Comparative Studies of Body Composition and Lipid Profiles of Tribal and Non-Tribal Children of 10-16 Years Age Group

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ABSTRACT

Sports talent may be identified among the children at their early childhood when they show interest in different sports. To identify athletic potentiality, body composition and lipid profiles have an importance because they represent the health and metabolic status of the athletes, which relates with the performance level of the athlete. Various factors like socio-economic condition, diet, physical activity may reflect on these variables.Three fifty male children of 10-16 yrs volunteered for this study, were divided into 2 groups- (a) tribal (n=175) and (b) non-tribal (n=175); and again divided into 7 sub-groups having 25 children in each group: (i) 10 yrs, (ii) 11 yrs, (iii) 12 yrs, (iv) 13 yrs, (v) 14 yrs, (vi) 15 yrs, (vii) 16 yrs. Body composition and lipid profiles were measured. Significantly higher ($P<0.05$) higher body mass, body fat, TC, TG, LDL-C; lower ($P<0.05$) HDL-C were observed in non-tribal children when compared to Tribal children. Identification of children at early stage of their growth and development may produce elite athletes in the future. It has been seen that tribal children have significantly better body composition and lipid-lipoprotein profile than non-tribal children. It can be suggested that more emphasis should be given on the tribal children for identification of potentiality and talent in sports.

Key words: body composition, lipid profile, health, children, sports

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1. Introduction

Sports talent may be identified among the children at their early childhood when they show interest in different sports. Anthropometric and physical fitness profiles contribute to selection procedures in different sports disciplines [1, 2]. Besides success in track and field discipline is based on the synthesis of anthropometric characteristics and motor abilities as well as optimal technique [2]. But overall characteristics are also influenced by genetic inheritance, morphology, personal interest and habitual activity. The level of fitness is highly associated with the body composition and performance of other health-related fitness parameters of the athletes [3]. To identify athletic potentiality, body composition profiles have an importance because they represent the general health and fitness status of the athletes, which relates with the performance level of the athlete [2, 3]. Lipids have important beneficial biological functions that include the use of triglycerides, for energy production or as stored fat in adipose tissue and use of cholesterol as a component, in conjunction with phospholipids of cellular membranes or in the synthesis of steroid hormones [4, 5]. Elevated plasma cholesterol concentrations have been implicated in the development of coronary artery disease (CAD) [4-6]. The primary function of high density lipoprotein cholesterol (HDL-C) is to serve as the cholesterol acceptor in the reverse transport and excretion of cholesterol [6]. On the other hand low density lipoprotein cholesterol (LDL-C) is directly associated with cholesterol [4-6]. It has been reported that LDL-C has the greatest correlation to severity of coronary atherosclerosis [4-6]. Therefore, monitoring of lipid profile in athletes can provide valuable information about their metabolic and cardiovascular status. To identify athletic potentiality, body composition and lipid profiles have an importance because they represent the health and metabolic status of the athletes, which relates with the performance level of the athlete [7]. Various factors like socio-economic condition, diet, physical activity may reflect on these variables.

In India there are about 8.6% ethnic (tribal) sharing approximately 70% of rural population [8]. Among the ethnic (tribal) races Santal, Lodha, Sabar etc. reside in West Midnapore district of West Bengal [8], and are mostly below the poverty line. However, the non-tribal people shares urban and rural population. The significant changes that accompany the transition from rural to urban societies have greatly impacted the social and biological transformation. Because of this transformation, non-tribal population is getting more access to education, sport facilities, sanitation and health services, and opportunities for physical activities in comparison to tribal population. Difference in socio-economic, nutritional and physical activity pattern of the tribal and non-tribal children may have some impact on the body composition and lipid profiles. In India, limited studies have been reported on the body composition and lipid profiles of the tribal and non-tribal children. In view of the above, a study was undertaken to investigate the body composition and lipid profiles of the tribal and non-tribal children of 10-16 years age group in order to identify potentiality and sports talent in them.

