

Directing certain biomechanical indicators to establish an evaluative framework using the characteristic curve for the top spinning skill in wrestlers.

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Introduction:

Biomechanical variables in the sports field provide an opportunity to study the details of technical performance and objective judgment at the level of mastering skill performance, which in turn contributes to the improvement of sports technique by correcting and developing it according to the latest scientific theories in the educational and training process.(Cicchella, Antonoio٢٠٠٥), (Carr, c١٩٩٧), (Frank Pyke٢٠١٣), biomechanics is considered one of the sciences that is interested in studying human performance from the point of view of structural structure and muscle work in addition to motor principles and biomechanical indicators that require accuracy of analysis, and is also interested in studying the course of movements, their manifestations and angles of the joints of the body to provide the mechanical foundations associated with skill performance objectively, which contributes to the development of performance, (٢٠٠١ Andrew Little), ((Branko, et al ٢٠٠٤, (Burnett, et al ٢٠١٣), (David La Valle٢٠٠, and attention has recently turned to how to apply the foundations, laws and scientific theories obtained from the physical and mechanical sciences to the development of human performance and contribute to improving the level of skilled performance. Jamal Aladdin nahidalsbag٢٠٠٧, Adil Kamal and Islam mustafin٢٠٢٠ (Alexander, R.&Vernon,A.١٩٩٩), (Sawsan Abdel Moneim et al. ١٩٩١), (Mohamed Brega and khairyeh Al-sakariyy٢٠٠٢).

Finding the ideal technical performance as a characteristic curve in the light of biomechanical indicators and performance requirements is a solution to the motor problems posed and the objective basis for the performance evaluation process, as well as the initial reference for the success of the training process. Lliot, b. h (١٩٩٢), (Schubin, m. and schustin, b, ٢٠٠٠), (Aweys Al-Jebali, ٢٠٠١), (Mohammed bereqa and khairyeh Al-sakriy, ٢٠٠٢), Carr, c, (١٩٩٧)) the skill of the middle Barma is considered one of the important skills in the sport of wrestling, as it is considered one of the offensive skills of wrestling players, it occupies the first place in accumulating points in the world championship ٤٦ (٣٣.٣٦٪) of the total movements performed, and also occupied the first place in the world championships of Greco-Roman wrestling from ٢٠١١ to ٢٠١٣, and therefore the player must have a large amount of strength that qualifies him to overcome the opponent using the skill of the middle Barma. (Mohammad Al-Rubi ٢٠٠٥), (Tülin Atan, Osman Imamoğlu ٢٠٢٢), (Tunnemann H ٢٠١١).

The top spin skill is one of the essential techniques for wrestlers, requiring an in-depth study of performance details through biomechanical analysis tools and the examination of elite athletes' performances. This allows for identifying objective evaluation methods, contributing to the advancement of training programs. Consequently, keeping up with technological developments has become increasingly necessary, underscoring the importance of biomechanical analysis for the execution of the top spin skill in wrestling.

Many reference studies have addressed this trend as Renger study in (١٩٩٦) with the theme "Preview of the profile of mood states (POMS) in the prediction of athletic success", the study of Feng-Jen Tsai, Vu Liu", Shau-Hua Chen", and Vun-Ching Huang (٢٠٠٤), her topic "Biomechanical Characteristics and EMG Activities of weighed", the study of Umaina Al-Ajmi (٢٠٠٤), her topic "building a calendar system using the characteristic curve most suitable for the dynamics of triple-shot shooting from jumping in basketball", the study of Ihab Abdul Basir (٢٠١٠), and her topic "graphical network for diagnosing kinematic pushing Al-Jalla", the study of Mahmoud Al-Mutbouli (٢٠١٦), and its topic "comparison of the curve of Biomechanical characteristics of the skill of bending backwards (front and back teeth) in the sport of wrestling", and the study of Shima Hassan (٢٠٢٢) directing some biomechanical indicators to put an orthopedic basis in the

light of the characteristic curve of the skill of discus throwing, and the study of Samiha Najah (٢٠١٨) with the theme "Building a calendar system using the characteristic curve of the dynamics of long jump performance", and Emad Salib study (٢٠٢٠) with the theme "the impact of functional strength training on some biomechanical indicators and the effectiveness of the skill performance of the back throw face-to-back for wrestlers"

Despite the importance of the characteristic curve in identifying the biomechanical characteristics of ideal performance, the possibility of using it in evaluation may be not widespread, each variable may be used separately, which makes it difficult for us to use these curves in evaluating performance and passing a judgment on it, so the two researchers conducted this study to design a characteristic curve using the biomechanical indicators of some current through the guidance of some biomechanical indicators To establish a calendar basis using the characteristic curve of twine skill from above for wrestling players.

