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Determinants of Macrosomia in Nigest Ellen Mohammed Memorial Comprehensive Specialized Hospital, Wachemo University, Ethiopia: Unmatched Case-Control Study

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Abstract

Background: Fetal macrosomia describes excessive intrauterine growth which leads to an increased birth weight. The limit which is set at a birth weight of ≥ 4,000 g regardless of gestational age is mostly used. There are many factors that affect fetal macrosomia. The aim of this study was to identify determinant factors of fetal macrosomia among neonates born in Nigest Ellen Mohammed Memorial Comprehensive specialized hospital, Wachemo university in 2020, South Ethiopia.

Methods: Unmatched case control study was employed from November 15th to December 15th, 2020. The required sample size was calculated using the EPI INFO tool. Total sample size was 284, with 71 cases and 213 controls. The data was collected from cases and controls by using the consecutive sampling technique until the desired sample size was reached. The data was entered, cleaned and analyzed using SPSS version 23.0 statistical software for windows analysis.

Result: A total of 279 participants (71 cases and 213 controls) were participated in the study. Mean age was 27.3 years, 80.3% of the mothers were married and 21.5% mothers were house wives. 80.6% mothers gave birth *via* spontaneous vaginal delivery 29.4% of women claimed they experienced a complication during their pregnancy and 42.3% of the newborns were males. The level of macrosomia was 24.7%. In multivariate logistic regression complications during pregnancy [7.24 (95% CI: 2.74-19.11)], parity (primipara [0.3 [95% CI: 0.11-0.84], multipara 0.1 [95% CI: 0.037-0.294]), and newborn sex (male) [2.23 (95% CI: 1.15-4.31)] were significantly and independently associated with macrosomic birth.

Conclusion: The prevalence of fetal macrosomia was 24.7%. This is relatively higher figure from other study area findings. Factors that affect macrosomic birth were complications during pregnancy, parity (primipara and multipara), and newborn sex (male). Obstetric care providers should assess those pregnant women with complications and pregnant women with male sex newborn for history of fetal macrosomia which would help them to be prepared for the managements of maternal and perinatal complications.

Keywords: Fetal macrosomia; Birth weight; Pregnancy

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Introduction

The term "fetal macrosomia" and "large for gestational age" are terms used interchangeably, however macrosomia is described excessive intrauterine which leads to an increased birth weight. In most investigations, the limit is set at a birth weight of ≥ 4,000 g, but in some cases also at a weight of ≥ 4,500. Alternatively, the term large for gestational age which is defined by growth above the 90th percentile can also be used to describe excessive intrauterine growth [1]. Additionally, macrosomia is growth beyond specific threshold regardless of gestational age, the threshold being 4,000 g, 4,500 g in developing and developed countries respectively [2].

Grading system suggested for decision making regarding operative delivery as grade 1 for neonate 4,000 g to 4,499 g, grade 2 for 4,500 to 4,999 and grade 3 for >5,000 [3]. The risk of complications increases with an increasing degree of macrosomia. A U. S. cohort study showed that delivery complications occur more frequently starting at a weight of ≥ 4,000 g, however neonatal morbidity increases significantly only starting at a weight of ≥ 4,500 g. Neonatal mortality increased

at a weight of ≥ 5,000 g [4].

A variety of factors predispose a newborn to macrosomia which can be modifiable and non-modifiable factors. The non-modifiable factors like genetic factors, fetal sex, parity, maternal age and height and post-term pregnancy. Modifiable factors are preexisting diabetes and GDM, maternal pre-pregnancy obesity, excessive gestational weight gain, abnormal fasting and postprandial glucose levels, a prior macrosomic newborn [5]. Data from the National Center for Health Statistics show that 7.8% of all live-born newborns in the United States weigh 4,000 g or more. Additionally, it showed women with Gestational Diabetes Mellitus (GDM) or obesity have higher rates of LGA newborns when nearly 10,000 women in the study showed that the rate of LGA newborns in normal-weight women without GDM was 7.7% and 13.6% in those who had GDM, compared with rate in LGA in obese women without GDM was12.7% and 22.3% in those who had GDM [6].

