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An Analytical Study to Compare Some Kinematic Variables between the Attempts of Failure and Success of the Skill of the Back Aerobic Somersault from Stability among Parkour Players

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Abstract

The purpose of this paper is to study compare the main kinematic variables between the attempts of failure and success of the skill of the back aerobic somersault from stability among parkour players. In this study, three cameras were used at a rate of 240 pictures per second. A success movement and a failure movement were selected for each player for the three-dimensional analysis, and through the results, it appeared that the path of trying to succeed was longer than trying to fail in time. The velocity of the hand clip and the maximum velocity in the successful attempt were greater than those in the failure attempt and this result was an increase in the velocity of the projectile and an increase in the vertical height of the center of mass. When getting up in event (2) the amount of flexion of the hip and knee joint angle contributed to the optimum state of getting up and at the peak point, the angle of the hip and knee joint was flexed to the maximum to reduce the moment of inertia. At this point, too, the upper extremities of the attempt to succeed are extended more than those of the attempt to fail.

Keywords: Biomechanics, aerobic somersault, parkour players.

Introduction:

Parkour is an activity that involves moving through obstacles as quickly as possible using the easiest and simplest method with the least energy consumption.It is a sport similar to gymnastics and an activity of martial arts-inspired origin whose goal is to move quickly and effectively through a complex physical environment. By far the most comprehensive study of posterior standing on the floor has been presented for the posterior pelvic airway. One objective was to determine the contributions of the arms, trunk, and legs to the body's total angular and linear momentum. He also used force pads to record ground reaction forces (GRF) during the support phase (touch down to get up) .The legs and torso were responsible for the majority of the thrust exerted on the ground while awake. Which was almost double the torso contribution due to its large mass. Therefore, the exact position of the legs when touching was of great importance in order to control the angular velocity of the indicated object. Based on the results of a selected color series performed by male and female gymnasts during the World Gymnastics Championships in Stuttgart 1989.They concluded that the most important factors in getting up to get a successful heart were jump height and angular momentum. In all cases, the legs played the dominant role in contributing to the overall angular momentum while getting up. They report selected biomechanical data for posterior triples on a single-player collected as part of an ongoing study in 3D automated analysis. Their findings showed a 29% increase in vertical

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velocity when getting up from that reported for a double aerobic somersault this gave a 57% increase in the height reached by the center of gravity. And in order to check their characteristics with regard to performance. In short, there is a wealth of information and a good understanding of the requirements for aerobic cardioversion. But there is much less information regarding the biomechanical comparison of flip techniques in all possible skill stages. Therefore, the importance of the research lies in the study of comparing the kinematic variables between success and failure attempts for the skill of the lateral aerobic somersault pellet from stability.

Research objective:

- This study aims to compare some kinematic variables between the attempts of failure and success of the skill of the spherical back aerobic somersault from stability among parkour players.

Research hypotheses:

- There are statistical differences in the values of some kinematic variables between success and failure attempts in performing skill of the spherical back aerobic somersault from stability among parkour players

Research fields:

- Human Field: Players from the parkour academy and free jogging in Basra.
- Time Field: from 3/1/ 2021 to 2/5/ 2021.
- Spatial Field: the hall of the Gymnastics Training Center of the Basra Education Directorate.

Research methodology and field procedures:

Research Methodology:

The descriptive approach was used to suit the nature of the research.

Sample research:

Four players from the parkour academy and free running in Basra were selected intentionally and who are training in the gymnastics training center hall of the Basra Education Directorate as a sample for the current study. Average age, average height, weight and training age in Table (1).

Table (1)shows homogeneity of the research sample.

