THE RELATIONSHIP BETWEEN MATERNAL WEIGHT GAIN IN THIRD TRIMESTER AND BIRTH WEIGHT AMONG NULLIPAROUS WOMEN IN TWO NIGERIAN TERTIARY HOSPITALS (68 NIGERIAN ARMY REFERENCE HOSPITAL YABA AND LAGOS UNIVERSITY TEACHING HOSPITAL)

ABSTRACT

Background: The reduction of maternal mortality and the improvement of infant survival are currently at the forefront of health issues and health sector reforms worldwide and in our country. Thus, efforts should be made to identify those risk factors that mitigate against achieving the above, with a view to putting in appropriate measures to combat them at all levels.

Aim: This prospective cohort study aimed to determine the relationship between maternal height, rate of weight gain in the third trimester of pregnancy and birthweight.

Methods: A prospective cohort study of pregnant women in the third trimester of pregnancy involving three measurements of weight at 30-, 34- and 38-weeks' gestation; maternal height at booking and their babies' weight at birth was conducted at two tertiary institutions in Lagos State. Analysis was done using Epi-info 2000 package.

Results: Two hundred and sixty pregnant women between the ages of 20 and 39 years, were involved in the study. The mean delivery age was 39 weeks with more male babies (55.2%) being delivered. The overall incidence of LBW in this study is 17%. Twenty-

eight and half percent (28.5%) of the women gained <1kg between 30 and 34 weeks of gestation with 22.7% of them having LBW babies (<2.5kg at birth). Between the 34th and 38th week of gestation, 21.6% of the women gained <1kg and 30% of them delivered LBW babies. Overall, between the 30th and 38th week of gestation, 12.5% of the women gained <1kg with 17.2% of them having LBW babies.

Conclusion: In conclusion this study showed the positive relationship between adequate maternal weight gain in pregnancy and normal neonatal birth weight and that poor weight gain is associated with low birth weight (LBW).

INTRODUCTION

The role women play during the reproductive stage, as guardians of family life and of the health of all its members, particularly children, is critical to the survival of the human race. It is well established that maternal nutritional status which is reflected by her pre-pregnancy weight, weight gain in pregnancy and other anthropometric parameters is critical both to maternal and fetal outcomes of pregnancy. This is true both in industrialized and developing countries[1]. However, in as much as adequate weight gain is required for good feto-maternal outcome, it is important to note that high pre-pregnancy weight is have negative impact on pregnancy outcomes.[1]

There are several reasons why weight relationships in pregnancy, especially the factors associated with low birth weight need re-consideration. In the first place, the major role played by low birth weight in neonatal and infant mortality is well known[1, 2, 3]. Secondly, superior mental development ensues in infants whose birth weight is above average and thirdly, both the mental and physical development of the child improves with

maternal weight gain[2, 3].

Monitoring weight gain has been the most common means of assessing the nutritional status of women (and their infants) during pregnancy.[4] This is because, maternal weight is sensitive to acute nutritional stresses during pregnancy, and it provides the most general impression of fetal growth.[1, 4] However, a disadvantage of weight gain is that it does not differentiate between weight of the mother, fetus or the various components (maternal fat stores, maternal lean tissue, water, blood volume, etc) necessary for favourable pregnancy outcome.[4] Wherever feasible, weight gain monitoring during pregnancy should be undertaken.[2, 4] A minimum weight gain of 12-20kg throughout pregnancy have been reported.[5] Lack of adequate weight gain two consecutive measurements four weeks apart have been shown to be detrimental to the fetus and/or mother[5].

This study therefore aims to determine the relationship between maternal weight in pregnancy and neonatal birthweight.

MATERIALS AND METHODS

STUDY SETTING/DESIGN

This was a prospective cohort study carried out in the department of obstetrics and gynaecology of Lagos University Teaching Hospital (LUTH) and 68 Nigerian Army Reference Hospital Yaba, Lagos Nigeria June 2022 and May 2024.

