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Effects of Consanguineous Matings on Anthropometric Measurements of Saudi Newborn Infants

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The effects of parental consanguinity on gestational age and anthropometric measurements of 4497 Saudi newborn infants have been evaluated. The incidence of consanguineous matings was high, about 54.3%. For purposes of statistical analysis, marriages were classified into three groups based on degree of consanguinity. The results of the study reveal no significant effects of inbreeding on gestational age. Neither were any significant differences observed by type of marriage in weight, height or head, chest and mid-arm circumference at birth. It is suggested that inbreeding does not lead to significant effects of fetal growth among Saudi newborns.

Various conclusions have been drawn in studies concerned with the impact of parental consanguinity on reproductive wastage.[1,2] The effect of consanguineous matings on fetal growth and development seems even more unclear.[3] Many investigators agree that there exists a trend toward smaller body dimensions in the offspring of consanguineous matings,[4] but others have not reached the same conclusion.[3] Furthermore, it has been contended that in some studies genetic effects are confounded with environmental and other non-genetic influences owing to decline in incidence of consanguinity to very low frequencies in most parts of the world, and the fact that those who still undertake these marriages are likely to belong to different groups compared with the general population.[3]

In Saudi Arabia, the incidence of consanguinity in the urban population is considerably high. Consanguineous mating has been common practice among Saudi people during the past decades and has not changed significantly even among the younger generation.[5] In view of this scope for a study of effects of inbreeding on fetal growth and development, a hospital survey of Saudi newborns was conducted during September 1983 to December 1986. The aim was to investigate the impact of parental consanguinity on gestational age, and birth measurements by comparing newborn infants from consanguineous and non-consanguineous parents.

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METHOD

The study sample consisted of 4497 randomly selected Saudi infants who were delivered at four major hospitals in Riyadh and were sampled for a study of fetal growth in order to construct fetal growth standards for clinical use in Saudi Arabia. These hospitals were King Khalid University Hospital, King Abdul Aziz University Hospital, Riyadh Children and Maternity Hospital and Nasseriah Maternity Hospital.

Each single liveborn child was visited by an anthropometrician within 24 hours of birth for recording of sex, gestational age and birth measurements. Five anthropometric measurements including weight (g), height (cm) and head and chest and mid-arm circumference (cm) were recorded. Weight was measured using a beam balance, height (crown–heel) was obtained using a Harpenden infantometer, and head, chest and mid-arm circumference by a Harpenden cloth tape. Gestational age was determined by asking the mothers about the duration of their pregnancy and the date of their last menstrual period. If a mother was not certain about this information, then the gestational age was determined from the Dubowitz chart.

The degree of consanguinity was ascertained by interviewing the parents of each infant. The sample was divided into three groups: first cousin group; far-

cousin or relative group; and not related or non-consanguineous group.

The data were processed by computer using the SAS package.

RESULTS

Consanguinity

The incidence of consanguineous matings in the sample was high. The overall consanguinity rate was 54.3%: 31.4% of the Saudi women were married to their first cousins, and 22.9% were married to their far cousins or relatives. The remainder (45.7%) were not related to their husbands.

Gestational Age

The proportion of babies who were born at a gestational age of 37 weeks or less was 6.1%. The proportions in relation to parental consanguinity are shown on Table 1. The proportion of low gestational age infants among the consanguineous marriages was slightly less than that for the non-consanguineous marriages. However, these differences were not statistically significant. There were no consistent trends by degree of inbreeding. Overall, the sampled newborns had an average gestational age of 38.3 weeks.

TABLE 1 *Percent of Saudi newborn infants with gestational age of 37 weeks or less by parental consanguinity*

Consanguinity	Percentage of babies of 37 weeks or less	Mean gestational age (weeks)
First cousin (n=1411)	5.9	38.2
Far cousin or relative (n=1032)	7.3	38.0
Not related (n=2054)	5.6	38.5
Total (n=4497)	6.1	38.3

n=total number of infants.

Birth Measurements

Weight. The distribution of birthweight by parental consanguinity is shown in Table 2. Overall, the proportion of sampled newborns with birthweight of 2500 g or less was very small—about 4.1%. The mean birthweight (± standard error) was 3242 ± 7 g (Table 3).

The proportion of low birthweight babies (less than 2500 g) among the non-consanguineous group was slightly higher than that among the consanguineous group. However, this difference was less than 1%, and the average birthweight was somewhat higher among the former group. None of the other differences between the proportions were significant. Furthermore, the chi-squared test result indicated that there was no significant difference in birthweight among the three groups (first-cousin group, far-cousin or relative group, and non-consanguineous group).

Height. The mean (±SE) for the birthweight measurements of the sample was 49.79 ± 0.04 cm. The mean heights and their standard error by consanguinity are shown in Table 3. It was found that there were no significant differences in body lengths by degree of parental consanguinity. This conclusion was also confirmed by the chi-squared test.

