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Inbreeding Effects on Metrical Phenotypes Among North Indian Children

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A B S T R A C T

This study aimed to examine the effects of inbreeding on 12 quantitative phenotypes like body weight, height, sitting height, head circumference, head length, head breadth, chest circumference, verbal, performance and full scale intelligence quotients, systolic and diastolic blood pressures among North Indian Children. The sample consisted of 3,253 subjects (1,683 males and 1,570 females) including offspring of first cousins, first cousins once removed, second cousins, (inbred part of samples) and unrelated spouses (non-inbred part of samples) ranging in age from 6 to 14 years from the Aligarh district, Uttar Pradesh in North India. Samples were selected purposively to estimate the average inbreeding coefficients based on 3 ancestral generations and using Wright's path method. The average inbreeding coefficient of the present inbred part of sample is 0.04609. The mean ages of males and females were almost equal for both inbred and non-inbred individuals. A significant reduction of means ($p < 0.05$) or inbreeding depression has been observed in inbred series for all anthropometric and psychometric traits for both the sexes. A significant elevation of mean with inbreeding is observed for systolic and diastolic blood pressure. The average inbreeding depression per 10% inbreeding appeared very high in verbal IQ (≥ 23), performance IQ (≥ 40), full scale IQ (≥ 28), systolic blood pressure (≥ 10) and diastolic blood pressure (≥ 12) among both sexes. On the whole, relatively greater amount of inbreeding effects are apparent among all measures of intelligence quotient and blood pressures compared to the anthropometric traits.The results of the present work have thrown light on the nature and mechanism of genetic effects of inbreeding on certain quantitative traits in human.

***Key words**: inbreeding, children, IQ, blood pressure, anthropometry, India*

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Introduction

Anthropometric Characters, intelligence quotient and blood pressure have been quite commonly used to study the genetic structure of human population among the human biologist[1–6]. Studies on inbreeding effect on metrical phenotypes have conducted over the last three and half decades[7–9]. Parental consanguinity increases the frequency of homozygotes in the offspring at the expense of heterozygotes, recessive and additive phenotypes would thus increase in frequency in the inbred individuals. Thus, inbreeding brings out previously hidden recessive and additive alleles contributing to the phenotypic variance[7] and hence it adds to the genetic variability. The most striking consequence of inbreeding is the reduction of mean values shown by characters connected with reproductive capacity, reduction of body size, delay of development or functional impairment known as inbreeding depression. In other species, the characters that form an important component of fitness such as early survival of offspring, litter size, lactation in mammals, egg number in poultry show a sensitivity to inbreeding[10]. Significant inbreeding effects for traits such as anthropometric, psychometric, physiometric and dermatoglypic among children and adults have found in different populations[4,8,9,11–12]. The basic model for genetic analysis of quantitative traits with known inbreeding levels is contained in the following deduction[13]: $m_F = m - 2 F \Sigma d pq$, where m and m_F are the mean values in the absence and presence of inbreeding at the level F respectively, p and q are allele frequencies ($p + q = 1$) and d the phenotypic value of heterozygote measured from the mid-value between two homozygotes at a locus, and Σ denotes summation over the involved loci assumed to be mutually additive. Therefore, the change of mean would reflect an amount of overall dominance of genes affecting the trait Σd# 0. In addition to that, as the change of mean would be in the opposite direction of the dominant phenotype, it would indicate whether the recessive genes should have positive or negative effects. If the genes having positive (which increase the value) are dominant, $d > 0$, over their alleles, which reduce the value, inbreeding results in a depression of mean. If the positive alleles are recessive, that is d has a negative value, the mean value is elevated by inbreeding. However, studies of inbreeding effects on quantitative especially anthropometric, psychometric and physiometric are only a few in India as elsewhere[14–21]. The purpose of the present study is to further elucidate the effects of genotypic difference between homozygotes and heterozygotes of involved genes of multilocus system determining various metrical characters.

