PHYSICAL EFFICIENCY TESTS IN INDIAN URBAN ADOLESCENT BOYS AND GIRLS

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ABSTRACT

Simple anthropometric measurements and physical efficiency tests were performed on adolescent Indian urban boys between 10-14 years and girls between 11-14 years of age. The similar height and weight of the subjects of both sexes were observed and was suggestive of higher growth rate in girls than the boys during only the initial phase of adolescent growth spurt. The vital capacity (total, ml/cm of height, l/m² of surface area), Peak Expiratory Flow Rate (total, l/cm of height, l/kg of weight, l/m² of surface area, l/year of age) and grip strength were observed to be insignificantly different between the sexes.

Key Words:

Urban adolescents, physical efficiency, simple anthropometry, vital capacity, peak expiratory flow rate, grip strength.

The adolescents are considered as one of the vulnerable population groups owing to their peculiar physiological states (De and Nagchaudhuri, 1976a; Shock, 1943a, 1946b). A considerable number of physiological changes occur during this period. Among the significant changes, some are well-documented; increased rate of growth, rise in the systolic blood pressure, lowering in heart rate, comparative increase of the basal metabolic rate etc. (Boas, 1930, 1932; Shuttleworth, 1937, 1939; Simmons and Gruelich, 1943). These changes are more closely related to the adolescent growth spurt and to the maturity of the reproductive capacity than to the chronological age. Various other factors like physique, season of the year, nutrition and socio-economic status influence the interrelationship genetic and environmental effects throughout the whole period of adolescence (Tanner, 1964).

It is well-known that onset of the adolescent growth spurt in girls occurs earlier and continues for a shorter duration, than in boys (Du-Bois, 1929; Boothby and

Sandeford, 1929; Topper and Mulier, 1932; Dakshayani and Ramanamurthy et al, 1962; De and Nagchaudhuri, 1975; Shock, 1946a). The present study was undertaken to compare some aspects of physical fitness/efficiency during the initial phase of adolescent growth spurt between boys and girls in an Indian urban community.

MATERIALS AND METHODS

Eighteen Bengalee boys and sixteen girls from the urban school (Jadavpur, Calcutta, West Bengal, India) were selected for this study. The subjects were from an income range between Rupees 1,200/- to 1,500/- per month. The questionnaire method of diet survey was suggestive of better calorie/protein intake of these subjects in comparison to those of the comparatively poorer section of Bengalee families. The age of the boys ranged from 10-14 years and the girls from 11-14 years. The height and weight of the subjects were noted. The vital capacity (VC) was recorded using Wright's Respirometer, the Peak Expiratory Flow Rate (PEF) with the help of Wright's Peak Flowmeter and the Grip Strength by Hand Dynamometer.

Growth performance of well-to-do Indian children with a follow up study were shown to be comparable to those of American children between 3 to 13 years of age (Vijayaraghavan, Singh et al, 1971; Vijayaraghavan, Sastry et al, 1971; Khan and Belavady, 1973). The subjects of the present investigation were also from a similar socio-economic status of different part of India. Du Bois nomogram, therefore, is applicable to determine the surface area of these subjects of both sexes, and was used for these subjects.

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RESULTS AND DISCUSSION

The results are summarised in Table I. The records of height and weight of the experimental subjects providing information on the growth processes shows both boys and girls have attained similar physical growth, during the initial phase of adolescence. The consequent changes in surface area are also given.

TABLE I

**Indian adolescents;
physical characteristics and respiratory efficiency.**

	BOYS N = 18	GIRLS N = 16
AGE (years) — range	10 - 14	11 - 14
mean & $\pm$ S.D.	12.11 $\pm$ 1.1	12.1 $\pm$ 0.9
HEIGHT (cms)	139 - 170 149.5 $\pm$ 9.1	134 - 158 148.4 $\pm$ 6.3
WEIGHT (kg)	25.5 - 51.0 35.7 $\pm$ 7.0	23.0 - 46.0 35.9 $\pm$ 6.4
SURFACE AREA (m ²)	1.04 - 1.58 1.24 $\pm$ 0.15	0.95 - 1.42 1.23 $\pm$ 0.12
GRIP STRENGTH (kg)	12 - 40	11 - 26
RIGHT	19.5 $\pm$ 7.5	18.0 $\pm$ 4.2
GRIP STRENGTH (kg)	11 - 32	10 - 23
LEFT	17.00 $\pm$ 6.8	16.7 $\pm$ 4.3
VITAL CAPACITY (litres)	1.80 - 3.40 2.41 $\pm$ 0.46	1.25 - 2.84 2.17 $\pm$ 0.44
VC as ml/cm height	12.95 - 21.93 16.04 $\pm$ 2.32	8.80 - 18.93 14.55 $\pm$ 2.72
VC as L/m ² surface area	1.67 - 2.48 1.94 $\pm$ 0.22	1.18 - 2.05 1.73 $\pm$ 0.23
PEAK EXPIRATORY FLOW (L/min)	235 - 465 351 $\pm$ 69	210 - 430 323 $\pm$ 64
PEF as L/cm height	1.70 - 2.93 2.34 $\pm$ 0.4	1.40 - 2.20 2.17 $\pm$ 0.4
PEF as L/kg weight	7.38 - 12.76 9.92 $\pm$ 1.4	6.40 - 12.4 9.12 $\pm$ 1.7
PEF as L/m ² surface area	225 - 349 284 $\pm$ 40	177 - 338 263 $\pm$ 44
PEF as L/age in years	22.9 - 35.8 28.9 $\pm$ 4.3	17.5 - 35.0 26.7 $\pm$ 5.2

