

Bio-Motor Performance of the Meitei Boys of Manipur

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ABSTRACT Six bio-motor performance tests viz., speed acceleration (50 m dash), agility (4 x 10 m shuttle run), cardio-respiratory endurance (600 m run), muscular endurance (flexed arm hang), strength-endurance (bent knee sit ups) and power (standing broad jump) have been administered on 969 boys aged 12 – 18 years belonging to the Meitei ethnic group of Manipur state, India. 488 of the boys are from affluent families and 481 from non-affluent families. The non-affluent boys are superior to the affluent boys in all the six tests in most of the age groups. Elder boys of both the socio-economic categories out-performed the younger ones in all the tests. The rate of performance increments during the growth phase are not uniform in both the boys groups. As revealed by the Hull scale scores, the most preferable event for the non-affluent boys appeared to be the cardio-respiratory test of 600 m run and that of the affluent boys, the power test of standing broad jump.

INTRODUCTION

Bio-motor performance is an expression used to describe a person's ability to perform efficiently basic skills involving such functional components like speed, agility, power, strength, endurance, etc. The tests for these components are more indicative of potential for athletic excellence than fitness for health promotion. Considering that each bio-motor skill has a dominant functional component, we may categorize a given exercise emphasizing quickness and high frequency as speed performance. When in a given exercise the load is maximized, it is called a strength performance. When distance, duration or the number of repetitions is maximized, one experiences an endurance performance (Bompa 1990). Furthermore, cardio-respiratory endurance is characterized by the ability of the circulatory and respiratory system to adjust to the vigorous exercise and to recover from the effect of that exercise (Phillips and Hornack 1979). However, performing an exercise is rarely dominated by only one component. Rather a movement is often the product or combination of two or more abilities. When strength and speed are almost equally dominant, as in jumping or throwing events, the product is called power. Power is the capability to give maximum acceleration to a body or competition implement or to counteract resistances with high speed (Neumann 1988). Whereas in some bio-motor skills the combination of speed and co-ordination i.e. agility is required. Agility is the ability of the body or parts of the body to change direction

quickly and to control body movement (Hockey 1973).

Studies on bio-motor performance of various bio-motor traits in the Indian populations are limited as yet (Punia 1988; Dhaliwal 1990). The present investigation has, therefore, been undertaken to fill this void by providing data on six bio-motor performances of the Meitei boys of Manipur state (India).

The Meiteis are the most populous community of the state of Manipur and mostly inhabit the valley region situated in the middle. The ethnic composition of the Meitei is predominantly mongoloid. The Meiteis have a rich culture, traditions, festivals, dances, handlooms and handi-crafts. They have also excelled in many games of physical activities resulting in many enthusiastic original indigenous games. Now reputed as an international game, Polo originated from the central valley of Manipur state (c. 3100 BC) when it was played as *Sagol Kangjei* (as recognized and approved by the Guinness Book of World records (1993). The language, spoken by them, popularly known as Manipuri or *Meiteilol*, belongs to Tibeto-Burman linguistic family.

MATERIAL AND METHODS

A cross-sectional sample of 969 apparently healthy Meitei boys ranging their age from 12 to 18 years have been selected from 22 educational institutions of the four valley districts of Manipur (India). To control the effect of physical training,

special care was taken to avoid anybody who had ever received any kind of physical / sports training prior to the present tests. 488 of the boys belong to affluent families and 481 to non-affluent families. The parents of affluent boys consisted of high ranking government officers of different statuses, doctors, advocates, engineers, university / college teachers and merchants. The parents of non-affluent boys comprised cultivators, carpenters, blacksmiths, retail traders, small-scale hotelieries, unskilled labourers, low grade government employees, unemployed and expired. Peak adolescent growth spurts pertaining to height and weight were found during 14 and 15 years in both the boys groups.

