BioKinematic analysis Moy on parallel bars in gymnastics

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Abstract

The purpose of this study was to provide an appropriate model for Moy movement performance and Moy movement training data by quantitative. Analysis of the kinematic variables of three players from the specialty school of gymnastics in Maysan. To acquire kinematical data, a digital Sony HDR-PJ10 video recording camera with a frame rate of 60 frames per second, were used during the execution by placing it right side of the subjects (gymnasts) and perpendicular to the sagittal plane. The digitization of the skill by converting raw data into numeric values was done with the help of kinovea software to obtain selected kinematic variables. As a result of this study, it appears that sudden drop and maximum shoulder joint extended is important when performing Moy motion in parallel bars. The maximum hip flexion at the starting point of the ascending swing, the sudden extended to the opposite direction of the shoulder and hip joints when leaving the parallel bars, the control of the body moving to the forward direction, and the reduction of the angle of the hip joint in the flight phase is important.

1- Definition of research:

1-1 Introduction and importance of research:

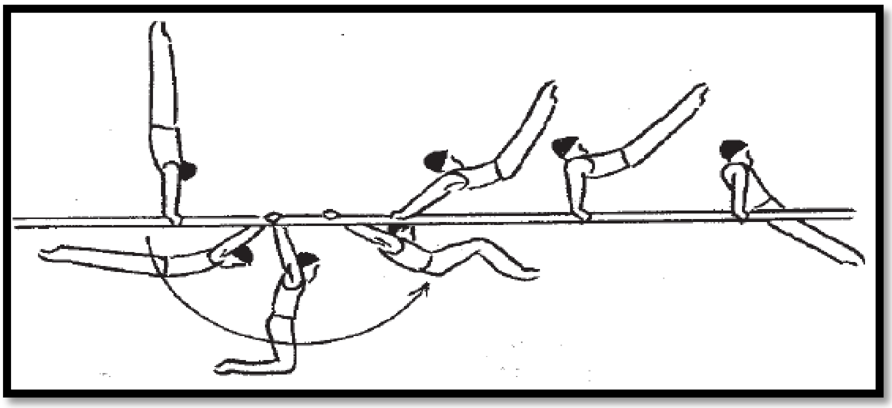
The men's gymnastics competitions consist of six apparatus: floor exercise, parallel bars, still ring, and vaults. Among these devices is a parallel device with a height of 195 cm and a length of 350 cm and a diameter of 5 cm. The skills of the parallel bars apparatus for men were rapidly improved by Japanese players in 1978, and in recent years, the technical performance of the parallel apparatus has become more versatile by integrating technical elements on the parallel apparatus.

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) [1]. Factor rather than physical structure or physiological capacity (Joshi, HC, 2014) [2]. 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) [3]. 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) [4]. 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 bought by sporting bodies (Hay, 1984) [5].

Gymnastics are currently training close to their bio-physical limits and with evolving code of point (F.I.G, 2013) and desire to continuously 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.

Moy a swinging skill that begins in a handstand swings below the bars, releasing and catching in an upright, supported position above the bars 3/4 giant (Gymnastics Terminology,2011) [6]. FIG element: B (0.2) (F.I.G, 2017) [7]. As in Figure 1

The present study hereby makes an effort to broaden the horizon of knowledge by bringing new facts and thoughts by exploring the relationship of selected kinematic variables with the performance Moy on parallel bars in men's artistic gymnastics. Therefore, the importance of research lies in the provision of technical training materials.



Figure; 1 Motion Path Moy to support bent legs on parallel bars (FIG).

1-2 Research problem:

Through the experience of the researcher in the field of gymnastics coach and referee for many years, he noted that there is weakness in the performance of skills with high difficulties on gymnastics apparatus of the general, including the parallel bars, this weakness leads to repeated cases of fall in the Iraqi players and this indicates the weakness of technical performance and It is evident by not investing in the biochemical aspects that serve performance.

1-3 Objective

The purpose of this study was to provide an appropriate model for Moy movement performance and Moy movement training data by quantitative.

2- Methodology

2-1 Subjects

Three male gymnasts from the specialized school of gymnastics talent Mysan. These gymnasts were selected based on their level of proficiency in Moy and they have a level in gymnastics competitions. all subjects were purposely selected, who had a good command in the particular skill (Moy) on Parallel Bars, were selected as the subject for the present study and there the characteristics of the Subjects are shown in Table 1.

