Kinematic Characteristics of Running for Gymnasts and Long Jumper

Piyali Mishra[a], Provash Das[a]
[a]Research Scholar .Department of physical Education, University of Kalyani, India
Corresponding author: Piyali Mishra

Abstract

Approach run is the preparatory phase for many sports skills. There are three aspects to the approach run, a combination of speed any rhythm, correct postural adjustment during the run, an accuracy. Running is involved in approach run of gymnastics, approach run of long jump and many such other preparatory phases of activities. It is interesting to analyze the basic characteristic of running in these cases and find out the differences between the activities, if any. The purpose of this study were stated below-a)To analyze the Kinematic characteristics of running for gymnasts. b) To find out the Kinematic characteristics of running for long jumper. c) To understand the difference in Kinematic characteristics of running between gymnasts and long jumper. A total of Eight (8) male subjects were selected for this study. Out of them four were from Gymnastics, four were from long jumper.. The subjects were of state level participation. The subjects were from different socioeconomic conditions but they all were college and university students. The data were collected in two phases. In the first phase the running action of the subjects were recorded by a making camera operate of a frequency at 24 frames per second. In the second phase the recorded movement was displayed in computer using a appropriate software [Silicon coach Lite live] the recorded movement was displayed in freeze frame condition. The selected parameters were measured from this picture. Selected kinematic parameters of the subjects were the criterion measure for the present study. Selected kinematic characteristics of running were:This included-The Velocity of the Body, Stride Length, Stride Frequency, Arm Velocity, Elbow Angle, Knee Angle, Body Lean. On the basis of results obtained out of statistical analysis of data and within the limitation of study following conclusions were drawn. There is no difference between Gymnastic group and long Jumper in Loco motor velocity of the Body, in Stride Length, in Stride Frequency, in Arm Velocity, in Knee angle, in Elbow angle, in Body Lean.

KEYWORDS: Gymnastics, long Jumper, Kinematic, Approach Run

INTRODUCTION

Running is a racial activity for human beings. One learns learning in the process of growth & development without much being taught. In the movement mosaic of human beings running comes in the second phase. It is considered as the fundamental movement and every normal human child can perform running.Running is a locomotor activity. An individual runs to move from to one place to other quickly. There are certain basic characteristics of running, which make the process deferent from another basic locomotor process – the walking. It is comparatively a faster process involving a fight phase in which the total contact with the supporting base is broken completely.It also differs between male and female. Generally, male is faster than female. It is also understood that running performance depends on body built, body composition and nature of muscle

fibers. Person with more lean body mass can run faster than the obese people. Persons having more fast twitch fibers can run faster with a high anaerobic capacity but the other group with slow twist fiber can run longer with a high aerobic capacity.From stand point of mechanics running performance depends on stride length and stride frequency. In fact the running speed is the product of these two factors. Of these two, stride frequency is basically hereditary in nature, but the stride length depends on structure and training. There are factors by which the process of running is described, these are called kinematic factors. Kinematic is the description of motion. This involves Distance, Displacement, Velocity, Acceleration, and Time of running. According to mechanics human beings used reaction force from ground, to run and this is regulated by Newton's third law motion. – "To every action there is an equal and opposite reaction". In modern term running is also considered to be an important sport. It is an important event in modern Olympic Games. Down through the ages person from the different countries of world have tried to prove their running ability. As a group of activity running involves different events for competition like Sprinting, Middle Distance Running, Long Distance Running, Running over the Hurdles, Road Running Cross Country Running etc.Fundamental movement of running is used as a component of movement structure of different games and sports. Running in involved almost in every game like Football, Cricket, Basketball, and Handball etc. But involvement of running in different games are not same. Nature of running style also differ from game to game. Thus, for running of a sprinter differs from a long distance runner. Again, the running style of an athlete differs from that of a swimmer. The basic characteristics of the process remain unchanged but differences appear in certain aspects according to the demands of the situation.

The analysis of sports skills depends upon nature of the sports skills. As the nature of movements in different sports and games is different, the component parts of different sports skills are also different. It is therefore very difficult to classify the component parts of different skills into well accepted groups. But experts agree on certain common elements of most of the skills in the process of analysis. It is believed that most of the skills have got three common elements. When arranged sequentially, they run as preparatory phase, main phase and follow through. Each of these phases has got unique contribution towards the results of the execution of skill. These phases are performed one after other in quick succession without any break in between.The preparatory part is designed to make the main part more effective. Depending on the nature of the main part, opportunity provided by rules and the characteristics features of the performers the preparatory part may also be different for different games and sports. Kinesiologically, the main muscle group is used opposite direction of movement desired. Mechanically, the main purpose here is to overcome inertia of rest, to increase the path of application of force during main part and so on.Approach run is the preparatory phase for many sports skills. There are three aspects to the approach run, a combination of speed and rhythm, correct postural adjustment during the run, an accuracy.