Material and Methods

Study populations

In the present study, samples were selected purposively from an urban section of Muslims living in Aligarh city in North India. In human population, the controlled experimental breeding is impracticable. Therefore, the only possible way of controlling for genes and environments together is to draw samples of different specific degrees of inbreeding from an endogamous population. From this point of the view the present study population of Aligarh city in North India provides a model for such studies. The subjects reside in quarters of uniform type of adjacent colonies. As the people are engaged in similar type of jobs (by profession were lock makers) and earn more or less the same money, they have very similar socio-economic and nutritional status. Occurrences of any subject from a high-income family are excluded from the sample. Thus, the gene pool and at least the food and work environment of the com-

TABLE 1
DESCRIPITIVE STATISTICS FOR AGE OF SUBJECTS BY SEX AND INBREEDING

Phenotypes	Sex	Sample size		Mean ± SD		Age range (yrs)
		F = 0	F > 0	F = 0	F > 0	
Anthropometrics	Male	295	555	10.12±2.57	10.00±2.62	6–14
	Female	188	405	9.92±2.49	9.99±2.52	6–14
Physiometrics	Male	575	1108	9.95±2.58	9.94±2.62	6–14
	Female	488	1082	9.92±2.56	10.02±2.59	6–14
Psychometrics	Male	255	555	9.90±2.56	10.00±2.62	6–14
	Female	195	421	9.97±2.53	9.85±2.59	6–14

pared inbred and non-inbred subjects were more effectively controlled.

The sample and inbreeding level

The distributions of sample for metrical traits by age and inbreeding levels are presented in Table 1. The samples consisted for present analysis of 3253 subjects (1683 males and 1570 females) including non-inbred and inbred subjects ranging in age from 6 to 14 years. The mean ages of males and females were almost equal for both inbred and non-inbred individuals.

The parents in age groups 35–45 years and having normal health and intelligence were sorted out who had children aged 6 to 14 years. Two children from the same parent were not included. The coefficient of inbreeding (F) were calculated from the pedigree data using slightly modified Wright's formula[22]: $F_1 = (1/2)^n (1+F_a)$ where n is the number of persons along the path through a common ancestor connecting two parental gametes and F_a the inbreeding coefficient of common ancestor.

The distributions of inbreeding coefficients in the inbred part of samples include the offspring of first cousins, first cousins once removed and second cousins. All the children were genealogically traced by the author, himself, to establish the degree of consanguinity between the parents. The pedigree data of the subjects were collected with great care up to three generations. For a direct study of genetic effects of inbreeding in man, it is of importance to trace the common ancestor through pedigree of a limited number of generations. The detection of remote relationships, beyond second cousins once removed, is rarely practicable in the absence of records and has negligible contribution to the average inbreeding coefficients of the offspring[22]. The author and two trained female health visitors took all the measurements of the subjects.

Anthropometric measurements

Seven anthropometric measurements as shown in Table 2 were taken on each individuals using standard anthropometric techniques[23–24]. The expected accuracy of measurements was 0.2 cm in height, 0.1 kg in weight, and 0.2 cm in head and chest circumference and head length, head breadth as well.

Psychometric measurements

The revised Weschler's Intelligence Scale (WISC-R) for children was preferred in the present case to assess the verbal, performance and full scale IQ. The WISC-R is made up of ten subtests in which five are verbal and five are performance. The verbal subtests include information, similarities, arithmetic, vocabulary and comprehension. The performance subtests are picture completion, picture arrangement, block design, object assembly and mazes.

Physiometric measurements

The right arm was used for the manual measurement of blood pressure with a standard clinical mercury sphygmomanometer by auscultatory method[25] after the subject had rested for at least 15 minutes. Three consecutive readings were taken with a gap of 5 minutes and the mean of three readings was used for analysis.