Research objective:

- Directing some biomechanical indicators to establish a calendar basis using the characteristic curve of twine skill from above for wrestling players.

The research question:

- Is there a correlation between some biomechanical indicators under study and the level of twine skill performance of top wrestling players?

Materials and Methods

Research methodology: the descriptive methodology was used to suit the nature of the research.

Research sample: the research sample was selected in a deliberate way, and they are (twelve) players from the Champions of the Republic in the sport of wrestling and registered with the Egyptian Wrestling Federation, they were distributed as follows: two players for the Reconnaissance experience, (ten) players for the basic experience.

Table ١: Statistical Indicators Describing the Research Sample in Terms of Body Mass, Chronological Age, Training Age, and Selected Anthropometric Variables of the Sample.

Torsion Skewness Coefficient	Standard deviation	Arithmetic Average	Median Broker	Measurement Unit	Variants
-١.٢٤٤	٦.٤٢٩	١٧٢.٣٣٣	١٧٥	Cm	Total length
٠.٣٩٧	٢.٥١٧	١٠٠.٣٣٣	١٠٠	Cm	Length of the lower limb
-٠.٦٥٥	١.٥٢٨	٩٠.٦٦٧	٩١	Cm	Trunk Length
٠.٦٥٥	٣.٠٥٥	٧٢.٦٦٧	٧٢	Cm	Arm Length
-٠.٦٥٥	٠.٧٦٤	٣٢.٨٣٣	٣٣	Cm	Humerus length
٠.٦٥٥	١.٥٢٨	٦٨.٣٣٣	٦٨	Kg	Mass
-٠.٦٥٥	١.٥٢٨	١٩.٦٦٧	٢٠	Year	Chronological age (lifetime)
-١.٧٣٢	٠.٢٨٩	٥.٨٣٣	٦	Year	Training age (Time)

It is clear from **Table No. (١)** the median, arithmetic mean, standard deviation, torsion coefficient of mass, Time age, training age and some anthropometric variables, that all values of standard deviations are lower than the arithmetic averages, and that all values of the torsion coefficient range between ٣, which indicates that the study sample represents a moderate community.

data collection tools and devices: special tools for imaging and kinetic analysis, and special tools for anthropometric measurements were used.

Survey (Pilot) study: the survey study was conducted on (٢) players from outside the basic sample on ١٥/١٢/٢٠٢٣ at Tanta Sports Club, with the aim of adjusting the variables of video shooting for the purpose of kinetic analysis, determining the angle and dimensions of the camera from the technical performance of the skill, as well as determining the location of the calibration model.

The Main Study:

- The technical performance of the top spin skill was recorded for the players for biomechanical analysis on ١٤/١/٢٠٢٤ during the national wrestling team trials.
- The section of the performance to be studied was identified in the motion analysis software using Kinovea ٨.٢٦, focusing on the following moments: (beginning of the basic phase, beginning of rotation to execute the movement, beginning of the player's back rotation toward the ground, and beginning of the opponent's contact with the ground). These moments were analyzed for the points: (center

of mass of the leg, center of mass of the body, center of mass of the arm), followed by the analysis process. The results were then extracted for statistical operations.

Motion Analysis Imaging Procedures:

- The players were prepared by placing (medical plaster) markers on the joint centers of the players.
- According to the results of the pilot study, two video cameras (Nikon $\gamma 100$) were fixed on a tripod, with the cameras' beams meeting at an angle of approximately 40° degrees over the performance area. The frame rate of each camera was 60 frames per second, and each camera was positioned 0.80 meters away from the center of the performance area. The center of the camera lens was positioned at a height of 90 cm from the ground.
- A calibration device was placed in the middle of the motion field, then removed.
- Three attempts were filmed and recorded for each player, with the best attempt being selected.
- The performance was analyzed by calculating the resultant velocity, acceleration, force, momentum, and kinetic energy for the points of the centers of mass (leg, body, arm). The following diagram illustrates the study moments.



