Low birth weight in the Taif Region, Saudi Arabia

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انخفاض أوزان المواليد في منطقة الطائف بالمملكة العربية السعودية

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تقدم هذه الورقة دراسة استباقية لحالات ذات شواهد، من المواليد ذوي الأوزان المنخفضة في مستشفى الولادة بمدينة الطائف بالمملكة العربية السعودية. ولقد أظهرت النتائج أن معدل وقوع الوزن المنخفض عند الميلاد (١٣,٦٪) يقل عما هو مبلّغ من البلدان النامية الأخرى. غير أن هذا المعدل يكاد يبلغ ضعفَيْ ما هو مسجل من مدن سعودية أخرى. كما تبين أن سائر أشكال مراضة الأجنّة ووفياتها كانت مفرطة الارتفاع بين المواليد ذوي الأوزان المنخفضة. وعلى الرغم من أن وزن الألفين وخمسمئة غرام الذي يقاس به انخفاض الوزن عند الميلاد، له أهميته في المقارنات التي تجرى بين الثقافات المختلفة، إلا أن نتائج هذه الدراسة توحي بأنه لابد لكل مجتمع من أن يحدد لنفسه معدلات أوزان المواليد الخاصة به.

The present study is a prospective case-control study on low-birth-weight (LBW) infants born at the maternity hospital in Taif city in Saudi Arabia. The results showed a lower incidence (13.6%) of LBW than that reported from other developing countries. However, this incidence was almost double that reported from other cities in Saudi Arabia. Almost all forms of fetal morbidities among LBW infants and mortalities showed significant increase. Although the 2 500 gram figure for identifying low birth weight is important for comparison across different cultures, the results of this study suggest that each population should also establish its own birth weight centile.

L'insuffisance pondérale à la naissance dans la région de Ta'if (Arabie saoudite)

La présente étude est une étude cas-témoins prospective sur les nouveau-nés présentant une insuffisance pondérale à la naissance (IPN) dans la maternité de la ville de Ta'if en Arabie saoudite. Les résultats de l'étude montrent que l'incidence de l'insuffisance pondérale à la naissance est plus faible (13,6%) que celle signalée dans d'autres pays en développement. Toutefois, l'incidence de l'IPN dans cette ville était presque deux fois plus élevée que celle signalée dans d'autres villes d'Arabie saoudite. Presque toutes les formes de morbidité foetale et la mortalité augmentaient de manière considérable chez les nouveau-nés présentant une insuffisance pondérale à la naissance. Bien que le chiffre de 2500 g pour définir une insuffisance pondérale à la naissance soit important à des fins de comparaison entre différentes cultures, les résultats de cette enquête donnent à penser que chaque population doit fixer son propre centile pour le poids à la naissance.

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Introduction

"Children's health is tomorrow's wealth" is one of WHO's slogans of recent years. However, children's health is to a great extent determined by factors that operate *in utero*, well before they are born. At birth, fetal weight is accepted as the single parameter that is directly related to the health and nutrition of the mother, and on the other hand, is an important determinant of the chances of the newborn to survive and experience healthy growth and development. This is because low birth weight has been shown to be directly related to both immediate, long-term and very long-term development and well-being [*1–4*].

WHO has defined low birth weight (LBW) as weight at birth of less than 2 500 grams [*5*]. This definition of LBW includes in its total a subgroup of infants who have suffered varying degrees of nutritional deprivation *in utero*. The latter subgroup, victims of intrauterine growth retardation (IUGR), constitutes the group at highest degree of risk of both short-term and long-term complications.

Fetal growth and birth weight is influenced by a variety of factors, racial, social and economic among others, as well as specific medical conditions that may be present or that may develop during pregnancy [*6*]. Hence, it is not surprising that mean birth weight shows a degree of variation from country to country and from area to area within the same country [*7*].

In many of the so-called developing countries, determinants of fetal weight at birth have not been precisely identified. Hence, intervention programmes are based on subjective unproven analysis.

