale studies with strong study design like cohort and experimental needs to be conducted.

Keywords: Low birth weight; Determinants; Anemia; Dire-dawa city administration

BACKGROUND

World Health Organization (WHO) defined low birth weight is birth weight less than 2500 g, it has been further divided in to three categories as low birth weight (<2500 grams), very low birth weight (VLBW;<1500 grams), extremely low birth weight (ELBW;<1000 grams) [1].

Globally, more than 20 million infants are born with low birth weight annually, most of these occurs in low-and middle-income countries, especially in most vulnerable populations accounting for 28% south Asia, 13% to 15% in sub-Saharan Africa and 9% in Latin America [2,3]. LBW is considered the single most important predictor of infant mortality, mainly death occur within the first 28 days of life, additionally, 75% of global neonatal death are among low birth weight [4,5]. According to study in Ethiopia, the occurrence of low birth weight is high and still major public health problem [6]. The last three Ethiopian demographic health surveys 2005, 2011, and 2016 result indicates that the prevalence of low birth weight were respectively 14%, 11% and 13% [7].

Low birth weight has both long and short term complication,

Correspondence to: Mustaf Mahdi Badal, Department of Biotechnology, College of Health Science Kebridahar, Kebridahar University, Ethiopia, E-mail: mustafemahdi86@gmail.com

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Among these, respiratory distress, sleep apnea, heart problems, jaundice, anemia, chronic lung disorders, mental retardation, stunting and developing non-communicable diseases in letter life [8].

Having basic knowledge about determinants of low birth weight is important to identify and to give appropriate attention to those mothers at risk. Thus, this study was conducted to identify the determinants factors of low birth weight among newborn babies delivered at public health facilities, in dire-dawa city administration eastern Ethiopia.

METHODS

Study design, period and area

Facility based unmatched case control study was conducted in public health facilities of dire-dawa city administration from June to august, 2020. The city is located 515 kilometers from Addis Ababa (capital city of Ethiopia), In terms of the distribution of health facilities, there are 2 governmental and 4 private hospitals, 8 health centers, 5 higher clinics, and 12 medium clinics in the city.

Cases: those live term singleton babies with birth weight<2500 grams.

Controls: those live term singleton babies with birth weight ≥ 2500 grams

Sample size determination: The sample size was calculated by Stat-Calc module of Epi-Info 7 by assuming the proportion of women with anemia among exposed controls were 12%, with 80% power of the study, 5% α two-sided; 95% confidence level and 1:3 ratio of cases and controls with 5% non-response. The final sample size of the study was 292(73 cases and 219 controls).

Data collection procedure: Pretested structured questionnaire, a face-to-face interview, anthropometric measurements and medical records reviews were used, the data were collected by 10 trained midwives working in delivery ward in the public health facilities and 4 supervisors. The questionnaire was taken from similar different published (validated) literatures and contextualized to study setting. The socio-demographic, obstetric, medical, behavioral and nutritional factors were the main variables. The weights of the newborns were measured within one hour of delivery using a digital Seca balance scale to the nearest 1 g. The scale was adjusted to the zero level before weighing each newborn. The serum hemoglobin level of mothers was extracted from their medical records since the hemoglobin level test is routinely done for all mothers who come for delivery services [8].

Data processing and analysis: Data were entered by using Epi Data version 3.1 and then exported to SPSS software version 23 for further analysis. Socio-demographic profiles of variables frequency distribution, summary measures such as mean and standard deviation were calculated for cases and controls. Presence of statistical association between each independent variables and dependent variable was observed by using bivariable logistic regression analysis. A P-Value<0.25 were used to select candidate variable for multivariable regression model. Multivariable Logistic Regression (MLR) analysis with backward stepwise method was used to control confounders and determine significant determinants of LBW. Model fitness was done by Hosmer and Lemeshow Goodness-of-fit-test (P>0.05). A P ≤ 0.05 and AOR and 95% CI were used to report significance and strength of association, respectively.

