

# Birth weight, length, head circumference and bilirubin level in Indian newborns in the Sioux Lookout Zone, northwestern Ontario

MARGARET MUNROE,\* MD  
CHANDRAKANT P. SHAH,†‡ MD, MRCP (GLASG), FRCP[C],  
FAAP, FACPM  
ROBIN BADGLEY,§||‡ PH D  
HARRY W. BAIN,||‡ MD, FRCP[C]

The norms for birth weight, length, head circumference and bilirubin level for native newborns have not been available. To develop appropriate norms, data were obtained from the charts on all live births in the Sioux Lookout Zone, northwestern Ontario, in 1968–69 and 1974–77. These data were correlated to maternal age and parity as well as sex of the infant. Despite impoverished living conditions, the birth weights of the study population were significantly higher than the Canadian norms; length and head circumference, however, were not significantly different. Over one third of the infants had serum bilirubin levels greater than 12 mg/dL (205  $\mu$ mol/L). Increased maternal age was associated with increased birth weight and length and a lower bilirubin level.

Vu l'absence de normes biométriques pour les nouveau-nés autochtones, les auteurs ont colligé les chiffres du poids, de la taille, du périmètre crânien et de la bilirubinémie à partir des dossiers de toutes les naissances vivantes de la Sioux Lookout Zone, dans le nord-ouest de l'Ontario, pour les années 1968–69 et 1974–77. Ces données sont mises en corrélation avec l'âge maternel, le rang de naissance et le sexe de l'enfant. En dépit de la pauvreté où vit cette population, les moyennes du poids à la naissance dépassent de façon significative les normes canadiennes; celles de la taille et du périmètre crânien n'en diffèrent pas. Plus d'un tiers des nouveau-nés ont une bilirubinémie dépassant 12 mg/dL (205  $\mu$ mol/L). À mesure que l'âge maternel augmente, le poids et la taille de l'enfant font de même; la bilirubinémie s'abaisse.

Interest in morbidity and mortality patterns among Canada's native people has increased markedly over the past two decades,<sup>1,5</sup> as has the effort to provide curative care to this population. Steps have also been taken to promote preventive health services to native peoples,<sup>6</sup> but these are impeded by the absence of norms. The

From the departments of †preventive medicine and biostatistics, §behavioural sciences and ||pediatrics, University of Toronto and the ‡department of pediatrics, Hospital for Sick Children, Toronto

\*Medical student, University of Toronto at the time of the study

Reprint requests to: Dr. Chandrakant P. Shah, Department of preventive medicine and biostatistics, Rm. 402, McMurrich Bldg., University of Toronto, Toronto, Ont. M5S 1A8

Canada Health Survey<sup>7</sup> does not provide norms for native peoples, who are ethnically and culturally distinct and whose lifestyle often resembles that seen in Third-World countries.

To develop norms for birth weight, length, head circumference and serum bilirubin level for Indian newborns we conducted a retrospective study of live births in two separate periods in the Sioux Lookout Zone of northwestern Ontario. The population setting and health care available to these people have been described previously.<sup>8,9</sup>

## Methods

Charts on all live births among Indians living in the Sioux Lookout Zone in 1968–69 and 1974–77 were reviewed to determine the birth weight, length, head circumference and sex of the newborns as well as maternal age and parity. The birth weight, length and head circumference measurements were depicted as histograms. Means and standard deviations were calculated, and normal distribution curves for these calculations were fitted to the frequency distribution and drawn over the histogram by computer to display the goodness of fit.

We also identified all neonates with jaundice whose serum bilirubin levels were over 8 mg/dL (137  $\mu$ mol/L). Infants with an identifiable cause of hyperbilirubinemia (e.g., ABO incompatibility or sepsis) were excluded from analysis. Our findings were correlated to maternal age and parity and were compared with Canadian norms. The level of significance used to evaluate our results was  $p < 0.05$ .

## Results

There were 1539 live births during the periods studied. We identified 1487 valid observations on birth weight, 1033 on length and 1174 on head circumference. The ratio of boys to girls was the same for all these observations. Sixty percent of the infants were born to women whose parity was less than 3; 25% were born to women who were para 4 to 6 and 15% to women who were para 7 or more.

