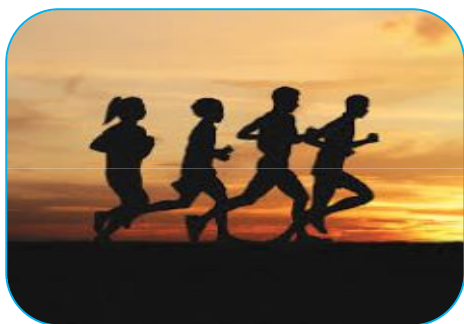




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ANALYSIS OF ANTHROPOMETRIC POWER INTERMITTENT GAIT AND PERFORMANCE RELATED PARAMETERS OF MIDDLE DISTANCE RUNNERS

**Dr.K. Sekarbabu¹, Dr.P.Kulothungan¹ and
 Dr. R. Prabhu²**

¹Assistant Professor, Department of physical education,
 Annamalai University, Chidambaram, Tamil nadu, India.
²Director of Physical Education, Jawahar Science College,
 Neyveli, Tamil Nadu, India.

ABSTRACT:

The aim of the present study was to investigate the anthropometric, power, intermittent gait and performance related variables of middle distance runners. The data were collected from 20 middle distance runners from various summer coaching camps, which were held during the year 2018-19 conducted by Sports Development Authority of Tamilnadu. The age of the selected subjects ranged from 18 to

25 years. The present study consists of one criterion variable namely performance of middle distance runners in 800mts running and twelve predictor variables namely height, arm girth, thigh girth, calf girth, arm length, leg length, explosive power, elastic power, stride length, stride rate, muscular strength and anaerobic power were selected for this study. They were measured by standard tests. The collected data were statistical analysis to determine the relationship between criterion and predictor variables by using the pearson's product moment correlation. The step wise selection method of multiple regressions was used in this study to find out the contributing variables that have the highest correlation with the criterion variable. The variables were entered into the equation depending on the contribution of each predictor. In all cases 0.05 level of significance was fixed. The results indicate that, the anthropometric, power, intermittent gait and performance related variables are significantly related to middle distance running performance.

KEYWORDS: Anthropometric, Power, Intermittent Gait and Middle distance runner.

INTRODUCTION:

The human body is a machine of wonderful complexity, capable of strong and violent movements. This machine is made up of slightly more than two hundred bones to which are attached better than six hundred muscles.

There are numerous factors, which are influencing performance of a sportsman

including shape, size, weight and height. Each and every nation wants to show their supremacy in sports and games. The Olympic motto itself shows "Faster, higher and stronger". The challenges inspire all the nations to exhibit greater performance in sports through application of research in modern science and technology. In order to dominate and excel in a particular sport, the player must possess all the essential elements required for the performance task. If a player

enters a competition for which he is unfit, he does so with distinct disadvantage compared to his opponent who possesses required features for meeting the challenges.

The most common middle distance track events are the 800 meters, 1500 meters and mile run, although the 3000 meters may also be classified as a middle distance event. The distance runners represent efficiency in a way that is rarely seen in sports. Their form is fluid and economical with little wasted

motion. The foot-strike is often near the heel in an effort to absorb impact, and the feet are lifted no higher than necessary to complete each stride.

In prediction, results are anticipated beforehand. Usually, the anticipated results are not chance guesses but are based upon some known facts of relationship or carefully conceived beliefs. Anthropometric measurements, power and gait are some of the factors which really dominate the middle distance running ability. Studies have pointed out the importance of physical characteristics for different sports such as volleyball **Malousarisa et al., (2007)**, rugby (**Gabbett, 2002**), and basketball (**Neto e César, 2005**). The changing nature of game demands better skill and increased physical abilities. It is a known fact that players should be better in morphological measures, body composition, motor fitness components and physiological traits. But there is no previous study in India to determine the factors, which dominate in middle distance runners and also to determine the factors, which contribute for successful outcome in the performance. The present study is a sincere attempt on the above so-far unexplored area. Hence, based on the available literatures and the researcher has made an attempt, to explore the analysis of anthropometric, power, gait and performance related variables of middle distance runners.

Methods

Subjects

The purpose of the study was to analyze the anthropometric, power, intermittent gait and performance related parameters of middle distance runners. To achieve these purposes 20 middle distance runners on the basis of performance from various summer coaching camps, which were held during the year 2018-19 conducted by Sports Development Authority of Tamilnadu were selected as subjects. The subject's age ranged from 18 to 25 years.