The six bio-motor performance tests administered following procedures given by Johnson and Nelson (1993) include:

<i>Performance test</i>	<i>Test items</i>
Speed acceleration	50 m dash Time (in sec) to complete the course in sprinting
Agility	4 x 10 m shuttle run Time (in sec) to run four times between two lines
Cardio-respiratory endurance	600m run Time (in sec) to run around 50 sq. m periphery three times
Muscular endurance	Flexed arm hang Maximal time (in sec) the subjects' chin stay above a horizontal bar
Strength-endurance	Bent knee sit ups Maximal repetitions the subjects' forehead touch the bent knees in supine lying position
Power	Standing broad jump Maximal jumping distance (in cm) as far forward as possible

Test and retest of the six test items were conducted on twenty subjects under more or less similar conditions prior to the mass testing and the test-retest yielded reliability co-efficients varying from $.92 < r < .96$. The raw scores of test items are also converted to standard scores by using the Hull scale (Mathews 1973) to enable comparison even among the tests of different natures. For statistical analysis, means, standard errors, standard deviations, and "t" test ($p < .05$ level) were calculated.

RESULTS AND DISCUSSION

Age-wise statistical constants for each bio-

motor performance test and composite score are depicted in tables 1 to 7. In the speed (acceleration), measured by 50 m dash (Table 1), the non-affluent Meitei boys are faster than the affluent counterparts in 12 to 15 years. Thereafter from 16 to 18 years the affluent boys show better performance than their non-affluent counterparts. Considering all the ages together, the average speed of the affluent boys is 8.43 sec which is slightly slower than the non-affluent boys, whose average speed is 8.38 sec.

In the agility test of 4 x 10 m shuttle run (Table 2), the speed is gradually accelerated from 12 to 18 years. It is noteworthy that the non-affluent boys are faster and more agile than their affluent counterparts at all age groups. Average performance of the affluent boys as a whole is 11.28 sec while that of the non-affluent boys is 11.18 sec.

Cardio-respiratory endurance, measured with the 600 m run test (Table 3), the non-affluent boys appear to be superior (better endurance) than the affluent coevals at all ages. The average performance of the non-affluent boys as a whole is 141.26 sec, whereas the affluent boys' average performance is 145.66 sec. The matured boys show better result than the younger ones. Gradually gaining results through ages, the fastest results achieved at 18 years is 130.81 sec for the affluent boys and 126.22 sec for the non-affluent boys.

In flexed arm hang test (Table 4) for muscular endurance of the arms, the mean value increases through ages culminating to 44.88 sec for the affluent boys and 47.08 sec for the non-affluent boys at 18 years. Overall average performance of the affluent boys is 39.79 sec and that of the non-affluent boys, 41.69 sec. The non-affluent boys show better performance than the affluent boys at every age group.

With regard to bent knee sit-ups test for strength-endurance of the abdominal muscles, overall mean score of the affluent boys is found to be 30 times, whereas that of the non-affluent boys is 31 times. It is observed that improvement of performance through aging is quite slow, showing no changes during 16 and 17 years (Table 5). The overall performance, however, is shown better by the non-affluent boys.

Like most of the tests discussed so far, better result of standing broad jump (Table 6), the test for power of the legs is also given by the non-affluent boys. Usual phenomenon of gradual improvement along with maturation is quite distinct. The overall average distance covered