In the past few decades, Saudi Arabia has enjoyed unprecedented economic and social development that has touched almost all aspects of life, including provision of health care. In a situation of such rapid transition, it is important to study indicators of health, and to analyse factors that are of significance in order to promote health and counteract negative trends.

The objective of the present study is: first, to determine the mean birth weight of newborns in the Taif area; second, to estimate the prevalence of LBW as defined by WHO; and third, to study the relation of recognized important determinants to fetal weight at birth in Taif.

Materials and methods

This study is a prospective case-control study, which was conducted in Taif Maternity Hospital over a period of 10 months, from January to October 1992. Taif Maternity Hospital is the only maternity hospital in the city, and about 8 000 deliveries take place there annually. We studied 470 LBW infants and 482 control infants. During the study period, for each low-birth-weight infant a control case (infant whose birth weight exceeded 2 500 grams) was included. Data for both, the LBW and control infants, were listed in a special questionnaire (Table 1).

Low birth weight (LBW) was defined as less than 2 500 grams at birth [*8*]. Very low birth weight (VLBW) and extremely low birth weight (ELBW) were defined as less than 1 500 grams and 1 000 grams respectively [*1*].

Taif was chosen because it lies inland and away from direct contact with other foreign cultures. It is located at the centre of the Sarat El-Hijaz mountains at about 2 400 metres above sea level.

Statistical analysis

For comparison between the incidence of distribution of low and normal birth weight (NBW) fetuses in relation to the various variables studied, analysis of variance and

Table 1 **The LBW data questionnaire**

Identification	File number, date, interviewer name
Demographic data	Age, work, marital status, literacy, parity, previous pregnancies outcome, antenatal care
Medical information	Health status of the mother during labour, type of delivery
Anthropometric measurement	Weight, height, arm circumference, skinfold thickness
Dietary history	24-hour dietary recall
Laboratory information	Haemoglobin level
Newborn data	Birth weight, sex, length of gestation, type of delivery, Apgar score, resuscitation status, admission to Special Care Baby Unit, whether single or multiple births

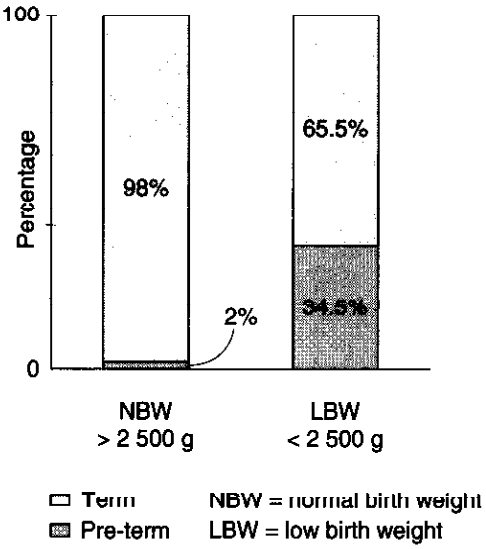

Figure 1 **Relation of birth weight to gestational age at delivery. Term (delivery after 37 weeks); pre-term (delivery before 37 weeks)**

chi-squared tests were used as appropriate. Logistic regression analysis was used to assess, for LBW and NBW, whether there was a correlation with certain maternal variables, some of which were found to have a significant relationship to fetal weight at birth. A p value of less than 0.05 was considered statistically significant.

Results

During the 10-month study period, a total of 6 220 deliveries took place. Of these 6 162 were live births and 58 were stillbirths. The mean birth weight of the whole sample was 3 044 ± 568 grams. We studied 470 LBW infants and 482 control infants. The perinatal mortality rate, stillbirth rate and the early neonatal mortality rate are shown in Table 2.

Table 2 **Perinatal, stillbirth and early neonatal mortality rates per 1 000 live births in Taif**

Mortality	Rate (%)
Perinatal	22.19
Stillbirth	9.33
Early neonatal	12.99

The incidence of LBW infants was 13.6% (844 infants); of those, 98 (11.6%) were VLBW, and 52 (6.2%) were ELBW. This represents 1.58% and 0.84% of the whole sample respectively.