(١)

The moment of the beginning of the basic stage



(٢)

The moment of the beginning of rotation for the execution of the movement



(٣)

Moment of Back Rotation Toward the Ground



(٤)

The moment the competitor first touched the ground

Figure ١: shows the moments of performing the twine skill from above for wrestling players

Subjecting these attempts to biomechanical analysis of the skill using the program (Kinovea ٨.٢٦), then conducting the analysis process and extracting the results

Results and Discussion:

Table ٢: biomechanical variables of the man's center of gravity during the two moments (the beginning of the basic phase, the beginning of the rotation for the execution of the movement) most closely related to the level of twine performance from above for wrestling players.

N = ١٠

Correlation Coefficient	Maximum Value	Minimum Value	Skewness Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement	Variables	
.٩١٣*	٤.٨١	٤.٢٢	.٠١٢	.١٨٧٠٦	٤.٥١٣٥	٤.٥٢٧٩	]m/s[	Resultant Velocity	The moment of the beginning of the basic stage
.٥٦٢*	١.٨٢	١.٢٣	.٠٠٣	.١٨٦٣٣	١.٥١٩٥	١.٥٣٣٤	[m/S']	Resultant Acceleration	
.٨٥٣*	٢٣.٧٥	٢٣.١٦	.٠٠٦	.١٨٦٧١	٢٣.٤٥٦٥	٢٣.٤٧١٠	[N]	Resultant Force	
-.٤٣٨	٦٣.٥٧	٦٢.٩٨	.٠٠٦	.١٨٦٧٦	٦٣.٢٧٥٥	٦٣.٢٩٠٣	Kg m/s	Momentum	
-.٥١٢	١٥١.٨١	١٥١.٢٢	.٠٠٩	.١٨٦٨١	١٥١.٥١٥٥	١٥١.٥٢٩٨	Kg m/s	Kinetic Energy	
.٧٧٨*	٤.٧١	٤.١٢	-.٠٠١	.١٨٦٢٩	٤.٤١٠٠	٤.٤٢٤٠	]m/s[	Resultant Velocity	The moment of the beginning of rotation for the execution of the movement
.٥٧٩**	.٧٣	.١٤	.٠٠٤	.١٨٦٤٥	.٤٢٨٥	.٤٤٢٥	[m/S']	Resultant Acceleration	
-.٤٤٤	٩.٢٤	٨.٦٦	.٠٠٥	.١٨٦٤٨	٨.٩٤٧٥	٨.٩٦١٤	[N]	Resultant Force	
.٠٥٣	٦٢.٢٠	٦١.٦١	.٠١١	.١٨٦٩٦	٦١.٩٠٣٥	٦١.٩١٧٨	Kg m/s	Momentum	
-.٤٨٢	١٤٥.٣٣	١٣٧.٢٩	-.٣٣٥	٢.٥٨٧٤١	١٤٢.١٤٣٠	١٤٢.٠٥٣٧	Kg m/s	Kinetic Energy	

Significance Level at $٠.٠٥ = ٠.٦٠٢$

Table ٣: Biomechanical Variables for the Center of Mass of the Leg During the Moments of (Beginning of Back Rotation Toward the Ground of the Player, Beginning of Opponent's Contact with the Ground) Most Correlated with the Performance Level of the Top Spin Skill in Wrestling Players .(N = ١٠)

