

ASSOCIATION OF MATERNAL WEIGHT GAIN AND FETAL WEIGHT AT TERM PREGNANCY: A CROSS SECTIONAL STUDY

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Summary

To evaluate the relationship between maternal weight gain and fetal weight in term pregnancy. An observational study was carried out in a private clinic in Cox's Bazar, from March 2011 to March 2012. Total 200 mothers with singleton pregnancy were selected. Maternal weights were recorded in 1st trimester and 3rd trimester. Fetal weights were noted at 37 completed weeks of gestation by ultrasonography. Most (63%) of the women were 20 - 29 years of age (mean 24.1±5.3) and 70.5% women got married at the age of 16 – 20 years (mean 18.71±2.79) and 11% of them had <2500gm fetus. The frequency of <2500gm fetus were 12% and 22.5% had > 1 children (mean 1.33±0.36), 46% of mothers having ≥3 children had <2500gm fetus (p = <0.05). It was detected that 65.5% of 20 – 24 years old mothers gained 10-12 kg. Mothers who gained < 8 kg of weight, 75% of them had <2500gm fetus, this study also revealed that 44.3% of mothers who gained 10 -12 kg weight had ≥2500gm fetus. There is significant correlation between the number of parity and variation of fetal weight.

Key words

Maternal weight; Fetal weight; Term pregnancy.

Introduction

In human life cycle the most vulnerable periods is intrauterine growth and development. It is dependent on maternal health, which can be assessed by maternal weight gain during pregnancy.

A total weight gain of 10 – 12 kg was described as “generally acceptable” in ACOG (American College of Obstetricians and Gynecologists) standard for obstetrics and gynecology service [1]. During pregnancy mother should gain 10 – 12.5 kg weight [2]. This was optimal weight gain. Fetal weight is correlated with maternal weight gain during pregnancy. At least 17 million infants are born worldwide every year with low birth weight, about 16% of all newborns in developing countries, with nearly 80% of all affected newborns with low birth weight at term being born in Asia, mainly South-Central Asia, Bangladesh having the highest incidence rate in the world [3,4]. Low birth weight (LBW) has been defined by the World Health Organization (WHO) as weight at live birth less than 2500 gm or 5.5 pounds (WHO, 1992). Birth weight is positively related both to maternal weight before pregnancy and weight gain in pregnancy, but these factors account for only about 10% of the variation in birth weight [5-8]. Though the study was prospective in nature, non-pregnant weight of mother was not available as women were identified in pregnancy. The sonographic fetal weight estimation correlated significantly with actual birth weight for all infants who delivered within 7 days of estimation (R = 0.0116, p <0.01) and of these fetal weight estimations, 81.3% were within 10% of the actual birth weight [9]. In developing countries, low birth weight with accompanying high mortality and morbidity continues to be a major public health problem [10].

Materials & methods

The study was an observational and place of study was a private clinic in Cox's Bazar, Bangladesh. Data were collected from March 2011 to March 2012. Total 870 pregnant women were attended for antenatal check up in that period. Among them 200 women were selected on the basis of defined criteria which included singleton baby without congenital anomalies, who did not experience diabetes or hypertension or any other chronic illness during pregnancy.

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One trained personnel collected general information following the questionnaire and specific information were collected by one female physician. Sonography was done for all women by the same physician with a 3.7 MHz transducer (Toshiba Just Vision 200, SSA – 320A, Japan) using standard Hadlock reference tables that used biparietal diameter, abdominal circumference and femur length for fetal weight calculation [11]. Women were registered at 1st trimester which included date of registration, age, parity, gestational age, weight, socioeconomic characteristics like education, income, dietary habit were obtained from a face to face interview using a structured questionnaire. The gestational age was estimated based on self – reported last menstruation period and first trimester ultrasound examination and those who could not report LMP there gestational age was only dependent upon ultrasonography. Gestational age is ideally assessed with early ultrasound [12]. First maternal weight <13 weeks measured in kilograms, An Indian study assumed no weight gain up to 13 weeks gestation, because they found that women do not gain much weight in this period [13]. Another study reported that maternal weight and body composition are unchanged in the first trimester [14].-Final maternal weight was measured after 37 completed weeks and fetal weight were obtained by ultrasonography using Hadlock formula [11]. Fetal weight was classified as follows: (<2.5 kg), (>2.5 kg) and maternal weight: optimal weight gain 10 – 12 kg, mild inadequate weight gain was 8 - < 10 kg and gross inadequate weight gain was < 8 kg. The socio-economic classification in this study was made according to 2006 Gross National Income (GNI) per capita and using the calculation of World Bank (WB) [15]. The groups were low-income \$75.41 or less (BDT<5360), lower middle-income \$75.5 - \$299.58 (BDT 5361-21270), upper middle-income \$299.68 - \$926.25 (BDT 21271- 65761) and high-income \$926.33 or more (BDT 65762).