### Birth weight

The mean birth weight in the study population (3608 g) was higher than that in the general population in Canada (3298 g) for the same years (according to data from Statistics Canada). A comparison of the birth weight, length and head circumference values with those reported by Blidner and colleagues<sup>10</sup> for urban Canadians also showed higher birth weights among native

infants (Table I). The Indian boys were heavier (3637 g) than the girls (3580 g) (Figs. 1 and 2). Compared with Canadian norms for the study years, the proportion of children (both boys and girls) weighing less than 2500 g was low in the study population (Table I). Overall, 14.3% of all newborns (15.3% of the boys and 13.7% of the girls) weighed 4001 to 4500 g. Eighty-nine newborns (6.5% of the boys and 5.6% of the girls) weighed above 4501 g.

There was no change in mean birth weight during the two periods studied. Increased maternal age and parity were associated with increased birth weight. The mean birth weight of infants born to women under 20 years of age was 3530 g, compared with 3633 g for infants of women who were 20 to 34 years of age inclusive and 3744 g for those women who were 35 years of age or older. These differences were statistically significant. The mean birth weight of infants whose mothers were para 3 or less was 3530 g, compared with 3706 g for those whose mothers were para 4 to 6 and 3765 g for those whose mothers were para 7 or more.

### Length

The mean length of the boys and girls was similar to that reported by Blidner and colleagues.<sup>10</sup> The boys were significantly longer than the girls (Figs. 3 and 4). The

babies of women whose mean age was 25 years had a mean length of 40 cm, whereas those born to women whose mean age was 33 years had a mean length of 60.5 cm. The mean birth weight of the babies 40 cm long

Table I—Norms for birth weight, length and head circumference of Indian newborns at Sioux Lookout Zone, north-western Ontario

Variable	Sioux Lookout Zone	Standard norms*
Mean birth weight (g)		
Boys	3637.0	3530.0
Girls	3580.0	3355.0
Mean length (cm)		
Boys	51.0	52.0
Girls	50.3	51.3
Mean head circumference (cm)		
Boys	35.6	35.2
Girls	35.0	34.4
Mean proportion weighing < 2500 g (%)		
Boys	2.7	5.9–7.2
Girls	2.4	6.9–8.5

\*Taken from reference 10, except for proportion weighing < 2500 g (reference 11).

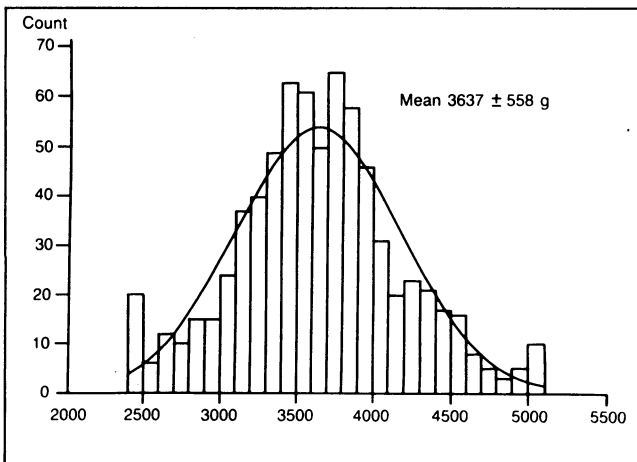


Fig. 1—Observed and fitted counts of boys, by weight.

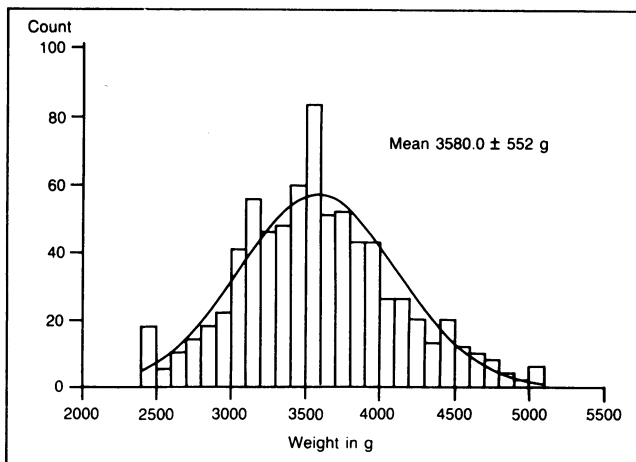


Fig. 2—Observed and fitted counts of girls, by weight.