RESULTS

Socio-demographic characteristics of the study: A total of 292 mothers with their respective newborns (73 cases and 219 controls) were included in the study, with response rate of 97.9%. The mean ± SD of maternal age among cases and controls was 25.1 ± 4.94 and 24.8 ± 4.96 years, respectively. The majority 74% of mothers in both cases and controls were in the age group of 21-35 years, followed by 19.2% and 18.3% of maternal age<20 years in the cases and controls, respectively. More than 90% of the participants in both cases and controls were married. Moreover, 89.0% and 87.2% of mothers among cases and controls were living in urban setting, respectively, While 24.7% and 18.7% among cases and controls had not attended formal education, respectively. Almost half of mothers in both cases 56.2% and controls 48.9% were house wife (Table 1).

Table 1: Socio-demographic characteristics of the participants among cases and controls in public health facilities dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Frequency of cases (Yes) N (%)	Frequency of control (No) N (%)
Age of the mother	≤ 20	14 (19.2)	40 (18.3)
	21-35	54 (74.0)	162 (74.0)
	>35	5 (6.8)	17 (7.8)
Marital status	Currently married	67 (91.8)	198 (90.4)
	Currently not married	6 (8.2)	21 (9.6)
Residence Area	Urban	65 (89.0)	191 (87.2)
	Rural	8 (11.0)	28 (12.80
Religion	Muslim	48 (65.8)	155 (70.8)
	Christian	25 (34.2)	64 (29.2)
Ethnicity	Somali	10 (13.7)	85 (38.8)
	Oromo	51 (69.9)	104 (47.5)
	Amhara	8 (11.0)	18 (8.2)
	Others	4 (5.5)	12 (5.5)
Maternal educational status	Informal education	18 (24.7)	41 (18.7)
	Formal education	55 (75.3)	178 (81.3)
Husband educational status	Informal education	15 (20.5)	37 (16.9)
	Formal education	58 (79.5)	182 (83.1)
Maternal occupation status	House wife	41 (56.2)	107 (48.9)
	Employee	21 (28.8)	71 (32.4)
	Merchant	6 (8.2)	27 (12.3)
	Others	5 (6.8)	14 (6.4)
Husband occupation status	Employee	34 (46.6)	102 (46.6)
	Farmer	11 (15.1)	26 (11.9)
	Merchant	20 (27.4)	77 (35.2)
Sex of newborn	Male	39 (53.4)	132 (60.3)
	Female	34 (46.6)	87 (39.7)

Maternal obstetric, medical, nutritional and behavioral characteristics of the study: The majority of mothers 63.0% among cases and 69.9% of controls were Multigravida. Regarding

the parity, 38% of both cases and control groups were Primipara mothers. The history of still birth among cases and controls were 16.4% and 11.4%, respectively. Maternal nutritional counseling during ANC visit was 60.3% among cases and 81.7% controls. Whereas, as the mothers among cases 41.1% and 63.0% controls had consumption extra meal during pregnancy. Less than half of mothers among cases 42.5% and 22.4% controls had not taken iron supplementation during pregnancy. The mothers among cases 16.4% and 11.0% controls were reported history of hypertension during current pregnant (Table 2).