After completion of data collection, all were comprehended, processed and edited by using Microsoft Office Excel 2003. Finally data were analyzed and interpreted using appropriate tables, figures and descriptions.

Results

An observational study was conducted in a private clinic in Cox's Bazar. From March 2011 to March 2012, 870 women with age range 16-45 years were attended for antenatal check up. According to define criteria 200 women were selected as study population.

The mean age was 24.1± 5.3 years majority 126 (63%) were in the age group of 20 – 29 years. Regarding the education of the 200 women it was found that 8.5% (17) were illiterate and in literate women 37.5% (75) were secondary level and only 6.5% (13) had graduation. In this study half 69.5% (139) of the women were from middle class and only 10% (20) were from low class (Table I).

Primigravida had significant weight gain than multigravida (Table II).

Out of 200 mothers 78 with fetal weight ≥ 2500 gm gained 10-12 kg and 18 with < 2500 gm fetus gained < 8 kg weight during pregnancy (Table III).

It was revealed that majority 67.5% (135) of women had 1st pregnancy occurred at the age group of 16 – 20 years. Mean age of these patients was 19.5 ± 2.8 (Fig 1).

It was found that 47% of the women were nulliparous while 22.5% were multiparous (Fig 2).

Table I : Socio demographic factors of the study population (n=200)

Parameter	Number	Percentage
Age		
16 – 19 yrs	40	20
20 - 24 yrs	84	42
25 - 29 yrs	42	21
30 - 34 yrs	28	14
35 – 39 yrs	04	02
40 - 45 yrs	02	01
Education		
Illiterate	17	8.5
Primary	34	17.0
Secondary	75	37.5
SSC	36	18.0
HSC	25	12.5
Graduate	13	6.5
Socio economic status		
Low	20	10.0
Middle	139	69.5
High	41	20.5

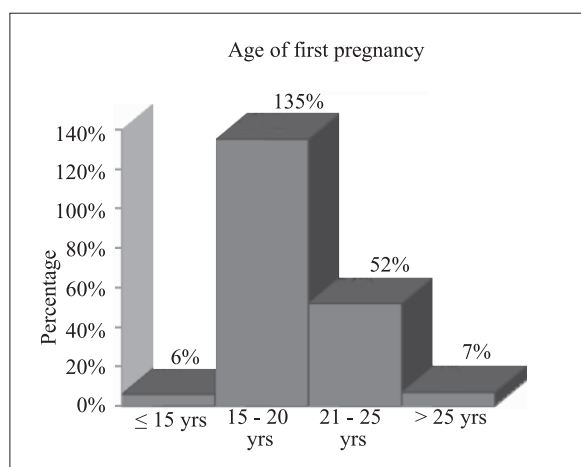
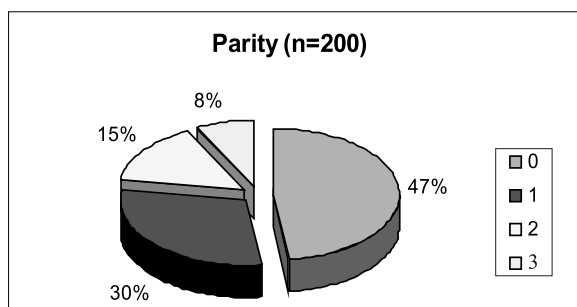
Table II : No. of Pg (Gravida) and Fetal wt