2. Materials and Methods

2.1. Subjects

A total of three hundred and fifty (N= 350) male children between 10-16 years volunteered for this study. The children were selected after proper medical checkups from different schools of West Midnapore districts of West Bengal, India, and were equally divided into 2 groups- (a) tribal children (n= 175) and (b) non-tribal children (n= 175). Further, in each group children were again divided into seven sub-groups according to age viz. (i) 10 years, (ii) 11 years, (iii) 12 years, (iv) 13 years, (v) 14 years, (vi) 15 years and (vii) 16 years. Twenty five (25) children were selected from each age category. Selected body composition and lipids-lipoprotein profiles were measured for each group. Statistical analysis was applied to observe the significance difference among the group. The subjects were informed about the possible complications of the study and gave their consent. Parental consent was also taken from the participants of this study. The institutional review board approval was also obtained for the present study.

2.2. Measurement of Body Composition Variables

Height and body mass were measured using standard methodology [9]. Body mass index (BMI) and Body surface area (BSA) were derived from the height and body mass using standard equations [9]. A skin fold calliper (Mitutoyo, Japan) was used to assess the body fat percentage, from biceps, triceps, sub-scapular and suprailiac skin fold sites. Body density was calculated according to the formulae of Durnin and Womersley [10]. Body fat was derived using the standard equation of Siri [11]. Subsequently, lean body mass (LBM) was derived by subtracting fat mass from total body mass using the standard equation [9].

2.3. Assessment of Lipid Profiles

A 5 ml of venous blood was drawn from an antecubital vein after a 12-hours fast and 24 hours after the last bout of exercise for the subsequent determination of selected biochemical parameters. The biochemical parameters were measured using standard methodology. All the reagents were supplied from Boehringer Mannhein, USA. Serum triglycerides [12], serum total cholesterol (TC) [13] and high-density lipoprotein cholesterol (HDL-C) [13] were determined by enzymatic method. Low-density lipoprotein cholesterol (LDL-C) was indirectly assessed following standard equation [14].

2.4. Statistical Analysis

All the values of body composition and lipids profiles variables were expressed as mean and standard deviation (SD). Analysis of Variance (ANOVA) followed by multiple comparison tests was performed to find out the significant difference in selected body composition and lipids profiles among the tribal and non-tribal children of different age group. In each case the significant level was chosen at 0.05 levels. Accordingly, a statistical software package (SPSS) was used.

3. Results and discussion

3.1. Body composition Variables of tribal and non-tribal children:

A significantly higher ($P<0.05$) body mass, waist hip ratio (WHR) and percent body fat were observed among the non-tribal children when compared to tribal children of some age groups. However, significantly lower ($P<0.05$) mid upper arm circumference (MUAC) was observed among the non-tribal children when compared to tribal children of some age groups. But, no significant difference was reported in height, body mass index (BMI), body surface area (BSA) and lean body mass (LBM) among the tribal and non-tribal children of either age group. On the other hand, a significantly higher ($P<0.05$) height, body mass, BMI, BSA, LBM and MUAC were noted with the advancement of age in both tribal and non-tribal children. However, significantly lower ($P<0.05$) body fat percent and WHR were observed with the advancement of age in both tribal and non-tribal children.

Table 1: Height, body mass, BMI and BSA of Tribal and Non-Tribal children of 10-16 years Age Groups