Variables	Mean	Std. Deviations	Median	Skew ness
Length	164.9	2.05	164.6	0.58
Mass	64.35	2.05	64.1	1.07
Age	18.5	1.3	18.6	0.19
training age	3.5	1	3.6	0

Videography:

Videography was used to analyze the posterior corpus callosum on the ground. Three (3) cameras were placed for the purpose of three-dimensional analysis (X, Y, Z). The first camera was placed at an angle of (45) degrees and is 6 meters away from the movement and at a height of 120 cm from the right and the second camera was placed at an angle of 45 degrees and 6

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meters from the movement and at a height of 120 cm and on the left and the third was placed vertically on the sagittal plane at an angle of 90 degrees and at a height of 120 cm also 240 picture per second in HD video quality and all cameras are mounted on a tripod. Players performed the skill three times and the best path of analysis was used.

Data collection procedures:

A filming process was done through the (Deep motion) program, and then the video was converted to a (Bvh) file, and then transferred to the (Motion Builder 2020) program and then converted to a file (C3d) for the purpose of dealing with it with the motion analysis program (PLAViMoP) and performing the motion analysis Three-dimensional. The kinematic variables of four selected stages of the complete skill were analyzed. Using the program (Wondershare Filmora) as shown in Figure (1).

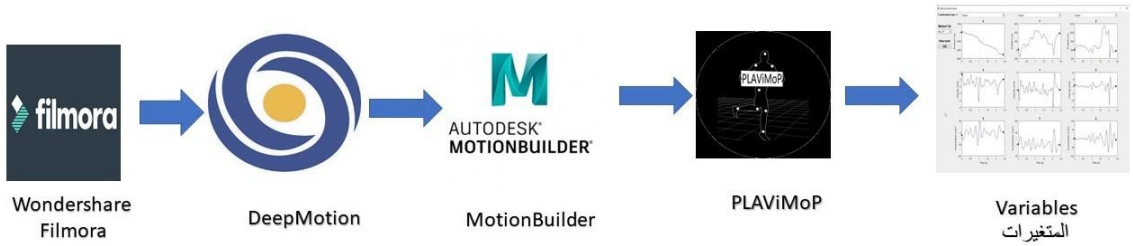

Fig.1 show sample data extraction process.

Statistical manipulations:

Statistical analysis was performed using (Minitab 18). The mean and standard deviation were calculated as a descriptive statistic and a (paired t-test) was used. Then, a t-value was obtained at the significance level (0.05).

Results and discussions:

Presentation, analysis and discussion of time:

Table(2) shows the time (unit per second) of attempts to succeed and fail.

Sample	Statistical variable	Stage 1	Stage2	Stage3	Stage4
succeed	Mean	1.10	0.40	0.29	0.39
	Std. Deviations	0.07	0.02	0.01	0.01
fail	Mean	0.86	0.39	0.27	0.36
	Std. Deviations	0.06	0.01	0.01	0.02
P value		0.010	0.60	0.113	0.043
T value		5.75	0.59	2.22	3.38

It is clear from tables (2) that there are statistically significant differences between the attempts of success and failure in the variable of time during stage (1, 4). To be a little big in the time trying to succeed. In particular, the time to attempt success was somewhat longer in the preparation section which is stage 1 and the time to attempt success in stage 4 which starts from

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the point where the center of gravity of the body is the highest point to the landing stage is somewhat longer which indicates that the flight time was longer. The researchers attribute this to the player's ability to take advantage of the amount of movement gained from each stage and benefit from it in the performance of the next stage due to the increase in the flexibility of the hip and knee joints. It was also found that the first stage of performance is the most time-consuming for the total skill performance. Include the beginning of the payment. Where the researchers noticed that this movement involved a large number of muscles in the body and motor coordination may take these muscles longer than charging the movement of fewer muscles as confirmed ([1). There is time for each muscle to complete muscle stimulation, so increasing these muscles increases the time required to stimulate them all.

Displacement on the sagittal plane:

Table (3) shows the displacement (unit: cm) of success and failure attempts.