Table 2: Frequency distribution of maternal obstetric, medical and behavioral characteristics among cases and controls in public health facilities dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Frequency of cases (Yes)	Frequency of control (No)
		N (%)	N (%)
Gravidity	Primi-gravidity	27 (37.0)	66 (30.1)
	Multi-gravidity	46 (63.0)	153 (69.9)
Parity	Primipara	28 (38.4)	83 (37.9)
	Multipara	45 (61.6)	136 (62.1)
Birth interval	<3 years	15 (33.3)	38 (28.1)
	≥ 3 years	30 (66.7)	97 (71.9)
History of stillbirth	Yes	12 (16.4)	25 (11.4)
	No	61 (83.6)	194 (88.6)
History abortion	Yes	14 (19.2)	32 (14.6)
	No	59 (80.8)	187 (85.4)
History of contraceptive methods	Yes	64 (87.7)	180 (82.2)
	No	9 (12.3)	39 (17.8)
ANC visit	Yes	61 (83.6)	201 (91.8)
	No	12 (16.4)	18 (8.2)
Times of visit	<3 visit	15 (24.6)	62 (30.8)
	≥ 3 visit	46 (75.4)	139 (69.2)
Nutritional counseling	Yes	44 (60.3)	179 (81.7)
	No	29 (39.7)	40 (18.3)
Additional meal	Yes	30 (41.1)	138 (63.0)
	No	43 (58.9)	81 (37.0)
Iron supplementation	Yes	42 (57.5)	170 (77.6)
	No	31 (42.5)	49 (22.4)
History of hypertension	Yes	12 (16.4)	24 (11.0)
	No	61 (83.6)	195 (89.0)
History of infection (syphilis)	Yes	21 (28.8)	49 (22.4)
	No	52 (71.2)	170 (77.6)
Substance abuse	Yes	24 (32.9)	62 (28.3)
	No	49 (67.1)	157 (71.7)

Anthropometric and laboratory investigation characteristics of the study: The maternal weight less than 50 kg were 12.3% and 7.3% among the cases and controls respectively. Likewise the maternal height less than 150 cm were 15.1% and 9.1% among cases and controls respectively. Maternal MUAC among cases 52.1% and 20.1% controls had MUAC<23 cm. Maternal Anemia status based on low hemoglobin concentration (<110 g/L) among cases and controls 32.9% and 14.6% respectively (Table 3).

Table 3: Frequency distribution of maternal anthropometrics measurement and laboratory investigation among cases and controls in public health facilities dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Frequency of Cases(Yes) N (%)	Frequency of Control (No) N (%)
Weight of mothers	<50kg	9 (12.3)	16 (7.3)
	≥ 50kg	64 (87.7)	203 (92.7)
Height of mothers	<150cm	11 (15.1)	20 (9.1)
	≥ 150cm	62 (84.9)	199 (90.9)
MUAC of mothers	<23cm	38 (52.1)	44 (20.1)
	≥ 23cm	35 (47.9)	175 (79.9)
Hemoglobin level	≥ 110g/dL	49 (67.1)	187 (85.4)
	<110g/dL	24 (32.9)	32 (14.6)

Bivariate logistic regression: In Bivariate analysis performed to identify candidate variables for multivariate analysis. Variables having P-Value<0.25 were entered to multivariate logistic regression for further analysis

Socio-demographic characteristics with LBW: Without adjusting potential confounders our study showed that socio-demographic factors such as maternal age, marital status, residence area, maternal educational status, maternal occupation, sex of newborn were not statically significant with low birth weight (Table 4).

Maternal obstetric, medical, nutritional and behavioral characteristics with LBW: Without any adjustments antenatal visit, nutritional counseling, additional meals, iron supplementation, history of hypertension during current pregnancy were significant associated with LBW. On other hand gravidity, parity, birth interval, history of still birth, history of abortion, history of contraceptive methods, history of infection, using any substance abuse during current pregnancy were not significant associated with LBW (Table 5).

Anthropometric and laboratory investigation characteristics with LBW: Without controlling possible confounders, mothers weight<50 kg, mothers height<150 cm, mothers nutritional status MUAC<23 cm and mothers hemoglobin level<110 g/dl were significantly associated with LBW (Table 6).

Determinants of low birth weight: In multivariate binary logistic regression analysis indicated that maternal who did not received nutritional counseling during current pregnancy [AOR=3.13; (95% CI, 1.59-6.16)], similarly maternal who did not take additional meals during current pregnancy [AOR=2.37 ;(95% CI, 1.26-4.44)], Likewise maternal lack of iron supplementation during current [AOR=2.21 ;(95% CI 1.14-4.29)], Maternal under nutrition [AOR=4.83;(95% CI 2.49-9.38)], and maternal anemic [AOR=3.51 ;(95% CI 1.64-7.53)] were significantly associated with LBW (Table 7).

