

THE RELATIONSHIP BETWEEN MATERNAL WEIGHT GAIN IN PREGNANCY, HEMOGLOBIN LEVEL, STATURE, ANTENATAL ATTENDANCE AND LOW BIRTH WEIGHT

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Abstract. Low birth weight (birth weight less 2,500 g) remains a major public health problem in many communities. Five hundred and twenty-eight (528) consecutive singleton maternities delivered at the Armed Forces Hospital Tabuk, northwest Saudi Arabia were studied to identify the relationship between prenatal weight gain, maternal hemoglobin at delivery, maternal stature, antenatal clinic attendance and low birth weight (LBW). Of the total number, 9.5% (50/528) babies were of low birth weight, 56% of which were preterm while 44% were term and small for gestational age, resembling the pattern observed in developed countries rather than developing countries. Mothers who delivered LBW babies gained significantly less weight in the 3rd trimester and last 4 weeks of term pregnancy when compared with controls who had normal weight babies (NW $\geq 2,500$ g) who were delivered in the study period ($t = 4.06$, $p < 0.0001$, $t=3.7$, $p < 0.001$). There was no significant difference in the prenatal weight gain in the second trimester for the two groups of mothers ($p = 0.53$). Mothers with LBW babies also had significantly lower Body Mass Index (BMI) at onset of pregnancy ($t = 3.8$, $p = 0.001$) and were shorter in height ($t = 2.12$, $p < 0.03$). Mothers who delivered preterm LBW babies had significantly lower hemoglobin levels at delivery when compared with those who had NW deliveries ($p < 0.002$). There was no difference in hemoglobin levels of mothers who had LBW babies at term and those with NW at term ($p = 0.72$). For this community, it is suggested that to reduce the LBW baby rate and improve birth weight, anemia must be prevented in pregnancy; attention needs to be paid to weight gained in the third trimester and the last 4 weeks of pregnancy encouraging antenatal clinic attendance, and improving the nutritional status of female children so that optimal height is achieved by the age of reproduction.

INTRODUCTION

Low birth weight (LBW) defined as birth weight less than 2,500g remains a major public health problem in many communities. It is a major contributory factor to infant and perinatal mortality as well as to different types of morbidity in childhood (Barros *et al*, 1992; Downes *et al*, 1991; Saugsted, 1981; Yersushalmy, 1970). The mean birth weight of newborn babies in certain geographical areas also reflects the level of socioeconomic development. More recent estimates by UNICEF (1995), show that the LBW rates in developed countries are between 4-7% while in developing countries it has been shown to be as high as 25% of all births (Fathalla, 1992; WHO, 1980). There is still a dearth of LBW data from the study area, particularly in relationship to maternal characteristics such as weight gain in pregnancy,

hemoglobin level, antenatal care and maternal stature. These have been shown by Lechtig (1988), not listed to be important determinants of birth weight. LBW rates have however been reported by Taha *et al* (1984), and Al-Sekait (1989), from other areas of the kingdom and none from this area. Knowledge about birth weights especially the incidence and prevalence rates for LBW, are important for planning, especially when needed to set up facilities in the delivery room or in special neonatal units designed to take care of these high risk deliveries. This study was carried out to identify any relationship between prenatal weight gain, maternal hemoglobin level at delivery, mothers stature, antenatal clinic attendance and the delivery of a low birth weight baby in northwest (NW) Saudi Arabia and also to identify which factors can be modified in order to reduce LBW rate in the study area.

MATERIALS AND METHODS

Data from 532 consecutive maternities for which complete information was available and who deliv-

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ered at the Armed Forces Hospital, Tabuk, NW Saudi Arabia were analysed. This hospital provides combined primary medical and speciality care including antenatal care in the same building. The available medical records therefore contain information about all clinic visits and admissions in the same folder and permits record linkage (Dunn, 1946). The study population consists of pregnant Saudi women from different parts of the kingdom. Information on each obstetric patient was obtained before discharge. These included data on age, parity, gravida status, past medical and obstetric history and the results of all investigations done in the hospital. Maternal weight was taken at every clinic visit with light clothing and no shoes on. Information on infant sex, birth weight and method of delivery were also recorded. Birth weight was recorded by nursing staff to the nearest 10 grams within 1 hour of delivery. Gestational age was assessed by fundal height and recorded at every clinic visit. It was also calculated from the first day of the last normal menstrual period. This was confirmed in over 40% of cases by sonogram because of disparity in dates. Anemia was defined as hemoglobin of less than 11g/100mls (WHO, 1968). A booked patient attended antenatal clinic once or more times before delivery. Age of mother was submitted by patient and verified with the age submitted during previous hospital visits. Mother's Body Mass Index ($\text{weight}/\text{height}^2$) was used as a proxy for stature. Mothers who delivered normal weight babies (2,500g and above) served as control. Permission was obtained from the hospital medical director to carry out the study. Analysed data was subjected to appropriate statistical analysis.

RESULTS

There were a total of 532 consecutive deliveries. This number included 4 twin deliveries which were excluded from the analysis. Of the total singleton deliveries, 9.5% (50/528) were LBW. When all the LBW deliveries were evaluated by gestational age, 56% (28/50) were preterm (less than 37 weeks gestation), while 44% (22/50) were at term (37 weeks and above) and small for gestational age (SGA).