Variables

Distance runners represent efficiency in a way that is rarely seen in sports. Their form is fluid and economical with little wasted motion. The foot-strike is often near the heel in an effort to absorb impact, and the feet are lifted no higher than necessary to complete each stride. Little vertical oscillation is found among distance runners, while arm motion is primarily for proper counterbalance. Internally, it is even more dramatic with lungs, muscles, and a heart that are incredibly adapted to handle long periods of stress. With distance running, however, there are elements of running technique that overlap. In the course of a distance event, there comes a time near the end of the race where economy of movement gives way to speed. The runners become less concerned with their economy and more concerned with crossing the finish line as soon as possible. Hence, the individual running performance of 800 meters was selected as criterion variable.

Human performance is a composition of many variables such as structure of the body, the specific measurements of the limb's circumferences, breadth and body build. Since motor performance is an outcome of various variables, there may be a direct relationship between certain specific measurements and motor performance. Through intensive study of literature of sport and on the basis of the experience oriented observation and a number of factors affecting sports performance were identified. Some of these factors were found to be intrinsic while some extrinsic. The intrinsic factors were found to be internal whereas that of the extrinsic factors was found to be external. Hence, considering the above facts and concepts, the anthropometric, power, intermittent gait and performance related parameters were selected as predictor variables for this study.

The selected criterion and predictor variables namely anthropometric, power, intermittent gait and performance related parameters and its respective tests are presented in the table-I.

Table-I: The selected criterion and predictor variables and its respective tests

S. No	Criterion Variable	
1.	800 meters Running Performance	
	Predictor Variables	Test items
Anthropometric Variables		
1.	Height	Stadiometer
2.	Calf Girth	Lufkin Anthropometric Tape
3.	Arm Girth	Lufkin Anthropometric Tape
4.	Thigh Girth	Lufkin Anthropometric Tape
5.	Arm Length	Lufkin Anthropometric Tape
6.	Leg Length	Lufkin Anthropometric Tape
Power Variables		
7.	Explosive Power	Standing Broad Jump
8.	Elastic Power	Bunny Hop Test
Intermittent Gait Variables		
9.	Stride Length	Digital Cameras For Pd 170
10.	Stride Rate	Digital Cameras For Pd 170
Performance Related Variables		
11.	Muscular Strength	Push-Ups
12.	Anaerobic Power	Margaria – Kalamen Test

Statistical Procedure

The present study consists of one criterion variable namely performance of middle distance runners and twelve predictor variables such as height, calf girth, arm girth, thigh girth, leg length, arm length, muscular strength, anaerobic power, stride length, stride rate, explosive power and elastic power. The collected data were subjected to statistical analysis as explained below. To determine the relationship between dependent variable and independent variable Pearson's product moment correlation was used. Step wise selection method of multiple regressions was used for the middle distance runners in this study. To find out the predictor variables that has the highest correlation with the criterion variable and it is entered into the equation first. The rest of the variables are entered into the equation depending on the contribution of each predictor. In all the cases 0.05 level of significance was fixed.

Results

The summary of the mean and standard deviation values on selected criterion and predictor variables have been presented in table-II.

Table-II: The summary of the mean and standard deviation values on selected criterion and predictor variables

S.No	Variables	Mean	Standard Deviation
1.	800mts Performance	2.77	0.42
2.	Height	175.55	2.64
3.	Arm girth	30.75	1.61
4.	Thigh Girth	57.25	1.16
5.	Calf Girth	35.37	2.28
6.	Arm Length	78.95	4.19
7.	Leg Length	95.12	3.98
8.	Explosive Power	2.85	0.21

9.	Elastic Power	9.46	0.09
10.	Stride Length	1.92	0.37
11.	Stride Rate	393.83	73.56
12.	Muscular Strength	22.70	2.92
13.	Anaerobic Power	104.20	3.92

The data on selected predictor and middle distance running performance variables were statistically analyzed by using co-efficient of correlation and the results were presented in table-III.

