

## **Secular Change in Newborn Adiposity in an Urban Hospital**

**Dheeraj Shah, H.P.S. Sachdev, Rajesh Gupta and S. Ramji**

*From the Divisions of Neonatology and Clinical Epidemiology, Department of Pediatrics, Maulana Azad Medical College, New Delhi 110 002, India.*

*Correspondence to: Dr. H.P.S. Sachdev, E-6/12 Vasant Vihar, New Delhi 110 057, India.*

*E-mail: hpssachdev@hotmail.com*

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*Triceps and subscapular skinfold thickness were measured in 1080 consecutive newborns and the values were compared with an earlier study reported in 1981 from the same institution. The skinfold thickness in the present study was higher at all gestational age groups (except for 41 weeks) in both sexes. These differences were statistically significant at all periods except for males at 38 weeks and females at 39 weeks. For term infants, the mean skin fold thickness (subscapular and triceps) was significantly higher among both males (3.5 mm vs 4.0 mm;  $p < 0.05$ ) and females (3.9 mm vs. 4.2 mm;  $p < 0.05$ ). The subscapular skin fold thickness in both males and females and triceps skin fold thickness in females were also significantly higher for all birthweight categories. The data suggests an increase in adiposity among newborns, over a period of two decades, in an urban poor population.*

**Key words:** Adiposity, Newborn, Secular, Skinfold thickness.

Obesity in adults and children is being increasingly linked to several chronic diseases including hypertension, coronary artery disease and non insulin dependent diabetes mellitus(1-4). Recent evidence indicates a disturbing trend of increasing adiposity in developed and developing countries(5-7) including in India. The earliest age of documentation of this trend appears to be in primary school children and preschoolers in developed countries(8-10). It would be of interest to determine if a similar trend is observable at an earlier age and that too from a developing country like India, which is currently undergoing a nutritional transition (11,12). This communication evaluates the change in newborn adiposity over a period of

twenty years in a hospital primarily catering to the urban poor.

### **Subjects and Methods**

Skinfold thickness measurements were made within 48 hours of birth in 1080 consecutive singleton infants of both sexes born to mothers without risk factors such as diabetes mellitus, hypertension, severe anemia, chronic heart disease or chronic infection. Infants with gross congenital malformations were also excluded. The measurements were done with a Holtain calipers (Holtain, U.K.). Triceps skin fold was measured over the posterior belly of triceps muscle of the right arm, halfway between the acromion and the olecranon, on a line passing

upwards from the olecranon in the axis of the limb, with the arm extended. Subscapular skinfold was measured immediately below the angle of the right scapula, in the natural cleavage line of the skin, with the arm held by the side of the body. Skinfold measurements were made by lifting the full thickness skin with the thumb and index finger, with care being taken to exclude any underlying tissue. These measurements were taken as per Tanner and Whitehouse suggestions(13), appropriately modified for newborns to accommodate their constant activity by recording in the sleeping state or while breastfeeding. The skinfold measurement was recorded 5 seconds after closing the blades(14). Each measurement was recorded twice and the mean used for analysis. The gestational age of the newborn was assessed from the last date of menstrual period in the mother, and in cases where there was doubt, it was clinically assessed using Ballard's scoring system. If discordance between both was more than 2 weeks, then the age estimated by Ballard's score was used for calculations. The recordings were made by two persons (DS and RG), the coefficient of variation between the two observers ranged from 3 to 6% for repeated measurements.

The measurements of the present study were compared with an earlier report in 1981 (15) from the same institution. Since the sex specific sample sizes in the earlier report(15) for gestations below 36 weeks and above 41 weeks were too small for any meaningful interpretation, comparisons were restricted between the gestational ages of 36 to 41 weeks. The mean values of subscapular and triceps skinfold thickness of two studies were compared by Student 't' test.

## Results

The gestation and sex specific skinfold

thickness in the two studies are compared in *Table I*. The skinfold thickness in the present study were higher at all gestational age groups (except for 41 weeks) in both sexes. These differences were statistically significant at all periods except for triceps skinfold thickness in males at 38 weeks and subscapular skinfold thickness in females at 39 weeks. For term infants, the mean skinfold thickness (subscapular and triceps) was significantly higher among both males (3.5 mm vs. 4.0 mm;  $p < 0.05$ ) and females (3.9 mm vs. 4.2 mm;  $p < 0.05$ ). The difference was also significant for males and females combined (3.7 mm vs. 4.1 mm;  $p < 0.05$ ).

A similar comparison was made for different birthweight categories. The increased adiposity was mostly independent of any change in birth weight for that gestational age as the increased skinfold thickness were documented for different birth weight categories (*Table II*). For triceps skinfold thickness, the difference was significant for females in all birthweight categories (*Table II*). However in males, triceps skinfold thickness were not significantly different from the previous study for all birthweight categories from 2000 g to 3500 g. The subscapular skinfolds were significantly thicker in all birthweight categories in males and females (except for 3501-4000 g) of the present study.

## Discussion

The results of this comparison indicate an increase in adiposity among newborns, over a period of two decades, in an urban hospital catering primarily to a poor population.