Table 4: Bivariate logistic regression analysis of socio-demographic characteristics with LBW in public health facilities dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Birth weight		COR(95%CI)	P-Value
		Frequency of cases N (%)	Frequency of control N (%)		
Age of the mother	≤ 20	14 (19.2)	42 (19.0)	1.47 (0.47~4.60)	0.512
	21-35	54 (74.0)	157 (71.0)	1	
	>35	5 (6.8)	22 (10.0)	0.65 (0.21~2.04)	0.46
Marital status	Currently Married	67 (91.8)	200 (90.5)	1	
	Currently not married	6 (8.2)	21 (9.5)	1.17 (0.45~3.03)	0.742
Residence Area	Urban	65 (89.0)	192 (86.9)	1	
	Rural	8 (11.0)	29 (13.1)	0.82 (0.36~1.87)	0.629
Maternal educational status	Informal education	18 (24.7)	41 (18.6)	1.43 (.76~2.70)	0.26
	Formal education	55 (75.3)	180 (81.4)	1	
Maternal occupation status	House wife	41 (56.2)	109 (49.3)	1	
	Employee	21 (28.8)	71 (32.1)	0.79 (0.43~1.44)	0.436
	Merchant	6 (8.2)	27 (12.2)	0.59 (0.23~1.54)	0.28
	Others	5 (6.8)	14 (6.3)	0.95 (0.32~2.80)	0.925
Sex of newborn	Male	39 (53.4)	133 (60.2)	1	
	Female	34 (46.6)	88 (39.8)	1.32 (0.77~2.25)	0.310

Table 5: Bivariate logistic regression analysis of maternal obstetric Ethiopia 2020, medical and behavioral characteristics with LBW in public health facilities dire-dawa city eastern.

Variables	Categories	Frequency of cases N (%)	Frequency of control N (%)	COR(95% CI)	P-Value
Gravidity	Primi-gravidity	27 (37.0)	66 (29.9)	1.38 (0.79~2.40)	0.258
	Multi-gravidity	46 (63.0)	155 (70.1)	1	
Parity	Primipara	28 (38.4)	83 (37.6)	1.04 (0.60~1.78)	0.903
	Multipara	45 (61.6)	138 (62.4)	1	
Birth interval	<3 years	15 (33.3)	38 (27.7)	1.30 (0.63~2.69)	0.474
	≥ 3 years	30 (66.7)	99 (72.3)	1	
History of stillbirth	Yes	12 (16.4)	25 (11.3)	1.54 (0.73-3.25)	0.255
	No	61 (83.6)	196 (88.7)	1	
History abortion	Yes	14 (19.2)	32 (14.5)	1.40 (0.70~2.80)	0.34
	No	59 (80.8)	189 (85.5)	1	
History of contra-captive	Yes	64 (87.7)	181 (81.9)	0.64 (0.29~1.38)	0.254
	No	9 (12.3)	40 (18.1)	1	
ANC visit	Yes	61 (83.6)	202 (91.4)	1	
	No	12 (16.4)	19 (8.6)	2.09 (0.96~4.55)	0.063
Times of visit	< 3 visit	15 (24.6)	63 (31.2)	0.72 (0.37~1.38)	0.324
	≥ 3 visit	46 (75.4)	139 (68.8)	1	
Nutritional counseling	Yes	44 (60.3)	181 (81.9)	1	
	No	29 (39.7)	40 (18.1)	2.98 (1.67~5.33)	0.0001
Additional meal	Yes	30 (41.1)	140 (63.3)	1	
	No	43 (58.9)	81 (36.7)	2.48 (1.44~4.25)	0.001
Iron supplementation	Yes	42 (57.5)	172 (77.8)	1	
	No	31 (42.5)	49 (22.2)	2.74 (1.56~4.80)	0.0001
History of hypertension	Yes	12 (16.4)	24 (10.9)	1.62 (0.76~3.42)	0.211
	No	61 (83.6)	197 (89.1)	1	
History of infection	Yes	21 (28.8)	50 (22.6)	1.38 (0.76~2.51)	0.289
	No	52 (71.2)	171 (77.4)	1	
Substance abuse	Yes	24 (32.9)	62 (28.1)	1.26 (0.71~2.22)	0.433
	No	49 (67.1)	159 (71.9)	1	