Fig. 1 shows the relation of birth weight to gestational age at delivery. Only 34.4% (290) of the LBW infants were pre-term (gestation less than 37 completed weeks). Of the entire sample, 6.4% (399) were pre-term.

Relationship between birth weight and demographic data.

There was a significant relationship between fetal birth weight and each of: the mother's

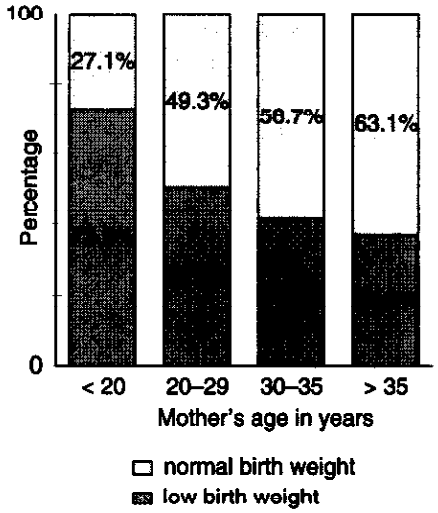

Figure 2 **Relationship between fetal weight at birth and mother's age**

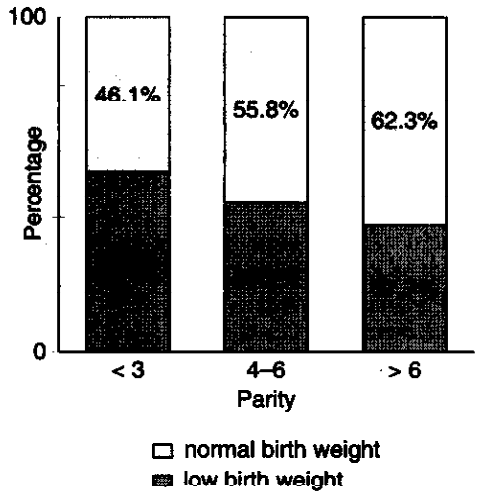

Figure 4 **Relationship between fetal birth weight and parity**

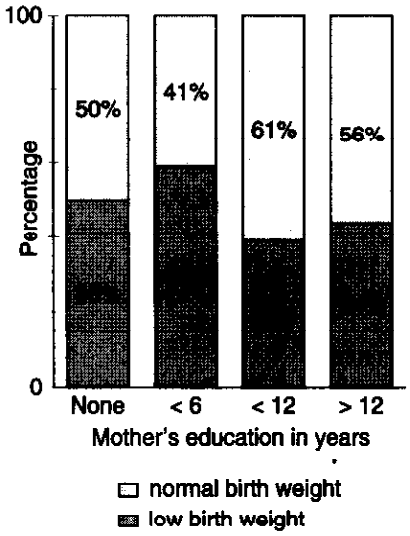

Figure 3 **Relationship between fetal birth weight and level of mother's education at term**

age, years of education and parity (Figs. 2–4, $p < 0.001$ in all variables). The other variables, namely working status, number of previous abortions and whether the mother had had antenatal care or not, did not have a significant relationship to fetal weight at birth.

Relationship between birth weight and anthropometric variables

Table 3 shows the mean and standard deviation of the anthropometric measurements (mother's weight, height–body mass index, mid-arm circumference and skinfold

Table 3 **Means (± SD) of some of the anthropometric measurements of the studied population**

Measurement	Mean
Height	154.5 ± 5.2 cm
Weight	57.2 ± 21.5 kg
Mid-arm circumference	27.3 ± 4.9 cm
Skinfold thickness	24.8 ± 6.2 cm

thickness) of the studied population. All the studied anthropometric parameters were significantly higher in mothers who had normal weight babies compared with those who delivered LBW babies ($p < 0.000\,1$ for all parameters except for height, where $p < 0.004$).