Prenatal weight gain

Mothers who delivered LBW babies gained significantly less weight in 3rd trimester when compared with mothers who had babies with normal

weight (NW) ($t = 4.06, p < 0.0001$). Mothers of LBW babies also gained significantly less weight in the last 4 weeks for term pregnancies when compared with those with NW babies ($t = 3.7, p < 0.001$). Mothers with preterm LBW babies gained significantly more weight in last 4 weeks of pregnancy when compared with mothers of term LBW babies ($t = 3.1, p < 0.003$). However, the mothers with preterm LBW babies all delivered in early 3rd trimester and their weight gain was not significantly different from the prenatal weight gain of mothers in 3rd trimester who also had LBW babies but delivered at term ($t = 0.63, p = 0.53$). There was no significant difference in prenatal weight gain in 2nd trimester for mothers who had LBW babies and those who did not ($t = 0.6, p = 0.53$) (Table 1).

BMI and maternal height

BMI at onset of pregnancy was significantly lower in mothers with LBW babies ($t=3.8, p < 0.001$). Mothers with LBW babies were also significantly shorter in height than mothers with normal weight babies ($t = 2.12, p < 0.03$) (Table 1).

Maternal hemoglobin at delivery

Maternal hemoglobin was assessed on admission before delivery. There was no significant difference in maternal hemoglobin at delivery for mothers at term, who had LBW babies and those at term who had normal weight babies (F-stat. 0.12, $p = 0.72$) (Table 1).

Mothers who delivered preterm LBW babies however had significantly lower hemoglobin levels when compared with mothers who had normal birth weight babies ($t = 2.34, p < 0.02$) (Table 1).

Antenatal clinic attendance

Among mothers who delivered LBW babies, 86% (43/50) attended antenatal clinic at least once in pregnancy. The mean attendance was 5.4 ± 2.9 (range 1-12) times, while 14% (7/50) did not attend at all. For those who had normal weight babies, a higher proportion, 90.7% (434/478) attended antenatal clinic and only 9.4% (49/478) did not attend at all. The mean attendance was 6.2 ± 3.2 (range 1-14 times). There was however no significant difference in the proportions that attended clinic in the two groups ($p = 0.37$).

DISCUSSION

Fetal growth and birth weight are significant

MATERNAL WEIGHT GAIN IN PREGNANCY

Table 1

Prenatal weight gain, maternal BMI at onset of pregnancy, hemoglobin level, maternal height and birth weight.

	Birth weight <2,500g (LBW) n = 50	Birth weight 2,500g and above n = 478
Prenatal weight gain 2 nd trimester (12-28 wks)	4.82 ± 2.9 kg	5.04 ± 2.3 kg
Prenatal weight gain 3 rd trimester (>28 wks)	1.95 ± 1.5 kg	3.19 ± 2.1 kg
Prenatal weight gain in last 4 wks of pregnancy	Term = 0.96 ± 0.4 kg (n = 22) Preterm = 2.19 ± 1.8 kg (n = 28)	1.51 ± 1.04 kg
Maternal BMI at onset of pregnancy (W/H ²)	19.9 ± 4.9	23.1 ± 5.7
Maternal hemoglobin level at delivery (g/dl)	Term = 11.2 ± 1.3 g/dl (n = 22) Preterm = 10.7 ± 1.8 g/dl (n = 28)	11.3 ± 1.3 g/dl
Maternal height (cm)	150.6 ± 6.4 cm	152.4 ± 5.6 cm

markers of the health status of child in infancy, in childhood and even in adult life. It has been known that babies with LBW have an increased risk for mortality not only in the immediate post partum period but also in infancy. Therefore as a public health measure, improving birth weight and reducing the incidence of babies born with LBW will certainly go a long way to improve child survival in any community. A lot of data published on LBW have failed to distinguish between preterm and term LBW babies. With major advances in technology and socio-economic development, prematurity has accounted for the majority of LBW babies born in the developed countries (Villar *et al*, 1982; Millar *et al*, 1991). On the other hand, in most developing countries, the large proportion of babies below 2,500g at birth in different communities have been found to be term babies with intrauterine growth retardation (Viedma, 1988; Soltani, 1991; Lawoyin *et al*, 1992; Villar *et al*, 1994). From the data presented, LBW characterized 9.5% of all singleton birth. This is similar to what was observed in Riyadh by Al-Eissa *et al* (1991) and in the Medina region (Al-Sekait, 1989). Also a slightly, but significantly higher proportion of LBW babies in this study were

preterm babies resembling the pattern observed in developed countries and not developing countries. This particular finding is consistent with data reported by Taha(1984) from another region in this country.

Considerable attention has been paid to evaluating the determinants of birth weight especially LBW so that risk factors can be identified.

From the data presented, it appears that women in this community with anemia have shorter pregnancies than non-anemic women and effort needs to be made to improve iron nutrition status of pregnant women in this area. Maternal weight has been known for several decades to play a role in pregnancy (Beilly and Kurkland, 1945). However, it is only recently that its importance to the outcome of pregnancy was properly recognized. From this study, mothers' weight gain in 3rd trimester and in the last 4 weeks of pregnancy were found to affect birth weight. This has been found in an ethnically different community (Lawoyin, 1991). The implication of this for many developing countries where women tend to present late for antenatal care is that there is an opportunity for intervention, particularly for

those pregnancies which are likely to deliver of LBW babies. A carefully designed nutrition intervention program will meet the need of these women. It is desirable however to study the weight changes in Saudi mothers with information on dietary intake and to establish guidelines appropriate for the community that will ensure adequate weight gain in both mother and fetus during pregnancy.

It is suggested that to reduce LBW rate and improve birth weight, anemia must be prevented in pregnancy, attention needs to be paid to weight gained in 3rd trimester and last 4 weeks of pregnancy, encouraging antenatal clinic attendance and improving the nutritional status of the girl child so that optimal height is achieved by the age of reproduction.

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