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Length Dimension Correlates of Longitudinal Physical Conditioning on Indian Male Youth

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Abstract**—**Various length dimensions of the body have been a variable of interest in the research areas of kinanthropometry. However the inclusion of length measurements in various studies remains restricted to reflect characteristics of a particular game/sport at a particular time. Hence, the present investigation was conducted to study various length dimensions correlates of a longitudinal physical conditioning program on Indian male youth. The study was conducted on 90 Indian male youth. The sample was equally divided into three groups namely, progressive load training (PLT), constant load training (CLT) and no load training (NL). The variables included sitting height, leg length, arm length and foot length. The study was conducted by adopting the multi group repeated measure design. Three different groups were measured four times after completion of each of the three meso-cycles of six-weeks duration each. The measurements were taken using the standard landmarks and procedures. Mean, standard deviation and analysis of co-variance were computed to analyze the data statistically. The post-hoc analysis was conducted for the significant F-ratios at 0.05 level. The study concluded that the followed longitudinal physical conditioning program had significant effect on various length dimensions of Indian male youth.

Keywords**—**Indian male youth, longitudinal, length dimensions, physical conditioning.

I. Introduction

KINANTHROPOMETRY is defined as the application of measurements of human size, shape, proportion, composition, maturation and gross functions. It has the purpose of helping us to understand human movement in the context of growth, exercise, performance and nutrition [1], [2]. The modern sports demands a detailed information regarding kinanthropometric characteristics of athletes as most of them are almost genetically determined [3].

Physical conditioning aims at developing physical fitness while adapting to an exercise program [4]. A conditioned body is essential to perform at a high level of effectiveness [5].

Appropriate conditioning helps in stretching and strengthening the connective tissue comprising tendons, ligaments, and joint capsules. It aids in the increase of the cross-sectional width of stretched muscles. The positive stress on bones increases their density and become stronger over a period of time. Conversely, soft tissue and bony tissue that are adversely stressed will become weakened over time [6].

The measurements of various dimensions of the human body have long been used by different researchers all over the world for different purposes [7]-[12]. Researchers in the field of human growth and development use these measurements to precisely study the age specific changes in the main body segments and the components of these segments. Through these changes, the amount and rate of growth can assessed for an individual [13]. However the inclusion of lengths in various studies remains restricted to reflect characteristics of a particular game/sport at a particular time. Hence, the present investigation was conducted to study the selected length dimensions correlates of a longitudinal physical conditioning program of 18-weeks duration on Indian male youth.

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II. Procedure

A. Sample

The study was conducted on 90 Indian male youth, with the age ranging between 17 and 23 years. The sample was equally divided into three groups. The first group was subjected to the progressive load of training and was coded as PLT. The second group was subjected to the constant load of training and was coded as CLT. The third group was the sedentary group or the no-load group which was coded as NL.

B. Variables

Sitting height, leg length, arm length and foot length were the selected variables for the purpose of the present study.

C. Experimental Protocol

The study followed a multi-group repeated measure design.

Three different groups were measured four times repeatedly at an interval of six weeks on completion of each of the three meso cycles. The PLT group participated in a step progression loading based physical conditioning program in addition to the regular physical activities of their curriculum. The subjects of the CLT group participated in the regular physical activities of their curriculum. The third group served as the control group as there was no training load of physical activities during the period of experimentation (NL).

D. Collection of Data

The data were collected using standard landmarks and measurement protocols.

E. Statistical Procedure

The data were statistically analyzed using mean and standard deviation for description, and analysis of co-variance for assessing the effect of conditioning program on selected groups during different stages of training and testing. The post-hoc analysis was conducted for the variables where, F-

ratio was observed to be significant at 0.05 level in ANCOVA.

III. Results and Discussion

The results have been presented in the Tables I-III and illustrated in Fig. 1.

The analysis of data in Table I and illustrated in Fig. 1 pertaining to the descriptive statistics of selected length dimensions of Indian male youth, reveals that the mean values of all the selected four variables observed an increasing trend among all the selected groups, i.e. the progressive training load or conditioning group (PLT), constant training load or non-conditioning group (CLT); as well as for the no-load or sedentary group (NL), reflecting that the training might have influenced the selected variables. The data were further subjected to the analysis of covariance to evaluate if the increase is due to the conditioning or growth. Its analysis is presented in Table II.

Table II pertains to the analysis of co-variance of selected length dimensions of Indian male youth demonstrated F-ratios for the adjusted post-test means for comparison among different groups namely PLT group, CLT group and NL group for different stages of conditioning program. The calculated 'F-ratios' significant at 0.05 level are marked with * symbol.