Table 6: Bivariate logistic regression analysis of maternal anthropometrics measurement and laboratory with LBW in public health facilities dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Frequency of Cases N (%)	Frequency of Control N (%)	COR(95% CI)	P-Value
Weight of mothers	<50kg	9 (12.3)	16 (7.2)	1.80 (0.76~4.27)	0.181
	≥ 50kg	64 (87.7)	205 (92.8)	1	
Height of mothers	<150cm	11 (15.1)	20 (9.0)	1.78 (0.81~3.92)	0.151
	≥ 150cm	62 (84.9)	201 (91.0)	1	
MUAC of mothers	<23cm	38 (52.1)	44 (19.9)	4.37 (2.48~7.69)	0.0001
	≥ 23cm	35 (47.9)	177 (80.1)	1	
Hemoglobin level	Normal (≥ 110g/dL)	49 (67.1)	189 (85.5)	1	
	Anemic (<110g/dL)	24 (32.9)	32 (14.5)	2.89 (1.56~5.35)	0.001

Table 7: Multivariate logistic regression analysis with determinants of low birth weight for newborns delivered public health facilities in dire-dawa city eastern Ethiopia 2020.

Variables	Categories	Frequency of cases N (%)	Frequency of controls N (%)	COR (95% CI)	AOR (95% CI)
ANC visit	Yes	61 (83.6)	201 (91.8)	1	1
	No	12 (16.4)	18 (8.2)	2.20 (1.00~4.81)	2.26 (0.85~6.02)
Nutritional counseling	Yes	44 (60.3)	179 (81.7)	1	1
	No	29 (39.7)	40 (18.3)	2.95 (1.65~5.27)	3.13 (1.59~6.16)*
Additional meal	Yes	30 (41.1)	138 (63.0)	1	1
	No	43 (58.9)	81 (37.0)	2.44 (1.42~4.20)	2.37 (1.26~4.44)*
Iron supplementation	Yes	42 (57.5)	170 (77.6)	1	1
	No	31 (42.5)	49 (22.4)	2.71 (1.55~4.75)	2.21 (1.14~4.29)*
History of hypertension	Yes	12 (16.4)	24 (11.0)	1.60 (0.76~3.39)	1.58 (0.65~3.88)
	No	61 (83.6)	195 (89.0)	1	1
Weight of mothers	<50kg	9 (12.3)	16 (7.3)	1.78 (0.75~4.23)	1.30 (0.46~3.54)
	≥ 50kg	64 (87.7)	203 (92.7)	1	1
Height of mothers	<150cm	11 (15.1)	20 (9.1)	1.77 (0.80~3.89)	0.89 (0.35~2.25)
	≥ 150cm	62 (84.9)	199 (90.9)	1	1
MUAC of mothers	<23cm	38 (52.1)	44 (20.1)	4.32 (2.45~7.60)	4.83 (2.49~9.38)*
	≥ 23cm	35 (47.9)	175 (79.9)	1	1
Hemoglobin level	Normal (≥110g/dL)	49 (67.1)	187 (85.4)	1	1
	Anemic (<110g/dL)	24 (32.9)	32 (14.6)	2.86 (1.55~5.30)	3.51 (1.64~7.53)*

OR=Odds Ratio
AOR=Adjusted Odds Ratio
CI=Confidence Interval
*=P-Value less than 0.05

DISCUSSION

AThis study was conducted to indentify determinants of low birth weight babies delivered public health facility at dire dawa city administration.