Running is involved in approach run of gymnastics, approach run of long jump and many such other preparatory phases of activities. It is interesting to analyze the basic characteristic of running in these cases and find out the differences between the activities, if any. With this consideration present project was developed as a research work.

PURPOSE OF THE STUDY

The purpose of this study were stated below-

(a) To analyze the Kinematic characteristics of running for gymnasts.
(b) To find out the Kinematic characteristics of running for long jumper.
(c) To understand the difference in Kinematic characteristics of running between gymnasts and long jumper.

SIGNIFICANCE OF THE STUDY

It was believed that the results of the study would be helpful for the field of Physical Education and Sports in following ways-

(a) The results of the study will help to understand the Kinematic characteristics of running of Gymnasts.
(b) It will be possible to understand the Kinematic characteristics of running of long jumper from the results of the study.
(c) The findings will show light on the differences in Kinematic characteristics between Gymnasts and long jumper..
(d) The results will provide important information for future research.

METHODOLOGY

THE SUBJECT

A total of Eight (8) male subjects were selected for this study. Out of them four were from Gymnastics, four were from long jumper.. The subjects were of state level participation.

The subjects were from different socioeconomic conditions but they all were college and university students. The subjects were selected keeping in view their level at performance in the respective field. The distribution of the subjects has been shown in Fig – 1.

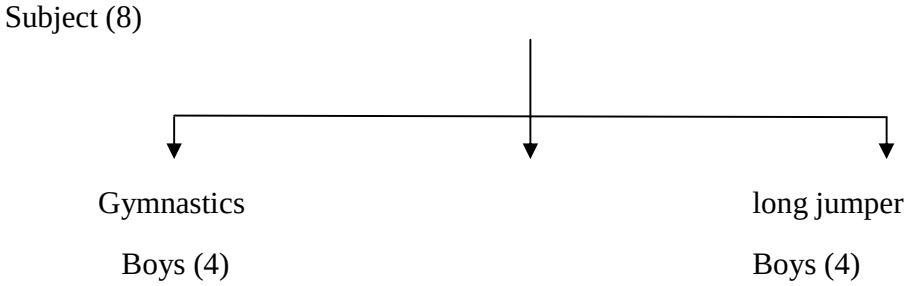


Fig- 1: Distribution of the subject

CRITERION MEASURE

Selected kinematic parameters of the subjects were the criterion measure for the present study. Selected kinematic characteristics of running were:This included-The Velocity of the Body, Stride Length, Stride Frequency, Arm Velocity, Elbow Angle, Knee Angle, Body Lean.

PROCEDURE FOR COLLECTING DATA

Procedure for collecting data for different events was as follows –The data were collected in two phases. In the first phase the running action of the subjects were recorded by a making camera operate of a frequency at 24 frames per second. In the second phase the recorded movement was displayed in computer using a appropriate software [Silicon coach Lite live] the recorded movement was displayed in freeze frame condition. The selected parameters were measured from this picture.Recording of movements at the subjects of different activities was done separately. For Gymnastics the recording was completed during approach run of the subject for Table Vault. The camera was placed at the distance at 27m from start. The axis of the camera were perpendicular of the direction of the running and height of the camera was one meter from the ground.For recording the movement of long jumper the camera was placed 27m from start with the similar position mention above for recording the movement of Gymnastics.

PRESENTATION OF DATA RESULT AND DISSCUSSION THE DATA

For the present study the data were the measurement at selected kinematic parameters of running of different groups of subjects. This included-The Velocity of the Body, Stride Length, Stride Frequency, Arm Velocity, Elbow Angle, Knee Angle, Body Lean. **PRESENTATION OF DATA**