One of the factors contributing for both neonatal and maternal morbidity and mortality is macrosomia and its complication. The magnitude of fetal macrosomia and its associated factors in the study area was not well known. Meanwhile, a better understanding of macrosomic factors in this particular setting is essential for designing specific cost-effective interventions aimed at reducing neonatal and maternal morbidity and mortality related to macrosomia. Therefore, the main aim of this study was to assess factors associated with macrosomia among neonates delivered at Wachemo University Nigest Ellen Mohammed Memorial teaching and referral hospital is found in the Hosanna Town, Hadiya Zone.

Methods and Materials

The study area, Nigest Ellen Mohammed Memorial Comprehensive specialized hospital, Wachemo University is found in the Hosanna Town; Southern Ethiopia. Hosanna town is found at a distance of 232 km from capital of Ethiopia, Addis Ababa. The hospital's maternity division includes an Antenatal Care (ANC) clinic, a postnatal ward, and delivery wards. Midwives, senior obstetricians, residents, general practitioners, and support workers are among the staff members.

Study design

Institution based unmatched case-control study was conducted using structured questionnaire population:

Source population: All neonates delivered at Nigest Ellen Mohammed Memorial Comprehensive specialized hospital, Wachemo university.

Study population: All neonates delivered in this hospital between September 1st, 2020 and February 15th, 2021 for both cases and controls. Cases were macrosomic neonates weighing more than 4,000 g, while controls were normal birth weight neonates weighing between 2,500 and 3,999 g. The cases and controls were singleton infants delivered during the data collecting period, independently of maternal age, gestational age, or number of births. Both cases and controls were excluded from the study if the delivery was complicated by abruptio placenta, placenta previa, multiple pregnancies, or a congenital abnormality.

Sample size determination and sampling technique

As the study was unmatched case control, the required sample size was calculated using the EPI INFO tool while account for the key factor. A minimum detectable Odds Ratio (OR) of 2.2 for macrosomic neonates versus controls, a 5% level of significance (two-sided), 80% power, and a one to three allocation ratio of cases to controls (1:3) were assumed in this study. The most important factor determining the maximum sample size was neonatal sex. Control exposure was 48.8%, according to a study conducted in Hawassa, Ethiopia. The sample size was 284 based on the assumptions above, with 71 cases and 213 controls. The data was collected from cases and controls by using the consecutive sampling technique until the desired sample size was reached. The study included all cases that met the case definition criteria for microsomic neonates. Controls for normal weight neonates were also included if they met the control definition criteria. Three controls were included in one case to ensure that the population from which they were drawn was representative. Neonates fail to fulfill inclusion criteria were excluded from the study.

Variables and measurement

Dependent variable: Fetal Macrosomia.

Independent variables: Maternal age, sex of the neonate, parity, pregnancy intention maternal diabetes, weight gain during current pregnancy, complication during pregnancy

Operational definition

Parity: Number of previous births to an infant, alive or dead.

Primiparous: Mothers who were experienced only 1 previous birth.

Multiparous: Mothers who had parity greater than or capable 2.

Grand multiparous: mother who had parity greater than 5. Macrosomia is infant weighing greater or adequate 4,000 gm.

Data collection method and procedures

The maternal age, neonatal gender, mode of delivery, maternal height, and maternal history of diabetes were obtained from the delivery report chart and from the mother using a maternal and neonatal information form. By interviewing the mother, we were able to acquire the data that was not written on the chart.

Data quality assurance

Data collection form was prepared and orientation provided by the investigators, data were collected from delivery report charts by trained nurses working outside the delivery ward. The objective of the study, data collection methods, and how to collect relevant information were all addressed in a one-day training session for data collectors. To confirm consistency and completeness of the checklist, a pretest was conducted on the 5% (50 charts) of the sample size. The investigators were in control of the overall data collection process.

Data processing and analysis

The data were entered using Epi data version 3.1 and were exported to SPSS version 20.0 statistical software packages for data cleaning and analysis. Descriptive analysis was conducted to explain number and percentage distribution of important variables. Binary Logistic regression model was used to identify association between outcome variable and explanatory variables. Both bivariate and multivariable logistic multivariate analysis was used. The crude and adjusted odds ratio along with their corresponding 95% confidence intervals was computed. A P-value <0.05 was considered to declare a result as statistically significant during this study.