Age Group (yr)	Height (cm)		Body mass (kg)		BMI (kg m^{-2})		BSA (m^{-2})	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
10	134.4 ±4.1	133.2 ^{NS} ± 4.2	29.9 ±2.7	30.8 ^{NS} ±2.9	16.4 ±1.1	17.3 ^{NS} ±1.8	1.1 ±0.1	1.1 ^{NS} ±0.1
11	136.8 ^{a} ±4.8	137.1 ^{a} ± 4.5	33.0 ^{a} ±2.9	34.6 ^{a} ±3.5	17.5 ^{a} ±1.7	18.5 ^{a} ±1.1	1.1 ±0.2	1.2 ^{a} ±0.2
12	147.6 ^{ab} ± 4.7	145.1 ^{ab} ± 4.7	36.6 ^{ab} ±3.1	39.1 $^{*\ ab}$ ±3.3	16.2 ^{b} ±1.5	16.7 ^{b} ±1.5	1.3 ^{ab} ±0.1	1.3 ^{a} ±0.2
13	153.9 $^{a\text{-}c}$ ±4.5	154.5 $^{a\text{-}c}$ ± 4.1	42.4 $^{a\text{-}c}$ ±2.5	46.2 $^{*\ a\text{-}c}$ ±3.1	17.9 ^{ac} ±1.9	19.5 $^{a\text{-}c}$ ±1.9	1.4 $^{a\text{-}c}$ ±0.2	1.4 $^{a\text{-}c}$ ±0.1
14	158.5 $^{a\text{-}d}$ ± 4.7	157.6 $^{a\text{-}d}$ ± 4.8	45.2 $^{a\text{-}d}$ ±3.1	48.2 $^{*\ a\text{-}d}$ ±3.3	18.2 ^{ac} ±1.5	19.6 $^{a\text{-}c}$ ±1.7	1.4 $^{a\text{-}c}$ ±0.1	1.5 $^{a\text{-}d}$ ±0.1
15	161.5 $^{a\text{-}e}$ ± 4.3	160.7 $^{a\text{-}e}$ ± 4.3	46.3 $^{a\text{-}d}$ ±3.0	49.1 $^{*\ a\text{-}d}$ ±3.2	18.3 ^{ac} ±1.9	19.3 ^{ac} ±1.6	1.5 $^{a\text{-}d}$ ±0.1	1.5 $^{a\text{-}d}$ ±0.1
16	164.0 $^{a\text{-}f}$ ±4.0	163.8 $^{a\text{-}f}$ ± 4.8	47.7 $^{a\text{-}e}$ ±2.9	50.8 $^{*\ a\text{-}e}$ ±2.8	17.8 ^{ac} ±1.1	19.1 ^{ac} ±1.1	1.5 $^{a\text{-}d}$ ±0.1	1.5 $^{a\text{-}d}$ ±0.1

All the values were expressed as mean and standard deviation (SD), N=25; $P<0.05$; * when compare to Tribal children, a when compare to 10yrs age group, b when compare to 11yrs age group, c when compare to 12yrs age group, d when compare to 13yrs age group, e when compare to 14yrs age group, f when compare to 15yrs age group; NS= not significant; BMI= body mass index, BSA= body surface area.

Table 2: Body composition, WHR and MUAC of Tribal and Non-Tribal children of 10-16 years Age Groups

Age Group (yr)	Body fat (%)		LBM (kg)		WHR		MUAC (cm)	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
10	18.7 ±3.1	21.3 * ±3.1	24.2 ±3.4	24.3 ^{NS} ±2.6	0.9 ±0.1	1.1 * ±0.1	18.7 ±1.4	18.4 ^{NS} ±1.8
11	16.6 ^{a} ±3.3	20.9 * ±2.6	27.6 ^{a} ±3.3	27.3 ^{a} ±2.4	0.8 ^{a} ±0.2	0.9 $^{*\ a}$ ±0.1	20.0 ^{a} ±1.1	18.9 * ±1.3
12	15.9 ^{a}	19.3 $^{*\ ab}$	30.8	31.6 ^{ab}	0.8 ^{a}	0.9 $^{*\ a}$	20.7 ^{a}	19.4 $^{*\ a}$

	±3.1	±2.0	ab ±2.4	±2.8	±0.1	±0.1	±1.8	±1.5
13	15.7 [a] ±2.7	19.1* [ab] ±2.8	35.8 [a-c] ±3.4	37.2 [a-c] ±3.0	0.8 [a] ±0.1	0.9* [a] ±0.1	21.1 [ab] ±1.1	19.6 * [a] ±1.6
14	14.5 [ab] ±2.6	18.8* [ab] ±2.2	38.6 [a-d] ±3.1	39.2 [a-d] ±2.9	0.8 [a] ±0.1	0.9* [a] ±0.1	21.7 [a-c] ±1.0	19.7* [a] ±1.9
15	14.2 [a-d] ±2.3	18.4* [ab] ±2.3	39.7 [a-d] ±3.3	40.5 [a-d] ±2.5	0.8 [a] ±0.1	0.9* [a] ±0.1	22.0[a-d] ±1.3	19.9 * [ab] ±1.3
16	13.9 [a-d] ±3.2	18.2* [ab] ±1.9	41.1 [a-e] ±3.2	41.6 [a-e] ±3.1	0.8 [a] ±0.03	0.9* [a] ±0.1	22.1[a-d] ±1.7	20.8* [a-c] ±1.5

All the values were expressed as mean and standard deviation (SD), N=25; P<0.05; * when compare to Tribal children, a when compare to 10yrs age group, b when compare to 11yrs age group, c when compare to 12yrs age group, d when compare to 13yrs age group, e when compare to 14yrs age group, f when compare to 15yrs age group; NS= not significant; LBM= lean body mass, MUAC= mid upper arm circumference, WHR= waist- hip ratio.