Table 1. Characteristics of the gymnasts

Subjects	Age(year)	Height (cm)	Weight (kg)	Training experience (years)
S1	**10**	**130**	**27.5**	**6**
S2	**13**	**162**	**49**	**10**
S3	**11**	**137**	**33.5**	**7**
M±SD	**1.53±11.33**	143±16.82	**11.09±36.67**	**2.08±7.67**

S=Subject, M= mean, SD= standard deviation

2-2 Analysis contents and experimental procedure

Analyzes are body centered position change, velocity change, shoulder and hip angle joint, and angle velocity. Videography was employed for the kinematics analysis of Moy to support bent legs on Parallel Bars. The camera that was used for this study was a standard Sony HDR-PJ10. The frequency of the camera was 60 frames/second with HD quality of video and the camera was operated about one second before the start of this operation so as to keep the camera speed constant. The video camera was mounted on the tripod stand at the vertical height of 1.50meters of capturing action on parallel bars the video camera was placed perpendicularly at center in the line of the subjects to the sagittal plane at a distance of 7 meters capturing action on parallel bars. The experimental setup is shown in (Figure 1).

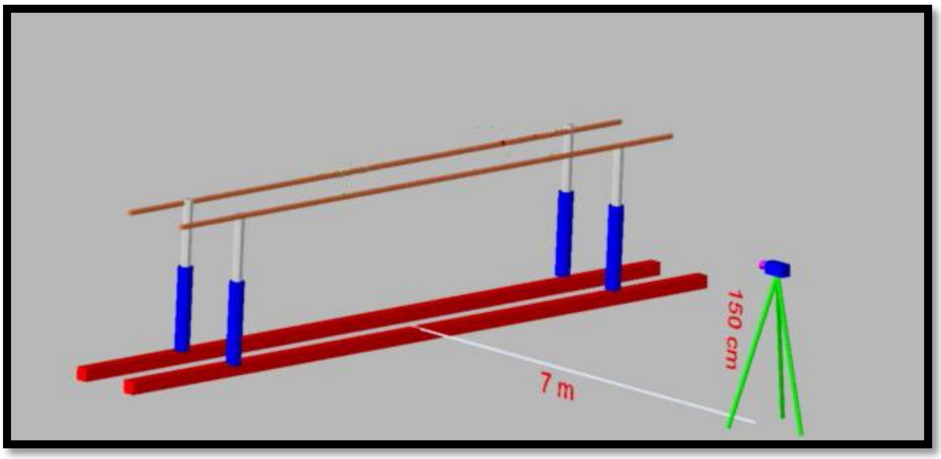


Figure 2. Placement of experimental equipment

2-3 Procedure for collection of data

Videography technique was employed in order to register the performance of the subjects in Moy on parallel bars in the study. Selected kinematics variables (table 1, table 2, table 3, table 4) and five selected stages (Figure 2) of whole skill were analysed. The selected stages were taken out from the video by using the latest version of kinovea software (08.25) was used for digitizing in the data and converting the raw data into numeric values. The subjects performed the skill with full of control and with proper technique. One best trail was taken into consideration. From the photographic sequence. The center of mass was located by using segmentation method (Hay, 1993).

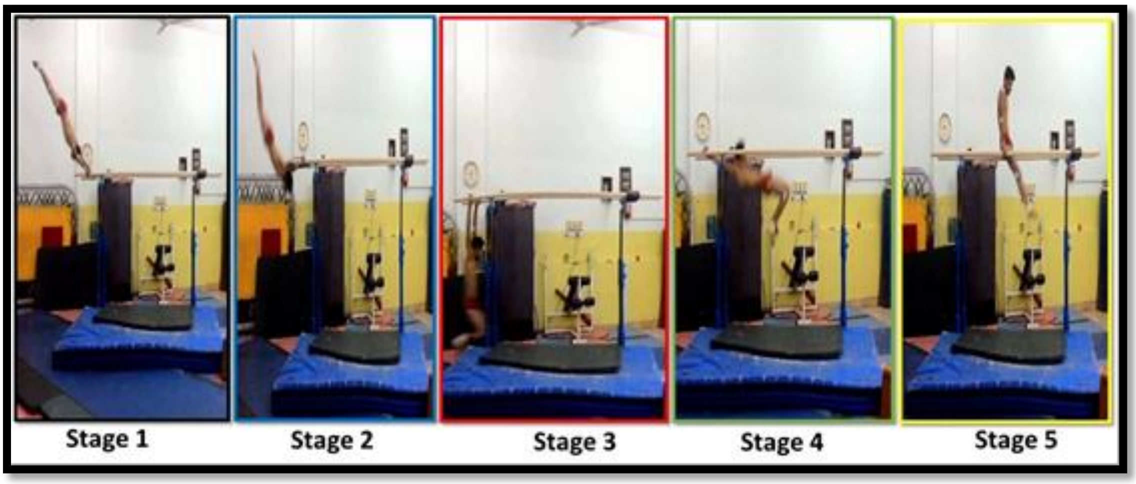


Figure 3: Stages classification of overall operation

3- Results and Discussion

Table 1: Changes in horizontal and vertical displacements (Unit; m).