Results

Descriptive statistics, including raw data means, standard errors and coefficient of variances of the 12 quantitative traits for inbred and non-inbred males and females children are presented in Table 2 the sample sizes vary across the traits although every subject was measured for every traits. Means and standard errors for males and female children showed considerable sex differences. As shown in Table 3, WT, HT, SHT, HC, HL, HB, CC, VIQ, PIQ and FIQ means were significantly higher ($p < 0.001$) in non-inbred children than inbred children for both sexes. The increase of mean values of systolic and diastolic blood pressure with inbreeding coefficient ($F > 0$) has been observed in both sexes. The difference between the means of non-inbred ($F = 0$) and inbred ($F > 0$) groups are significant at 5% probability level among both male and female children. The sex differences have also been found statistically significant ($p < 0.001$) in all anthropometric measurements and blood pressures among both inbred and non-inbred children. The sedentary life-style of an average Indian girl leads to higher blood pressure. However, another note worthy aspect about IQ is that male subjects score 0.68 to 2.1 points higher than female counterparts due to greater environmental exposures. But this differences are not statistically significant with $p = 0.05$ among both groups.

The changes of coefficient of variances with inbreeding for different quantitative traits are also presented in Table 2 among male and female children for comparison of the change of phenotypic variance. The coefficients of variance of seven anthropometric measurements appear to be greater in the inbred series in both sexes. The increase of variance is however, make marked for anthropometric measurements than for psychometric or physiometric traits.

In this study, mean differences between sexes of each inbred and non-inbred groups was examined by comparison of means through t-test. Table 3 presents t-values for 14 quantitative phenotypes. The mean differences of all phenotypes are highly statistically significant ($p < 0.001$) among inbred and non-inbred children in both sexes.

The correlation between phenotypes and F values and regression of measurement of F and inbreeding depression per 10% F on anthropometric, psychometric and physiometric are presented in Table 4. As expected, all anthropometric and psychometric measurements generally display a significant ($p < 0.05$) negative association with F values of individuals in either sex as reflected by negative correlation with and regression on F. On the other hand, blood pressure display positive correlations (r) and regressions (slope) on F in each sex.

It we compare the rank orders of correlation of different characters with F values among males. It has been found that such correlation is largest for WT, HC, HL, HB and PIQ. Similarly among

TABLE 2
MEANS, STANDARD ERRORS AND COEFFICIENTS OF VARIATION OF THE 12 QUANTITATIVE PHENOTYPES AMONG INBRED (F>0) AND NON INBRED (F=0) NORTH INDIAN CHILDREN FOR BOTH SEXES

Phenotypes*	Male children						Female children					
	Inbred (F>0)			Non-Inbred (F=0)			Inbred (F>0)			Non-Inbred (F=0)		
	N	X±SE	CV(%)	N	X±SE	CV(%)	N	X±SE	CV(%)	N	X±SE	CV (%)
Weight (WT)[a]	555	18.29±0.17	33.53	295	21.12±0.21	23.81	405	14.44±0.17	27.58	188	16.64±0.26	17.03
Height (HT)	555	119.43±0.19	9.57	295	123.18±0.26	7.42	405	107.40±0.30	6.92	188	112.67±0.60	4.58
Sitting height (SHT)	555	63.24±0.10	12.13	295	65.60±0.12	10.59	405	56.88±0.16	9.22	188	61.03±0.17	5.41
Head circumference (HC)	555	50.32±0.08	8.91	295	53.15±0.09	6.78	405	48.56±0.15	8.19	188	52.17±0.13	5.41
Head length (HL)	555	17.55±0.03	21.22	295	20.23±0.09	14.99	405	17.12±0.04	21.62	188	17.99±0.07	16.68
Head breadth (HB)	555	14.03±0.02	26.32	295	17.24±0.12	17.44	405	13.65±0.03	29.86	188	14.37±0.05	20.74
Chest circumference (CC)	555	58.11±0.02	10.24	295	60.90±0.25	8.58	405	55.93±0.20	8.38	188	57.80±0.31	5.51
Verbal intelligence quotient (VIQ)	555	97.35±0.75	16.24	255	105.51±1.06	13.93	421	95.74±0.77	16.43	195	104.83±1.11	14.26
Performance intelligence quotient (PIQ)	555	97.86±0.79	17.08	255	111.18±1.07	13.38	421	97.07±0.83	17.57	195	109.51±1.16	14.28
Full scale intelligence quotient (FIQ)	555	99.23±0.76	16.16	255	108.47±1.12	14.35	421	97.30±0.77	16.19	195	106.37±1.13	14.33
Systolic blood pressure[b] (SBP)	1108	106.71±0.07	9.98	575	102.7±0.09	9.53	1082	107.37±0.09	11.02	488	103.44±0.13	10.88
Diastolic blood pressure[b] (DBP)	1108	66.69±0.06	15.87	575	62.01±0.12	14.5	1082	71.99±0.10	15.08	488	64.63±0.13	16.01