Relation between birth weight and medical history

Of the studied population, 218 (22.9%) mothers had haemoglobin levels less than 11 g/dl and 734 (77.1%) mothers more than 11 g/dl. Diastolic blood pressure = 90 mmHg (12 kPa) was taken as a cut-off point; 933 (98%) had blood pressure less than 90 mmHg while only 19 (2%) had diastolic blood pressure more than 90 mmHg. None of these two variables had any correlation with weight at birth.

Of the studied population, 701 (73.6%) attended the antenatal clinic at least once, while 251 (26.4%) did not have any form of antenatal care. Of those who attended the clinic, only 29% made five or more visits to the clinic. Neither attendance at antenatal clinic nor the number of visits of those who attended antenatal care showed any significant correlation with fetal birth weight.

However, mothers who were admitted to the hospital had significantly more chance of delivering LBW babies ($p < 0.001$).

Relation between birth weight and dietary history (24-hour dietary recall)

The mean total calorie intake for pregnant mothers was 1 346 ± 568 calories. When various food groups were analysed (namely: milk, fruits, vegetables, meat, simple and complex carbohydrates) only consumption of milk and simple carbohydrates showed a borderline significant difference between mothers who gave birth to LBW babies compared with those who delivered NBW babies. However, it is likely that the calorie intake obtained in this study is in fact an underestimation.

Smoking did not show a significant correlation with low birth weight; however, only 81 (8.5%) mothers were reported smokers.

Relation between birth weight and pregnancy outcome

Vaginal delivery took place in 890 (93.5%) cases, and 62 (6.5%) were delivered by caesarean section. Of those who delivered vaginally, 9 (1%) and 20 (2.4%) were forceps and ventouse deliveries, respectively. The sex of the newborns showed borderline association with birth weight ($p = 0.057$); the mean birth weight for males and for females was 2 598 grams and 2 510 g, respectively. More males were born with NBW than females.

There was a significant relation between birth weight and each of Apgar score at 1 and 5 minutes ($p < 0.001$).

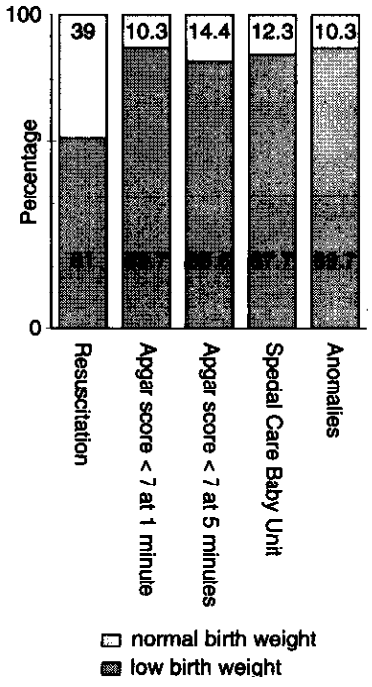

Figure 5 **Relationship between fetal birth weight and infant morbidity**

Resuscitation and admission to the Special Care Baby Unit were significantly more common with low-birth-weight infants.

Finally, the incidence of twin pregnancy and congenital malformations were more commonly associated with low-birth-weight infants ($p < 0.000\ 1$). Fig. 5 shows the increased incidence of fetal morbidity among low-birth-weight infants.

Multiple logistic regression analysis

To test the hypothesis whether parity, age of the mother, body mass index (BMI) and educational level were associated with birth weight independently, a multiple logistic regression model with birth weight as the dependent variable (LBW = 0, NBW = 1) together with parity, age of the mother, BMI and educational levels as predictors were run.

The model had a good fit with $\chi^2 = 816$, d.f. = 795 and $p = 0.3$. All the variables were independently and significantly associated with birth weight except parity, which became insignificant when it was entered in a multiple logistic regression model.

Discussion

Low birth weight is a global problem of great importance [*5*]. Its incidence varies from as low as 3% in countries such as Norway to as high as 30% in some Asian and African countries [*5*]. Its significance is due to its association with immediate, as well as late complications. In the present study, the incidence of immediate morbidity, i.e., low Apgar score, need for resuscitation, admission to the Special Care Baby Unit and congenital malformations were all higher in LBW babies compared with NBW ones. Several studies have also shown that subsequent school performance and IQ development is usually less optimal in LBW compared with NBW infants [*1*]. Furthermore, recent epidemiological data have shown an increased risk of development of late adulthood diseases such as diabetes, strokes, high blood pressure, obesity for babies of low birth weight [*2*]. This finding has led to the concept of *in utero* programming of adulthood diseases.