Table 1: Descriptive statistics pertaining to 50 m dash of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	N	Meitei affluent boys				N	Meitei non-affluent boys				't' value**
		Raw Score (sec)		Hull Scale Score			Raw Score (sec)		Hull Scale Score		
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.	
12	68	9.26 $\pm$ 0.04	0.31	31.46	6.66	69	9.12 $\pm$ 0.03	0.29	34.00	6.23	2.27*
13	72	9.14 $\pm$ 0.03	0.25	34.25	6.31	68	9.01 $\pm$ 0.04	0.29	36.72	6.37	2.80*
14	69	8.67 $\pm$ 0.04	0.35	43.61	8.59	66	8.56 $\pm$ 0.05	0.38	44.91	10.04	1.74s
15	69	8.44 $\pm$ 0.05	0.44	48.70	9.36	70	8.34 $\pm$ 0.05	0.40	50.86	7.34	1.40
16	72	8.15 $\pm$ 0.03	0.25	54.92	5.21	68	8.20 $\pm$ 0.03	0.29	53.68	6.12	1.05
17	66	7.70 $\pm$ 0.05	0.40	64.70	7.07	70	7.77 $\pm$ 0.05	0.70	62.97	8.70	0.95
18	72	7.63 $\pm$ 0.05	0.46	67.33	9.18	70	7.73 $\pm$ 0.04	0.36	64.11	7.85	1.37
Total	488	8.43 $\pm$ 0.03	0.70	49.27	15.01	481	8.38 $\pm$ 0.03	0.61	49.72	13.36	1.18

*Statistically significant at 0.05 level ** Comparison between raw scores

Table 2: Descriptive statistics pertaining to shuttle run (4 x 10 m) of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys					Meitei non-affluent boys					't' value**
	N	Raw Score (sec)		Hull Scale Score		N	Raw Score (sec)		Hull Scale Score		
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.	
12	68	12.04 $\pm$ 0.04	0.34	33.68	6.34	69	12.01 $\pm$ 0.04	0.32	34.13	6.00	0.53
13	72	11.90 $\pm$ 0.07	0.61	36.33	11.75	68	11.80 $\pm$ 0.04	0.37	36.72	6.37	1.18
14	69	11.52 $\pm$ 0.08	0.68	44.58	13.34	66	11.45 $\pm$ 0.07	0.58	45.00	11.42	0.65
15	69	10.99 $\pm$ 0.07	0.59	54.70	11.93	70	10.81 $\pm$ 0.06	0.47	57.66	8.85	2.00*
16	72	10.93 $\pm$ 0.05	0.47	54.96	8.81	68	10.80 $\pm$ 0.06	0.53	58.00	10.22	1.53
17	66	10.81 $\pm$ 0.08	0.63	57.09	12.07	70	10.77 $\pm$ 0.07	0.60	58.46	11.55	0.38
18	72	10.78 $\pm$ 0.07	0.57	58.33	11.43	70	10.72 $\pm$ 0.07	0.61	59.91	11.50	0.60
Total	488	11.26 $\pm$ 0.03	0.75	48.80	14.10	481	11.18 $\pm$ 0.03	0.72	50.08	14.16	1.69

*Statistically significant at 0.05 level ** Comparison between raw scores

Table 3: Descriptive statistics pertaining to 600 m run of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys					Meitei non-affluent boys					't' value**
	N	Raw Score (sec)		Hull Scale Score		N	Raw Score (sec)		Hull Scale Score		
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.	
12	68	160.94 $\pm$ 0.35	2.89	31.10	3.19	69	159.97 $\pm$ 0.37	3.06	32.15	3.35	1.91
13	72	158.53 $\pm$ 0.41	3.51	33.73	3.88	68	157.45 $\pm$ 0.44	3.61	34.65	3.82	1.80
14	69	149.06 $\pm$ 0.80	6.63	43.89	7.06	66	146.34 $\pm$ 0.78	6.30	46.80	6.93	2.44*
15	69	146.60 $\pm$ 0.80	6.68	46.59	7.29	70	139.45 $\pm$ 0.83	6.92	54.29	7.43	6.20*
16	72	139.86 $\pm$ 0.77	6.56	53.92	6.98	68	132.44 $\pm$ 0.82	6.77	61.84	7.50	6.58*
17	66	133.85 $\pm$ 0.63	5.12	60.29	5.55	70	128.01 $\pm$ 0.50	4.17	66.73	4.47	7.27*
18	72	130.81 $\pm$ 0.54	4.62	64.25	4.89	70	126.22 $\pm$ 0.42	3.55	68.67	3.86	6.65*
Total	488	145.66 $\pm$ 0.54	11.97	47.69	13.04	481	141.26 $\pm$ 0.64	14.00	52.28	14.85	5.26*

*Statistically significant at 0.05 level **Comparison between raw scores

by the affluent boys is 184.8 cm and that of the non-affluent boys, 186.6 cm.