* All anthropometric measurements are presented in cm except where indicated. a – kg; b – mmHg

TABLE 3
T-VALUES BETWEEN INBRED (F>0) AND NON-INBRED (F=0) MALE AND FEMALE CHILDERN AND ALSO SEX DIFFERENCES AMONG INBRED AND NON-INBRED CHILDREN FOR 12 QUANTITATIVE PHENOTYPES

Phenotypes	Inbred versus non-inbred		Sex differences	
	Male	Female	Inbred	Non-inbred
Weight	10.14***	7.18***	15.61***	13.34***
Height	11.61***	8.75***	35.41***	18.25***
Sitting height	14.47***	15.82***	35.30***	9.08***
Head circumference	22.13***	15.18***	10.51***	6.38***
Head length	34.45***	11.52***	8.77***	17.77***
Head breadth	34.99***	12.93***	10.93***	18.42***
Chest circumference	15.13***	5.17***	12.63***	7.75***
Verbal IQ	6.18***	6.67***	1.47^{ns}	0.43^{ns}
Performance IQ	9.69***	8.55***	0.68^{ns}	1.05^{ns}
Full scale IQ	6.82***	6.62***	1.75^{ns}	1.29^{ns}
SBP	34.29***	24.56***	5.80***	4.78***
DBP	39.01***	42.61***	45.67***	14.79***

***$p \le 0.001$, $^{ns}p > 0.05$

females, WT, HT, SHT, HC, HB and PIQ have higher correlation with F. The estimate of percent inbreeding depression (ID%) has been obtained on the basis of mean depression in inbred sample (F > 0). The estimates obtained by the two methods [on average and on regression (b/10)] do not appear to coincide for any of the anthropometric, psychometric and physiometric traits. In the both estimates psychometric variables have shown higher depression in both sexes.

Discussion

In view of the strong earlier suggestion of inbreeding depression in quantitative traits especially on physical measurements in the case of adequately controlled data[2,19,26–28], the results amply strengthen the hypothesis of an average recessiveness of the genes with negative effects. However, inbreeding may have a significant influence on late-onset traits like blood pressure and other complex diseases[29–30]. Some studies on inbreeding effects on blood pressure in adults show decrease of mean values in the inbred series[1,9,31]. Whereas, other studies on inbreeding effects on DBP among adults and children uniformly indicate a rise of mean values in the inbred series[8,12,29,32–33]. Whereas, in the present study, the significant increase of blood pressure in the children of age ranges 6–14 years of each sex with inbreeding apparently agrees with the hypothesis of some recessive gene or genes for higher blood pressure[12,31,32]. In the support of this hypothesis and consistent overall trend of increased prevalence of blood pressure among worldwide inbred communities have been reported by several authors[8,9,34–38].

