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Biomechanical Indicators Which Discriminate the Performance Using Arms and Without Using Arms in the Vertical Pushing as a Basis to Design Training Programs.

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Abstract

The current study aims at Identify biomechanical indicators discriminating the performance of using arms and without using arms in the vertical pushing as the basis of designing a training program, through: Identifying the biomechanical variables using and without using arms in the vertical pushing, Identifying the biomechanical indicators discriminating the performance by using and without arms in the vertical pushing, The two researchers used the descriptive method, And the research sample of the first-team of Tanta and KafrelSheikh Sports Clubs, it included on (8) of players, were selected as follows: 2 Volleyball players, 2 basketball players, 2 football players, 2 high jump players, The results showed: using of arms in the vertical pushing led to increased pushing distance, and the contributing percentage of the arms (29.84%), and there are discriminating indications by using the Force Platform in the resultant of pushing Force for the two moments of beginning and the end of the damping for the benefit of performance of using arms. There are biomechanical indications that discriminate of the vertical pushing at the moment damping begins without using arms, in: Momentum of the gravity center of foot segment and angular displacement of the head with the trunk. There are biomechanical indications discriminating in vertical pushing by using arms: Momentum of the gravity center of forearm segment, Elbow angular velocity for the moment damping begins, Resultant Force of the gravity center of forearm segment, Momentum of the gravity center of body the moment damping ends. Resultant velocity of the gravity center of forearm segment, Momentum of the gravity center of body the moment pushing begins, Resultant Force of the center of gravity of forearm segment, Momentum of the center of gravity of foot segment at the moment pushing ends, Resultant Force and Momentum of the center of gravity of forearm segment at the moment hopping begins, momentum of the center of gravity of forearm segment, Resultant Force of the gravity center of trunk segment at the maximum height .

Key words*: indicator – the discriminating indicators..*

Introduction:

The scientific method is the basis of reaching to the upper levels and to establish the rules of the sports renaissance, where the importance of scientific research lies in its ability to reach to results of adding new scientific, where its increasingly important when it can be used in the scientific field to achieve a Sports leap aims to increase effectiveness of the performance, and developing it to contribute in the upgrading the level of performance of the players. (1)

And improving of the skill performance is Linked with extent the trueness of the details of the partial movement and how its union, and during of the performance, one can be directing and controlling it, so it is important to understand not only how to build a system of movements in skill performance, but also how the individual can directing and controlling, benefiting from its building, Therefore we can say that the various parts of the body movements that uniting and joining in the completely system, directing to movements to configure the performances or moving (dynamic) behaviors full completed. (2)

Therefore the full knowledge of information that associated with the movement of human body in terms of anatomy, physiological, biological and biomechanics are consider one of the basic components in the success of growing and developing methods of moving performance, the study of the mechanical dimension one of the most important science for all those who interesting in the sports, and using the biomechanical analysis for performances and sport skills is the Scientific way of developing the performance and training programs. (3)

Then, it can Dependence on the sports technique for the players of international Levels as a normative model when evaluating of the skill performance, and dealing with skills using continues biomechanical analysis can help to imagine what it must be a typical performance from multiple perspectives. (4), (5), (6)

The intervention of the basic skills or primary movements as the vertical pushing within building of all skills in the different sports, and when doing the training, it should be divided skills, according to the training programs, but on any basis can be interested by arms, and what is the percentage of sharing of the arms exercises within the training programs, and any biomechanical indicators should be attention, during the vertical pushing in the presence or without arms. thereof, After it became clear that the interest by legs training only without the interest of arms, where it provides the body with momentum during the performance, Especially in skills which contain the vertical pushing, such as hitting a ball by head, and the make a repel wall in Volleyball, and some jumps in basketball, and the high jump in athletics.