Correlation Coefficient	Maximum Value	Minimum Value	Skewness/ Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement	Variables	
.٧٤٢*	٤.١٩	٣.٦٠	.٠٠٨	.١٨٧	٣.٨٩٥	٣.٩٠٩	[m/s]	Resultant Velocity	Moment of the Player's Back start to Rotation Toward the Ground
.٧٤٢*	.٦٢	.٠٣	.٠١١	.١٨٧	.٣٢٣	.٣٣٨	[m/S ^٢]	Resultant Acceleration	
-.٤٣٧	٧.٨٤	٦.٦٢	-.٧٤٢	.٣٩١	٧.٤١٧	٧.٣٠٧	[N]	Resultant Force	
.٧٤١*	٥٥.٣٥	٥٤.٧٦	.٠١٥	.١٨٧	٥٥.٠٥٢	٥٥.٠٦٦	Kg m/s	Momentum	
-.٤٥١	١٠٥.٩٧	١٠٤.٠٣	-.٩٤١	.٦٣٠	١٠٥.٣٤٠	١٠٥.٢١٥	Kg m/s	Kinetic Energy	
.٧٥٤*	٣.٦٧	٣.٠٨	.٠٠٩	.٢٠٢	٣.٣٧١	٣.٣٦٨	[m/s]	Resultant Velocity	Moment of the Opponent's Back First Contact with the Ground.
.٧٤١*	٨.١٩	٧.٦٠	.٠٠٧	.١٨٧	٧.٨٩٧	٧.٩١١	[m/S ^٢]	Resultant Acceleration	
-.٥٧٦*	١٠٥.٨٧	١٠٤.٣٣	.٠٥٩	.٥٢٠	١٠٥.١٥١	١٠٥.٠٧١	[N]	Resultant Force	
-.٤٣١	٤٨.٣٦	٤٦.٠٠	-.٥٦٥	.٨٣٠	٤٧.٣٠٤	٤٧.٢٧٥	Kg m/s	Momentum	
-.٢٠٥	٨٧.٨٧	٨٦.٧٦	-١.٠٥٩	.٣٣٣	٨٧.٥٠٢	٨٧.٤٢٠	Kg m/s	Kinetic Energy	

Morale level at $\alpha = 0.05$ = ٠.٦٠٢

Table ٤ : biomechanical variables of the center of gravity of the body during the two moments (the beginning of the basic stage, the beginning of the turn to perform the movement) most correlated with the level of twine performance of the top wrestling players N = ١٠

Correlation Coefficient	Maximum value	Minimum Value	Skewnes/ Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement	Variables	
.٧٤٠*	٥.٤٥	٤.٣٣	-.٦٥٢	.٣٧٧	٥.٠٩٣	٤.٩٥٨	[m/s]	Resultant Velocity	Moment of the Beginning of the Core Phase
.٦٨٧*	١.٩٦	١.٠٥	-.١٢٧	.٣١٨	١.٥٣٠	١.٤٩٧	[m/S ^٢]	Resultant Acceleration	
.٠٩٢	٢.٠٧	١.٢٨	-.٤٦٨	.٢٩١	١.٧٢٨	١.٧٢٩	[N]	Resultant Force	
.٧٣٤*	٣٨٥.٨٠	٣٦٧.٨٠	-.٢٩٩	٥.٦٤٠	٣٧٧.٩٤٧	٣٧٧.٦٨٣	Kg m/s	Momentum	
.٣٢٤	١٠٥٢.١٩	١٠٢٤.١٩	-.٢١٢	٨.٨٢٩	١٠٣٩.٨٢٣	١٠٣٩.٨٤٢	Kg m/s	Kinetic Energy	
.٨٥٩*	٥.٢٦	٣.٨٢	-.٧٨٢	.٤٤٤	٤.٨٦٩	٤.٧٤٧	[m/s]	Resultant Velocity	Moment of the Start of Rotation to Execute the Movement
.٠٩٤	٢.٨٧	٢.٠٧	-.٤٦٢	.٢٩٢	٢.٥٢٣	٢.٥٢٤	[m/S ^٢]	Resultant Acceleration	
.٠٩٢	٢٠٠.٨٢	٢٠٠.٠٣	-.٤٦٧	.٢٩١	٢٠٠.٤٧٧	٢٠٠.٤٧٨	[N]	Resultant Force	
.٧٥٣*	٣٢٥.٦١	٣٠٥.٢١	.٠٤٦	٧.١٥٣	٣١٣.٤٢٢	٣١٤.٣٨٩	Kg m/s	Momentum	
-.٠٤٩	٧٣٥.٨٨	٧١٠.٧١	-.٥١٧	٧.٦١٥	٧٢٥.٦٤٤	٧٢٥.٥٤٤	Kg m/s	Kinetic Energy	