Lowering of IQ after inbreeding is perhaps among the best line of evidence we have for heredity control of intelligence[39]. Jensen[40] and Plomin[41] expresses a similar opinion that the most impressive lines of evidence for the involvement of genetic

TABLE 4
CORRELATIONS, REGRESSION COEFFICIENTS AND INBREEDING DEPRESSION PER 10% F FOR THE OBSERVED QUANTITATIVE PHENOTYPES ON INBREEDING COEFFICIENTS (F≥0) AMONG MALE AND FEMALE NORTH INDIAN CHILDREN

Phenotypes	Sex	r ± SE	Slope	Intercept	p*	Inbreeding depression 10% F	
						On average	On regression
Weight	M	–0.29±0.08	–83.33±26.17	20.89	0.005	7.24	8.33
	F	–0.30±0.08	–41.06±15.42	15.72	0.010	6.13	4.11
Height	M	–0.20±0.09	–113.37±50.37	123.22	0.010	9.56	11.34
	F	–0.35±0.09	–102.61±31.82	110.62	0.005	14.68	10.26
Sitting height	M	–0.19±0.08	–70.37±35.68	65.66	0.050	6.04	7.04
	F	–0.38±0.10	–82.81±19.57	59.75	0.001	11.99	8.28
Head circumference	M	–0.37±0.07	–77.46±18.04	52.06	0.001	6.95	7.75
	F	–0.36±0.09	–58.52±15.55	51.43	0.001	9.24	5.85
Head length	M	–0.32±0.06	–62.33±15.16	18.01	0.000	6.76	6.28
	F	–0.14±0.11	–16.28±8.38	17.67	0.100	2.43	1.63
Head breadth	M	–0.38±0.08	–72.91±14.11	17.72	0.000	8.04	7.29
	F	–0.13±0.05	–13.15±7.78	14.11	0.100	1.92	1.32
Chest circumference	M	–0.26±0.06	–84.81±25.67	58.73	0.001	7.23	8.48
	F	–0.22±0.10	–37.95±18.67	55.83	0.050	5.36	3.80
Verbal IQ	M	–0.28±0.04	–187.20±23.70	104.79	0.000	23.20	18.72
	F	–0.32±0.04	–213.38±25.16	104.12	0.000	26.14	21.34
Performance IQ	M	–0.36±0.03	–251.10±24.06	107.46	0.000	43.42	25.11
	F	–0.33±0.04	–237.46±25.75	106.06	0.000	40.15	23.75
Full scale IQ	M	–0.28±0.04	–191.58±25.03	106.11	0.000	28.65	19.16
	F	–0.28±0.03	–175.70±24.88	104.69	0.000	28.86	17.57
SBP	M	0.19±0.05	91.92±27.14	101.93	0.001	10.58	9.19
	F	0.17±0.06	83.40±28.50	103.32	0.005	10.46	8.34
DBP	M	0.22±0.06	95.75±25.65	62.75	0.001	12.19	9.58
	F	0.28±0.07	127.62±26.91	66.37	0.000	19.76	12.76

* Indicate significance levels when testing the observed slope against zero

factors in intelligence comes from the study of the effects of inbreeding. In the present study, the higher rates of inbreeding depression on performance, verbal and full scale IQs than in anthropometrics, indicate the occurrence of a relatively larger increase of homozygosity of recessive genes in these traits. Otherwise, inbreeding depression of IQ test scores would suggest that this trait has undergone selection.

The inbreeding effects observed in the present study are brought together to review the possible mechanism of phenotypic change and further knowledge of genetics of the traits derived from them. The present results bring out the conclusion that a systematic indication of linear effects of inbreeding depression for almost all of the traits. This represents a certain amount of average dominance/ recessivity of genes for the traits.

The effects of inbreeding in the present study also suggest the occurrence of recessive genes to be different with respect to different traits. This explains the mechanism of the diversity of inbreeding effects on mean, depression or elevation in the traits. The present analysis extends the support of further possibilities of understanding the genetics of quantitative traits with respect to inbreeding. Therefore, the general effects of inbreeding, in fact, not only reveal the non-additives components of the traits, they also reflect the homozygosity and heterozygosity due to recessive additive, non-additive genes under the natural selection and even refer to the frequencies at genes and genotypes, which would suggest the genetic structure of the base population.