Table-III: Co-Efficient of Correlation between the Selected Predictor Variables and Performance of Middle distance runners

S.No	Variables	"R" Value
1.	Height	.55*
2.	Calf Girth	.21
3.	Arm Girth	-.03
4.	Thigh Girth	-.34
5.	Arm length	-.07
6.	Leg length	-.32
7.	Explosive Power	-.28
8.	Elastic power	.34
9.	Muscular Strength	-.32
10.	Anaerobic Power	.50*
11.	Stride Length	-.55*
12.	Stride Rate	.56**

*Table value required for significance is 0.549 at .01 level of confidence

The table - III shows that the height, anaerobic power, stride length, and stride rate showed significant associations with performance of middle distance runners. The associations were moderate to high and ranged from 0.50 to 0.56. The arm girth, thigh girth, leg length, explosive power and muscular strength showed no significant association with performance of middle distance runners.

The data on selected predictor and middle distance running performance variables were statistically analyzed by using pearson's product moment correlation and the results were presented in table-IV.

Table-IV: Pearson's Product Moment Correlation between Criterion and Determinant Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1	1											
2	.25	1										
3	.32	.19	1									
4	.40	-.01	.40	1								
5	.18	.04	-.14	.38	1							
6	.21	.05	.10	.58**	.86**	1						
7	.25	-.21	.19	.63**	.29	.53*	1					
8	.34	-.09	.00	-.31	-.14	.23	-.26	1				
9	-.25	-.36	-.10	.22	-.08	-.24	.01	-.21	1			

10	-.11	.23	-.43	-.55*	-.17	-.52*	-.73**	.36	.08	1		
11	-.08	.14	.07	.33	.26	.61**	.53*	-.16	-.45*	-.47*	1	
12	.06	-.11	-.11	-.36	-.22	-.60**	-.57**	-.06	.43	.52*	-.99**	1

*Correlation at .05 level

** Correlation at .01 level

1 -Height, 2- Calf girth, 3- Arm girth, 4 -Thigh girth , 5-Arm Length, 6- Leg Length,7- Explosive power, 8-Elastic power, 9- Muscular strength, 10- Anaerobic power, 11- Stride length and 12- Stride rate.

The table-IV shows that the thigh girth is having significant association with leg length, explosive power and anaerobic power. The leg length is having significant association with thigh girth and arm length, the explosive power is having significant association with thigh girth and leg length, the anaerobic power is having significant association with thigh girth, explosive power and leg length the stride length is having significant association with leg length, explosive power, muscular strength and anaerobic power and the stride rate is having significant association with leg length, explosive power anaerobic power and stride length . The association of these variables was moderate to high ranging from 0.45 to 0.99.

Multiple regression equation was computed since; the multiple correlations are sufficiently high to warrant prediction from it. Then, the correlation identifies the independent variables to be included and their order in the regression equation. Multiple correlations were computed by stepwise selection method on data obtained from the middle distance runners and the results were presented in table-V.

Table-V: Multiple Correlation Co-Efficient for the Predictors of Performance of Middle distance runners

S. No	Variables (step wise method)	R	R Square	Adjusted R Square	R Square Change
1	Stride rate	.565	.319	.281	.319
2	Stride rate Muscular strength	.850	.723	.690	.404
3	Stride rate Muscular strength Height	.915	.837	.806	.114
4	Stride rate Muscular strength Height anaerobic power	.939	.881	.850	.045
5	Stride rate Muscular strength Height Anaerobic power Explosive power	.991	.981	.974	.100

From the table-V, it was found that the multiple correlation coefficient for predictors such as stride rate, muscular strength, height, anaerobic power and explosive power 0.991 which produce highest multiple correlation with performance of middle distance runners. R square values showed that the percentage of contribution of predictors to the performance of middle distance ability (dependent variable) in the following order.

1. About 31% of the variation in the middle distance ability was explained by the regression model with one predictor variable namely stride rate.

2. About 72% of the variation in the middle distance ability was explained by the regression model with two predictors, stride rate and muscular strength. An additional 32 % of the variance in the middle distance ability is contributed by stride rate.
3. About 84% of the variation in the middle distance ability was explained by the regression model with three predictors stride rate, muscular strength and height. An additional 12% of the variance in the middle distance ability is contributed by height.
4. About 88% of the variation in the middle distance ability was explained by the regression model with four predictors, stride rate, muscular strength, height, and anaerobic power. An additional 4% of the variance in the in the middle distance ability is contributed by anaerobic power.
5. About 98% of the variation in the middle distance ability was explained by the regression model with four predictors, stride rate, muscular strength, height, anaerobic power and explosive power. An additional 10% of the variance in the middle distance ability is contributed by explosive power.