Sample	variable	Stage 1		Stage2		Stage3		Stage4	
axles		Y	z	y	z	y	z	y	z
succeed	Mean	4.99	-23.43	21.68	21.32	22.15	36.83	27.75	65.72
	Std. Deviations	3.01	0.60	2.09	0.18	1.66	3.63	4.97	3.02
fail	Mean	4.78	-18.09	23.73	14.99	28.58	34.48	36.78	-63.06
	Std. Deviations	4.19	1.75	1.73	3.69	0.61	1.30	0.83	4.64
P value		0.937	0.010	0.192	0.042	0.005	0.311	0.037	0.00
T value		0.08	-5.79	-1.51	3.43	-7.28	1.22	-3.58	46.52

Considering the displacement of the body in the sagittal plane, the y-axis showed similar results in the first stage, but the z-axis achieved a great success attempt. In stage (1-2-3) the y-axis showed a slightly larger attempt to fail and the z-axis had a slightly greater success attempt. In general, the z-axis, the up and down movement, was large in the attempt to succeed, while the y-axis, the backward movement, was large in the attempt to fail. As a result of checking the difference between the attempts to shift the centre of gravity of the body according to the stages, there was a significant difference in the displacement of the z-axis in the first stage. However, when looking at the variables of the centre of gravity of the body, it was found that the attempt to succeed increased the vertical movement instead of showing a lot of movement back, which led to the increase in the body area where the player can invest the energy transferred from the horizontal speed during the moment of contact and convert it into speed and thrust at the moment of breaking the connection to increase the acceleration of the body upwards so that the player can complete the performance of the rotation at the moment of balling, and this view is confirmed by [(2,3)].

In the failed attempt, it was found that the backward movement is large and the vertical movement is small so that the height of the body is not large, which caused the failure. The two researchers explain the continuation of the increase in the displacement on the y axis with the continuation of the increase in the velocity on the y-axis for this moment from the displacement on the z-axis and the velocity on the y-axis for the same moment to the attempt to reach the

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center of gravity of the body in the direction of the vehicle y and at a high speed to achieve the motor duty in the next moment through a flying arc High.

Presentation, analyze and discuss the speed of success and failure attempts:

Table (4) Shows the speed (unit: meter/second) for success and failure attempts

Sample	Statistical variable	Stage 1	Stage2	Max speed	Stage3	Stage4
succeed	Mean	0.89	5.870	14.432	-2.93	1.96
	Std. Deviations	0.38	0.585	0.616	0.64	0.29
fail	Mean	0.37	4.23	12.91	-3.44	1.35
	Std. Deviations	0.50	0.13	0.10	0.68	1.76
P value		0.148	0.002	0.003	0.315	0.315
T value		1.66	5.45	4.87	1.10	1.10

The upper extremity movement in the rear somersault movement plays a very important role because it enhances and controls the movement pattern and momentum. And by displaying the results of each stage and the maximum speed of the hand clipas shows in Table (4).

In the results above it means the speed of the entire hand section at the point where the hand speed in the attempt of success is greater. At the maximum speed and in stage 2, the maximum speed in the attempt success was (14.43 m / s) and the failure period was (12.91 m / s), indicating that the maximum speed in the attempt success was higher than that in the failure attempt. As "swinging the right arms helps to raise the center of gravity of the body mass when jumping between (20-25%) of the jump" [(4)]. As a result of checking the difference between the two stages in the speed of the hand clip, there was a statistically significant difference in stage 2. In this stage where the foot supports the ground in case of maximum hyperextension of the shoulder joint In addition to this the maximum speed occurs in this stage and there is also a big difference between trying and failing It can be seen that the movement of the parts of the upper limb including the hand section accelerates before the body falls In the air, this can be considered as a measure to ensure maximum movement, as the speed of swinging the arms contributes to raising the center of gravity of the body by (5.00%) at the moment of launch [(5)].

Presentation, analysis and discussion of the shoulder angle:

Table (5) Shows the shoulder angle (unit: degrees) for success and failure attempts.