Ethical consideration

Wachemo University's ethical approval committees have

Table 1: Sociodemographic characteristics of study participants.

Variables	Categories	Frequency		Percent
		Birth weight		
		Macrosomia	Non-macrosomia	
	<20	7	48	19.7
Age of mother in years	20-30	37	83	43
	31-40	19	58	27.6
	>40	6	21	9.7
Education status of mother	Cannot read and write	4	58	22.2
	Primary school	27	58	30.5
	Secondary school	22	48	25.1
	Higher education	16	46	22.2
Occupation of mother	Merchant	21	28	17.6
	House wife	16	44	21.5
	Government employee	3	37	14.3
	Farmer	4	42	16.5
	Teacher	13	29	15.1
	Other	12	30	15.1
Marital status	Married	63	161	80.3
	Single	3	21	8.6
	Widowed	1	13	5
	Divorced	2	15	6.1

approved this study in accordance with the university's relevant guidelines and regulations. Wachemo University provided a formal letter, which was submitted to the hospital's administrators. After permission, informed consent was obtained from all the subjects after clearly explaining the purpose of the study since there is no need to take blood sample, body fluid or others, other than verbal responses. They have been told that they could withdraw from the involvement at any time without any restriction. The confidentiality of participants was also ensured throughout the research process.

Result

Sociodemographic characteristics of study participants

The study involved the participation of 279 participants, with a response rate of 98.2%. The mothers' mean age was 27.3 years. Majority of the, 224 (80.3%) of the mothers were married. And, 60 (21.5%) mothers were house wives by their occupation. And 85 (31.5%) were attended primary school (Table 1).

Obstetric characteristics of study participants

A total of 185 (66.3%) of the 279 mothers had ANC follow-up, with 24 (8.6%) of them having at least four visits during their pregnancy. In terms of delivery method, 225 (80.6%) mothers gave birth via spontaneous vaginal delivery. A total of 82 (29.4%) of women claimed they experienced a complication during their pregnancy. Moreover, 161 (57.7%) of the newborns were females (Table 2).

Determinants of macrosomia

In bivariable analysis: Complication during pregnancy, history of known diabetic, weight gain during pregnancy, parity and neonatal sex were statistically significant at a p-value of 0.25. However, in the multivariable model, complication during pregnancy, parity and neonatal sex were statistically significant associated factors with

Table 2: Obstetric characteristics of study participants.

Variables	Categories	Frequency		Percent
		Birth weight of the neonate		
		Macrosomia	Normal birth weight	
Parity	Nulliparous	18	69	31.2
	Primipara	22	61	29.7
	Multipara	14	68	29.4
	Grand multipara	15	12	9.7
Gravidity	Primigravida	18	69	31.2
	Multigravida	36	129	59.1
	Grandmultipara	15	12	9.7
ANC visit	No visit	14	80	33.7
	One visit	1	32	11.8
	Two visit	12	43	19.7
	Three visit	42	31	26.2
	Four and more visits	0	24	8.6
Do your recall LNMP	I do not recall	6	95	32.2
	I recall	63	115	63.8
Do you recall pre-pregnancy weight	I do not recall	21	138	57
	I recall	48	72	43
If you recall, how much was your BMI?	18.5-24.9	30	56	72.9
	25-29.9	16	16	27.1
Weight gained during pregnancy	<12 Kg	19	88	38.4
	12-16 Kg	37	88	44.8
	>16 Kg	13	34	16.8
Do you recall Previous baby weight?	I do not recall	19	70	47.9
	I recall	32	71	52.1
If she recall weight	<2500 kg	1	22	22.3
	2500-4000 kg	18	49	65
	>4000 kg	13	0	12.6
Are you known diabetic	Yes	59	194	90.7
	No	10	16	9.3
Current RBS	<140	50	169	78.5
	140-200	12	35	16.8
	>200	7	6	4.7
Mode of delivery	SVD	27	0	9.7
	Cesarean section	39	186	80.6
	Operative vaginal delivery	3	24	9.7
If C/S or instrumental indication	Macrosomia	20	0	37
	Others	10	24	63
Any Complication during pregnancy	No	62	135	70.6
	Yes	7	75	29.4
Neonate weight	<2500	2	38	14.3
	2500-4000	14	172	66.7
	>4000	53	0	19
Neonate sex	Male	39	79	42.3
	Female	30	131	57.7
Neonate outcome	No complication	47	201	88.9
	Complication	22	9	11.1