Head, chest and mid-arm circumference. The measurements of head, chest, and mid-arm circumference of the sampled newborns are also given in Tables 2 and 3. The data indicated that there were no significant differences in head, chest and mid-arm circumference by degree of inbreeding. This was further confirmed by the chi-squared test results.

DISCUSSION

The effects of inbreeding on human fetal growth and development cannot be easily detected because of the polygenic and multifactorial inheritance of human traits.[3] A few studies have evaluated the effects of inbreeding on gestational age. For example Rao[3] examined data on Indian babies and reported that there were no significant effects of inbreeding on gestational age. It is contended that this parameter is subject to great variation and is particularly difficult to assess.[3] The duration of normal pregnancy is known to vary with the sex of the baby,[3] with geographical region,[6] and with the normal length of the mother's menstrual cycle.[3] In one study, it was estimated that the proportion of infants delivered after only seven or eight months' gestation was 1.6% in the consanguineous group and 3.2% in the control; this difference was not statistically significant.[8] This was on the basis of all liveborn children who were alive at the time of the survey. A reanalysis, including all liveborn children, came to the same conclusion.[8] The present investigation also reveals no significant effects of consanguineous matings on gestational age.

In characteristics that are multifactorially determined, such as anthropological measurements, where environment plays a substantial role, inbreeding effects may take longer to become manifest, and more studies are needed to explore this phenomenon.[3] Birthweight is known to differ with race, sex and geographic regions, with maternal characteristics such as height, weight, and parity, and with several other familiar characteristics. Maternal nutrition during the third trimester particularly seems to have a significant effect on birthweight.[3] In a country such as India, where chronic undernutrition and malnutrition are common, the birthweights would

TABLE 2 *Anthropometric measurements of 4497 Saudi newborn infants*

	Percentage of infants by consanguinity of parents			
	First cousin (n=1411)	Far cousin or relative (n=1032)	Not related (n=2054)	Total (n=4497)
Weight (g)				
<2500	4.1	3.6	4.3	4.1
2500 – 2999	25.6	23.5	20.9	22.9
3000 – 3499	40.5	43.3	45.4	43.4
3500 – 3999	23.3	23.3	22.8	23.1
>4000	6.5	6.3	6.6	6.5
	χ^2=14.36, df=8, NS			
Height (cm)				
<45.0	1.6	2.5	1.4	1.7
45.0 – 49.9	50.4	51.6	50.4	50.7
50.0 – 54.9	46.5	43.7	46.2	45.7
>55.0	1.5	2.2	2.0	1.9
	χ^2=8.27, df=6, NS			
Head circumference (cm)				
<32.0	2.8	2.5	2.6	2.6
32.0 – 33.9	28.6	28.4	30.1	29.3
34.0 – 35.9	53.7	52.3	52.5	52.8
>36.0	14.9	16.8	14.8	15.3
	χ^2=3.46, df=6, NS			
Chest circumference				
<30.0	4.8	7.1	5.9	5.8
30.0 – 31.9	22.6	24.3	24.4	23.8
32.0 – 33.9	41.8	37.5	41.1	40.5
34.0 – 35.9	25.1	25.9	22.7	24.2
>36.0	5.7	5.2	5.9	5.7
	χ^2=13.69, df=8, NS			
Mid-arm circumference				
<90.0	4.2	4.7	4.5	4.4
90.0 – 104.9	50.9	51.8	52.8	52.0
105.0 – 119.9	38.7	38.1	36.4	37.5
>120.0	6.2	5.4	6.3	6.1
	χ^2=3.22, df=6, NS			

NS=not significant
n=total number of infants

probably be influenced much more by environmental factors than by genetic ones.[3]

In a study of 26 anthropometric variables among 480 Mexicans living in Paracho, Michigan, and in 609 Peruvians of the province of Lambayeque on the north coast of Peru, it was found that there was a significant lowering for seven of the variables in the Mexicans only; neither the Peruvians nor the total series showed such effects with inbreeding.[7] Among the Japanese, there appears to be some depression (about 30 g) with inbreeding for birthweight, and with the large numbers studied this was statistically significant.[9] In the present study, these depressions were not observed and the results were not statistically significant for all the five anthropometric measurements.

TABLE 3 *Mean anthropometric measurements of 4497 Saudi newborn infants*

	Mean (SE) measurement by consanguinity of parents			
	First cousin (n=1411)	Far cousin or relative (n=1032)	Not related (n=2054)	All (n=4497)
Weight (g)	3232 (13)	3236 (15)	3252 (10)	3242 (7)
Height (cm)	49.77 (0.06)	49.67 (0.09)	49.86 (0.05)	49.79 (0.04)
Head circumference (cm)	34.35 (0.04)	34.36 (0.06)	34.32 (0.04)	34.34 (0.02)
Chest circumference (cm)	32.75 (0.05)	32.63 (0.07)	32.62 (0.05)	32.67 (0.03)
Arm circumference (cm)	102.7 (0.2)	102.4(0.3)	102.6(0.3)	102.6(0.2)

SE=standard error

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