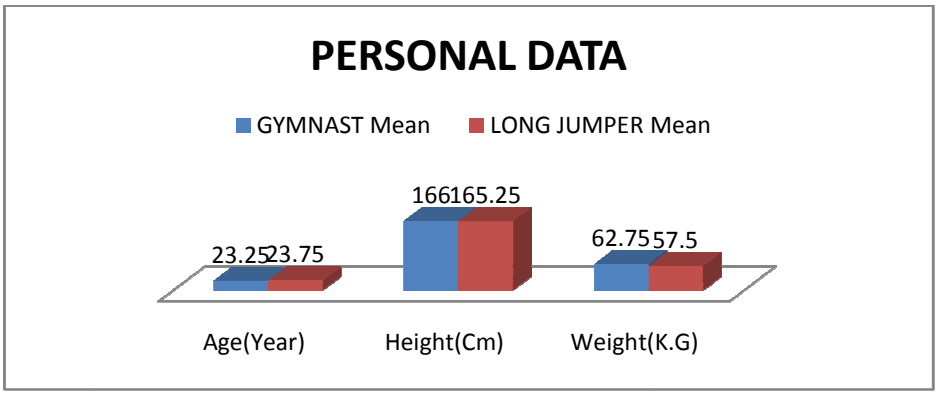
The data for different parameters and their statistical analysis have been presented in following sections.

Personal Data

The Personal Data of the subjects mainly Age, Height, Weight –their mean & S.D have been presented in **Table-1** for both Gymnast and Long Jumper.

Variables		Age(Year)	Height(Cm)	Weight(K.G)
Gymnast	Mean	23.25	166	62.75
	SD	2.36	4.08	5.5
Long Jumper	Mean	23.75	165.25	57.5
	SD	1.70	1.25	2.08

The difference of Mean between Gymnast and Long Jumper in Age ,Height, Weight is presented in Fig-2



Data regarding velocity of the body of the subjects

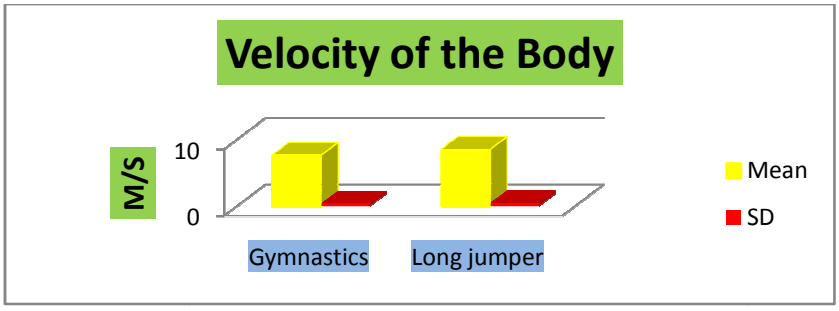
Mean, S.D. of the different group of subjects have been presented in Table-2

Table-2: Mean, S.D. of velocity of the body for two different groups of subject

Sl. No.	Events	Mean Velocity(m/s)	S.D.(m/s)	't'	Significance		DF
1.	Gymnastics (n=4)	7.67	± .42	2.35	NS	0.05	6
2.	Long jumper(n=4)	8.55	± .50				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the loco motor velocity of the body for two different groups of subject were different. The loco motor velocity of the body was for Long jumper with the mean value of 8.55 m/s and the loco motor velocity of the body for Gymnasts with the mean value of 7.67 m/s. As there were differences between mean values, the statistical significance of this difference was tested by the technique of't'-Test. It is seen from table that The 't' value was 2.35 and it was not significant of 0.5 levels. The difference of Mean and S.D between gymnast and Long jumper in Loco motor Velocity of the body is presented in Fig-3



Data regarding Stride Length of the subjects

Mean, SD of the different groups of subjects have been presented in Table-3.

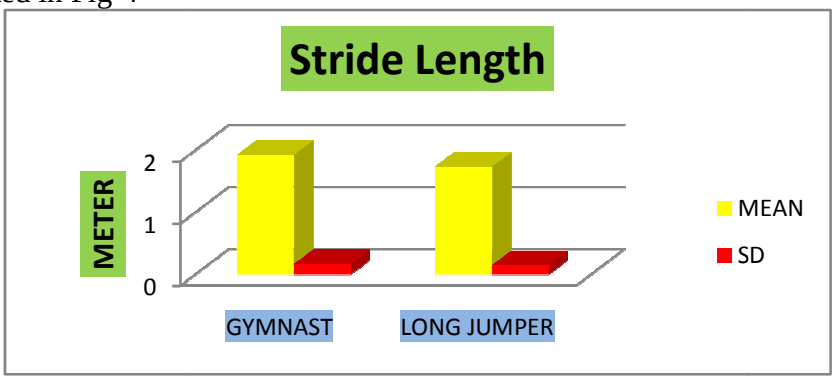
Table-3: Mean, SD of Stride Length for two different groups of subject

Sl. No.	Events	Mean Stride Length(m)	S.D.(m)	't'	Significance		DF
1.	Gymnastics (n=4)	1.93	± 0.17	1.9	NS	0.05	6
2.	Long Jumper (n=4)	1.74	± 0.15				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Stride Length for two different groups of subjects were different. The Stride Length was for gymnastics with the mean value of 1.93 /m and the mean value was for Long Jumperwith value at 1.74 /.m. As there were differences between mean values, the statistical significance of this difference was tested by the technique of t-test. It is seen from table that the 't' value was 1.9 and it was not significant of 0.5 levels.

