Anthropometry of Saudi Neonates

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4 Saudi neonates were examined anthropometrically. The mean birthweight of this group was 3.24 kg (SD 0.46 kg) and mean length, 51.2 cm (SD 2.4 cm). Simple correlation coefficients (r) of birthweight with head circumference (0.718) and chest circumference (0.784) were strongly related (p < 0.01). Birthweight increased with rising gestation. The use of low birthweight (< 2500 g) was found to be 6.6%.

Whereas the average birthweight in a nation parallels the level of socioeconomic development, some studies have emphasized the differences in birthweight to be ethnic in origin.2-7 Yu and Harlap5 have convincingly shown high birthweight in North African women of low socioeconomic status to support the claims of ethnicity on birthweight. How do the Saudis fare in neonatal anthropometry? The current use of Western standards in this situation may be inappropriate. For an accurate assessment of fetal growth and maturity of Saudi births as well as meaningful prognostic judgements on infant morbidity and mortality, the need to develop local standards was felt necessary.

So far, studies on Saudi births have been reported from the western, central and southern provinces10,11 but none from the eastern region of Saudi Arabia. Since variations within the same country are not unusual,12 we attempted to study the anthropometric parameters of Saudi newborns in Al-Khobar, eastern province of the Kingdom. An effort was also made to investigate the association of birthweight with some important variables.

Methods

The present research was a cross-sectional study of Saudi babies born consecutively over a 1-year period (October 1985 to September 1986) at King Fahd University Hospital, Al-Khobar. According to estimates made from

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a Ministry of Health report, 13 40% of the total births in the Kingdom occur in hospitals, with higher figures for maternity care in urban compared with rural areas. The present sample, though not representative of the whole region, is largely reflective of births from an urban area in a population belonging to the middle and upper socioeconomic group. Booked deliveries accounted for 65%; the rest were emergency cases.

A total of 1094 Saudi births were included in the study after eliminating babies that were stillbirths, twins or those with major congenital anomalies. As suggested by Keeping et al., 14 we included all other mothers whether with normal or pathological pregnancies on the basis of attempting to reflect a range of birthweights for the local population and not one for entirely normal pregnancies.

The gestational age of the infants ranged from 28 to 44 weeks. This was calculated by completed weeks of gestation from the first day of the last menstrual period. Where the date was uncertain, estimations were made by an ultrasound scan during pregnancy and later followed by Dubowitz scoring 15 of the baby by a pediatrician.

The anthropometric measurements included birthweight, crown-heel length, head circumference and chest circumference. The birthweight of the baby was measured without clothes to the nearest 10 g on an infant’s beam balance which was calibrated daily for accuracy. Measurements were taken within a few hours of birth. An infant’s measuring board was used to determine the crown-heel length with the neonate lying flat and legs extended. The head circumference (occipitofrontal) was measured to the nearest 5 mm with an inelastic tape whereas chest girths were determined at the level of the xiphisternum in front and inferior angle of the scapula posteriorly.

Analysis of the data included mean and standard deviations of birthweight, neonate lengths, head and chest circumferences of babies at (a) term (37–42 weeks gestation), (b) other gestational ages and in relation to (c) sex. The association of birthweight with maternal age and parity (number of pregnancies ending in live and stillbirths) was also studied. Statistical tests included ‘Students’ t test and analysis of variance to compare mean birthweights wherever required. Simple correlations r were computed to study the strength of association of birthweight with other anthropometric measurements and with variables of gestational age, maternal age and parity. We then further evaluated for the effect of these variables by performing multiple regression analysis and obtained a quantitative estimate of the association of each explanatory variable while controlling for the effects of the others. The following categories in gestational age (28–32 weeks, 33–36 weeks, 37–40 weeks, 41–42 weeks, 43–44 weeks), maternal age (< 19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, 40–44 years, ≥ 45 years), parity (1, 2–4, ≥ 5) and sex (male/female) of the baby were treated as dummy variables in the regression analysis.

Results

Out of the 1094 singleton infants, there were 571 (52.2%) male and 506 (46.3%) female babies. Information regarding sex of the baby was not available in 17 (1.6%) infants. Term births (≥ 37–42 weeks) constituted 95.5% (1045/1094) of the total births whereas 3.38% (37/1094) were born before term (< 37 weeks). The mean birthweight of term babies was 3.24 kg (SD 0.46 kg) and mean length, mean head circumference and mean chest circumference of this group was 49.21 cm (SD 2.4 cm), 33.94 cm (SD 1.5 cm) and 33.18 cm (SD 1.8 cm) respectively. The median weight (3.22 kg) was close to the mean weight (3.24 kg) with the tenth and ninetieth percentile weights being 2.72 kg and 3.72 kg respectively. The incidence of low birthweight (< 2500 g) in our series was found to be 6.6%.

