



RELATIONSHIP OF SELECTED KINEMATIC VARIABLES WITH THE PERFORMANCE OF UPSTART (KIP) ON HORIZONTAL BAR IN MEN'S ARTISTIC GYMNASTICS

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Abstract

The purpose of this study was to investigate the relationship of selected kinematic variables with the performance of upstart (kip) on horizontal in men's artistic gymnastics. A total of five ($n = 5$) best male gymnasts of 18 to 23 years old from L.N.I.P.E., Gwalior (M.P.) were selected for the present study as subjects. To acquire kinematical data, a digital Nikon D-3100 video recording camera with a frame rate of 30 frames per second, were used during the execution by placing it left side of horizontal bar and perpendicular to the sagittal plane. From the video, the photograph of selected four phases (i.e. initial swinging phase, pike phase, kicking & pulling up phase, and support phase) were obtained by using snipping tool software. Joint Point Method was used in order to obtain the values of selected angular kinematic variables by developing stick figure. Height of Center of Gravity was calculated by segmentation method suggested by Hay in 1993. To determine the degree of relationship between selected kinematic variables (linear and angular) with the upstart (kip) performance of gymnasts on high bar, Pearson's Product Moment Correlation technique was used. The level of significance was set at 0.05. The results revealed that all selected linear and angular kinematic variables at all the phase had shown insignificant relationship ($r < .878$) with the dependant variable (upstart performance). On the basis of results it is concluded that that the performance of any games and sports depending upon the multidimensional factors such as physical factors, physiological factors, psychological factors and so many

other factors. Only due the slight association in the selected kinematics variables, the performance of the athlete cannot vary directly.

Keywords: Biomechanics, kinematics, upstart (kip) on horizontal bar, sagittal plane, joint point method, segmentation method.

Introduction:

Correct execution of body movement leads to a successful sports performance. Biomechanics is "the study of the structure and function of biological systems by means of the methods of mechanics" (Hatze, 1974). It is most helpful in improving the performance in terms of correct body position in sports or activities where technique is the dominant factor rather than physical structure or physiological capacity (Joshi, H.C., 2014). Since biomechanics is essentially the science of movement technique. In the recent years, greater stress has been laid on quality rather than quantity of training (Singh D. et al., 2011). The coaches and teachers of physical education want their athletes to extract maximum achievement from their training procedure without causing too much strain on them. (khalil, 1986). It may be necessary to develop programs of study for the training of technique in sports biomechanics, technicians who can provide the kind of services sought by sporting bodies. (Hay, 1984).

Gymnastics are currently training close to their bio-physical limits and with evolving code of point (F.I.G, 2013) and desire to continually strive for complex and innovation moments. In gymnastics, every skill is having biomechanical orientation. In this context, the mechanical principles such as motion, speed, center of gravity, angle of take-off, push-off, landing angle play an important role related with the performance. The ultimate aim of the coaching biomechanics interface in gymnastics training is to make training more effective, efficient and safe.

Upstart (kip) is a basic movement found not only in horizontal bar but in rings and parallel bars routines as well. Execution of upstart needs considerable coordination, feeling for movement and strength.

In this skill take a medium swing on horizontal bar. During a forward swing the head is slightly kept forward towards the chest. Just before the end of forward swing a quick bending in the hip joint start. As the shoulder pass the vertical line, a forceful forward upward extension of trunk angle takes place. At the same time bar is forcefully pressed downward with straight arms. Legs swing is abruptly retarded when the shoulders have passed the grip point. With the abrupt retardation of legs swing, transfer of momentum from legs to trunk takes place. Shoulders are raised higher and change of the wrist (grip) takes place. The support position is completed as the trunk-leg angle reaches to about 130° to 140° .

In numerous similar types of studies have addressed the descriptive and causing (kinematic and kinetic) aspects of different games and sports during last decade and the researchers

found the insignificant relationship between the independent variables (selected kinematics) and dependent variables (sports performances) except very less kinematic variables (Bal et. al., 2011; Kumar S. et. al., 2011; Kumar D. et. al., 2013; Pandey et. al., 2012; Singh R., 2012, Joshi H.C., 2014). Whereas, the researcher Singh D. et. al., 2011 has found insignificant relationship of all the selected kinematic variables with the performance of flick in hockey.

The present study hereby makes an effort to broaden the horizon of knowledge by bringing new facts and thoughts by investigating the relationship of selected kinematic variables with the performance of upstart (kip) on horizontal bar in men's artistic gymnastics. Therefore, I tested the hypothesis that there is the significant relationship in all selected kinematics variables with the upstart (Kip) performance (one tail hypothesis).