Through the studies, which Conducted in this field as the studies of : Bernardo Requena et al (2012) (7), - M.C. Marques & J.J. González-Badillo (2011)(8), - Young-Kwan K, & Yoon Hyuk K (2011) (9), - Daniel R , et al (2010)(10), which draws attention to arms for its role in the performance of different skills, in order to draw the attention the trainers toward the indicators which discriminate the performance by using and without using arms and its percentage in performance to design training programs . (11), (12)

Despite of our strong needs to use of modern scientific technology methods in training, and the significant progress in the recent time in the field of movement sciences and biomechanics and sports training, but, it did not address any of the scientists and researchers as the limits of two researchers knowledge to study the discriminating indicators of performance using arms and without using them, and its the contribution ratio during the performance, as well as the non-adoption of the coaches in training programs on those biomechanical indicators which discriminate the performance, and its contribution ratio, that prompting the two researchers to study biomechanical indicators which discriminate the performance using and without using arms in the vertical pushing as a basis to design training programs.

<u>Aim of study:</u>

The current study aims at identify the Biomechanical indicators of the performance discriminatory using arms and without using arms in the vertical pushing as a basis to design training programs, through:

1- Identifying the biomechanical variables using arms and without using arms in the vertical pushing.

2- Identifying the biomechanical indicators which discriminate performance by using arms and without using arms in the vertical pushing.

<u>Hypotheses</u>: The two researchers propose that:

There are the biomechanical indications of performances discriminate by using arms in the vertical pushing.

There are the biomechanical indications of performances discriminate without using arms in the vertical pushing.

<u>Methodology:</u>

<u>Design</u>: The two researchers used the descriptive method because its suitable for the nature of current study.

<u>Samples of study</u>: the sample of study has been selected using the deliberate method from the first-team of Tanta and KafrelSheikh Sports Clubs, it consisted (8) players of different games, it selected as following: 2 of Volleyball players, 2 of basketball players, 2 of football players, 2 high jump players.

<u>Data collection methods:</u>

We used special tools for force Platform, Special tools of photography and moving analysis, and machines, tools for anthropometric measurements.

<u>The exploring Studies</u>:

The two researchers conducted an exploring study in 1/3/2012 on a sample of (4 athletes) to check the suitability of the data collection methods for the sample and to check on videotaping equipment to be used for moving analysis, and to check on tools and procedures running the force Platform with a moving analysis.

<u>Procedures of the Main study</u>:

Procedures for photography and analysis from:

- Players of the research sample are equipped inside a Laboratory of moving analysis at Faculty of Physical Education, KafrelSheikh University, from the warm-up and the phosphorous labeling on centers of joints the body.

- The camera was connected, and equipment of force Platform to the moving analysis equipment (Dmas 7), to work together at the same time simultaneously during the performances in order to extract the moving analysis variables and variables of force Platform at the same moment of moving cadres.

- It has been used of camera high-speed (300 cadre/ sec.), at(120 cadre/ s), the Calibration scale has been put within the field of imaging, Then remove it before the performance, and camera was installed and adjust it in the direction of the left side to the players, and far from the middle of the force platform which the players standing to performance the jump by (6.10 m), and the height of the middle of the lens from the ground was (1.41 m).

- The attempts was performing and recording as three correcting attempts for each player, then, chosen the best attempt for each player in terms of Digital Level for the study and analysis.

- Identify the part to be analyzing on moving analysis set and variables of force Platform, then making the analysis and extracting the results.

Results and Discussion:

The two researchers confirmed the moderation of data in both of :chronological age, training age, weight, overall length, the length of the lower limb, Arm length, vertical distance of pushing using arms, vertical Distance of pushing without using arms at Statistical characterization of the sample data in the basic initial variables as shown in table (1). It is clear that the values squewness ranged between 3 ±, that indicating to moderation of data.

Table (1)

Statistical characterization of the sample data in the basic initial variables

variables	Mean	Median	SD	Squewness
Chronological age (year)	23.50	23.50	1.20	0.00
training age (year)	8.25	8. 5	.89	-0.62
Weight (kg)	76.50	76.5	1.20	0.00
Overall length (cm)	177.50	177.5	1.20	0.00
The length of the lower limb (cm)	98.25	98	1.16	0.81
Arm length (cm)	80.38	80	1.19	0.39
vertical Distance to pushing using arms (cm)	62.00	62	1.69	0.00
vertical Distance to pushing without using of arms (cm)	43.5	43.5	.53	0.00