STUDY POPULATION

This included women who attended antenatal clinic and labour ward unit of the two hospitals during the study period.

INCLUSION CRITERIA

Patients who attended the antenatal clinic of the above institutions and satisfied the inclusion criteria of:

* Nulliparous women aged 20 – 39 years, with a viable, singleton pregnancy and who consented to participate in the study.

EXCLUSION CRITERIA

Mothers with certain complications known to affect birth weight and multiparous women were excluded from the study. These women included those with hypertensive disorders in pregnancy, preterm rupture of membranes, multiple pregnancy, Diabetes in pregnancy, sickle cell disease and antepartum hemorrhage.

ETHICAL CONSIDERATION

Approval for the study was obtained from the Research and Ethical Committee of both hospitals. Participation of the women in the study was entirely voluntary. Each woman gave a verbal consent prior to joining the study population.

DETERMINATION OF SAMPLE SIZE

A minimum sample size of 75 was calculated. This was based on 5% margin of error, 95% confidence interval, response distribution rate of 50% and 20,000,000 estimated population was derived using the Raosoft online sample calculator.[7] However, to improve the power of the study, more pregnant women were recruited.

DATA COLLECTION

Each antenatal clinic was visited and consecutive consenting women who were eligible were selected. The maternal height as recorded at the time of booking using the

Avery height scale was used. The babies were weighed using the weighmaster. The patients' case notes were reviewed following delivery to collect data relating to the weight gain during pregnancy. A total of 260 women were recruited into the study. Twenty-eight of them had missing data on account of either not keeping their appointments or delivery outside the study hospital. Therefore, only 232 were analysed.

Data collected was entered into an excel spread sheet and later analysed using SPSS version 29 (IBM UK). Measures of central tendency and dispersion were computed for quantitative variables such as age. Frequency distribution tables were also generated where appropriate. The statistical significance or otherwise of observed differences were determined using chi square test. A p-value of <0.05 was considered significant.

KEY TERMS AND DEFINITIONS

1. Birth weight: This is the weight of a child at the time of delivery.
2. Low birth weight: This is defined as a birth weight less than 2,500 grams.

RESULTS

The study population included 260 pregnant women. Twenty-eight of them had incomplete data. The overall incidence of LBW in the study is 17%.

The age distribution of the study group was between 20 and 35 years. The mean age was 28.12 with a standard deviation of +/-3.573. The highest frequency (18.5%) was recorded in the 28-year-old group. **See figure 1.**

Between the 30th and 34th week of gestation, 66 women (28.5%) gained < 1kg. This is shown in **figure 2.**

Fifteen (22.7%) out of the above 66 women delivered babies who were low birth weight (LBW) i.e. weighed <2.5kg at birth. Therefore, the incidence of LBW babies in this group is 23%. The odds ratio of having a LBW baby in the group is 0.3. The p value is 0.0001. **Figure 3** shows the observed birth weight pattern in the study against what is expected.

Between the 34th and 38th week of gestation, 50 women (21.6%) gained <1kg. This is shown in **figure 4**.

Fifteen (30%) of the above 50 women delivered babies who were LBW.

Therefore, the incidence of LBW babies in this group is 30%. The odds ratio of having a LBW baby in the group is 0.4. The p value is 0.0001. **Figure 4** shows the observed birth weight pattern in the study against what is expected.