* Morale level at ٠,٠٥ = ٠,٦٠٢

Table (٥) biomechanical variables of the center of gravity of the body during two moments (the beginning of the player's back turning to the ground, the beginning of the opponent touching the ground) most correlated with the twine performance level from the top for wrestling players N = ١٠

Correlation Coefficient	Maximum value	Minimum Value	Skewness/ Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement		
.٦١٢*	٤.٣٣	٣.٠٣	-.٥٤٧	.٤٤	٣.٨٣	٣.٧٨	[m/s]	Resultant Velocity	Moment of the Start of the Player's Back Rotation Toward the Ground
.٦٩٩*	٣.٨٥	٢.٤١	-.٢٠١	.٥٢	٣.١٣	٣.٢١	[m/S ^٢]	Resultant Acceleration	
.٥١٤	٢٢٢.٣٤	١٨٩.٥٨	.٥١٦	٩.٢٦	٢٠١.٠٨	٢٠٤.٠٢	[N]	Resultant Force	
-.٣٣٨	٢٦٥.٥٨	٢٤٠.٤١	-١.٢٣٥	٧.٢٩	٢٥٨.٩٨	٢٥٧.١٨	Kg m/s	Momentum	
-.٢٨٠	٥٠٣.٨١	٤٣١.٦١	-.٦٩١	٢٢.٤٥	٤٧٩.٥٨	٤٧٥.٨٢	Kg m/s	Kinetic Energy	
.٧٤٥*	٣.٧٧	٢.١٤	-.٢٥٦	.٤٨	٣.١٢	٣.٠٤	[m/s]	Resultant Velocity	Moment of the Opponent's First Contact with the Ground
.٠٩٢	١.٥٠	.٧١	-.٤٦٥	.٢٩	١.١٦	١.١٦	[m/S ^٢]	Resultant Acceleration	
-.٤٢٨	١٠٥.١٦	٨٣.٩٣	-.٥١٧	٦.٧٩	٩٧.٢١	٩٦.٣٦	[N]	Resultant Force	
.٥٧٦*	٢٢٤.٧٠	١٦٨.٦٢	-.٦٠٦	١٧.٦٩	٢٠٤.٦٨	٢٠٣.٠٧	Kg m/s	Momentum	
-.٤٣١	٣٦٠.٦٦	٣١٨.٤٣	-.٥١٨	١٣.٦٦	٣٤٥.٢١	٣٤٣.٣٥	Kg m/s	Kinetic Energy	

Significance Level at $٠.٠٥ = ٠.٦٠٢$

Table (٦): Biomechanical Variables for the Center of Mass of the Arm During the Moments of (Beginning of the Core Phase, Beginning of Rotation to Execute the Movement) Most Correlated with the Performance Level of the Top Spin Skill in Wrestling Players (N = ١٠).

Correlation Coefficient	Maximum value	Minimum Value	Skewness/ Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement	variables	
.٦٥٠*	٤.٥٠	٣.٣٨	-.٨٤٢	.٣٥٤	٤.٠٧٦	٤.٠٤٦	[m/s]	Resultant Velocity	Moment of the Start of the core Phase.
.٨٠٥*	٢.٦٧	١.٤٣	.١٨٣	.٤٣٩	١.٩٤٤	٢.٠١٥	[m/S ^٢]	Resultant Acceleration	
.٠٧٤	٨.٨٠	٦.٢٩	-١.٠٩٣	.٦٧٢	٧.٩٣٩	٧.٨٣٣	[N]	Resultant Force	
-.٠٦٩	١٨.٨٩	١٥.٣٦	-.٧٧١	١.٤٠٨	١٨.٣٧٠	١٧.٥٧٨	Kg m/s	Momentum	
.٠٥٦	٤٢.٤٤	٤٠.٤٧	-.٩٠٥	.٦٣٧	٤١.٩٧٢	٤١.٧٤٦	Kg m/s	Kinetic Energy	
.٨٢٢*	٤.٨٣	٣.٢٦	-.٩٤٧	.٤٦٩	٤.٣٧٤	٤.٢٦٩	[m/s]	Resultant Velocity	Moment of the Start of Rotation to Perform the Movement.
.٧٦٣*	٣.٥٣	١.٩٧	.١٩٩	.٤٥٢	٢.٦٢٧	٢.٧٣٢	[m/S ^٢]	Resultant Acceleration	
-.٠٦٠	١٠.٦٢	١٠.٠٣	.١٩٠	.٢٢٤	١٠.٢٣٨	١٠.٣١٥	[N]	Resultant Force	
-.٠٤٦	٢٠.٢٨	١٧.١٥	-٢.٣٧٦	.٨٩٢	١٩.٨٦٠	١٩.٦٣٨	Kg m/s	Momentum	
-.٤٢٧	٤٨.٩٧	٣٤.٨٠	-.٥٠٧	٤.٥٢٦	٤٣.٦٤٤	٤٣.٠٧١	Kg m/s	Kinetic Energy	