MATERIAL AND METHODS

The methodology of the study consist of selection of subjects, selection of variables, criterion measures, filming protocol, testing procedure and the technique employed for analysis of data.

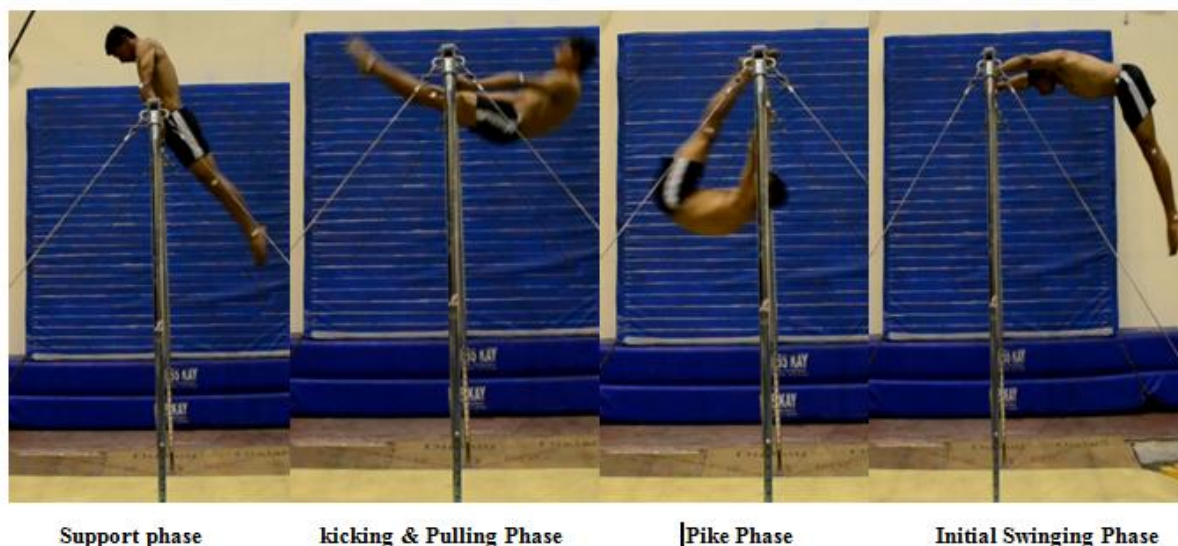
Selection of subjects:

Five male gymnasts of Lakshmibai National institute of Physical Education, Gwalior from the gymnastics match practice group, who had a good command in the particular skill (upstart (kip) on horizontal bar), were selected as the subject for the present study and there range of mean age, mean height and mean weight was 20.2 ± 0.84 years, 166.8 ± 4.60 cm and 62.7 ± 6.45 kg respectively.

Experimental filming protocol:

Videography was employed for the biomechanical kinematics analysis of upstart (kip) on high bar. The camera that was used for this study was a standard Nikon D3100 (with motor drive). The video camera was mounted on the tripod stand at the height of 2.37 mts. from the ground. The video camera was placed perpendicularly at center in the line of inner bar and parallel to the sagittal plane at a distance of 4.52 mts. The frequency of the camera was 30 frames/second. The subjects performed the skill three times and the best trail was used for the analysis.

Figure 1: photographic sequence of selected phases (starting from right) of the whole skill.



Procedure for collection of data:

Videography technique was employed in order to register the performance of the subjects in upstart (kip) on high bar in the study. Selected kinematics variables (table 2 & table 3) and four selected phases (Figure 1) of whole skill i.e. positioning of initial swinging phase, pike phase, kicking and pulling up phase and support phase were analysed. The selected phases were taken out from the video by using snipping tool software. From the photographic sequence, the stick figures (Figure 1) of selected movements were prepared by using joint point method and the selected angular kinematic variables were obtained at initial swinging phase, pike phase, kick phase and support phase. The centre of gravity of pike phase was located by using segmentation method (Hay, 1993). The angles of selected joints were measured by the help of protector at the nearest of degrees. The performance of each subject of upstart (kip) on horizontal bar was collected on the basis of three judge's evaluation. The average of three judges was considered as the final point obtained by each gymnast. Further, to easy calculation it was reduced out of ten points. The evaluating criteria are mentioned in Table 1.

Statistical Technique:

The relationship of selected kinematic variables with the performance of upstart (kip) on horizontal bar were obtained by employing the Pearson's product moment correlation technique by using SPSS (20.0) and for testing the hypothesis the level of significance was set at 0.05.