Table 7 exhibits age wise composite scores (total scale score of all the six tests) of bio-motor performances separately for the affluent and non-affluent boys. There is gradual increase of score from 12 to 18 years in both the affluent and non-

affluent groups. Better bio-motor performance of the non-affluent boys than their affluent counterparts at every age is very clearly seen in the table.

Results of 't' test show statistically significant difference between the affluent and non-affluent Meitei boys at 12 and 13 years in 50 m dash. Differences in other bio-motor performances are

Table 4: Descriptive statistics pertaining to flexed arm hang of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys					Meitei non-affluent boys					't' value**
	N	Raw Score (sec)		Hull Scale Score		N	Raw Score (sec)		Hull Scale Score		
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.	
12	68	35.32 $\pm$ 0.56	4.66	42.40	6.52	69	36.56 $\pm$ 0.56	4.64	44.20	6.63	0.77
13	72	35.33 $\pm$ 0.60	5.05	42.67	7.18	68	37.90 $\pm$ 0.80	6.57	46.21	9.34	1.59
14	69	35.88 $\pm$ 0.98	8.11	43.37	11.59	66	38.19 $\pm$ 1.10	8.90	46.67	12.79	0.11
15	69	39.43 $\pm$ 1.13	9.43	48.61	13.33	70	42.00 $\pm$ 1.24	10.35	52.16	14.69	0.15
16	72	43.13 $\pm$ 1.08	9.19	53.83	13.04	68	44.19 $\pm$ 1.61	13.32	55.09	19.87	0.55
17	66	44.58 $\pm$ 1.00	8.15	55.97	11.57	70	45.54 $\pm$ 1.38	11.55	56.96	16.42	0.56
18	72	44.88 $\pm$ 1.26	10.72	56.31	15.17	70	47.08 $\pm$ 1.54	12.85	59.09	18.14	1.11
Total	488	39.79 $\pm$ 0.41	9.14	49.03	13.01	481	41.69 $\pm$ 0.50	10.90	51.54	15.47	1.07

**Comparison between raw scores

Table 5: Descriptive statistics pertaining to bent knee sit ups of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys						Meitei non-affluent boys						't' value**
	N	Raw Score (sec)		Hull Scale Score		N	Raw Score (sec)		Hull Scale Score				
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.			
12	68	25 $\pm$ 0.44	3.60	40.47	6.14	69	26 $\pm$ 0.33	2.70	43.09	4.46	1.83		
13	72	27 $\pm$ 0.51	4.34	43.54	7.48	68	27 $\pm$ 0.43	3.57	44.68	5.99	1.08		
14	69	29 $\pm$ 0.87	7.23	47.04	12.16	66	30 $\pm$ 0.95	7.70	49.03	13.04	0.82		
15	69	32 $\pm$ 1.37	11.40	52.48	19.39	70	32 $\pm$ 1.05	8.78	52.77	15.43	0.27		
16	72	33 $\pm$ 1.13	9.57	54.25	16.22	68	34 $\pm$ 1.07	8.84	55.62	14.82	0.44		
17	66	33 $\pm$ 1.13	9.14	54.58	15.49	70	34 $\pm$ 1.11	9.31	56.26	16.23	0.77		
18	72	34 $\pm$ 0.91	7.73	55.33	13.28	70	35 $\pm$ 1.03	8.59	57.31	14.59	0.82		
Total	488	30 $\pm$ 0.39	8.61	49.68	14.67	481	31 $\pm$ 0.37	8.22	51.30	13.95	0.53		