Subjects	Direction	Stages				
		1	2	3	4	5
S1	H	2.27	1.79	2.42	3.31	3.89
	Y	1.88	1.32	0.13	0.58	1.11
S2	H	2.37	1.82	2.28	3.26	3.84
	Y	1.90	1.44	0.16	0.43	1.32
S3	H	2.40	1.93	1.85	3.06	3.58
	Y	1.86	1.57	0.37	0.27	1.14
M±SD	H	2.35±0.07	1.85±0.07	2.18±.030	3.21±0.13	3.77±0.17
M±SD	Y	1.88±0.02	1.44±0.13	0.22±0.13	0.43±0.16	1.19±0.11

S=Subject, M= mean, SD= standard deviation

1- Horizontal and vertical displacements

Moy to support bent legs table 1 shows the change of body center position during each stage. The horizontal displacements were decreased only in the second stage, and gradually increased from the third stage. In the first stage it gradually decreased from stage 3 to stage 4, and increased from stage 4 to stage 5. In Down Swing, all subjects showed similar body-centered displacements. However, in the case of the three stage vertical displacement value S1 is 0.13m, S2 is 0.16m, S3 is 0.37m and S3 is which were higher than those of the other subjects. In addition, in stage 4, S1 represents horizontal displacement value of 3.31 m and vertical displacement value of 0.58m, S2 represents horizontal displacement value of 3.26m and vertical displacement value of 0.43m, S3 represents horizontal displacement value 3.06m, vertical displacement 0.27m. Respectively. Thus, we can see that S1 is sorted in the highest position and released at the lowest position. In stage 5, S1 shows the horizontal displacement value of 3.89m and the vertical displacement value 1.11m represents, S2 represents horizontal displacement value of 3.84m and vertical displacement value of 1.32m, S3 represents horizontal displacement value of 3.58m and vertical displacement value of 1. 14m.Therefore, it can be seen that S2 is the start operation at the highest position. The horizontal movement distance of s1 is large due to the large circular motion, and the vertical movement distance of S2 is large, it is assumed that the starting operation is performed at the position. assumed that the starting operation is performed at the position.

Table 2. Changes the velocity of the center of mass of each stage: (Unit; m/s).

Subjects	Velocity	Stages				
		1	2	3	4	5
S1	H	-0.77	-1.21	4.89	1.46	1.71
	Y	-0.67	2.25	-0.32	2.41	0.02
	R	1.02	2.55	4.90	2.82	1.70
S2	H	-0.78	-1.49	5.15	2.33	1.21
	Y	-0.38	-2.05	-1.10	3.75	0.33
	R	0.86	2.53	5.27	4.41	1.27
S3	H	-0.62	-1.22	4.03	3.96	1.22
	Y	0.19	-1.20	2.91	3.14	1.85
	R	0.65	1.71	2.97	5.05	2.21
M±SD	H	-0.72±0.09	-1.31±0.16	4.69±0.59	2.58±1.27	1.38±0.29
M±SD	Y	-0.29±0.44	-0.33±2.28	.50±2.130	3.10±0.67	0.73±0.98
M±SD	R	0.84±0.19	2.26±0.48	1.024±4.38	4.09±1.15	1.73±0.47

S=Subject, M= mean, SD= standard deviation

2- Velocity

As the change in the synthesis rate of each stage is observed, it gradually increases in the first and second stages, the highest speed in the third stage, and gradually decreases in the fourth and fifth stages S1 and S2 exhibited the lowest velocities at 1.71m/s and 2.54m/s, respectively. From S3 down swing is performed quickly. In the third stage, the synthesis velocity values were similar to those of the subjects, and S3 was the largest at 2.91m/s in the vertical velocity value. In the fourth stage, the maximum value of S1 the lowest value of 2.41m/s was shown. In the fifth stage, the composite velocity of S2 was 1.27m/s, and the smallest value of S3 was 2.21m/s. Therefore, the S3 was operated at a high velocity in the fifth stage due to the fast horizontal velocity It showed that performing a fast control speed is being kept operating. As a result, in S1, at the end of the down swing, the vertical speed rapidly decreased in the third stage in the second stage, S2 is maintained at a high speed, and the vertical speed is increased in the case of the serial speed, it is considered to facilitate movement.