The mothers who did not receive nutrition counseling during pregnancy had higher risk to deliver low birth weight babies compared to their counterparts. This finding was consistent with other studies done in Ethiopia [9-11] the reason might be nutritional counseling improve their feeding behavior and enhance their nutritional status which may help mothers to decrease risk of delivering low birth weight babies.

The mothers who did not take additional on daily meals during the current pregnancy were higher odds giving birth with LBW babies when compared to mothers who did take additional daily meals during current pregnancy. This finding was supported with studies done in Ethiopia [12]. This might be due to Mothers who did eat more foods during pregnancy 88% less likely to give low birth weight babies than their counterpart. There is mounting evidence from the controlled trails that improving food intake during pregnancy effectively reduces the risk of giving birth to low birth weight [13,14]

Likewise mothers who did not take iron supplementation during pregnant were significantly associated to deliver low birth weight

babies as compared to their counterparts. This finding is similar study from Bangladesh that founded intake of iron supplements during pregnancy could protect against low birth weight [15]. These findings were also supported with other studies done in Ethiopia [16] the possible explanation could be due to iron supplementation during pregnancy protect mothers becoming anemic and subsequent increased risk of delivering low birth weight babies [17]. Iron-alone supplementation could protect against LBW compared to multiple micronutrients supplementation [18] in addition, an overview of controlled trails suggested to 41% decline incidence of intra uterine growth retardation when the pregnancy mothers had iron acid supplementation [19].

Furthermore in this study found that anemic had higher odds of delivering LBW baby, compared to their counterparts. This finding was also found with other studies done in Ethiopia. As well as other studies done Pakistan and Nepal [20,21]. The reason might be due to micronutrients deficiencies during pregnancy has been showed to have serious implications on developing fetus and hence birth weight, severe anemia could impair oxygen delivery to the fetus and thus interfere with normal intrauterine growth [22].

Moreover, the risk of low birth weight was higher among the mothers with under nutrition compared to their counterparts. Supportive finding was obtained with other studies conducted in Ethiopia [23] and somewhere else like Yemen and India [24]. This might be explained by the mistaken perception of women that frequent and much diet consumption during pregnancy could lead to excessive fetal growth which they perceive would be beyond tolerance of the birth canal and pose difficulty during childbirth thus, they might be prone to under-nutrition [25,26].

CONCLUSION AND RECOMMENDATION

Low birth weight is significance public health concern linked multiple factors. According to the findings of this study Poor nutrition related activities interims of nutritional counseling, iron supplementation, maternal feeding especially during pregnancy and others were the main problems identified in this study. Therefore, Government and non-governmental NGOs would work together to reduce LBW by establishing appropriate intervention, awareness creation and Behaviors Change Communication (BCC) and development of effective strategy and policy to improve maternal nutritional status and prevent maternal anemia are curtail. In addition, a large scale studies with strong study design like cohort and experimental needs to be conducted.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance was obtained by institutional review board (IRB) college of medicine and health science, Jigjiga University with IRB protocol number O33/116/JJU. Further Permission was obtained from dire dawa city administration health bureau. A written consent was obtained all caregivers and this study is done in accordance with declaration of Helsinki.

CONSENT

The authors confirm that all caregivers provided informed consent forms

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are available at corresponding authors

COMPETING OF INTERESTS

The authors declare that they have no competing interests

FUNDING

Not applicable

AUTHORS' CONTRIBUTION

MM, RA, MO and AY contributed from conception of the research idea, study design, collected data, did the analysis, interpretation and manuscript write-up. AS, AM participate in conceptualization of idea and assisted draft finalizing. All authors read and approved final manuscript.

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