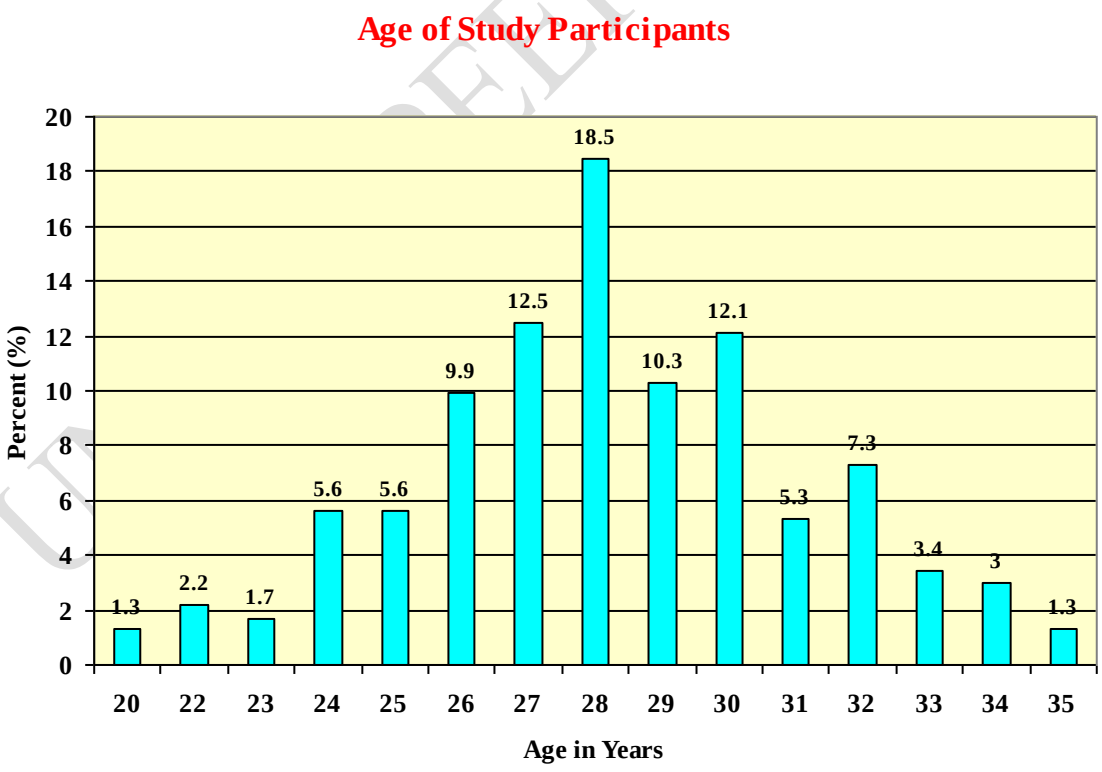

FIGURE 1- Age distribution of the participants.