Table (2)

the differences between vertical Distance to pushing using arms and without using arms

Variable	using arms		without using arms		Means difference		(t)	%
	Mean	SD	Means	SD	Mean	SD		
Vertical Distance to pushing	62.oo	1.69	43.50	0.53	18.50	1.20	*43.78	42.53

*Significance on $p \leq 0.05 = 2.36$

Table (3)

(discriminating indicators) in the pushing indicators (using Force platform)
in the vertical pushing using arms and without using arms

Variables	Value of lambada	Parabolic (F)	Level of significance
Pushing Force the moment damping ends	0.001	14064.1	Sig.
Pushing Force the moment damping begins	0.00	30063.31	Sig.
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.713		
Total variation Abstract	100		
The Latent root	4625.125		
Collective coefficient Correlation	1.000		

Table (4)

(the standard significance and non-standard) in the pushing indicators (using Force platform) in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Pushing Force at the moment the damping begins	-28.896	-14.522
Pushing Force at the moment damping ends	4.657	14.961
The stability of the non- standard equation	-0.027	———

Discrimination significance = -0.027 *+ (*Pushing Force at the moment the damping begins × *-28.896) + (*Pushing Force at the moment damping ends × *4.657)*

Table (5)

(discriminating indicators) in the Biomechanical indicators (the moment damping begins) in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Momentum of the center of gravity of forearm segment	0.00	28692.1	Sig.
Momentum of the center of gravity of foot segment	0.00	30524.43	Sig.
Angular displacement of the head with the trunk	0.00	29908.24	Sig.
Angular velocity of Elbow	0.00	36562.53	Sig.
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	113.943		
Total variation Abstract	100.000		
The Latent root	13295.465		
Collective coefficient Correlation	1.000		

Table (6)

(the standard significance and non-standard) in the Biomechanical indicators (the moment damping begins) in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Angular velocity of Elbow	0.2403	0.8754
Angular displacement of the head with the trunk	0.2902	1.0734
Momentum of the center of gravity of forearm segment	67.7771	2.3663
Momentum of the center of gravity of foot segment	-908.3154	-2.0613
The stability of the non- standard equation	-67.8104	———

Discrimination significance *= -67.8104 + (*Angular velocity of Elbow × *0.2403) + (*Angular displacement of the head with the trunk × *0.2902) + (*Momentum of the center of gravity of forearm segment × *67.7771) + (*Momentum of the center of gravity of foot segment × *-908.3154)*

Table (7)

(discriminating indicators) in the Biomechanical indicators (the moment damping ends) in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Resultant Force of the center of gravity of forearm segment	0.00	31117.11	Sig.
Momentum of the center of gravity of the body	0.00	30680.35	Sig.
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.977		
Total variation Abstract	100.000		
The Latent root	4720.05		
Collective coefficient Correlation	1.000		

Table (8)

(the standard significance and non-standard) in the Biomechanical indicators (the moment damping ends) in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Resultant Force of the center of gravity of forearm segment	0.1671	5.0263
Momentum of the center of gravity of the body	-350.7928	-4.4006
The stability of the non- standard equation	0.5158	———

Discrimination significance = 0.5158 + (Resultant Force of the center of gravity of forearm segment × 0.1671) + (Momentum of the center of gravity of the body × -350.7928).

Table (9)

(discriminating indicators) in the Biomechanical indicators (the moment (pushing begins) in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Resultant velocity of the center of gravity of forearm segment	28169.98	0.00	Sig.
Momentum of the center of gravity of the body	30547.85	0.00	Sig.
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.921		
Total variation Abstract	100.000		
The Latent root	4699.67		
Collective coefficient Correlation	1.000		

Table (10)

(the standard significance and non-standard) in the Biomechanical indicators (the moment pushing begins) in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Resultant velocity of the center of gravity of forearm segment	0.0953	4.2387
Momentum of the center of gravity of the body	-288.2775	-3.6633
The stability of the non- standard equation	0.4001	———

***Discrimination significance* = 0.4001**+ (**Resultant velocity of the center of gravity of forearm segment × 0.0953**) + (**Momentum of the center of gravity of the body** × **-288.2775**).