**Comparison between raw scores

Table 6: Descriptive statistics pertaining to standing broad jump of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys					Meitei non-affluent boys					't' value**
	N	Raw Score (sec)		Hull Scale Score		N	Raw Score (sec)		Hull Scale Score		
		Mean $\pm$ S.E.	S.D.	Mean	S.D.		Mean $\pm$ S.E.	S.D.	Mean	S.D.	
12	68	156.6 $\pm$ 0.87	7.18	32.46	4.46	69	158.9 $\pm$ 0.77	6.40	33.93	3.87	1.98
13	72	162.5 $\pm$ 1.22	10.35	36.08	6.47	68	164.2 $\pm$ 0.81	6.70	37.12	4.06	1.16
14	69	177.2 $\pm$ 1.85	15.33	45.07	9.31	66	178.0 $\pm$ 1.90	15.47	45.61	9.41	0.30
15	69	187.2 $\pm$ 1.95	16.19	51.26	9.89	70	191.1 $\pm$ 1.69	14.18	53.64	8.63	1.51
16	72	198.0 $\pm$ 1.67	14.20	57.85	8.69	68	198.2 $\pm$ 2.11	17.42	57.94	10.66	0.07
17	66	205.3 $\pm$ 2.27	18.42	62.45	11.56	70	206.5 $\pm$ 2.37	19.86	62.99	12.13	0.37
18	72	206.7 $\pm$ 1.91	16.18	63.06	9.91	70	207.9 $\pm$ 1.68	14.05	64.36	8.88	0.47
Total	488	184.8 $\pm$ 1.07	23.54	49.75	14.46	481	186.6 $\pm$ 1.06	23.24	50.90	14.29	1.20

**Comparison between raw scores

not significant in these two age groups. However, composite scale scores differ significantly during 12 and 13 years. In 14 years group, the performance of 600 m run is significantly different i.e. significantly better among the non-affluent boys. Differences in other performances including the composite scores are not significant. In 15 years group, significant difference between the affluent and non-affluent boys is observed in two tests

viz. 4 x 10 m shuttle run and 600 m run. Of course, composite scale score is also significantly different. In the following 16, 17 and 18 years groups, significant difference between the affluent and non-affluent boys is found only in 600 m run. Their composite scores are also not significantly different. It is observed that distinctive difference between the Meitei boys of affluent and non-affluent families is shown by the performance of

Table 7: Descriptive statistics pertaining to bio-motor performance composite scores of the affluent and non-affluent Meitei boys by age group and 't' value for comparison

Age (in years)	Meitei affluent boys			Meitei Non-affluent boys			't' value
	N	Hull Scale Composite Score		N	Hull Scale Composite Score		
		Mean $\pm$ S.E.	S.D.		Mean $\pm$ S.E.	S.D.	
12	68	211.56 $\pm$ 1.85	15.28	69	221.37 $\pm$ 1.87	15.52	3.73*
13	72	226.60 $\pm$ 2.83	24.03	68	240.21 $\pm$ 2.71	22.32	3.47*
14	69	267.93 $\pm$ 4.30	35.69	66	277.47 $\pm$ 4.87	39.53	1.45
15	69	292.89 $\pm$ 5.44	45.16	70	318.00 $\pm$ 4.22	35.27	3.65*
16	72	329.77 $\pm$ 4.20	35.63	68	340.54 $\pm$ 4.14	34.13	1.83
17	66	355.08 $\pm$ 4.39	35.64	70	362.93 $\pm$ 5.02	42.02	1.18
18	72	364.46 $\pm$ 4.99	42.36	70	367.60 $\pm$ 4.53	37.94	0.47
Total	488	292.66 $\pm$ 2.98	65.93	481	304.52 $\pm$ 2.92	63.99	2.84*

*Statistically significant at 0.05 level

600 m run. This is true from 14 years onward. During the early stage of 12 and 13 years, significant difference is seen only in 50 m dash. With regard to composite scores, statistical difference is observed in 12, 13 and 15 years groups. The remaining age groups viz. 14, 16, 17 and 18 years display agreement between the affluent and non-affluent boys. Gross composite score (total of all the composite scores) is, however, significantly different.