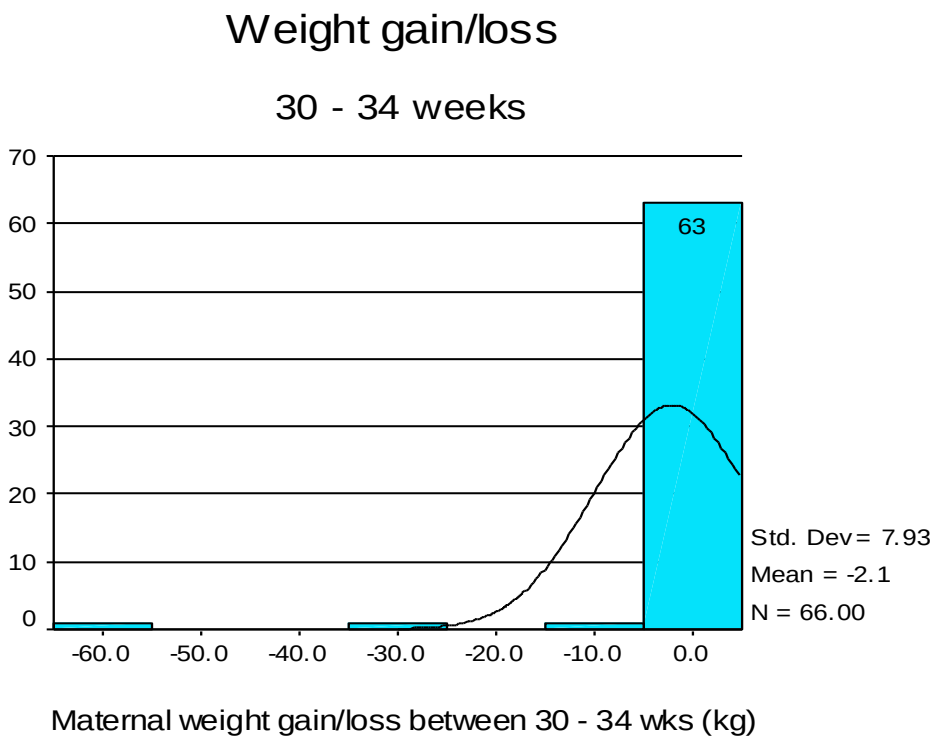

FIGURE 2- maternal weight gain between 30 and 34 weeks.