Table (11)
(discriminating indicators) in the Biomechanical indicators (the moment pushing ends)
in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Resultant Force of the center of gravity of forearm segment	24652.31	0.00	Denote
Momentum of the center of gravity of foot segment	30079.66	0.00	Denote
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.720		
Total variation Abstract	100.000		
The Latent root	4627.641		
Collective coefficient Correlation	1.000		

Table (12)
(the standard significance and non-standard) in the Biomechanical indicators (the moment pushing ends)
in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Resultant Force of the center of gravity of forearm segment	0.0596	1.8434
Momentum of the center of gravity of foot segment	-45.0993	-1.4573
The stability of the non- standard equation	0.1501	———

Discrimination significance = 0.1501 + (Resultant Force of the center of gravity of forearm segment × 0.0596) + (Momentum of the center of gravity of foot segment × -45.0993).

Table (13)
(discriminating indicators) in the Biomechanical indicators (the moment hopping begins)
in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Resultant Force of the center of gravity of forearm segment	21696.03	0.00	Denote
Momentum of the center of gravity of forearm segment	30080.57	0.00	Denote
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.721		
Total variation Abstract	100.000		
The Latent root	4627.780		
Collective coefficient Correlation	1.000		

Table (14)
(the standard significance and non-standard) in the Biomechanical indicators (the moment hopping begins)
in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Resultant Force of the center of gravity of forearm segment	0.1159	3.122
Momentum of the center of gravity of forearm segment	-27.1213	-2.6709
The stability of the non- standard equation	0.0843	———

***Discrimination significance* = 0.0843 + (Resultant Force of the center of gravity of forearm segment × 0.1159) + (Momentum of the center of gravity of forearm segment × -27.1213).**

Table (15)

(discriminating indicators) in the Biomechanical indicators (the moment hopping ends) in the vertical pushing using arms and without using arms

Biomechanical Variables	Value of lambada	Parabolic (F)	Level of significance
Resultant Force of the center of gravity of trunk segment	20758.28	0.00	Denote
Momentum of the center of gravity of forearm segment	30286.92	0.00	Denote
Lambadi Value to equation	0.000		
Final square value of (k) and its Moral	109.809		
Total variation Abstract	100.000		
The Latent root	4659.527		
Collective coefficient Correlation	1.000		

Table (16)

(the standard significance and non-standard) in the Biomechanical indicators (the moment hopping ends) in the vertical pushing using arms and without using arms

Variables	Non-standard significance	The standard significance
Momentum of the center of gravity of forearm segment	-146.2064	-1.5158
Resultant Force of the center of gravity of trunk segment	0.0112	1.8353
The stability of the non- standard equation	0.4225	———

Discrimination significance **= 0.4225 + (Momentum of the center of gravity of forearm segment × -146.2064) + (Resultant Force of the center of gravity of trunk segment × 0.0112).**

Figure (1)

Vertical Distance to pushing by using and without using arms

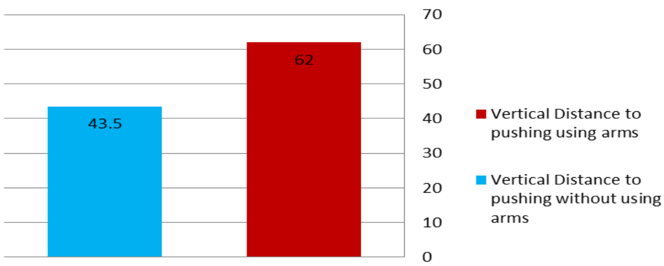


Figure (2): Dynamic of Pushing Force for force Platform during vertical pushing without arms

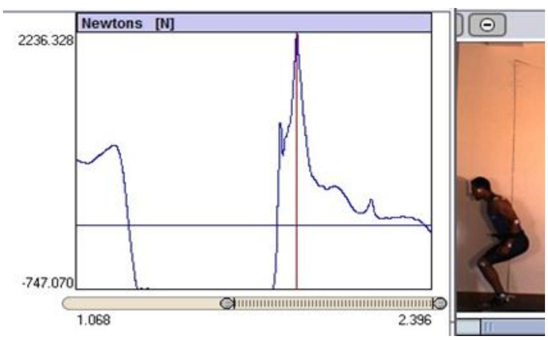


Figure (4): Resultant force Dynamics of the center of gravity of body during vertical pushing without using arms