Childhood and adolescence are crucial periods of life, since dramatic physiological and psychological changes take place at these ages. During childhood and adolescence, body size and composition change markedly, which are strongly associated with the development of various physical performance characteristics. Body size plays important role during selection of players [15, 16, 17]. The tall players get an advantage during recruitment in athletics, soccer, volleyball and other games. Body mass is a considerable factor in games and sports, since body contact is essential in sports like soccer, field hockey and some other games [18, 19]. Body mass index (BMI) has been used as a simple anthropometric index which reflects the current nutritional status of an individual, and that of body surface area (BSA) can be made of an individual's daily resting energy expenditure [20]. In the present study, a significantly higher height, body mass and BSA were observed in Postpubertal children when compared to Prepubertal and Pubertal children. However, no significant change was reported in BMI among the groups. The possible reason for the increase in height Prepubertal to Pubertal and Postpubertal children might be the osteotropic response to exercise. The osteotropic effect of exercise is dependent on load dynamics, the volume, intensity and duration of training, administered on the individual and the period in life when exposure occurs [21]. The gain in height is dependent on growth hormone and exercise is a potent stimulus for growth hormone [22]. It has been reported that genetic influence can alter morphological status only within a narrow limit, set by his genotype [23]. Increment in body weight in each age category might be due to the increment in bone and muscle weight. The gain in weight is dependent on growth hormone and exercise is a potent stimulus for growth hormone [22]. It is possible that a particular body size will encourage acquisition of certain skills and force gravitation towards a specific playing position: this is likely to occur before maturity so that the individual will tend to favour one positional role before playing at senior level [18]. Similar findings were also noted by other research groups who reported significant change in these parameters with the advancement of age, level of maturation and exposure to high intensity of exercise for long time among the children [24, 25, 26].

The percentage of body fat plays an important role for the assessment of physical fitness of the players [18, 27, 28]. Generally, the amount of fat in an adult male in his mid-twenties is about 16.5% of body weight [20, 29, 30]. A lean body is desirable for all sports discipline [31, 32, 18]. A low-body fat may improve athletic performance by improving the strength-to-weight ratio [20, 29, 30]. Excess body fat adds to the load without contributing to the body's force-producing capacity [20, 29, 30]. A significantly lower ($P<0.05$) percent body fat was observed in Postpubertal children when compared to Prepubertal and Pubertal children. The lower body fat values in the postpubertal children might be because of exposure to long term and higher intensity of aerobic endurance training compared with Prepubertal and Pubertal children. This was supported by the evidence of significant increase in LBM in Postpubertal children when compared to Prepubertal and Pubertal children. This might be again due to long term effect of exercise among the Postpubertal children than Prepubertal and Pubertal children which reduced body fat and increased LBM among the Postpubertal children [32, 29, 17]. The observations of our study are supported by several studies, where decrease in body fat was noted with the advancement of age of the players [32, 29, 17].

3.2. Lipid-lipoprotein profiles of tribal and non-tribal children:

A significantly (P<0.05) higher total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) were observed among the non-tribal children when compared to tribal children of some age groups. On the other hand, significantly (P<0.05) lower high-density lipoprotein cholesterol (HDL-C) was noted among the non-tribal children when compared to tribal children of some age groups. On the other hand, a significantly higher (P<0.05) higher total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were noted with the advancement of age in both tribal and non-tribal children. However, significantly lower (P<0.05) body fat percent and WHR were observed with the advancement of age in both tribal and non-tribal children.

