Original Research Article

A Comparative Analysis of Back Handspring and Forward Handspring with Angular Kinematics Variables

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Abstract

The purpose of this study was to investigate the difference of kinematic variables between two. Back handspring and Forward Handspring performance of 05 male gymnasts of L.N.I.P.E, Gwalior was recorded. They aged between 19 to 25 years. Purposive sampling technique was used for choosing highly skilled gymnast. These gymnasts had 7 to 12 years training experience and were technically sound on the stated skills. Videography technique was employed in order to register the performance of the subjects in Back Handspring and Forward Handspring. The Canon – 70D camera was used with the frequency of 24 frames per second and the subjects were video graphed in horizontal plane (sagittal plane) from the left side. Each subject was given three trails and the best trail was used for analysis. The selected phases were taken out from the video by using snipping tool software. From the photographic sequence, the stick figures of the selected movements and there angles were located by kinovea software. The data was analyzed by using Independent T-Test. There were two skills that were Back handspring and Forward handspring which was further divided into two phases, Initial Phase and Ground Touch Phase and Shoulder joint, Elbow Joint and wrist joint were selected as the angular kinematics variables. The level of significance was set at 0.05. The results revealed that all selected angular kinematic variables at all the phase had shown insignificant deference with the Back Handspring and Forward Handspring. 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.
Keywords: Biomechanics, Angular kinematics, Back Handspring, and Forward Handspring.

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.

Back handspring is an element which is performed on floor exercise. It is a basic movement for learning the advance skill involving after the back handspring (e.g.- back handspring to back sato, straight

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boby, 360^0, etc.). back handspring is an "a" class element come under the EGR- II i.e. under swing as per the "MAG coad of point 2016". Back roll, Handstand, back turnover are the prerequisites for learning this element.

Forward handspring is an element which is performed on floor exercise. It is a basic movement for learning the advance skill involving after the forward handspring (e.g.- hand front, double hand front, hand front to $360^{0,}$ etc.). Forward handspring is an "a" class element come under the EGR- II i.e. under swing as per the "MAG code of point 2016". Forward rolls, Handstand, Front turn over are the prerequisites for learning this element.

The purpose of the present study was to determine the impact force and kinematic analysis of forward hand spring and back hand spring technique on floor exercise in artistic gymnastics. This was selected keeping some important points in the mind by the scholar. Artistic gymnastics is a technical sport and technique plays an important role to learn the skill. In gymnastics each and every skill is technique oriented. Forward hand spring and back hand spring is a basic and important skill in artistic gymnastics, and large number of gymnast performs this skill on tumbling in series routine. Forward hand spring and back hand spring hand placement phase is also a very important phase because these phase is very important to learn others skill, as most of the other skills hand placement are very much similar to the hand placement phase of forward and back hand spring. As scholar I felt that a large number of gymnast perform these skill without knowing the technical aspects of forward and back hand spring and they don't have the logical answer, same is the condition of coaches. So the gymnast performs this skill by hook and crook. This technique is a basic skill in gymnastics, and when gymnasts have mastery on this skill then he can learn some other difficult skills very easily.

METHODOLOGY
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
Back handspring and Forward handspring performance of 05 male gymnasts of L.N.I.P.E, Gwalior was recorded. They aged between 19 to 25 years. Purposive sampling technique was used for choosing highly skilled gymnast. These gymnasts had 7 to 12 years training experience and were technically sound on the stated skills. Since the gymnast had been trained for a considerable period of time, they were considered skilled and their technique was treated as stabilized. All the subjects were explained the purpose of the study and were requested to put in their best during each attempt or trial.

Experimental Filming Protocol
Videography technique was employed in order to register the performance of the subjects in Back Handspring and Forward Handspring. The Canon – 70D camera was used with the frequency of 24 frames per second and the subjects were video graphed in horizontal plane (sagittal plane) from the left side. Each subject was given three trails and the best trail was used for analysis.