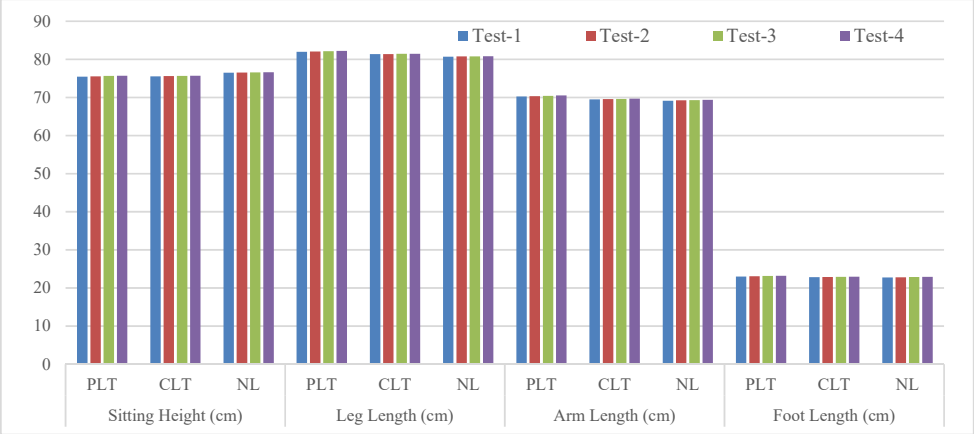

Fig. 1 Comparison of Selected Length Dimensions of Indian Male Youth

TABLE I
Descriptive Statistics of Selected Length Dimensions of Indian Male Youth

Variable	Group Code	N	*Test-1*		Test-2		Test-3		Test-4	
			Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Sitting Height (cm.)	PLT	30	82.57	3.06	82.63	3.06	82.72	3.06	82.81	3.08
	CLT	30	81.46	2.91	81.53	2.89	81.61	2.90	81.69	2.90
	NL	30	82.07	3.08	82.10	3.10	82.14	3.09	82.18	3.07
Leg Length (cm.)	PLT	30	87.70	3.02	87.79	3.03	87.88	3.03	87.98	3.04
	CLT	30	86.89	2.50	86.94	2.51	86.99	2.51	87.03	2.51
	NL	30	86.87	2.57	86.95	2.57	87.00	2.56	87.05	2.54
Arm Length (cm.)	PLT	30	77.15	3.09	77.28	3.07	77.43	3.08	77.53	3.10
	CLT	30	77.14	3.17	77.21	3.16	77.26	3.16	77.30	3.16
	NL	30	75.97	2.49	76.05	2.53	76.14	2.52	76.21	2.52
Foot Length (cm.)	PLT	30	25.41	1.20	25.46	1.20	25.60	1.18	25.64	1.17
	CLT	30	25.08	1.08	25.15	1.09	25.19	1.10	25.23	1.09
	NL	30	24.57	1.46	24.60	1.46	24.69	1.43	24.74	1.44

PLT = Progressive Load Training (Conditioning Group); CLT = Constant Load Training (Non-Conditioning Group); NL = No Load (Sedentary Group)

TABLE II
Analysis of Covariance of Selected Length Dimensions of Indian Male Youth

Variable	Difference of Means					
	Stage-1 (0-6 weeks)	Stage-2 (0-12 weeks)	Stage-3 (0-18 weeks)	Stage-4 (6-12 weeks)	Stage-5 (6-18 weeks)	Stage-6 (12-18 weeks)
Sitting Height	10.85*	15.04*	24.10*	2.99	10.12*	6.59*
Leg Length	3.13*	6.73*	14.21*	2.82	10.05*	5.57*
Arm Length	3.11	19.03*	27.30*	16.63*	25.81*	4.96*
Foot Length	3.62*	6.00*	4.31*	6.05*	3.89*	0.07

The findings exhibit that sitting height and leg length were found to be statistically significant in all the stages of training

and testing except for stage-4 i.e. 6-12 weeks of training, where insignificant differences were observed. Arm Length observed statistically insignificant difference at stage-1, however, it was significant for all other stages of training. Foot Length also observed statistically significant difference in all the stages of experiment except for stage-6 i.e. 12-18 weeks.

The post-hoc t-test for paired mean comparison was applied where F-ratio was found to be statistically significant to find out which of the groups significantly differed in the adjusted post means. Results pertaining to the same are presented in Table III.

TABLE III
POST-HOC COMPARISON OF ADJUSTED POST MEANS OF SELECTED LENGTH DIMENSIONS OF INDIAN MALE YOUTH

Variable	Mean Difference between PLT and CLT					
	Stage-1 (0-6 weeks)	Stage-2 (0-12 weeks)	Stage-3 (0-18 weeks)	Stage-4 (6-12 weeks)	Stage-5 (6-18 weeks)	Stage-6 (12-18 weeks)
Sitting Height	0.044	0.053	0.066	0.009	0.023	0.013
Leg Length	0.046	0.086*	0.144*	0.040	0.098*	0.058
Arm Length	0.050	0.16*	0.22*	0.11*	0.17*	0.06*
Foot Length	0.016	0.080	0.078	0.064*	0.062	0.002
	Mean Difference between PLT and NL					
Variable	Stage-1 (0-6 weeks)	Stage-2 (0-12 weeks)	Stage-3 (0-18 weeks)	Stage-4 (6-12 weeks)	Stage-5 (6-18 weeks)	Stage-6 (12-18 weeks)
Sitting Height	0.087*	0.130*	0.187*	0.043	0.100*	0.057*
Leg Length	0.013	0.046	0.097*	0.034	0.085*	0.051
Arm Length	0.04	0.11*	0.14*	0.07*	0.100*	0.030
Foot Length	0.050	0.079	0.072	0.030	0.023	0.006
	Mean Difference between CLT and NL					
Variable	Stage-1 (0-6 weeks)	Stage-2 (0-12 weeks)	Stage-3 (0-18 weeks)	Stage-4 (6-12 weeks)	Stage-5 (6-18 weeks)	Stage-6 (12-18 weeks)
Sitting Height	0.043	0.077*	0.120*	0.034	0.077*	0.043
Leg Length	0.033	0.040	0.047	0.007	0.013	0.007
Arm Length	0.01	0.05	0.080	0.04	0.07*	0.03
Foot Length	0.033	0.001	0.006	0.034	0.038	0.004