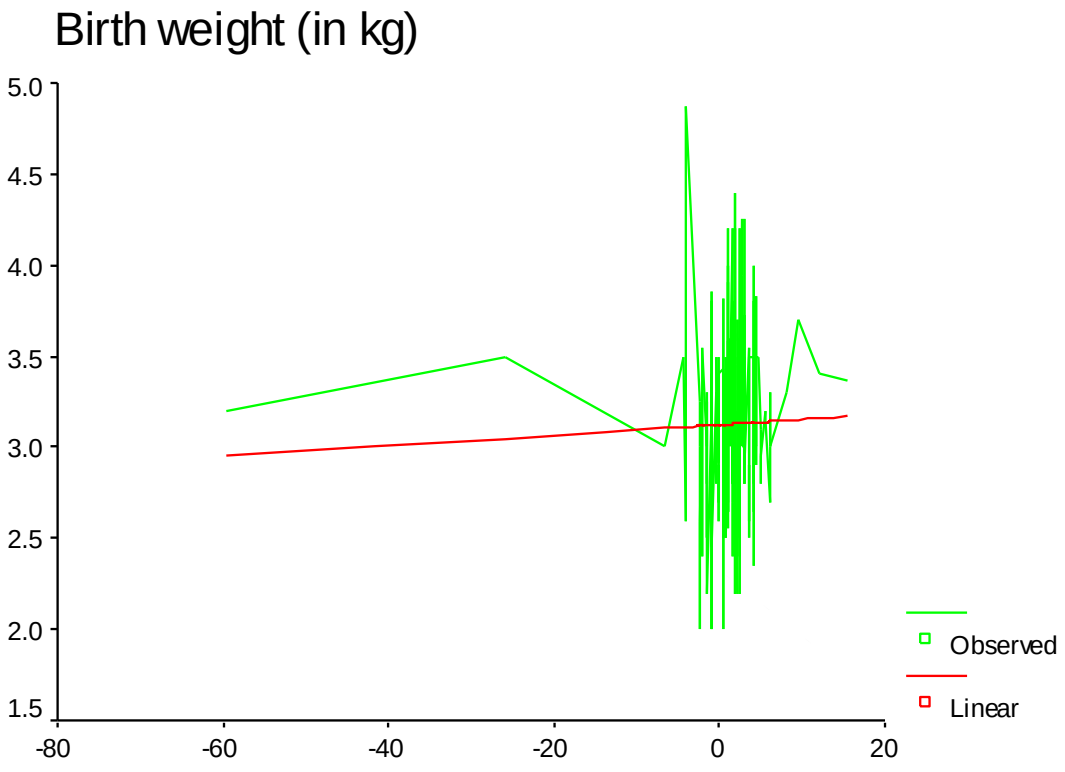

FIGURE 3- neonatal birthweight at delivery

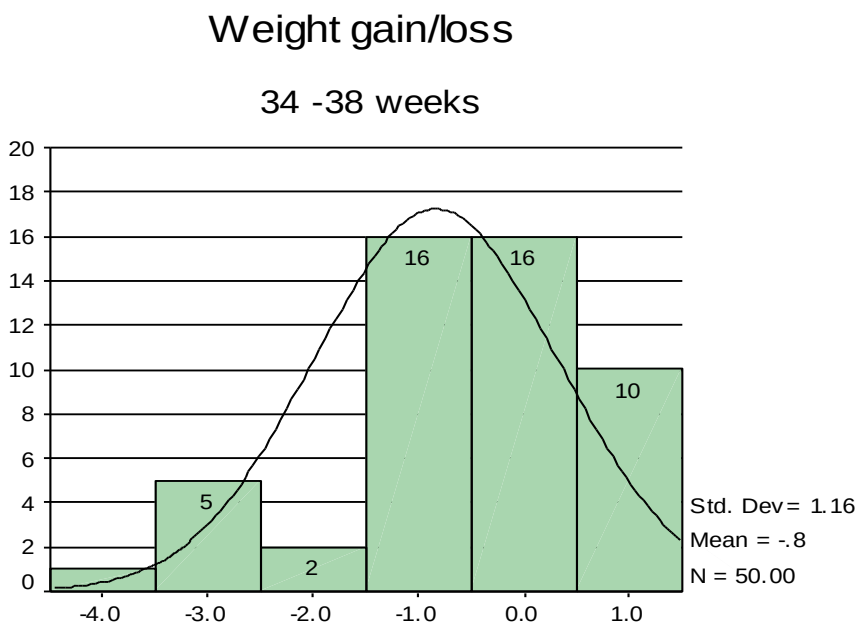

FIGURE 4– maternal weight distribution from 34-38 weeks.

DISCUSSION

Reducing the incidence of low birthweight (LBW) will in no doubt reduce infant mortality in developing countries and as such reduce the number of times a woman will desire to procreate and eventually dying from pregnancy related causes. This is because LBW has consistently been fingered as one of the factors associated with the high perinatal and neonatal mortality rates across Nigeria.[8, 9, 10]

The incidence of LBW in this study is 17%. This is similar to the estimated global average of LBW which is between 15-20%.[11] However, this is lower than the prevalence of LBW in India reported recently which ranges from 20.1-21%. [12] This difference may be because our study was conducted for a short duration, it may also be because it was a hospital-based study. The Indian study was a national family survey with over 149,279 women. This may have accounted for its robust nature and heterogeneity.

The incidence of LBW among the women who gained <1kg between the study periods i.e. 30-34, 34-38 weeks of gestation were statistically significant at p-values of 0.0001, 0.0001. respectively. This is supported by other studies. [12, 13] Maternal and fetal weight gain in pregnancy is a complex process. The association of poor or excessive maternal weight in pregnancy have been in implicated in many adverse pregnancy outcomes.[1, 11, 13] This study was able to demonstrate that poor maternal weight gain in pregnancy is associated with poor fetal weight gain which will invariably lead to increased neonatal mortality, morbidity, extended neonatal intensive care unit admission and increased healthcare cost.

We do acknowledge that his study was limited by some factors such as irregular antenatal clinic attendance by some mothers thereby making weight assessment at the specified periods impossible. It was also limited to only two facilities in a state with a population of over 20 million people.

In conclusion this study showed the positive relationship between adequate maternal weight gain in pregnancy and normal neonatal birth weight and that poor weight gain is associated with LBW.

Currently, the reduction of maternal morbidity and mortality and improvement of infant survival is at the forefront of health issues and health sector reforms in Nigeria. One of the ways of achieving this is to carry out studies that aim to identify those risk factors for LBW, which is an important cause of perinatal/neonatal morbidity and mortality

REFERENCES

1. Oluwole AA, Ugwu AO. Impact of first-trimester body mass index on pregnancy outcomes: observational study. Annals of Clinical and Biomedical Research. 2023; 4(1): 70-76. https://doi.org/10.4081/acbr.2023.273
2. Jana A, Saha UR, Reshmi RS, Muhammad T. Relationship between low birth weight and infant mortality: evidence from National Family Health Survey 2019-21, India. Arch Public Health. 2023 Feb 21;81(1):28. doi: 10.1186/s13690-023-01037-y. PMID: 36803539; PMCID: PMC9942291.

3. WHO. Newborns: improving survival and well-being. Geneva: World Health Organization; 2020. https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality. Accessed 10 July 2024.