Table 3: Serum lipid and lipoprotein profiles of Tribal and Non-Tribal children of 10-16 years Age Groups

Age Group (yr)	TC (mg/dl)		TG (mg/dl)		HDL-C (mg/dl)		LDL-C (mg/dl)	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
10	159.2 ±8.5	171.5* ±9.8	68.8 ±4.9	79.2* ±6.2	32.8 ±3.9	29.6* ±2.4	110.9 ±8.0	126.1* ±7.8
11	157.5 NS ±9.1	169.5* ±7.5	67.8 ±5.9	74.4* ±5.2	33.4 ±3.0	30.5* ±2.1	112.2 ±7.5	124.1* ±8.6
12	154.2 a ±7.3	167.4* ±8.5	68.6 ±6.2	77.4* ±7.9	34.6 ±2.4	31.1* ±2.8	105.8 ±6.9	120.8* ±7.4
13	154.1 a ±7.4	164.6* ±8.5	66.5 ±8.9	75.8* ±6.7	34.7 ±2.7	31.7* ±3.4	106.1 ±7.7	117.8* ±5.3
14	153.3 a ±8.9	169.7* ±6.4	69.4 ±5.6	84.3* ±7.6	35.1 ±3.4	31.8* ±3.3	104.3 ±6.8	121.1* ±8.6
15	154.6 NS ±9.2	168.5* ±9.7	73.2 ±7.8	86.1* ±6.3	35.2 ±2.9	31.9* ±3.4	104.7 ±8.2	119.4* ±7.9
16	153.1 a ±7.7	167.6* ±11.4	77.9 ±6.4	86.3* ±7.2	34.5 ±2.8	31.1* ±2.9	106.2 ±6.6	121.2* ±8.4

All the values were expressed as mean and standard deviation (SD), N=25; P<0.05; * when compare to Tribal children, a when compare to 10yrs age group, b when compare to 11yrs age group, c when compare to 12yrs age group, d when compare to 13yrs age group, e when compare to 14yrs age group, f when compare to 15yrs age group; NS= not significant; TC=serum total cholesterol, TG=Serum triglycerides, HDL-C=high-density lipoprotein cholesterol, LDL-C=low-density lipoprotein cholesterol.

Lipids and lipoprotein profiles indicate the cardiovascular and metabolic status of athletes [4, 5]. Activity levels have significant impacts on the lipids and lipoprotein levels of athletes [4]. In the present study, a significantly ($P<0.05$) higher total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) were observed among the non-tribal children when compared to tribal children of some age groups. These changes might be due to exposure to high level of physical activity and or training among the tribal children when compared to non-tribal children. On the other hand, significantly ($P<0.05$) lower high-density lipoprotein cholesterol (HDL-C) was noted among the non-tribal children when compared to tribal children of some age groups. On the other hand, a significantly higher ($P<0.05$) total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were noted with the advancement of age in both tribal and non-tribal children. It indicates that as the maturation, level increase the level of HDL-C and lowers the level of triglyceride among the children. The possible reason for the reduction in triglyceride and elevation in HDL-C is physical activity and exercise training [4, 33, 34]. But no significant change was noted in total cholesterol and LDL-C level among the children. This may be because of low intensity and short duration of activities or improper optimization of the training load among the children. Our findings are supported by observations of other researchers in their recent studies [4, 33]. Cross-sectional studies also reported an increase in HDL-C level and decrease in triglyceride level after exercise [4, 33, 34]. A recent study showed significant increase in HDL-C level and decrease in LDL-C level, with no change in total cholesterol and triglycerides [33, 34]. Therefore, regular monitoring of lipids and lipoproteins profiles of young athletes is essential to optimize their health status which has direct effect on performance of the players.

4. Conclusion

Identification of children at early stage of their growth and development may produce elite athletes in the future. Talent identification also can be used as a counseling technique that helps to discover and explore areas of talent for particular athletes. In order to reach their goals, young children should be subjected to a series of tests reflecting their body composition and lipid-lipoprotein profile which indicate the metabolic status of the children. Improvement in these parameters depends on level of maturation factors and / or motivation, and exposure to long term and higher intensity of training. It has been seen that tribal children have significantly better body composition and lipid-lipoprotein profile than non-tribal children. It can be suggested that more emphasis should be given on the tribal children for identification of potentiality and talent in sports.

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