It would be prudent to consider the limitations of such epidemiological comparisons made two decades apart: (i) A systematic error of instruments and measurement techniques cannot be excluded with

**TABLE I**—Comparison of Skinfold Thickness in Relation to the Gestational Age.

Gestation (in weeks)	Sex	n		Triceps (mm) (Mean ± SD)		Subscapular (mm) (Mean ± SD)	
		Present	Puri(15)	Present	Puri(15)	Present	Puri(15)
36	M	24	39	3.2 ± 0.8	2.5 ± 0.2	3.3 ± 0.7	2.1 ± 0.2
	F	11	41	3.3 ± 1.0	2.0 ± 0.2	3.3 ± 0.9	2.3 ± 0.3
37	M	64	50	3.6 ± 0.7	3.3 ± 0.5	3.8 ± 0.7	3.2 ± 0.5
	F	67	50	3.8 ± 1.0	3.2 ± 0.1	4.2 ± 1.0	3.5 ± 0.4
38	M	114	36	3.9 ± 0.8	3.6 ± 0.3	4.1 ± 1.0	3.2 ± 0.3
	F	98	25	4.0 ± 1.0	3.5 ± 0.5	4.3 ± 1.0	3.7 ± 0.4
39	M	116	53	3.9 ± 0.8	3.5 ± 0.3	4.1 ± 0.8	3.1 ± 0.3
	F	87	52	4.2 ± 1.0	3.6 ± 0.3	4.4 ± 1.2	4.2 ± 0.4
40	M	253	115	4.1 ± 0.8	3.9 ± 0.2	4.2 ± 0.9	3.5 ± 0.2
	F	195	94	4.1 ± 1.0	3.8 ± 0.2	4.5 ± 1.0	4.3 ± 0.4
41	M	26	43	4.0 ± 1.0	4.0 ± 0.4	4.3 ± 1.3	3.6 ± 0.3
	F	25	52	3.8 ± 0.9	3.9 ± 0.1	4.1 ± 0.9	4.3 ± 0.4

**TABLE II**—Comparison of Skinfold Thickness in Relation to Birth Weight.

Birthweight (grams)	Sex	n		Triceps (mm) (Mean ± SD)		Subscapular (mm) (Mean ± SD)	
		Present	Puri(15)	Present	Puri(15)	Present	Puri(15)
2001-2500	M	127	60	3.4 ± 0.7	3.4 ± 0.5	3.6 ± 0.7	3.2 ± 0.4
	F	127	71	3.5 ± 0.7	3.2 ± 0.3	3.8 ± 0.8	3.5 ± 0.4
2501 - 3000	M	267	193	3.8 ± 0.7	3.8 ± 0.2	4.0 ± 0.7	3.4 ± 0.3
	F	237	148	4.2 ± 0.9	3.7 ± 0.3	4.4 ± 1.0	4.2 ± 0.3
30001 - 3500	M	158	27	4.3 ± 0.8	4.3 ± 0.5	4.5 ± 0.9	3.7 ± 0.2
	F	93	58	4.6 ± 1.0	3.9 ± 0.3	4.9 ± 1.1	4.5 ± 0.5
3501 - 4000	M	37	6	5.1 ± 0.9	4.2 ± 0.4	4.9 ± 1.1	3.7 ± 0.3
	F	13	5	4.9 ± 0.8	3.9 ± 0.5	5.4 ± 0.8	5.1 ± 0.2

### Key Messages

- Newborn adiposity has increased over last two decades in an urban hospital predominantly catering to the poor.
- There was a propensity for an increase in central patterning of adiposity in males.

certainty; however, the consistency of relationship makes this possibility unlikely; (ii) The relative socioeconomic profile of the hospital clientele may have improved. Although there is no objective data in this context, general impressions indicate that if at all, the newborns delivered in the hospital have parents who are relatively poorer.

Studies from developed and developing countries(8-10) indicate a secular increase in adiposity in preschoolers, school going children and adolescents. India is also undergoing a period of rapid nutritional transition(11) with increases in body mass index of preschool children and fat fold thickness of adolescents; even in the relatively poor rural population. The current data suggests that the secular increase in adiposity is present even at birth in a poor population.

Another interesting observation was the documentation of significant secular change for subscapular skinfold thickness (a measure of central obesity) in males in birthweight categories 2001 g to 3500 g but not for triceps skinfold thickness (a measure of peripheral obesity). This could indicate propensity for a central pattern of adipose tissue distribution in males. A secular trend, especially in males, towards central pattern of adiposity in school children and adolescents has been reported earlier(16).

A possible explanation for our observations could be increased gestational serum glucose levels as a consequence of nutritional

transition. The birth weight and skinfold thickness of infants born to mothers with gestational diabetes is increased(17,18). Data from developed countries documents an increased incidence of gestational diabetes (19,20) in recent years, although similar robust data from the Indian setting is lacking.

A practical implication of our findings, if validated in other settings, is that measures to control the emerging epidemic of obesity should not neglect the gestational and newborn periods of the life cycle.

In conclusion, data from this study suggests an increase in adiposity among newborns, over a period of two decades, in an urban poor population.

*Contributors:* DS participated in collection and interpretation of data and drafted the manuscript. HPSS and SR conceptualized and designed the study, analysed the data and finalized the manuscript. RG participated in collection of data and helped in analysis and final draft of the article. HPSS shall act as the guarantor.

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