Table 1: Evaluating criteria of the cast performance of the gymnasts.

S. No.	COMPONENTS	POINTS
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1.	Body position during initial swinging phase	10
2.	Body position during pike phase	10
3.	Body position during kicking and pulling up phase	10
4.	Body position during supports phase	10
5.	Overall Execution of whole movement	10
Total		50

RESULTS AND DISCUSSION OF FINDING

The coefficient of correlation (r) of selected angular and linear kinematics variables with dependent variable are presented separately in the preceding tables:

The results of the product moment correlation which were obtained in order to ascertain the relationship of selected angular kinematics variables i.e. the angle at neck (in relation to torso), left shoulder joint, left elbow joint, left hip joint and left knee with the performance of cast to upper arm hang on parallel bars during initial swinging phase, kicking and pulling up phase, pike phase and support phase have presented in table 2 mentioned below:

Table 2: Relationship of selected angular kinematic variables with the upstart (kip) performance.

Variables	Initial Swinging Phase (r)	Pike phase (r)	Kicking & Pulling Up Phase (r)	Support Phase (r)
Angle at neck (in relation to torso)	.202	-.336	.419	-.518
Shoulder Joint (Left)	-.494	.746	-.262	.424
Elbow joint (Left)	-.452	-.712	-.846	-.846
Hip Joint (Left)	-.727	-.616	-.226	.741

Knee joint (Left)	.205	.328	.117	.657
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* Significant at $r_{0.05}(3) = 0.878$

The findings of table 2 showed the insignificant relationship of selected angular kinematic variables with the performance of upstart (kip) on horizontal bar in all selected. Because the value of coefficient correlation was less than the tabulated value ($r=.878$) at 0.05 level of significance. In that case the null hypothesis was failed to reject for all variables in all phases.

The result of product moment correlation which were obtained in order to ascertain the relationship of the selected linear kinematics variables i.e., height of center of gravity at pike phase and time taken during complete movement with the performance of upstart (kip) on high bar has been presented in table 3.

Table 3: Relationship of selected linear kinematic variables with the upstart (kip) performance

Variables	Correlation (r)
Height of C.G. at pike phase	.778
Total time taken during whole movement	.810

*Significant at $r_{0.05}(3) = 0.878$

The findings of table 3 mentioned below also showed insignificant relationships of both the variables with the performance of the gymnasts in upstart (kip) on high bar. Because the value of coefficient correlation (r) in case of both the variables was less than the tabulated value ($r=.878$) at 0.05 level of significance.

The finding showed, the linear and angular kinematic variables showed insignificant relationship in case of all the variables in all phases of skill with the upstart (kip) performance. The similar types of studies were undertaken by other research scholars also and mostly the relationships of selected kinematic variables with the dependant variables were showed insignificant except very less kinematic variables in their area of specialization. The main reason of insignificant results in their sports was that the performance of any games and sports depending upon the multidimensional factors such as physical factors, physiological factors, psychological factors and so many other factors. Only due the slight association in the selected kinematics variables, the performance of the athlete cannot vary directly.

Small sample size, level of performance of gymnasts and unavailability of sophisticated equipments may also be one of the reasons of indicating insignificant relationship of selected linear and angular kinematics variables to performance in gymnastics.

CONCLUSION

Based on the analysis and within the limitation of present study following conclusion were drawn:

- 1) All the selected angular kinematic variables did not show any significant relationship with the performance of upstart (kip) on horizontal bar at all the phases.
- 2) All the selected linear kinematic variables also did not show any significant relationship with the performance of upstart (kip) on horizontal bar.

Although, statistically results showed insignificant relationship in kinematic variables but these variables specially the body joints have also some importance for improving the technique of the gymnasts in terms of body position at extent. In the present study the insignificant results may be due to some other factor; less sample size, performance level of the subjects, psychological factors or subjects may not be familiar with the administration of test.

RECOMMENDATIONS

Based on the conclusions drawn in this study, the following recommendations have been made:

- 1) The results of this study may be helpful for the analysis of other elements in gymnastics.
- 2) The results may be used by the gymnasts for self evaluation of their photographic techniques.
- 3) Similar studies would be conducted by using cinematography and multidimensional photographic as well as the videographic techniques.
- 4) The study would also be conducted on different age level, different performance level and also on different sex for comparing the performance.
- 5) The finding of the present study may be helpful to the gymnast to know the correct technique of upstart (kip) on horizontal bar.

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