Figure (3): Dynamic of Pushing Force for force Platform During vertical pushing using arms

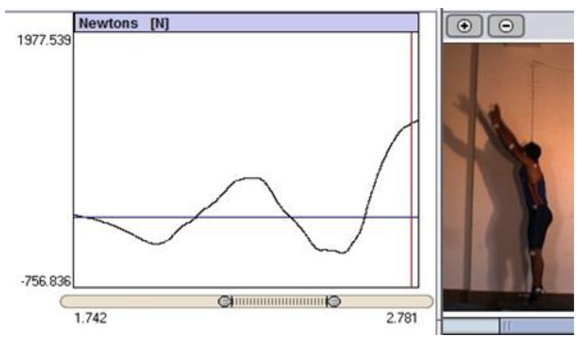


Figure (5): Resultant force Dynamics of the center of gravity of body during vertical pushing using arms

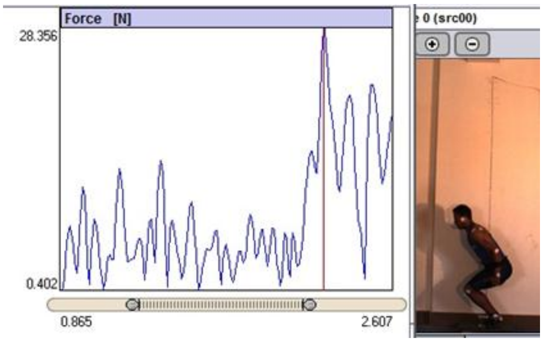


Figure (6): Momentum Dynamics of the center of gravity of body during vertical pushing without using arms

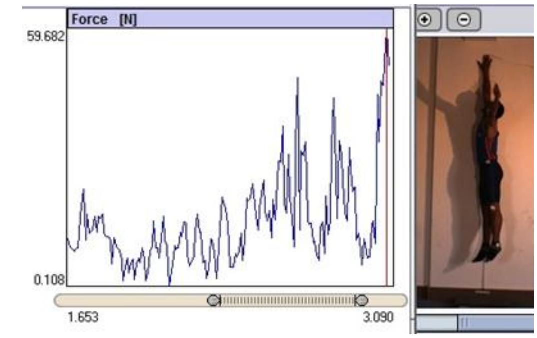
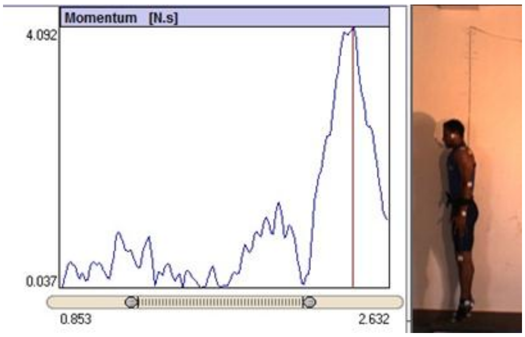
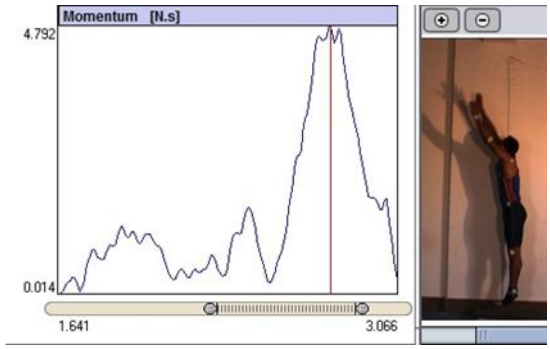


Figure (7): Momentum Dynamics of the center of gravity of body during vertical pushing using arms





From table (2) and Figure (1) its indicates that there are significant differences in the index of distance vertical pushing, between vertical pushing using arms, and without using arms, for the benefit of performance using arms, due to the transmission of the momentum from the Parties to the trunk, thus the body benefits of this, and, Sawsan Abdel-Moneim et al (1991), Talha Hosam El Din (1994), Mohamed Brekaa and khiria Elsocari were confirmed this result (2002). (13), (14), (15).