Ft. wt.	1st		2nd		>3rd		Total	P Value*
	No.	%	No.	%	No.	%		
≤2500gm	06	25	07	29	11	46	24	<.005
>2500gm	90	51	52	30	34	19	176	
Total	96	76	59	59	45	65	200	

* $\chi^2 = 9.61 > 3.84$ $p = < 0.05$ significant

Table III : Maternal wt. gain and fetal wt

Ft. wt.	< 8 kg		8 - <10kg		10 - 12 kg		Total
	No.	%	No.	%	No.	%	
<2500gm	18	75	06	25	0	0	24
≥2500gm	40	22.7	58	33	78	44.3	176

**Fig 1 :** Age of First pregnancy**Fig 2 :** No. of parity among the respondents

Discussion

Improvement of maternal health and reduction of child mortality are a health related indicators in Millennium Development Goal. Gestational weight gain and fetal growth is associated with maternal health. Low birth weight in developing countries occurs primarily because of poor maternal health and nutrition [16]. In this study 200 pregnant women, 16 to 45 years of age, from 1st trimester to 37 completed weeks were studied to correlate maternal weight gain with their fetal weight. Gestational age was measured by LMP and sonography. Some mother could not tell LMP, their gestational age was assessed with early ultrasound [11]. First maternal weight was measured in kg (≤ 13 wks). Last measurement was done after 37 completed weeks of gestation. Hadlock formula 1 in sonographic was used for fetal weight estimation. Fetal ultrasound is a useful tool to estimate birth weight [17]. Baum et al. showed no significant difference between clinical and sonographic estimates of fetal weight; 64.0% versus 62.5% of the estimates respectively were within 10% of the actual birth weigh [18]. They were advised to take vitamins, iron, calcium and extra food during pregnancy. Low birth weight (<2.5kg) continue to be a major public health issue with a worldwide incidence of 15% and estimated incidence in Bangladesh of 30% [19,20]. These infants have a higher rate of morbidity and mortality extending to chronic disease in adulthood [21,22,23]. In this study investigator found only 12% fetuses were <2500gm. A hospital based study in Bangladesh reported 15% LBW and another study showed that 17% of LBW which is comparable [24,25]. These mothers were regular monthly antenatal check up. One study reported that the mean maternal weight gain was less in young (<20 years) women than in older women (>25 years ; P <0.05), less in parous than in primigravid women (P <0.05)26. In this study majority (65.5%) of 20 - 24 years aged mothers gained gestational weight 10-12 kg, where as <20 years as well as ≥ 25 years aged mother gained 20% and 19.7% respectively. Another study reported that advanced maternal age is associated with an increased risk of low birth weight [27]. Similar findings also detected in this study, where 100% mother having age ≤ 15 years had fetal weight < 2500gm, 11.1% mother

with 16 - 20 years had this fetal weight and with the increased age that is among >20 years mother got fetal weight only 5.1% of < 2500gm. Mothers (46%) having ≥ 3 children had <2500gm fetus ($p = <0.05$) and who gained < 8 kg of weight, 75% of them had < 2500gm fetus. In this study 44.3% of mothers who gained 10 - 12 kg weight had ≥ 2500 gm fetus.

Conclusion & Recommendation

This study revealed the significant correlation between the number of parity and variation of fetal weight, it was also observed that fetal weight is directly related with the maternal age as well as maternal weight gain during pregnancy. So the maternal factors like marital age, weight, age of pregnancy and nutritional status should be emphasized before thinking about healthy baby from a healthy mother.

Disclosure

All the authors declared no competing interest.