Procedure for collection of data
Videography technique was employed in order to register the performance of the subjects in Back Handspring and Forward Handspring in the study. Selected kinematics variables and two selected phases (Figure 1) of whole skill i.e. positioning of Initial Phase and Ground 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 of selected movements were prepared by using joint point method and the selected angular kinematic variables were obtained at Initial Phase and Ground Support phase. The angles of selected joints were measured by the help of kinovea. The performance of each subject back handspring and forward handspring on floor 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
For the purpose of the study, descriptive statistics and Independent T-test was employed by 'Statistical Package for Social Sciences' (SPSS) software version 20. The level of significance will be set at .05 level.

Evaluating criteria of the back handspring and forward handspring performance of the gymnasts
1. Initial Phase   10
2. Ground Support phase   10

RESULTS AND DISCUSSION OF FINDING
The Independent T-Test was employed on selected angular Kinematics variables are presented separately.

The results of the Independent T-Test which were obtained in order to ascertain the difference between the Kinematic variables i.e. the angle at shoulder joint, angle at elbow joint, and angle at Wrist joint in two different phases (Initial Phase and Ground Touch Phase) in Back Handspring and Forward Handspring, the descriptive statistics of the concerned variables are mentioned below:

Table 1: Kinematical Variables Descriptive Statistics of Back Handspring and Forward Handspring at Different Phase

Groups		N	Mean	Std. Deviation
Shoulder Joint (Initial Phase)	Back Handspring	5	21.6000	1.81659
	Forward Handspring	5	48.6000	6.80441
Wrist Joint (Initial Phase)	Back Handspring	5	119.2000	9.41807
	Forward Handspring	5	118.2000	4.96991
Elbow Joint (Initial Phase)	Back Handspring	5	180.0000	0.00000
	Forward Handspring	5	178.8000	2.68328
Shoulder Joint (Ground Touch Phase)	Back Handspring	5	177.0000	4.63681
	Forward Handspring	5	174.8000	6.83374
Wrist Joint (Ground Touch Phase)	Back Handspring	5	52.8000	3.03315
	Forward Handspring	5	50.0000	3.80789
Elbow joint (Ground Touch Phase)	Back Handspring	5	172.6000	9.71082
	Forward Handspring	5	174.2000	7.91833

Above table clearly show the mean and Standard Deviation mean of Back Handspring and Forward Handspring at the two different phases i.e Initial Phase and Ground Touch Phase.

Table 2: Independent T Test of Back Handsring and Forward Handspring at Different Phase

Variables		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Shoulder Joint (Initial Phase)	Equal variances assumed	9.498	*.015*	8.573	8	.000
Wrist Joint (Initial Phase)	Equal variances assumed	2.552	.149	.210	8	.839
Elbow Joint (Initial Phase)	Equal variances assumed	7.111	*.029*	1.000	8	.347
Shoulder Joint (Ground Touch Phase)	Equal variances assumed	.419	.535	.596	8	.568
Wrist Joint (Ground Touch Phase)	Equal variances assumed	.206	.662	1.286	8	.234
Elbow joint (Ground Touch Phase)	Equal variances assumed	1.443	.264	-.286	8	.782

In the above table, Scholar firstly test equality of variances and for that Levene's Test was used. Table shows that *shoulder joint at initial phase (F 9.498)* and *elbow joint at initial phase (F 7.111)* which is significant as the *p-value is .015* and *.029 (shoulder joint and elbow joint at initial phase)* which less the 0.05. And rest of variables found Insignificant.

It can be seen that for testing the difference in the groups, the scholar used Independent T – Test which reveals that shoulder joint at initial phase with the value of t -8.573, this value is significant as the p-value is 0.000. Which is less than 0.05, In-spite this rest of the variable found Insignificant.

The stated test shown insignificant result because the sample size is small, level of performance of gymnasts and unavailability of sophisticated equipment's may also be one of the reasons of indicating insignificant result, some time environmental condition also affect the performance and it can also be one of the reason for insignificant result.

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

- All the selected angular kinematical variables of Back Handspring and Forward Handspring, found insignificant.

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 can be conducted by using cinematography and multidimensional photographic as well as the video graphic techniques.
4. The study may also be conducted on different age level, different performance level and also on different sex for comparing the performance.

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