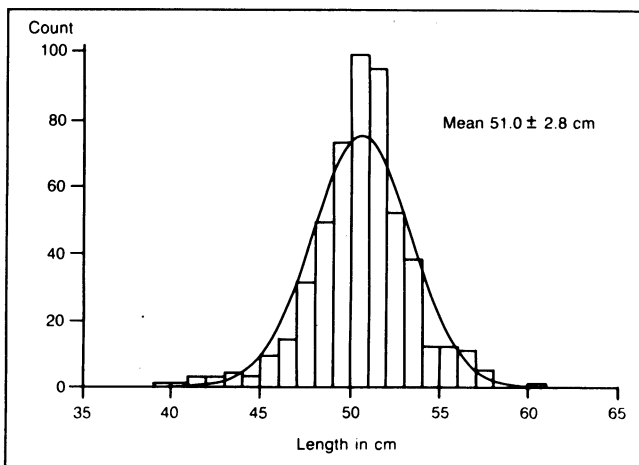


Fig. 3—Observed and fitted counts of boys, by length.

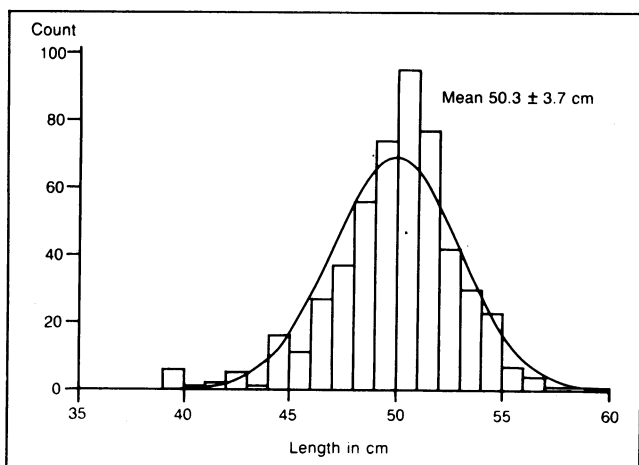


Fig. 4—Observed and fitted counts of girls, by length.

was 3321 g, compared with 4780 g for those who were 60.5 cm long. Parity was not associated with length at birth.

**Head circumference**

The mean head circumference for each sex was similar to the Canadian norm<sup>10</sup> (Figs. 5 and 6).

**Bilirubin level**

The incidence of hyperbilirubinemia increased from 12.1% in 1969 to 54.5% in 1974 (Table II). More than one third of the children had bilirubin levels over 12 mg/dL (205 μmol/L). None of these children required an exchange transfusion. High levels of bilirubin were not associated with birth weight, length or head circumference. Bilirubin levels were significantly lower in infants of older women and significantly higher in those of women with higher parity. The mean maternal age was 26.3 ± 6.3 years when peak bilirubin levels were less than 8 mg/dL (137 μmol/L), compared with 23.4 ± 7.5 years when peak bilirubin levels were 18 mg/dL (308 μmol/L) and over. Similarly, higher parity was associated with lower bilirubin levels.

**Discussion**

In Third-World countries poverty, isolation and low

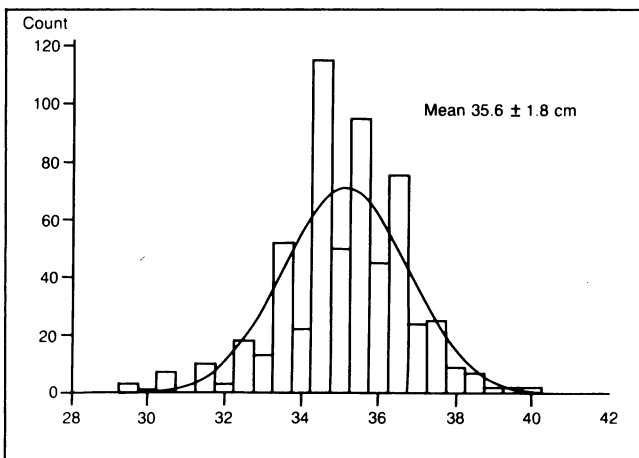


Fig. 5—Observed and fitted counts of boys, by head circumference.

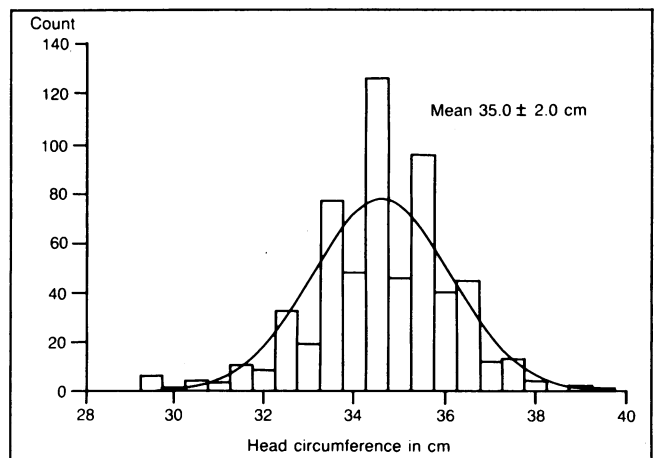


Fig. 6—Observed and fitted counts of girls, by head circumference.