In the tables, the performance scores are shown in two ways: actual (raw) scores and Hull scale scores. The latter scores enable us to compare among different bio-motor components. This will facilitate in identification of the most efficient component of an individual or a group. Considering the overall mean value (taking all the age groups together), the order of preference of the bio-motor efficiency among the affluent Meitei boys, as revealed by Hull scale scores, is: Power (standing broad jump) > Strength-endurance of abdominal muscles (bent knee sit ups) > Speed acceleration (50 m dash) > Muscular endurance of the arms (flexed arm hang) > Agility (4 x 10 m shuttle run) > Cardio-respiratory endurance (600 m run). The non-affluent boys' preferential order is quite different from the above. Their successive order of preference is Cardio-respiratory endurance (600 m run) > Muscular endurance of the arms (flexed arm hang) > Strength-endurance of abdominal muscles (bent knee sit ups) > Power (standing broad jump) > Agility (4 x 10 m shuttle run) > Speed acceleration (50 m dash). It is now very clearly confirmed that the discriminatory line between the affluent and non-affluent Meitei boys is drawn by 600 m run. Of all the six tests, the non-affluent boys performed the best in this test as revealed by Hull scale scores. On the contrary,

the affluent boys' performance in this test is the worst of all the tests.

The matter of concern, obtained from the six bio-motor performances is the dominance of the non-affluent boys over the affluent boys in almost all ages during 12 to 18 years. This is in contrast to the simple expectations that the boys from affluent families, who are supposed to have better nourishment and eventually experienced faster growth than those of non-affluent boys, would give better performance in various bio-motor tests. The present finding is, however, in conformity with that of Ponthioux and Barker (1965) who reported that subjects from lower socio-economic status performed better on agility, speed and strength tests of abdominal and hip flexor muscles. The present author observes that the boys from non-affluent families have thinner subcutaneous fat layers (Singh et al. 2001) and consequently greater muscular and skeletal masses (Singh et al. 1999) which may provide better mechanical efficiency in performing bio-motor activities. A low body fat percentage has been shown to improve performance in endurance events, while a large muscle mass is important during strength and power activities (Heyward and Stolarczyk 1996). The affluent boys with substantial amount of adipose tissue i.e. fat mass, have greater energy demand to perform bio-motor activities because of heavier weight of fat. An increase in fat mass and consequent loss of lean body mass is reported to lead to decrease in work capacity and muscular strength (Grimby and Saltin 1983; Flynn et al. 1989). Moreover, luxurious lifestyle of the affluent boys with modern amenities including motor vehicles may have restricted body movement and exercise by which fat mass could not be properly utilized for better development of muscle mass.

As expected, the more maturing boys perform better than younger ones. As the adolescent grows in age, neuromuscular and qualitative changes in muscle tissues enable him to coordinate and utilize these developments to the advantage of improving performances on bio-motor tasks. Increase in length and frequency of strides as the adolescents grew are the reasons for the superiority in speed, agility and endurance with the increase in chronological age. The linear gains in speed acceleration and agility by age are in agreement with those indicated by other studies (Cratty 1975; Corbin 1976; Sohi 1986). The increase of strength with size and maturity is evident and has been demonstrated (Jones 1949; Hunsicker and Greey 1957; Dhaliwal 1990).

It is evident that bio-motor performances do not show the same identical pattern of changes relative to periods of maximum growth in height and weight. The greatest peak performances in speed (50 m dash), cardio-respiratory endurance (600 m run), and power (standing broad jump) tests are appeared one year before the maximum growth spurts in height and weight i.e. during 13 to 14 years in both the affluent and non-affluent boys. Agility test of 4 x 10 m shuttle run and muscular- endurance test of flexed arm hang demonstrate peak changes coincident with height and weight spurt in both the boys groups. Strength-endurance measured with bent knee sit ups test exhibits peak change during 14 to 15 years among affluent boys and between 13 and 14 years among non-affluent boys.

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