In this study, the prevalence of LBW was almost double that reported from some other areas in Saudi Arabia [*9–12*]. This finding cannot be due to sampling bias. As Taif Maternity Hospital is the only maternity hospital in Taif city, and at least two thirds of the deliveries take place in this hospital, the studied population is representative of the community in Taif. It is, however, possible that the high prevalence of LBW in Taif is due to its geographical nature, being a high-altitude area approximately 2 400 metres above sea level. In a study from Colorado, US, on the relationship between altitude and birth weight, the mean birth weight and the prevalence of LBW infants (3 058 grams and 13.1% respectively) were almost similar to that found in the present study [*13*]. Tissue hypoxia and reduced oxygen tension have been proposed as the most likely explanation for birth weight reduction at high altitude [*13,14*].

However, the incidence of LBW in Taif, although high, is still lower than that reported from some other developing countries such as Nigeria [*15*] and Tanzania [*16*].

One of the important variables that had a significant correlation with birth weight was teenage pregnancies. Mothers whose age was less than 20 had higher risk of delivering low-birth-weight infants. This study also shows that healthier and taller mothers give birth to LBW infants less frequently. Educated mothers were less likely to give birth to low-birth-weight infants. Only very few mothers were reported smoking or working during their pregnancy.

It was of interest that neither antenatal care nor the number of antenatal visits correlated with fetal weight at birth. This finding should not undermine the value of antenatal care. On the contrary, it could be due to poor compliance by the mothers since 71% of those who appeared for antenatal care attended the clinic fewer than five times. It is also possible that those who did not attend antenatal care at all (less than 25%) comprise the group at higher risk of pregnancy complications. The findings indicate that, while more effort is needed to stimulate public awareness of antenatal care, the approach to antenatal care needs re-evaluation, with more emphasis on simple and reliable means of identifying at-risk groups.

The relation between nutrition and the chances of having LBW babies was not clearly apparent in this study. Availability of food is usually not a major concern in most cities of Saudi Arabia. It is usually erroneous or inadequate consumption that causes problems. However, obtaining an accurate and meaningful dietary history requires a purposely designed study that does not depend only on dietary history but biochemical and metabolic analysis for important nutritional elements and vitamins. Recent work has shown a significant relation between folic acid deficiency and neural tube defects [*17*].

In the study, 90% of the diagnosed congenital anomalies were discovered in LBW infants. However, the details (the types and nature of the malformations) were not available. It is also known that many more anomalies and malformations may not appear until a later age. Further studies are needed in order to identify the nature and size of the problem of congenital anomalies.

In general, the results of the present study, in agreement with other studies, show that fetal weight at birth is influenced by, besides the mother's health status, a variety of biological, social and even geographical factors. Most of these factors are known to have variable prevalence in different regions even in the same country. An example of this is Taif city, which differs from other areas in Saudi Arabia in being at high altitude. The incidence of LBW was almost double that reported from other areas of Saudi Arabia. Therefore, it may, neither clinically nor epidemiologically, be appropriate to apply the WHO cut-off level of 2 500 grams for identifying LBW infants in the local population. Indeed, it has been suggested that for all ethnically homogenous populations there are fundamentally normal distributions for each gestational age, sex and parity group that are optimal with regard to mortality risk in the sense that the mode of the curve coincides with the birth weight at which the risk of mortality is minimal. Thus the use of the same arbitrary cut-off point in different populations will result in the establishment of proportions in each category that vary in size, with differing degrees of deviation from the population norm [7]. There is a need to identify a population based birth weight centile. Such a centile can then be used to identify those at risk from the consequences of LBW but those who are actually victims of intrauterine growth retardation.

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