Table 1 shows the proportionate increase of mean birthweight according to gestational age with the difference between these weights highly significant (p < 0.005). A correlation analysis between birthweight and gestational age showed a positive trend and was of the order of r = 0.299 (p < 0.01). Mean birthweight of male babies (3.24 kg ± 5.3) for all gestational ages was significantly higher than that for female infants (3.18 kg ± 4.5) (p < 0.005). This feature was consistent from 28 weeks to 40 weeks of gestation.

Other anthropometric measurements of babies which included mean length, mean head circumference and mean chest circumference also increased with advancing maturity (Table 2). As seen for birthweight, the differences in these measurements for male and female babies were obvious up to 40 weeks of gestation. Simple correlation coefficients (r) of birthweight with length, head and chest circumference respectively showed a strongly significant relationship with values of 0.721, 0.718 and 0.784 (p < 0.01).

Table 1

<table>
<thead>
<tr>
<th>Gest. age (weeks)</th>
<th>All babies</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Mean birthwt (kg)</td>
<td>No.</td>
</tr>
<tr>
<td>28–32</td>
<td>7</td>
<td>1.69 (0.42)</td>
<td>6</td>
</tr>
<tr>
<td>33–36</td>
<td>30</td>
<td>2.56 (0.47)</td>
<td>15</td>
</tr>
<tr>
<td>37–40</td>
<td>960</td>
<td>3.23 (0.47)</td>
<td>505</td>
</tr>
<tr>
<td>41–42</td>
<td>85</td>
<td>3.37 (0.39)</td>
<td>39</td>
</tr>
<tr>
<td>&gt;42</td>
<td>12</td>
<td>3.62 (0.52)</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>1094</td>
<td>3.24 (5.3)</td>
<td>506</td>
</tr>
</tbody>
</table>

Sex of 17 babies was not known.
The figures in parenthesis are standard deviations.
Table 2
Mean length, mean head and chest circumferences of Saudi neonates according to gestational age and sex

<table>
<thead>
<tr>
<th>Gest age (weeks)</th>
<th>Sex of baby</th>
<th>No.</th>
<th>Mean length (cm)</th>
<th>No.</th>
<th>Mean head circumference (cm)</th>
<th>No.</th>
<th>Mean chest circumference (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28–32</td>
<td>Male</td>
<td>5</td>
<td>42.40 (3.1)</td>
<td>5</td>
<td>29.30 (1.5)</td>
<td>3</td>
<td>25.0 (3.7)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1</td>
<td>37 (0)</td>
<td>1</td>
<td>26 (0)</td>
<td>1</td>
<td>22.5 (0)</td>
</tr>
<tr>
<td>33–36</td>
<td>Male</td>
<td>14</td>
<td>47.57 (3.4)</td>
<td>15</td>
<td>33.06 (1.6)</td>
<td>14</td>
<td>31.86 (2.5)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>14</td>
<td>45.89 (1.9)</td>
<td>14</td>
<td>31.82 (1.8)</td>
<td>10</td>
<td>30.45 (2.9)</td>
</tr>
<tr>
<td>37–40</td>
<td>Male</td>
<td>491</td>
<td>49.40 (2.6)</td>
<td>486</td>
<td>34.06 (1.6)</td>
<td>477</td>
<td>33.19 (1.8)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>410</td>
<td>48.94 (2.2)</td>
<td>408</td>
<td>33.69 (1.4)</td>
<td>402</td>
<td>33.06 (1.7)</td>
</tr>
<tr>
<td>41–42</td>
<td>Male</td>
<td>38</td>
<td>49.27 (1.7)</td>
<td>37</td>
<td>34.31 (1.0)</td>
<td>36</td>
<td>33.46 (1.1)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>43</td>
<td>49.48 (1.9)</td>
<td>44</td>
<td>34.31 (1.5)</td>
<td>44</td>
<td>33.85 (1.8)</td>
</tr>
<tr>
<td>&gt;42</td>
<td>Male</td>
<td>6</td>
<td>50.58 (2.3)</td>
<td>6</td>
<td>35.25 (1.3)</td>
<td>6</td>
<td>34.66 (1.9)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>6</td>
<td>50.41 (1.5)</td>
<td>5</td>
<td>34.5 (2.1)</td>
<td>4</td>
<td>34.87 (0.7)</td>
</tr>
</tbody>
</table>

Total 1028\(^a\) 1021\(^b\) 997\(^c\)

The figures in parentheses are standard deviations. \(^a\)Missing data in 66 babies. \(^b\)Missing data in 73 babies. \(^c\)Missing data in 97 babies.