Sample	Statistical variable	event 1	event 2	event 3	event 4	event 5
succeed	Mean	143.8	-62.88	129.5	12.38	14.51
	Std. Deviations	4.111	2.126	11.8	7.849	1.978
fail	Mean	151.3	-56.01	118.7	8.674	1.656
	Std. Deviations	15.48	6.664	7.041	2.379	1.447
P value		0.388	0.097	0.166	0.401	0.000

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T value	-0.93	-1.96	1.58	0.90	10.49

The upper extremity movement of the rear somersault has an important meaning in that it enhances the rotational component by creating balance and momentum. The angle of the shoulder joint is the relative angle between the vector of the humeral section from the shoulder joint to the elbow joint and the vector of the trunk section from the shoulder joint to the hip joint. The angles of the shoulder joint according to the events are shown in Table (5).

From the above result in the event (2) which is the stage of the jump, the arm is the point at which the arm extends back and from this point, the movement of the arm moves forward again and the speed of the arms increases and the amount of movement increases the upper limb. Therefore, the greater the angle of expansion, the greater the momentum, so it can be said that the angle in trying to succeed is more effective. In an attempt to succeed, the angle of the shoulder joint between an event (4), which is the highest point in the centre of the body during flight, and event (5), which is the landing stage, appears larger, which is desirable so that the centre of gravity of the body can be controlled with the upper limbs in the landing stage. As a result of statistical verification between the two periods of the shoulder joint angle, it was found that there is a significant difference in the event (5).

Presentation, analysis and discussion of hip angle:

Table (6)Shows the hip angle (unit: degrees) for success and failure attempts

Sample	Statistical variable	event 1	event 2	event 3	event 4	event 5
succeed	Mean	188	80.78	171	64.82	99.81
	Std. Deviations	0.63	0.35	4.16	1.963	4.833
fail	Mean	192.3	85.66	183.4	96.38	93.59
	Std. Deviations	0.552	0.62	3.787	5.033	1.247
P value		0.000	0.000	0.005	0.000	0.047
T value		- 10.26	-13.69	- 4.40	-11.68	2.49

The angle of the hip joint is defined as the angle between the vector of the trunk section from the hip joint to the shoulder joint and the vector of the femoral part of the hip joint to the knee joint. In the posterior heart to examine the relationship between upper and lower body movements. The results of the hip joint angle by stage are shown in Table (6).

Considering the above results the failed attempt was slightly extended in the preparation mode for event 1. In event 2 in the preparation stage for the jump the success attempt was 80.78 ± 0.35 degrees. As for the failed attempt, it was 85.66 ± 0.62 degrees. In event 3, he showed a pass attempt of 171 ± 4.16 score. and 183.4 ± 3.79 degrees. To try to fail indicating that during the attempt to succeed it turned out to be easy in the air for them while maintaining more flexion. This is evidence that the angle at which the object is dropped in the air is smaller in the attempt to succeed. At the point of the peak in the center of gravity of the body. In event 4 the hip angle was 64.82 ± 1.96degrees for the attempted pass and 96.38 ± 5.03 degrees for the failed attempt. Flexion appears more than attempted failure. This can be seen to be more effective in acceleration. In the downward phase of Event 5, the attempt to succeed shows a greater angle

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than the attempt to fail. This is because the angle of the hip joint must be full extension to achieve the maximum height that the player can reach after the technical push It was found that the success attempt showed greater flexion than the failed attempt in both the torso and femur sections in the event (2,3,4), which increases the completeness of the movement performance. This confirms that the decrease in potential energy at the expense of the increase in kinetic energy and vice versa, i.e. it shows through the figure that the kinetic energy (kinetic and position) when the body of the gymnast player moves while performing the front jump and the increase of one of the two energies and the decrease of the other according to the movement and height of the body [(6)].