Table (3) shows statistically significant differences in the index of Force Resultant Pushing (FR), between the performance of vertical pushing with arms and without using arms, at the two moments of beginning and the end of the damping, for the benefit of performance using arms, Facility (1- a), explains that, it may be due to the importance of the movement of arms in the introductory part of pushing, where the transmission of the momentum from the arms to the trunk, which led to the compilation of force and its focus in the legs, to be ready to take it out at a certain moment, and this consistent with what indicated both of: Sawsan Abdel-Moneim et al (1991), Talha Hosam El Din (1994), Mohamed Brekaa and khiria Elsocari (2002). (13), (14), (15).

Table (5) shows that there are statistically significant differences in the indicator of the momentum of the gravity center of forearm segment, the angular velocity of Elbow at the moment of beginning of damping in the vertical pushing using arms and without using arms For the benefit of performance using arms, as attached (1 - b) explains, this may be due to the main role of the arms through primaries Swing to back to increase the range of motion to be preparing for strong and fast Swing during the main part of the movement, that represents in Transfer of the momentum from the two arms to the body, Talha Hosam El Din (1994) confirms that, (14), and study of Andre S. Salles, et al (2011 m). (16)

Also it shows that there are statistically significant differences in the index of the momentum of the gravity center of foot segment, angular displacement of the head with the trunk, at the moment damping begins in the vertical pushing using and without using arms, for the benefit of performance without using arms. This may be due to the concentration from the player to compensate for the absence of arms in the increase torques around the joints and damping overload, which leads to loss a part of the force to resist gravity, this illustrated through increasing flexion the joints of the head with the trunk, hip, knee, and ankle, trying to compensate for lost of momentum as a result to the absence of arms work, and that illustrates in attached (1- b, c), and Talha Hosam El Din. (1993). (3), confirms that, and study of AbdElRahman Akl (2012), they refer to the importance of the additional push using arms; by preliminary movement in improve the vertical height distance. (17)

Tables (7, 9) indicates that there are statistically significant differences in the index of Resultant Force of the gravity center of forearm segment, momentum of the gravity center of body, at the moment damping ends, velocity resultant of the gravity center of forearm segment, momentum of the gravity center of body, at the moment of beginning of pushing, in the vertical pushing using and without using arms, for the benefit of performance using arms, as attached (1 – c, d) explains. This may be due to the importance of velocity variable, especially for arms in transmission of momentum, where the momentum is the result of multiplying the mass of the segment in its velocity, and as a result of increase the velocity, then, increasing the Acceleration and thus force, where that force is the result of multiplying mass x the acceleration, and when the momentum Transfers from the arms to the trunk, the momentum of the body increases during these moments, Sawsan Abdel-Moneim et al (1991), Talha Hosam El Din (1994), Mohamed Brekaa and khiria Elsocari (2002) confirmed that (13) (14) (15)

Tables (11, 13) indicates that there are statistically significant differences in the index of Force Resultant of the gravity center of forearm segment, at the two moments of the end of pushing and the beginning of hopping, momentum of the gravity center of foot segment, at the moment pushing ends, momentum of the gravity center of forearm segment, at the moment hopping begins, in the vertical pushing using and without using arms, for the benefit of performance using arms, and attached (1- e, f) illustrates that, This may be due to the important role of the arms during the main stage of pushing through the velocity of movement of the arms, which give results in increasing the momentum to forearm segment and Force Resultant, and thus Transferring of momentum to the body, which helps to increase the momentum for the rest of parts, This is indicated by the study of Adrian, L et al (2004), the Swing arms in the vertical pushing, led to increased the muscle activity Gastronomies, and thus velocity of the movement of pushing the foot to land and increase its momentum. (18)