The difference of Mean and S.D between gymnast and Long Jumper in Stride Length is presented in Fig-4



Data regarding Stride Frequency of the subjects

Mean, SD of the different groups of subjects have been presented in Table-4.

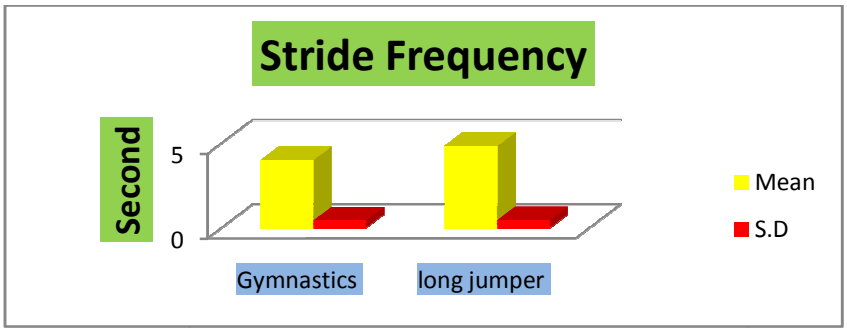
Table-4: Mean, SD of Stride Frequency for two different groups of subject

Sl. No.	Events	Mean (per sec.)	S.D (per sec.)	't'	Significance		DF
1.	Gymnastics (n=4)	4.00	± .44	2.30	NS	0.05	6
2.	long jumper (n=4)	4.85	± .46				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Stride Frequency for two groups of subjects were different. The Stride Frequency was for Gymnast with the mean value of 4.00/s and the Stride Frequency was for long jumper with the value of mean 4.85/s.As there were differences between mean values, the statistical significance of this difference was tested by the technique of t-test .It is seen from table that the 't' value was 2.30 and it was not significant of 0.5 levels.

The difference of Mean and S.D between gymnast andlong jumper in Stride Frequency is presented in Fig-5



Data regarding Arm velocity of the subjects-

Mean, SD of the different groups of subjects have presented in Table-5

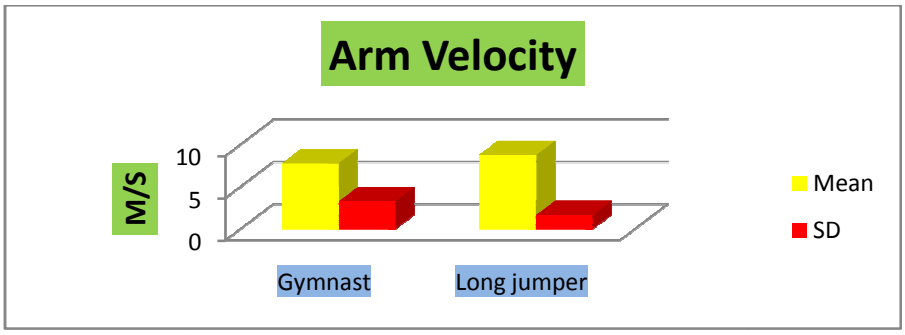
Table-5: Mean, SD of Arm velocity for twodifferent groups of subject

Sl. No.	Events	Mean velocity(m/s)	S.D(m/s)	't'	Significance		DF
1	Gymnastics (n=4)	7.80	± 3.31	0.467	NS	0.05	6
2	Long Jumper(n=4)	8.8	± 1.66				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Arm velocity for two groups at subjects were different. The arm velocity was for Long jumper with the mean value at 8.88 m/s and the arm velocity was for Gymnastics with the mean value of 7.80 m/s. As there was difference between mean values, the statistical significance of this difference was tested by the technique of 't'-Test. It is seen from table that the 't' value was 0.467 and it was not significant at 0.5 levels .

The difference of Mean and S.D between gymnast and Long Jumperin Arm velocity is presented in Fig-6



Data regarding Elbow Angle of the subjects

Mean, SD of the different groups of subjects have been presented in Table-6.