The mothers were grouped into six categories according to parity (Table 3). The mean birthweight was lowest in the primipara (para 1) and highest in those who had borne six or more children. The correlation coefficient (r) value of 0.18 between birthweight and parity was positive and significantly related (p<0.01).

We then attempted to evaluate the impact of gestational age, maternal age, parity and sex on birthweight by the multiple regression technique. Table 4 shows the regression coefficients of each variable, value of beta and level of significance. Maternal age is largely a function of parity, the two variables depending upon each other. Our estimations showed that when parity was not included in the equation, the regression coefficient for maternal age was 87.59 g, but with its inclusion, the coefficient was reduced to 62.06 g indicating some influence of parity on maternal age though not entirely. All the factors were significantly related to birthweight but showed a low explaining power (r²) of 13.3%.

Discussion
An incidence of 6.6% for low birthweight in our study is comparable with that reported for the whole kingdom\(^{13,16}\) and to figures for industrialized

Table 3
Mean Saudi birthweights by parity

<table>
<thead>
<tr>
<th>Parity</th>
<th>No.</th>
<th>Mean birthwt (kg)</th>
<th>SD (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>212</td>
<td>3.10</td>
<td>4.15</td>
</tr>
<tr>
<td>2</td>
<td>195</td>
<td>3.17</td>
<td>4.88</td>
</tr>
<tr>
<td>3</td>
<td>185</td>
<td>3.15</td>
<td>4.72</td>
</tr>
<tr>
<td>4</td>
<td>143</td>
<td>3.19</td>
<td>4.35</td>
</tr>
<tr>
<td>5</td>
<td>107</td>
<td>3.32</td>
<td>4.62</td>
</tr>
<tr>
<td>6+</td>
<td>236</td>
<td>3.37</td>
<td>5.32</td>
</tr>
</tbody>
</table>

\(^a\)Parity not known for 16 mothers.

Figure 1 shows the mean birthweights of babies according to maternal age. The mean weight of babies rose from the youngest age group of mothers (≤19 years) to a plateau in maternal age groups 25–34 years, and thereafter increased gradually with advancing years, the differences in birthweight along the age groups being significant (p<0.05). A correlation analysis between maternal age and birthweight showed an r value of 0.225 (p<0.01).
Birthweight increased with rising gestational age in our findings which is similar to the observations of other Saudi\textsuperscript{8,10} as well as Western\textsuperscript{23,24} and East European\textsuperscript{27} studies. Though the number of babies studied by us in the lowest and highest gestational ages was few, we found this feature to be true from 28 weeks to as late as 44 weeks of gestation, contradicting the estimates of slow growth rate in late pregnancy made by some authors\textsuperscript{28,29} for developing countries. A significant correlation coefficient ($r$) of 0.721 for birthweight and length of the baby in our study is close to 0.61 found by Lesinski\textsuperscript{27} on data from Warsaw.

Many studies\textsuperscript{8,7,14,19,20,30} have shown increasing age of mother and rising parity an advantage to birthweight. We also found such a trend in our naive initial evaluations made by cross-tabulations (Fig. 1 and Table 3). However, in the fully specified regression of our study, the beta value for maternal age (0.15) and parity (0.1) though significant, showed a poor positive slope. The low 'explaining power' ($r^2 = 13.3\%$) of the variables analysed clearly indicates the need to explore other factors that may contribute to birthweight.

Several researchers\textsuperscript{2-27,14,26,30-32} have studied with variable conclusions, the relationship of birthweight with ethnic, socioeconomic, physical, nutritional and medical factors; the impact of smoking on birthweight has also been well documented. In the Kingdom of Saudi Arabia, smoking by women is relatively uncommon. In fact, none of the women in our sample smoked during pregnancy. The role of the above mentioned factors has not yet been explored in this country and is a subject of further investigation which is being pursued by us for future publication.

Within the limitations of available Saudi birthweight data from an entirely hospital population, our study and that of others\textsuperscript{9} from a middle and upper class population has shown that the incidence of low birthweight in Saudi Arabia is similar to that reported for industrialized nations; the tenth centile of term births matches Aberdeen standards,\textsuperscript{24} and mean as well as centile birthweights of well-to-do Saudis\textsuperscript{9} concur in general, with European\textsuperscript{24} and Montreal\textsuperscript{23} values. Thus, in an economically affluent country like Saudi Arabia, the use of certain Western standards\textsuperscript{21,24} may not be entirely inappropriate.

\textbf{Acknowledgement}

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References