As a result of the statistical validation at the hip angle, it was found that there was a significant difference between the two attempts at the time when the shoulder was highly stretched in event 2, in addition, it was found that there was a significant difference between the two attempts at the point where the foot was easy on the ground (event 3) and the point where the foot reached in which the center of the body is to its maximum height (event 4). The two researchers explain the high rates of the beginning of balling by that the hip joint is responsible for directing the body parts to the lower end and moving them from bottom to top to complete the rotation by reducing the radius of rotation. Responsible for leading the body parts of the lower limb to complete the operation of the individual in order to achieve the skill duty at this moment and to achieve a successful landing. By increasing the bending angle, which gives a greater opportunity in the upward thrust phase, as well as decreasing the preparatory time and the negative gravitational torque" [(7)].

Presentation, analysis and discussion of the knee angle:

Table (7) Shows the knee angle (unit: degrees) for success and failure attempts

Sample	Statistical variable	event 1	event 2	event 3	event 4	event 5
succeed	Mean	178.3	117.4	132	73.4	130.6
	Std. Deviations	2.288	1.02	4.928	1.9	1.59
fail	Mean	183.1	131.7	132.9	78.56	140.5
	Std. Deviations	0.926	1.91	3.005	1.92	4.409
P value		0.009	0.000	0.781	0.009	0.005
T value		-3.83	-13.16	-0.29	3.84 -	4.24-

The angle of the knee joint is the angle between the vector of the lower section of the thigh from the knee joint to the ankle joint and the vector of the femoral section of the knee joint to the hip joint. The angle of the knee joint is easy to check the movement of the lower extremity through the relationship of flexion and extension between the thigh and the lower leg. The results of the knee joint angle by stage are shown in Table (7).

In the total phase, it becomes clear that the angle of the knee joint is smaller in the attempt to succeed than in the attempt to fail. The knee joint angle in Event 2, which changes to the jump phase, provides great force to drop the body in the air. At this point, the pass attempt was 117.4 ± 1.02 degrees. The failed attempt was 131.7 ± 1.91 degrees, which indicates that the flexion angle in the successful attempt was greater than that in the failed attempt, indicating that the knee joint angle is perfect. Even at event 4 the highest point in the body, the success period

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was 73.4 ± 1.9 degrees. The failure period was 78.56 ± 1.92 degrees. This indicates that the tendency to rotate by reducing the moment of inertia during aerodynamic motion is greater than in the successful attempt. As a result of statistical verification of the angle of the knee joint it was found that there is a significant difference in event 2 which is the point at which the shoulder joint is hyperextended and event 4 when the center of gravity of the body reaches its maximum height. He asserts that "the preparatory section through which the muscles are stretched so that the muscle tension reaches a maximum or something close to the main section is the optimal use of force in the main section, raising the center of mass of the body in front of the fulcrum base, and then the vertical distance of the center of mass of the body will increase and in turn leads To achieve better flight that contributes to achieving a state of balance of masses of body parts that will contribute to the process of good kinetic transmission and achieving good alignment [8].

Conclusions and Recommendations:

Conclusions:

- The total time required for the movement in the attempt to succeed is shorter because this skill requires speed of performance from the failure period.
- The maximum success speed of the hand clip is higher than the failure resulting in an increase in the velocity of the center of gravity of the body in the air and resulting in a large vertical displacement.
- In the jump phase event 2 the optimum state of the jump was carried out by increasing the change in the angle of the hip-shoulder joint and the angle of the knee joint and the rotational speed was increased by decreasing the moment of inertia by bending the maximum from the point where the center of gravity of the body reaches the highest point.
- In the jump phase the upper limb portion is stretched more than the attempt to fail and the amount of movement is increased by increasing the angle of the upper limb around the shoulder.

Recommendations:

- Work on developing qualitative exercises for each moment of the technical performance of the front side air cycle skill based on the biomechanical and linear indicators that have been reached.
- The need to pay attention to the development of the relative strength of the legs, especially for the front and rear pelvic air circulations.
- Work on the necessity of conducting a similar study on different samples and other skills.

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