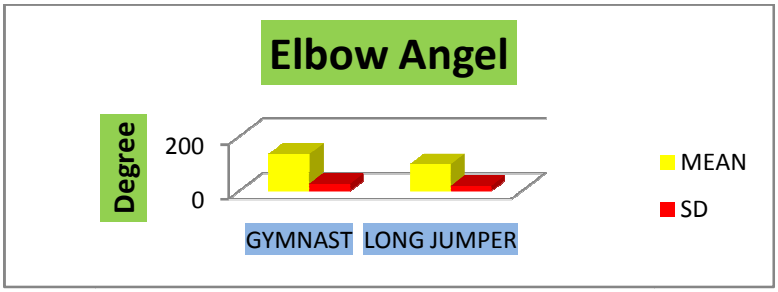
Table-6: Mean, SD of Elbow Angle for 'two' different groups of subject

	Events	Mean angle (degree)	S.D(degree)	't'	Significance		DF
1	Gymnastics (n=4)	136.75º	± 26.28	2.04	NS	0.05	6
2	Long Jumper (n=4)	98.50º	± 19.04				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Elbow Angle for two groups of subjects were different. The Elbow Angle was for Gymnastics with the mean value of 136.75º and the Elbow Angle was for Long Jumper with the value of 98.50º.As there was difference between mean values the statistical significance of this difference was tested by the 't'-Test technique .It is seen from Table that 't' value was 2.04 and it was significant of 0.05 levels. So, it is understood that there was no statistically significant difference between the mean values of two groups.

The difference of Mean and S.D between gymnast and Long Jumper in Elbow Angle is presented in Fig-7



Data regarding Knee Angle of the subjects

Mean, SD of the different groups of subjects have been presented in Table-7

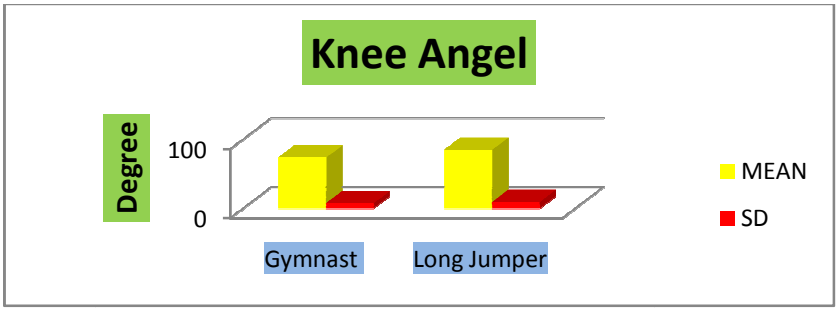
Table-7:Mean, SD of Knee Angle for Two different groups of subject

Sl. No.	Events	Mean angle (Degree)	S.D (Degree)	't'	Significance		DF
1	Gymnastics (n=4)	73.75º	± 7.49	1.40	NS	0.05	6
2	Long Jumper(n=4)	85 º	± 9.35				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Knee Angle for two groups of subjects were different. The Knee Angle was for Gymnast with the mean value of 73.75º and the Knee Angle was forLong Jumper with the value of 85 º. As there were differences between mean values, the statistical significant of this different was tested by the technique of 't'-Test.It is seen from table that 't' value was 1.40 and it was not significant of 0.5 levels.

The difference of Mean and S.D between gymnast and Long Jumper in Knee Angle is presented in Fig-8



Data regarding Body Lean of the subjects

Mean, SD of the different group of subjects have been presented in Table-8

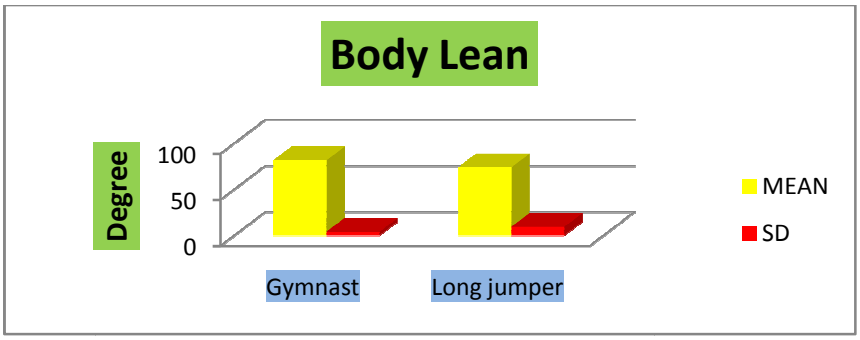
Table-8:Mean, SD of Body Lean for two different groups of subject

Sl. No.	Events	Mean angle (degree)	S.D (degree)	't'	Significance		DF
1	Gymnastics (n=4)	81.67	± 4.01	1.30	NS	0.05	6
2	Sprinting (n=4)	74	± 9.43				

Table value for 't' Test at 0.05 level for Df 6 is 2.45.