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R E F E R E N C E S

1. NEEL, J. V., W. J. SCHULL, M. YAMAMOTO, S. SCHIDA, T. YANASE, N. FUJIKI, Am. J. Hum. Genet., 22 (1970) 263. – 2. MUKHERJEE, D. P.: Inbreeding and genetics of quantitative traits in Man. In: MALHOTRA, E. C., A. BASU (Eds.): Human genetics and adaptation. (ISI, Calcutta, 1884). – 3. CHAKRABORTY, R., Hum. Biol., 62 (1990) 147. — 4. BADARUDDOZA, Behav. Genet., 23 (1993) 343. — 5. ABNEY, M., M. MCPEEK, C. OBER, Am. J. Hum. Genet., 66 (2000) 629. – 6. BLANGERO, J., Hum. Biol., 62 (1990) 27. – 7. CROW, J. F., M. KIMURA: An introduction to population genetics. (Harper & Row Publisher, New York, 1970). – 8. KRIEGER, H., Am. J. Hum. Genet., 21 (1968) 537. — 9. MARTIN, A. O., T. W. KURCZYNSKI, A. G. STEINBERG, Am. J. Genet., 25 (1973) 581. — 10. CHARLESWORTH, B., D. CHARLSWORTH, Genet. Res., 74 (1999) 329. — 11. MUKHERJEE, A., Am. J. Phys. Anthropol., 81 (1990) 77. — 12. RUDAN, I., N. SMOLEJ-NARANČIĆ, H. CAMPBELL, A. CAROTHERS, A. WRIGHT, B. JANIĆIJEVIĆ, P. RUDAN, Genetics, 163 (2003) 1011. — 13. FALCONER, D. S.: Introduction to quantitative genetics. (Oliver and Boyed, England, 1989). – 14. MALHOTRA, K. C., J. Biosoc. Sci., 2 (1979) 397. – 15. RAO, P. S. S. S., S. G. INBARAJ, Soc. Biol., 24 (1977) 281. — 16. AGRAWAL, N., S. N. SINHA, R. JENSEN, Behav. Genet., 14 (1984) 579. — 17. BADARUDDOZA, M. AFZAL, Man in India, 72 (1992) 431. — 18. BADARUDDOZA, Acta. Med. Auxol., 32 (2000) 159. — 19. BADARUDDOZA, J. Hum. Ecol., 12 (2001) 457. —20. AFZAL, M., Behav. Genet., 18 (1988) 583. — 21. BITTLES, A. H., J. Genet., 81 (2002) 91. — 22. WRIGHT, S. Am. Nat., 56 (1922) 330. — 23. SINGH, I. P., M. K. BHASIN: Anthropometry. (Kamla-Raj Enterprises, Delhi, 1968). — 24. WEINER, J. S., J. A. LOURIE: Practical human biology. (Academic Press, London, 1981). — 25. ROSE, G., H. BLACKHURN: (WHO monograph series No. 56, 1982). — 26. RAO, P. S. S. S., S. G. INBARAJ, G. JESUDIAN, J. Med. Genet., 9 (1972) 174. — 27. MUKHERJEE, D. P.: Consanguineous marriage and their genetical consequence in some Indian population. In: ROBERTS, D. F., N. FUJIKI, T. TORIZUKA (Eds.): Isolation, migration and health. (Cambridge University Press, Cambridge, 1992). — 28. CHARLESWORTH, B., K. A. HUGHES: The maintenance