Table (15) shows that there are statistically significant differences in the index of Force Resultant of the gravity center of trunk segment, momentum of the gravity center of forearm segment, at the moment of end the hopping (height Maximum), in the vertical push, using and without using arms, For the benefit of performance using arms, and attached (1- g), illustrates that, this due to the fast arms motion during the main part of the movement, This fast movement showing clearly in the end of forearm, and as a result of Transmission the momentum from arms to trunk, which led to velocity and accelerate of the movement of the trunk and thus increase the force because force is the result of multiplying the mass in the acceleration which segment moves by it, which confirmed by Sawsan Abdel-Moneim et al (1991), Talha Hosam El Din (1994), Mohamed Brekaa and khiria Elsocari (2002). (13), (14), (15).

Figures (2-7) which had been extracted from a motor analysis (Dmas 7) to some of the dynamics in: Pushing Force of the Force platform, Resultant force, Momentum of the center of gravity of the body through the vertical pushing using arms and without using arms, which includes to Position a player at the moment the value highest of the variable and shows that the vertical line on the curve.

Conclusion:

Based on the above mentioned information, the researchers concluded the following:

1- That use of arms in the vertical pushing led to increased pushing distance and the percentage contribution of the arms (29.84%).

2- Discriminatory indications using the Force platform in the pushing Force Resultant (FR) for moments the beginning and end of the damping, for the benefit of performance using arms.

Discrimination significance = -0.027 + (pushing Force to moment the beginning of the damping × -28.896) + (Pushing Force to moment the end of the damping × 4.657)

3- Biomechanical indications which discriminate of vertical pushing:

A- At the moment damping begins without using arms in: Momentum of the gravity center of foot segment, angular displacement of the head with the trunk.

B- At the moment damping begins using arms in indications: Momentum of the center of gravity of forearm segment, angular velocity of Elbow.

Discrimination significance = -67.8104 + (Angular velocity of Elbow × 0.2403) + (Angular displacement of the head with the trunk × 0.2902) + (Momentum of the center of gravity of forearm segment × 67.7771) + (Momentum of the center of gravity of foot segment × -908.3154)

4- Biomechanical indications which discriminate of vertical pushing using arms:

A- At the moment the end of the damping: Resultant Force of the center of gravity of forearm segment, Momentum of the center of gravity to body.

Discrimination significance = 0.5158 + (Resultant Force of the center of gravity of forearm segment × 0.1671) + (Momentum of the center of gravity of body × -350.7928).

B- At the moment the beginning of the pushing: Resultant velocity of the center of gravity of forearm segment, Momentum of the center of gravity to body.

Discrimination significance = 0.4001+ (Resultant velocity of the center of gravity of forearm segment × 0.0953) + (Momentum of the center of gravity of body × -288.2775).

C- At the moment the end of the pushing: Resultant Force of the center of gravity of forearm segment, Momentum of the center of gravity of foot segment.

Discrimination significance = 0.1501 + (Resultant Force of the center of gravity of forearm segment × 0.0596) + (Momentum of the center of gravity of foot segment × -45.0993).

D- At the moment the beginning of the hopping: Resultant Force and Momentum of the center of gravity of forearm segment.

Discrimination significance = 0.0843 + (Resultant Force of the center of gravity of forearm segment × 0.1159) + (Momentum of the center of gravity of forearm segment × -27.1213).

E- At the moment the end of the hopping (height maximum): Momentum of the center of gravity of forearm segment, Resultant Force of the center of gravity of trunk segment.

Discrimination significance = 0.4225 + (Momentum of the center of gravity of forearm segment × -146.2064) + (Resultant Force of the center of gravity of trunk segment × 0.0112).

Recommendations:

Based on the study results, the two researchers recommend the following:

1- Guided by the biomechanical indicators discriminatory for vertical pushing using arms in putting the training programs for skills which contain of vertical pushing.

2-Guided by the Percentage contribution of the arms in the vertical pushing in putting the training programs for skills which contain of vertical pushing.

3- Guided by biomechanical indicators discriminatory for vertical pushing without using arms in putting the training programs for skills which contain of vertical jumping. And requires a performance in the absence of arms, or in cases of disability.

4- Conducting such this study in the horizontal jumps.

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