PLT = Progressive Load Training (Conditioning Group); CLT = Constant Load Training (Non-Conditioning Group); NL = No Load (Sedentary Group); *Significant at .05 level; NS = Not Significant at .05 level

The analysis of data in Table III displays that both the progressive load and constant load of training bring changes in various length dimensions of Indian male youth. The changes are as follows:

- The progressive load of training (conditioning program of 18-weeks duration) had the following effects (difference between PLT and CLT):
  - Insignificant changes in sitting height in all the stages of experimentation.
  - Significant changes in leg length in stage-2, stage-3 & stage-5 and insignificant change during stage-1, stage-4 & stage-6 of training.
  - Significant changes in arm length during stage-2, stage-3, stage-4, stage-5 & stage-6 and insignificant changes during stage-1 of training.
  - Insignificant changes in foot length during all the stages of training except stage-4 i.e. 6-12 weeks of training, where significant changes were observed.
  - Six-weeks of conditioning has insignificant effect on all the selected length dimensions.
  - Twelve-weeks as well as 18-weeks of conditioning observe significant changes in the leg length and arm length; and insignificant changes in sitting height and foot length.
  - The intermittent stages of testing reveal that Stage-4, i.e. 6-12 weeks of conditioning, observe significant changes in arm length and foot length, while insignificant changes are observed for sitting height and leg length. Stage-5, i.e. 6-18 weeks of conditioning, observe significant changes in leg length and arm length; and insignificant changes in sitting height and foot length. Stage-6, i.e. 12-18 weeks of conditioning, observe significant changes only in the leg length; and insignificant changes in sitting height, leg length, and foot length.
- The combination of progressive load (conditioning program of 18-weeks) and constant load of training (regular physical education program of the institute) observed the following effects (difference between PLT and NL):
  - Significant changes in sitting height in all the stages except stage-4 i.e. 6-12 weeks of training.
  - Significant changes in leg length during stage-3 & stage-5, and insignificant changes during stages stage-1r, stage-2, stage-4 & stage-6 of training.
  - Significant changes in arm length during stage-2, stage-3, stage-4 & stage-5 of training and insignificant changes during stage-1 & stage-6.
  - Insignificant changes in foot length during all the stages of training and testing.
  - Six-weeks of conditioning had significant effect on sitting height and insignificant effect on leg length, arm length and foot length.
  - Twelve-weeks of conditioning observed significant changes in the sitting height and arm length; and insignificant changes in leg length and foot length.
  - Eighteen-weeks of conditioning observed significant changes in the sitting height, leg length, & arm length; and insignificant changes in foot length.
  - The intermittent stages of testing reveal that, Stage-4, i.e. 6-12 weeks of conditioning, observed significant changes in arm length only while insignificant changes are observed for all other variables including sitting height, leg length and foot length. Stage-5, i.e. 6-18 weeks of conditioning, observed significant changes in sitting height, leg length and arm length; and insignificant changes in foot length. Stage-6, i.e. 12-18 weeks of conditioning, observed significant changes only in the

sitting height and insignificant changes in leg length, arm length and foot length.

- The constant load of training (regular physical education curriculum) had the following effects (difference between CLT and NL):
  - Significant changes in sitting height during stage-2, stage-3 & stage-5 and insignificant changes in stage-4 i.e. 6-12 weeks of training.
  - Insignificant changes in leg length and foot length during all the stages of training and testing.
  - Significant changes in arm length only during stage-5 and insignificant changes during stage-1, stage-2, stage-3, stage-4 & stage-6 of training.
  - Six-weeks of conditioning had insignificant effect on all the selected variables.
  - Twelve-weeks of conditioning observed significant changes in the sitting height; and insignificant changes in arm length, leg length and foot length.
  - Eighteen-weeks of conditioning observed significant changes in the sitting height; and insignificant changes in arm length, leg length and foot length.
  - The intermittent stages of testing reveals that the stage-4, i.e. 6-12 weeks, and stage-6, i.e. 12-18 weeks of conditioning, observed insignificant changes in all the selected variables during all the stages of experimentation. Stage-5, i.e. 6-18 weeks of conditioning, observed significant changes in sitting height, and arm length; and insignificant changes in foot length.

IV. Conclusion

The study concluded that both the progressive and constant load of conditioning had significant effect on selected length dimensions of Indian male youth.

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