References

1. American College of Obstetricians and Gynecologists. Standards for obstetric-gynecologic services. Washington, DC: American College of Obstetricians and Gynecologists, 1985.
2. DGHS Bangladesh. Training on Nutrition for field Service Providers. 2012; 111.
3. Cerqueiro M, Murtagh P, et al. Epidemiologic risk factors for children with acute lower respiratory tract infections in Buenos Aires, Argentina: a matched case-control study. *Reviews of Infectious Diseases*. 1990; 12(S8):S1021-S1028.
4. Chandra RK, Nutrition and immunology: from the clinic to cellular biology and back again. *Proceedings of the Nutrition Society*. 1999; 58(3):681-683.
5. Abrams BF, Laros RK. Pre-pregnancy weight, weight gain, and birth weight. *Am J Obstet Gynecol* 1986;154:503-509.
6. Möller B, Gebre-Medhin M, Lindmark G. Maternal weight, weight gain and birthweight at term in the rural Tanzanian village of Ihula. *Br J Obstet Gynaecol*. 1989;96: 158-166.
7. Seidman DS, Ever-hadani P, Gale R. The effect of maternal weight gain in pregnancy on birthweight. *Obstet Gynecol* 1989;74:240-246.
8. Dawes MG, Grudzinskas JG. Patterns of maternal weight gain in pregnancy. *Br J Obstet Gynaecol*. 1991;98:195-201.
9. Asma S. Basha, Ilham B. Abu-khader et al. Accuracy of Sonographic Fetal Weight Estimation within 14 Days of Delivery in a Jordanian Population Using Hadlock Formula 1. *Med Princ Pract*. 2012;21:366-369.
10. R.Janathan, D.G.N.G. Wijesinghe, T. Sivananthawerl. Maternal Anthropometry as a Predictor of Birth Weight. 2009;21(1):89-98.
11. Hadlock F, Harrist R et al. Estimation of fetal weight with the use of head, body and femur measurements. *Am J Obstet Gynecol*. 1985;151:333-337.
12. Lynch CD, Zhang J. The research implications of the selection of a gestational age estimation method. *Paediatr Perinat Epidemiol*. 2007;21(S2):86-96.
13. Tripathi, AM, Agarwal et al. Nutritional status of rural pregnant women and fetal outcome. *Indian Pediatr*. 1987;24: 703-712.
14. Fattah C, Farah N et al. Maternal weight and body composition in the first trimester of pregnancy. *Acta Obstet Gynecol Scand*. 2010;89:952-955.
15. Hoque ANMN. The middle-income matrix. *The Daily Star*, November 18, 2007.
16. Ann K. Blanc, Tessa Wardlaw. Monitoring low birth weight: an evaluation of international estimates and an updated estimation procedure. *Bulletin of the World Health Organization*. 2005;83: 178-185.
17. MW Pang, TN Leung et al. A validation study of ultrasonic foetal weight estimation models for Hong Kong Chinese singleton pregnancies. *Hong Kong Med J* 2004;10:384-388.
18. Baum JD, Gussman D et al. Clinical and patient estimation of fetal weight vs ultrasound estimation. *Obstetrical and gynecological survey*, 2002;57(9):558-559.
19. UNICEF, WHO. Low birthweight: country, regional and global estimates. New York: UNICEF; 2004.

20. UNICEF, The state of the world's children 2009: maternal and newborn health. New York: UNICEF; 2008.
21. Barker DJ. Adult consequences of fetal growth restriction. Clin Obstet Gynecol. 2006;49:270-283.
22. Wilcox AJ. On the importance-and the unimportance-of birthweight. Int J Epidemiol. 2001;30:1233-1241.
23. McIntire DD, Bloom SL et al. Birth weight in relation to morbidity and mortality among newborn infants. N Engl J Med. 1999;340: 1234-1238.
24. Dhar B, Mowlah G et al. Newborn anthropometry and its relationship with maternal factors. Bangladesh Medical Research Council Bulletin. 2003; 29: 48-58.
25. Shamsun Nahar, CGN Mascie-Taylor et al. Maternal anthropometry as a predictor of birth weight. Public Health Nutrition. 2007; 10(7):965-970.
26. M. G. Dawes, J.G. Grudzinskas. Patterns of maternal weight in pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology. 1991; 98: 195-201.
27. Nahum GG, Stanislaw H. Validation of a birth weight prediction equation based on maternal characteristics. J Reprod Med. 2002;47:752-760.