levels of education are associated with low birth weight. However, in the Sioux Lookout Zone these conditions were associated with birth weights above the Canadian norms. Our findings confirm earlier studies of Indians in the United States<sup>11,12</sup> and at James Bay.<sup>13</sup>

The higher birth weights among Indians have been attributed to various factors, including ethnic variation and food utilization patterns,<sup>11,13</sup> maternal age, parity and stature, weight before pregnancy and weight gain during pregnancy.<sup>14</sup> Ounsted and Ounsted<sup>14</sup> reported an increase in fetal growth associated with increased parity, especially second parity, but found no significant association of maternal age alone with increased birth weight. They agreed that weight gain during pregnancy and weight before pregnancy were significant.

A Nutrition Canada survey<sup>15</sup> showed that 60% of native women between 20 and 40 years of age were at moderate to high risk of obesity, in contrast to the Canadian rate of 43%. Obesity increases the risk of diabetes, as does multiparity, especially in women who have had more than four pregnancies.<sup>16</sup> Approximately 40% of the women in our series were gravida 4 or more. With higher parity the mean birth weight may increase overall owing to the greater prevalence of gestational diabetes.

Schaefer<sup>17</sup> found that birth weights among Inuit increased after their diet changed from high protein to high carbohydrate and low protein. Our study did not include maternal dietary history, but in view of changes

Table II—Incidence of elevated bilirubin level in Indian newborns, by year of birth\*

Year	No. of newborns	No. of newborns with		Incidence of elevated bilirubin level per 100 newborns
		Bilirubin level of 8–12 mg/dL (137–205 μmol/L)	Bilirubin level > 12 mg/dL (205 μmol/L)	
1969	279	2	34	12.2
1974	283	77	77	54.4
1975	282	83	70	54.2
1976	252	49	78	50.4
1977	273	56	101	57.5

\*Data on bilirubin levels were not available for 1968.

in the dietary patterns of Indians over the past 20 years, the consumption of a high-carbohydrate, low-protein diet may have produced a similar result.

The low incidence of infants of low birth weight (less than 2500 g) in our study population may be explained by the relatively high incidence of stillbirth (11.2 to 28.4 per 1000 live births in 1974-77) and the higher mean birth weight. Our finding is consistent with that of Kershaw and Allen<sup>18</sup> and others.<sup>19</sup>

The incidence of physiologic jaundice in our study population has been increasing since 1969. This may be an artificial increase resulting from better medical records since the University of Toronto became involved in providing health care in the zone in 1969, but some of the native midwives claimed that they had not seen "yellow babies" before the 1960s. Breast-feeding has been implicated as a cause of hyperbilirubinemia in the newborn. Approximately 68% of Indian women breast-feed their babies, and the trend toward breast-feeding is increasing,<sup>6</sup> as it is in the rest of the Canadian population.

In our study the peak bilirubin levels tended to decrease with increasing maternal age after the age of 25. This is contrary to the findings of Jeffares,<sup>20</sup> who reported no significant relation between bilirubin levels and maternal age, length of gestation or birth weight.

Horguchi and Bauer<sup>21</sup> found a statistically higher incidence of physiologic jaundice among Japanese infants than in a control Caucasian group. The incidence of physiologic jaundice appears to be higher in Orientals than in Caucasians, possibly as a result of genetic differences in bilirubin metabolism.<sup>22</sup> In contrast, only about 13.2% of Cree infants in the James Bay area were found to have bilirubin levels over 12 mg/dL (205  $\mu$ mol/L).<sup>23</sup>

Since the Indian children in our series were heavier at birth, another factor that may have contributed to the higher bilirubin levels is the higher total blood volume: this makes more hemoglobin available for breakdown, resulting eventually in an increased pigment load.

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**"The annual meeting of the Medical Alumni Association of the Hospital for Sick Children, Toronto will be held at the hospital November 8-9, 1984. This year's program will be highlighted by a special dedication booklet to the late Dr. Alan Brown. All former residents and fellows are invited to attend. For further information contact: Dr. Michael Lester, Chairman, Medical Alumni Association Committee, Hospital for Sick Children, 555 University Avenue, Toronto, ON M5G 1X8".**

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