It is seen from the above table that the Body Lean for two groups of subjects were different. The angle of Body Lean was for Gymnastics with the mean value of 81.67º and the angle of Body Lean was for long Jumper 74º. Higher angle indicated lower Body Lean. As there was difference between mean values the statistical significance of this difference was tested by the 't'-Test .It is seen from Table that the 't' value was 1.30 and it was not significant of 0.5 level.

The difference of Mean and S.D between gymnast and long jumper in Body Lean is presented in Fig-9



RESULT

On the basis of statistical analysis of data the following results were obtained.

(a) There were no statistically significant differences between the groups for the loco motor velocity of the Body.
(b) There were no statistically significant differences between the groups for the Stride Length.
(c) There were no statistically significant differences between the groups for the Stride Frequency.
(d) There were no statistically significant differences between the groups for the Arm Velocity.
(e) There were no statistically significant differences between the groups for the Elbow angle.
(f) There were no statistically significant differences between the groups for the knee angle.
(g) There were no statistically significant differences between the groups for the Body Lean.

DISCUSSION OF RESULT

According to results obtained the Gymnastic group, Sprinting group were similar in many kinematic parameters of running such as loco motor velocity of the Body, Stride Length, Stride Frequency, Arm Velocity and Body Lean and knee angle ,Elbow angle . This may be due to the fact that all the groups tried to achieve as high velocity as possible with short approach run.

CONCLUSION

On the basis of results obtained out of statistical analysis of data and within the limitation of study following conclusions were drawn.

(a) There is no difference between Gymnastic group and long Jumper in Loco motor velocity of the Body.
(b) There is no difference between Gymnastic group and long Jumper group in Stride Length.
(c) There is no difference between Gymnasts andlong Jumper in Stride Frequency.
(d) There is no difference between Gymnasts and long Jumper in Arm Velocity.
(e) There is no difference between Gymnasts andlong Jumper in Knee angle.
(f) There is no difference between Gymnastics and long Jumper group in Elbow angle.
(g) There is no difference between Gymnastics and long Jumper group in Body Lean.

RECOMMENDATION

On the basis of result obtained and conclusion drawn following recommendations were made for future study and investigation.

(a) Similar studies can be conducted in future with female subjects.
(b) Similar study can be conducted with more number of subjects.
(c) Future study can be planed to analyze kinetic parameters of movement.
(d) Studies of similar nature can be planed for analyzing other phases of movement structure.
(e) The results may be used as the guidelines for training of Table vault.
(f) Future studies may be taken up to analyze the movement activities using computer simulation technique

REFERENCES

A. Books

Best, S.W. (1983).Research in Education (4th Edition).New Delhi: Prentice Hall of India (P) Ltd.

Brooks, J.D. and Whiting (1973). H.T.A. Human Movement: A Field Study. London: Henry Kempton Publishers.

Frederick, A.B. (1969). Gymnastics for men. Dubuque, lowa: William C. Brown.

Howard and Payne, R. (1981).The science of Track and Field Athletes. London: Pelham Books.

Hay, J.G. (1978). The Biomechanics of Sports Techniques (2nd Edition). Englewood: Cliffs, Prentice Hall, Inc.

Zinkovsky, A. et al.(1980). Biomechanical analysis of the formation of gymnastic skill. In Biomechanics (V-B, ed.).Park Press: Baltimore, University P.V. Komi pp. 322-25.

B. JOURNALS

Adelaar,R.S,the practical Biomechanics of running,American Journal of Sports Medicine 14, 497-500.

Willman, J.H. and Keogh, J.F. (1975). 'Kinematic Analyses of Running', Exercise and sport sciences Reviews, 3.

C. DISSERTATION

Khan, Jamaul Islam.(1992). 'Study of Kinematic characteristics of trained and untrained athletes in spring running.'MPED Dissertation, Department of Physical Education, Kalyani University.

Yasmin, Sadeka. (2003). "A study on the velocity pattern at different phases of 100m spritn." MPED Dissertation for PG Diploma in sports Biomechanics. Bangladesh Institute of Sports, National University, Bangladesh.