of genetic variation in life–history traits. In: SINGH, R. S., C. B. KRIMBAS (Eds.): Evolutionary genetics: From molecules to morphology. Vol. 1. (Cambridge University Press, Cambridge, 1999). — 29. RUDAN, I., D. RUDAN, H. CAMPBELL, A. CAROTHERS, A. WRIGHT, N. SMOLEJ-NARANČIĆ, B. JANIĆIJEVIĆ, L. JIN, R. CHAKRABORTY, R. DEKA, P. RUDAN, J. Med. Genet., 40 (2003) 925. — 30. CHARLESWORTH, B., K. A. HUGHES, Proc. Natl. Acad. Sci. USA, 93 (1996) 6140. — 31. BARBOSA, C. A. A., H. KRIEGER, Hum. Hered., 29 (1979) 106. —32. BADARUDDOZA, M. AFZAL, J. Biosci., 24 (1999) 177. — 33. WRIGHT, A., B. CHARLESWORTH, I. RUDAN, A. CAROTHERS, H. CAMPBELL, Trends. Genet., 19 (2003) 97. — 34. HURWICH, B. J. B., N. ROSNER, E. NUBANI, H. KASS, H. I. LEWITTER, Am. J. Epidemiol., 115 (1982) 646. — 35. WAHID, S. S. S., F. J. AL-SHAMMARY, T. A. KHOJA, T. J. HASHIM, C. C. ANOKUTE, S. B. KHAN, J. Hum. Hypertens., 10 (1996) 583. — 36. HALBERSTEIN, R. A., Hum. Biol., 71 (1999) 659. — 37. RUDAN, I., H. CAMPBELL, P. RUDAN, Coll. Antropol., 23 (1999) 531. — 38. RUDAN, P., A. SUJOLDŽIĆ, D. ŠIMIĆ, L. A. BENNETT, D. F. ROBERTS: Population structure in the eastern Adriatic: The influence of historical processes, migration patterns, isolation and ecological pressures and their interaction. In: ROBERTS, D. F., N. FUJIKI, T. TORIZUKA (Eds.): Isolation, migration and health. (Cambridge University Press, Cambridge, 1992). — 39. EYSENCK, H. J.: The Inequality of man. (San Diego, California, 1973). — 40. JENSEN, A. R., Harvard. Educ. Rev., 39 (1969) 1. — 41. PLOMIN, R., M. J. OWEN, P. MCGUFLIN, Science, 264 (1994) 1733.

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UČINAK SROĐIVANJA NA BIOMETRIJSKE OSOBINE KOD DJECE IZ SJEVERNE INDIJE

S A Ž E T A K

Cilj je ove studije bio kod djece iz sjeverne Indije ispitati učinke srođivanja na različite kvantitativne osobine (tjelesna masa, visina, sjedeća visina, opseg glave, duljina i širina glave, opseg prsnog koša, rezultati testova verbalnog izražavanje i inteligencije, te vrijednosti sistoličkog i dijastoličkog krvnog tlaka). Uzorak se sastojao od 3253 ispitanika (1683 dječaka i 1570 djevojčice), dobi od 6 do 14 godina, iz okruga Aligarh, Uttar Pradesh, sjeverna Indija. Uzorak je podijeljen na dva pod-uzorka od kojih je jedan uključivao potomstvo krvno-vezanih brakova (djecu rođaka u 1. 1,5. i 2. koljenu), a drugi djecu koja nisu potekla iz krvno-vezanih brakova. Uzorak je izabran u cilju procjene koeficijenta srođivanja korištenjem Wright-ove path metode koja se temelji na 3 generacije predaka. Srednja vrijednost koeficijenta srođivanja u pod-uzorku djece koja su potekla iz krvno-srodnih brakova iznosio je 0.04609. Srednja dob dječaka i djevojčica bila je podjednaka u oba pod-uzorka. Značajno smanjenje ($p < 0,05$) u srednjim vrijednostima (»inbreeding depression«) primijećeno je u srođenom pod-uzorku za sve ispitivane antropometrijske i psihometrijske osobine u oba spola, dok su vrijednosti i sistoličkog i dijastoličkog krvnog tlaka bile značajno više. Srednja vrijednost »inbreeding depression« u oba spola za svakih 10% srođivanja bila je vrlo visoka kod testova verbalne inteligencije ($IQ \geq 23$), spretnosti ($IQ \geq 40$), ukupne inteligencije ($IQ \geq 28$), sistoličkog (≥ 10) i dijastoličkog krvnog tlaka (≥ 12). Može se zaključiti da je relativno veći učinak inbreeding depression primijećen kod testova inteligencije i krvnog tlaka u odnosu na učinak kod antropometrijskih osobina. Rezultati ukazuju na prirodu i mehanizme genetskih učinaka srođivanja na neke kvantitativne osobine čovjeka.