Table 3. Angle change of shoulder and hip joints at each stage: (unit; degree). S=Subject, M= mean, SD= standard deviation

Subjects	Joints	Stages				
		1	2	3	4	5
S1	Shoulder	170	213	167	180	11
	Hip	192	236	114	206	106
S2	Shoulder	168	218	162	165	-15
	Hip	204	238	116	189	130
S3	Shoulder	171	213	159	168	65
	Hip	184	227	125	143	154
M±SD	Shoulder	169.67±1.53	214.67±2.89	162.67±4.04	7.94±171	20.33±40.81
M±SD	Hip	193.33±10.07	233.67±5.86	118.33±5.86	5.86±32.59	130±24

3- ANGLES

Moy to support bent legs table 3 shows during the operation, only the angular changes of the shoulder and hip joints, which have the greatest effect on the motion, are observed the subjects had similar shoulder angles at each stage, but at the second stage, S3 was 213°, S2 was 218°, and s-1 at stage 3 167°, S3 was 159°, S1 was 180° and S2 was 165° in the fourth stage. At the time of release, S1 was due to rebound structure extension of the shoulder joint, and S2 and S3 It seems that rebound was caused by flexion of shoulder joint. In the fifth stage, S3 was 65° and S2 was -15° The S2 is expected to maintain the front shoulder angle at the start of operation so that the swing motion by the arm support can be achieved, facilitating the technical connection after operation. In addition, when looking at the angle change of the hip joint, S1 and S2 are 236° and S3 is 2 38° to respectively, and in stage 3 S3 shown 125° and S2 had 116°. In the fourth stage, S1 showed 206° and S3 had 143°. Thus, S1 appears to have been subjected to columnar action with the extension of the heel plate, while S3 appears to have been subjected to roll to roll bending. As to the same results as seen when the two-stage swing down the shoulder and the hip joint come to full extension suppress rotational movement coming upon release it is considered to act advantageously on swing vertical movement.

Table 4. Changes in angular velocity of the shoulder hip joints at each stage (Unit; deg/s).

Subjects	Joints	Stages				
		1	2	3	4	5
S1	Shoulder	-20	15	127	145	-151
	Hip	159	4	132	247	-231
S2	Shoulder	-9	35	102	93	-172
	Hip	-121	41	130	426	-114
S3	Shoulder	-38	23	24	-38	-1652
	Hip	78	27	-156	601	-465
M±SD	Shoulder	-22.33±14.64	24.33 ±10.07	84.3±53.7	94.3±366.7	-658±861
M±SD	Hip	38.7±144.1	24.0±18.7	35.3±165.7	425±-177	-270±179

S=Subject, M= mean, SD= standard deviation

4- Angular velocity

Table 4 shows changes in angular velocity of shoulder and hip joints at each stage during operation of Moy to support bent legs.

Looking at the change in angular velocity of each stage of the shoulder In Stage 2 S2 is 35, S1 15 in stage 3 S1 127deg/s ,S3 is 24deg/s in stage 4 S1 is -145deg /s , S3 -38deg /s In addition, The change in angular velocity of the hip in stage 2 S2 41deg /s ,S1 4deg/s , in stage 3 S3 -156deg/s ,S1 132deg/s in stage 4 S3 601deg/s , S1 40deg/s ,stage 5 S3 -465deg/s ,S2 -114deg/s , As a result, the angular velocity of the hip joint is drastically reduced in the S1, and the angular velocity of the shoulder joint is rapidly decreased at the release of S3 This angular velocity is thought to affect the low center of gravity in fifth stage. However, S2 has been shown to accelerate the shoulder and hip joint angular velocities in the columnar system and to perform a high center of gravity in the fifth stage. Therefore, it is considered that stable start-up operation will be achieved by inducing the height of the shoulder and the height of the body due to the rapid angular velocity of the hip joint at release.

3- Conclusion and Recommendations:

3-1 Conclusion

1) In landing phase, the vertical displacement of cm shown the height of 1.11m for S1 1.31.m for S2 and 1.14m for S3. S2 preformed the highest height at landing.

2) In the release phase, the resultant velocity of CM was 2.82m / s for S1 and 4.41m/s for S2 'And S3 performed the fastest velocity of 5.05 m / s. Also the vertical velocity shown the velocity of 2.41m/s for S1, 3.75m/s for S2 and 3.14m / s for S3, S2 performed the fastest velocity at release.

3) .At the moment of release, the angle of shoulder joint shown the angle of 180° for s1.164° for S2 and 168° for S3, S1 show the largest angle at shoulder joint

4) During down swing stage, the angular velocity of shoulder joint indicated the angular velocity of 15deg/s for S1 and 23deg /s for S3 and S2 performed the down swing with the fastest angular velocity of 34deg/s. Also at the moment of release, the

angular velocity of hip joint was 40deg/s for s1.426deg /s for S2 and 601deg/s for S3. S3 showed the most extreme angular velocity.

3-2 Recommendations

Based on the findings of this study, the following recommendations were made:

1) The results of this study may be useful for the analysis of other elements in gymnastics.
2) Similar studies will be conducted using cinematography and multidimensional photography as well as video imaging techniques.
3) The study will also be conducted on different age levels, different performance levels, as well as on the different gender to compare performance.
4) The result of this study may be useful for a gymnast to learn the correct technique of Moy to support bent legs on parallel bars.

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