If yes neonate complication	Hypoglycemia	1	16	22
	PNA	3	23	33.7
	Clavicular fracture	3	16	24.6
	Brachial plexus injury	3	12	19.4

macrosomia (Table 3).

Discussion

The purpose of this case study was to identify the factors that influence the occurrence of macrosomia at birth. In this study level of macrosomia was 24.7%. This finding is higher than study conducted in Iran (11.8%), Gonder (7.54%), Mekelle city (19.1%) and Hawassa (11.86%) [7-10]. The difference might be sociodemographic, study period and population difference. According to the findings, the most important risk factors for macrosomia were complications during pregnancy, parity (primipara and multipara), and newborn sex (male). According to the findings of this study, there was a significant difference in neonatal gender between the case and control groups (OR=2.23 [95% CI: 1.15-4.31]), and thus the risk of macrosomic birth was shown to be higher among male newborns than female newborns. This finding is in line with the results obtained in university of Gondar specialized hospital indicated that male neonates were significantly associated with macrosomia. This study is supported by the finding of Hawassa city shows that being a male was significantly associated with macrosomia [8].

The findings of this study revealed that a significant difference in pregnancy complications between the mothers in the case and control groups. Neonatal macrosomia was associated to complications during pregnancy in a multivariate logistic multivariate analysis (OR=7.24 [95% CI: 2.74-19.11]). Consistently, previous studies have confirmed the impact of complication during pregnancy on birth weight and

Table 3: Determinants of macrosomia.

Variables	Categories	Frequency		Odds ratio (OR)	
		Birth weight		COR (95% CI)	AOR (95% CI)
		Macrosomia	normal birth weight		
Age of mother in years	<20	7	48	0.5 (0.153-1.70)	
	20-30	37	83	1.5 (0.58-4.18)	
	31-40	19	58	1.4 (0.40-3.25)	
	>40	6	21	1	
Education status of mother	Cannot read and write	4	58	0.2 (0.62-0.63)	
	Primary school	27	58	1.3 (0.64-2.77)	
	Secondary school	22	48	1.3 (0.62-2.81)	
	Higher education	16	46	1	
Occupation of mother	Merchant	21	28	1.8 (0.78-4.50)	
	House wife	16	44	0.9 (0.37-2.19)	
	Government employee	3	37	0.2 (0.05-0.78)	
	Farmer	4	42	0.24 (0.70-0.81)	
	Teacher	13	29	1.1 (0.44-2.85)	
	Other	12	30	1	
Marital status	Married	63	161	2.9 (0.65-13.2)	
	Single	3	21	1.07 (0.16-7.22)	
	Widowed	1	13	0.57 (0.047-7.11)	
	Divorced	2	15	1	
Parity	Nulliparous	18	69	0.2 (0.083-0.523)	0.53 (0.17-1.59)
	Primipara	22	61	0.29 (0.117-0.711)	0.3 (0.11-0.84)
	Multipara	14	68	0.16 (0.064-0.427)	0.1 (0.037-0.294)
	Grandmultipara	15	12	1	1
Weight gained during pregnancy	<12 Kg	19	88	0.56 (0.25-1.26)	0.66 (0.27-1.61)
	12-16 Kg	37	88	1.1 (0.52-2.31)	1.9 (0.85-4.59)
	>16 Kg	13	34	1	1
Are you known diabetic	Yes	59	194	0.49 (0.210-1.130)	0.45 (0.16-1.20)
	No	10	16	1	1
Any Complication during pregnancy	Yes	7	75	4.9 (2.14-11.29)	7.24 (2.74-19.11)
	No	62	135	1	1
Neonate sex	Male	39	79	2 (1.24-3.74)	2.23 (1.15-4.31)
	Female	30	131	1	1

macrosomic birth in Hawassa city and Iran which is in congruence with the results of the present study [7,10]. Similarity may indicate that the presence of complication during pregnancy may predispose macrosomic birth.