Multiple regression equation was computed and the results were presented in table-VI

Table-VI: Regression Coefficients for the Predicted Variables with Performance of Middle distance runners

Variables	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	Beta
(Constant)	1.224	.541	
Stride rate	.004	.001	.565
(Constant)	2.724	.466	
Stride rate	.006	.001	.875
Muscular strength	-.104	.021	-.707
(Constant)	-7.605	3.118	
Stride Rate	.005	.001	.798
Muscular Strength	-.085	.017	-.582
Height	.058	.017	.356
(Constant)	-10.995	3.092	
Stride Rate	.004	.001	.629
Muscular Strength	-.075	.016	-.514
Height	.067	.016	.413
Anaerobic Power	.019	.008	.261
(Constant)	-11.138	1.276	
Stride rate	.006	.000	.929
Muscular strength	-.106	.007	-.724
Height	.036	.007	.222
Anaerobic Power	.040	.004	.538
Explosive power	1.280	.149	.594

From the table-VI, the following regression equations were derived for middle distance runners with Predicted variables.

1 -Regression Equation in obtained scores form = Performance

$$\text{Performance} = -11.138 + (0.006 \times \text{Stride Rate}) + (-0.106 \times \text{Muscular Strength}) + (0.036 \times \text{Height}) + (0.040 \times \text{Anaerobic Power}) + (1.280 \times \text{Explosive Power})$$

The regression equation for the prediction of middle distance ability includes stride rate, muscular strength, height, anaerobic power and explosive power. As the multiple correlations on middle distance ability with the combined effect of these independent variables is highly significant, it is

apparent that the obtained regression equation has a high predictive validity. Thus, this equation may be successfully utilized in selecting middle distance runners.

FINDINGS

Sports performance is based in a complex and intricate diversity of variables, which include physical (general and specific conditions), psychological (personality and motivation) and body (body morphology, anthropometry and body composition) factors. The relationship between morphological variables and sports performance is the object of study of anthropometry and it's an important element to be analyzed. The performance of middle distance runner has been regularly influenced to a great extent by anthropometric, power, intermittent gait and performance related variables. The primary purpose of the study was to analyze the selected anthropometric, power, intermittent gait and performance related variables of middle distance runners. The researcher reviewed number of related studies, books and research articles and found that significant relationship between performance and the entire selected anthropometric, power intermittent gait and performance related variables of middle distance runners. **Abhariam (2011)**, has predicted the performance ability of middle distance runners in relation to selected anthropometric measurements namely standing height, weight, upper leg length, hip width, shoulder width, and chest width are significantly related to running performance. **Abraham (2010)**, stated that, the anthropometry and body composition associated with performance of university level male track and field athletes of South India **Van Someren and Palmer (2003)**, were determined that superior upper body dimensions and anaerobic capacities distinguish international-level kayakers from national-level athletes and may be used to predict 200-m performance. **Pui Kong (2008)**, has proved that the success of Kenyan distance runners. The slim limbs of Kenyan distance runners may positively contribute to performance by having a low moment of inertia and thus requiring less muscular effort in leg swing. The short ground contact time observed may be related to good running economy since there is less time for the braking force to decelerate forward motion of the body. **Niels (2005)**, have compared the anthropometry of middle distance runners and people belonging to the normal population. These anthropometric characteristics typical of runners might be explained, in part, by the influence the anthropometric characteristics have on relative muscle strength and step length. **Olmo and Castillo (2005)** have documented that the strength is an important factor in athletic performance. Therefore the use of this parameter is recommended for measuring explosive strength related to running performance in the athlete. However, the findings of above studies are in agreement with the findings of present study. Thus, the investigation clearly points out that the middle distance ability is mostly based on anthropometric, power intermittent gait and performance related variables.

CONCLUSIONS

Within the limitations and delimitations of this study, the following conclusions were made.

1. It concluded that, the predictor variables namely stride rate, muscular strength, height, anaerobic power and explosive power can be used to predict the middle distance running ability of the middle distance runners.
2. The study concluded that, a significant relationship between selected anthropometric, power, intermittent gait, and performance related variables with 800 meters running performance.

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Dr.K. Sekarbabu

Assistant Professor, Department of physical education, Annamalai University, Chidambaram, Tamil nadu, India.