The characteristics of respiration change during adolescence. The rate of respiration during basal conditions is known to decrease steadily throughout childhood and a similar trend continues during puberty, without show-

ing any sex difference (Iliff and Lee, 1952). Shock (1946a, 1946b) has reported that resting respiratory minute volume increased considerably in boys, and very little, if at all, in girls. The present study indicates that there was no significant difference of the observed values of vital capacity (VC) between boys and girls, similarly VC when expressed in ml/cm of height was not significantly different. Further, the VC even when presented in terms of l/unit of surface area (m²) was also not significantly different.

There was no significant difference in the PEF values between the boys and girls. The PEF values expressed as l/min/cm height, l/kg of weight, l/min/m² surface area or, l/min/age were all found to be insignificantly different (Burr, Eldridge et al, 1974). Although the reports in the literature showed that the boys had higher values of vital capacity, maximum breathing capacity, inspiratory and expiratory flow rates than the girls during the period of adolescence (Åstrand, 1952; Ferris and Whittenberger et al, 1952; Ferris and Smith, 1953; Kennedy and Thursby-Pelham et al, 1957), the studies were conducted on the population of different socio-economic status. The findings in the present study that the VC and PEF values were not different during the early period of adolescence in both the sexes, might be due to the fact that the subjects were selected from only a specific comparable socio-economic group.

The muscles of the adolescents not only increase in size but also gain proportionately in strength. The early reports regarding the strength gain tests, hand grip, arm pull and arm thrust had shown a more marked adolescent spurt in boys than in girls. However, this spurt was observed among the boys from the age of 13-16 years for all the strength tests, whereas a less definite spurt was seen in the case of girls between 12-13½ years, when the grip strength test was taken as an index (Schlesinger, 1934; Bookwalter, 1950; Cullumbine and Bibile et al, 1950). Our results using hand dynamometer for measuring the grip strength showed that the boys did not have a better strength gain than the girls.

Since the onset of puberty occurs earlier and early growth rate is faster in girls than in boys (Patwardhan, 1956; Phansalkar and Patwardhan, 1956; Rao and Pasricha et al, 1958; De and Nagchaudhuri, 1976a, b; Banerjee and Bhattacharya, 1964; Shock, loc. cit.), the observed values of height and weight of both the sexes were very close to each other. The similar values of different physical efficiency tests as observed for boys and girls during the initial phase of adolescence may thus be explained.

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NOTICE

MEETING OF OTHER ORGANISATIONS – A.C.P.S.M. July 6th–8th, 1979

The sixth Annual Residential Congress of the Association of Chartered Physiotherapists in Sports Medicine will take place in the University Hall, Cardiff from Friday, 6th to Sunday, 8th July, 1979. Following lunch at 12.30 hrs. the first symposium commences at 14.00 and includes papers on facial injuries in Rugby Football (R. Hopkins, B.D.S., M.R.C.S.) physiology of fitness (J. A. Fowler, M.C.S.P.) and applied kinesiology (B. M. Butler). A film on the 1978 Commonwealth Games will be shown at 20.30. On Saturday, 09.20 – Carbon filament replacement surgery (D. H. Jenkins, F.R.C.S.), interferential therapy (B. Savage, M.C.S.P.), functional aspects of throwing events (R. A. C. Davies, F.R.C.S.), therapeutic ultrasound (G. White, M.C.S.P.), and in the afternoon, 14.00, flexibility of the foot (S. Bracey, M.Ch.S.) strapping techniques (A. Bonelle, M.C.S.P.) and manual techniques in injury prevention and treatment (K. Slocombe, M.C.S.P.). The annual dinner (black ties) concludes the day's activities. On Sunday 09.00, doping in sport (provisional – speaker to be announced), impact therapy (J. B. Tracey, M.B., B.Ch.). The Annual General Meeting for members of A.C.P.S.M. ends the programme at 11.45 but lunch is available for those who give notice.

The fee for the complete conference including full board and residence is £32.50, with reduced rates for part-time attendance, for students and for non-residents. Enquiries and applications for places should be sent as soon as possible to:—

Mr. J. R. Cross, M.C.S.P.,
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Tel. Exmouth (03952) 75592 or 78406.

For members of A.C.P.S.M., application forms will be sent out in the next issue of *Physiotherapy on Sport*.