Findings of the current research indicated a statistically significant difference in the parity between the case and control groups primipara OR=0.3 [95% CI: 0.11-0.84], multipara OR=0.1 [95% CI: 0.037-0.294]. This finding is in line with the study of Iran [7] where multiparity was highly associated with macrosomia. But unlike to this study finding of Gonder and Mekelle city [8,9] did not support it [11-13].

Conclusion and Recommendation

The prevalence of fetal macrosomia in this study was 24.7% which is higher than studies conducted in other areas. Complications during pregnancy, parity (primipara and multipara), and newborn sex (male) were the factors that affect macrosomic birth. Thos obstetric care providers should assess those pregnant women with complications, pregnant women with male sex for history of fetal macrosomia which would help them to be prepared for the managements of maternal and perinatal complications.

References

1. Bjørstad AR, Irgens-Hansen K, Daltveit AK, Irgens LM. Macrosomia: Mode of delivery and pregnancy outcome. Acta Obstet Gynecol Scand. 2010;89(5):664-9.
2. Voldner N, Qvigstad E, Frøslie KF, Godang K, Henriksen T, Bollerslev J. Increased risk of macrosomia among overweight women with high gestational rise in fasting glucose. J Matern Fetal Neonatal Med. 2010;23(1):74-81.
3. Ouzounian J, Hernandez G, Korst L, Montoro M, Battista L, Walden C, et al. Pre-pregnancy weight and excess weight gain are risk factors for macrosomia in women with gestational diabetes. J Perinatol. 2011;31(11):717-21.
4. Koyanagi A, Zhang J, Dagvadorj A, Hirayama F, Shibuya K, Souza JP, et al. Macrosomia in 23 developing countries: an analysis of a multicountry, facility-based, cross-sectional survey. Lancet. 2013;381(9865):476-83.
5. Martorell R, Khan LK, Hughes ML, Grummer-Strawn LM. Obesity in women from developing countries. Eur J Clin Nutr. 2000;54(3):247-52.
6. Young BC, Ecker JL. Fetal macrosomia and shoulder dystocia in women with gestational diabetes: Risks amenable to treatment? Curr Diab Rep. 2013;13(1):12-8.
7. Lawlor DA, Fraser A, Lindsay RS, Ness A, Dabelea D, Catalano P, et al. Association of existing diabetes, gestational diabetes and glycosuria in pregnancy with macrosomia and offspring body mass index, waist and fat mass in later childhood: Findings from a prospective pregnancy cohort. Diabetologia. 2010;53(1):89-97.
8. Stotland N, Caughey A, Breed E, Escobar G. Risk factors and obstetric complications associated with macrosomia. Int J Gynaecol Obstet. 2004;87(3):220-6.
9. Yadav H, Lee N. Factors influencing macrosomia in pregnant women in a tertiary care hospital in Malaysia. J Obstet Gynaecol Res. 2014;40(2):439-44.
10. Amini P, Moghimbeigi A, Zayeri F, Mahjub H, Maroufizadeh S, Omani-Samani R. Evaluating the impact of risk factors on birth weight and gestational age: A multilevel joint modeling approach. Int J Fertil Steril. 2018;12(2):106-13.
11. Kayode-Adedeji B, Egharevba O, Omoregbee H. Prevalence of fetal macrosomia and neonatal complications in a Nigerian suburban hospital: A five-year study. J Pediatr Neonatal Individ Med. 2018;7(1):70120.
12. Mengesha HG, Sahle BW. Cause of neonatal deaths in northern Ethiopia: A prospective cohort study. BMC Public Health. 2017;17(1):62.
13. Malik M, Khanna P, Verma R. The association of maternal risk factors to macrosomia in rural areas of Haryana, India: A community-based study. Int J Community Med Public Health. 2018;5(9):3842-6.