4. Miele MJ, Souza RT, Calderon IM, Feitosa FE, Leite DF, Rocha Filho EA. *et al*, Maternal Nutrition Status Associated with Pregnancy-Related Adverse Outcomes. Nutrients. 2021 Jul 13;13(7):2398. doi: 10.3390/nu13072398. PMID: 34371906; PMCID: PMC8308922. 5.

5. Aoyama T, Li D, Bay JL. Weight Gain and Nutrition during Pregnancy: An Analysis of Clinical Practice Guidelines in the Asia-Pacific Region. Nutrients. 2022 Mar 18;14(6):1288. doi: 10.3390/nu14061288. PMID: 35334946; PMCID: PMC8949332.

6. Mohamed HJJ, Loy SL, Mitra AK, Kaur S, Teoh AN, Rahman SHA, Amarra MS. Maternal diet, nutritional status and infant birth weight in Malaysia: a scoping review. BMC Pregnancy Childbirth. 2022 Apr 6;22(1):294. doi: 10.1186/s12884-022-04616-z. PMID: 35387600; PMCID: PMC8988411.

7. Calculating the Sample Size Using Raosoft Software. https: www.researchgate.net/fig Accessed on July 11 2024.

8. Dahlui M, Azahar N, Oche OM, Aziz NA. Risk factors for low birth weight in Nigeria: evidence from the 2013 Nigeria Demographic and Health Survey. Glob Health Action. 2016 Jan 19;9:28822. doi: 10.3402/gha.v9.28822. PMID: 26790460; PMCID: PMC4720686.

9. Woelile TA, Kibret GT, Workie HM, Amare AT, Tigabu A, Aynalem YA, Chanie ES, Birlie TA. Survival Status and Predictors of Mortality Among Low-Birth-Weight

Neonates Admitted to the Neonatal Intensive Care Unit at Felege Hiwot Comprehensive Specialized Hospital, Bahir Dar, Ethiopia, 2020. Pediatric Health Med Ther. 2021 Sep 4;12:451-466. doi: 10.2147/PHMT.S323526. PMID: 34512075; PMCID: PMC8427078.

10. Adetola AO, Tongo OO, Orimadegun AE, Osinusi K. Neonatal mortality in an urban population in Ibadan, Nigeria. Pediatr Neonatol. 2011 Oct;52(5):243-50. doi: 10.1016/j.pedneo.2011.06.001. Epub 2011 Aug 4. PMID: 22036218.

11. Thapa P, Poudyal A, Poudel R, Upadhyaya DP, Timalsina A, Bhandari R, Baral J, Bhandari R, Joshi PC, Thapa P, Adhikari N. Prevalence of low birth weight and its associated factors: Hospital based cross sectional study in Nepal. PLOS Glob Public Health. 2022 Nov 2;2(11):e0001220. doi: 10.1371/journal.pgph.0001220. PMID: 36962657; PMCID: PMC10021178.

12. Perumal N, Wang D, Darling AM, Liu E, Wang M, Ahmed T, Christian P, Dewey KG, Kac G, Kennedy SH, Subramoney V, Briggs B, Fawzi WW; GWG Pooling Project Consortium. Suboptimal gestational weight gain and neonatal outcomes in low and middle income countries: individual participant data meta-analysis. BMJ. 2023 Sep 21;382:e072249. doi: 10.1136/bmj-2022-072249. PMID: 37734757; PMCID: PMC10512803.

13. Wen T, Lv Y. Inadequate gestational weight gain and adverse pregnancy outcomes among normal weight women in China. Int J Clin Exp Med. 2015 Feb 15;8(2):2881-6. PMID: 25932249; PMCID: PMC4402896.

12. Singh, D., Manna, S., Barik, M. et al. Prevalence and correlates of low birth weight in India: findings from national family health survey 5. BMC Pregnancy Childbirth 23, 456 (2023). https://doi.org/10.1186/s12884-023-05726-y