* Morale level at ٠,٠٥ = ٠,٦٠٢

Table (٧) biomechanical variables of the center of gravity of the arm during two moments (the beginning of the player's back turning to the ground, the beginning of the opponent touching the ground) most correlated with the twine performance level from the top for wrestling players N = ١٠

Correlation Coefficient	Maximum value	Minimum Value	Skewness/ Torsion Coefficient	Standard Deviation	Median	Arithmetic Mean	Unit of Measurement	variables
.٦٣١*	٤.٥٦	٣.٣٤	.٢٢٩	.٣٩٠	٣.٨٩١	٣.٨٨٥	[m/s]	Resultant Velocity
.٨٧٣*	١٠.٨١	٨.١١	-.٤٧٦	.٨٠٧	٩.٧١٣	٩.٤٦٢	[m/S']	Resultant Acceleration
-.٤٥٩	٤٢.٢٣	٢٨.٦٦	-.٦١٣	٤.٣٨١	٣٧.٥٤٤	٣٦.٨٣١	[N]	Resultant Force
-.٠٥٨	١٦.٨١	١٦.٢١	.١٩٥	.٢٢٥	١٦.٤٢٢	١٦.٤٩٩	Kg m/s	Momentum
-.٢٧٨	٣٣.٦٤	٢٧.٤٣	-.٤٤٨	١.٨٥٥	٣١.١١٧	٣٠.٩٤٢	Kg m/s	Kinetic Energy
.٦٤٣*	٣.٠٠	١.٩٠	-.٣٩٩	.٤٠٦	٢.٥٦٨	٢.٥١١	[m/s]	Resultant Velocity
.٢٨٤	٧.٣٩	٥.٥١	-١.٧٥٠	.٥٣٤	٧.٠٠٥	٦.٨٩٤	[m/S']	Resultant Acceleration
-.٤٢٣	٢٩.٠٦	٢٠.٣٨	-.٤٩٤	٢.٧٣٤	٢٥.٦٩٩	٢٥.٣٨٧	[N]	Resultant Force
.٩٠٨*	١٠.٣٧	٨.٣٠	-.٩١٦	.٥٨٦	٩.٨٠٨	٩.٥٦٢	Kg m/s	Momentum
.٠٢٤	١٢.٧٧	٨.٢١	-.٧١٨	١.٧٧٤	١٢.٣٠٦	١١.١٦٤	Kg m/s	Kinetic Energy

* Morale level at $0.05 = 0.602$

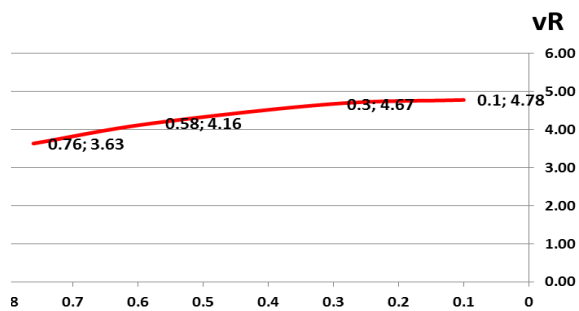


Figure (٧): The Characteristic Curve of the Dynamics of the Resultant Velocity of the Center of Mass of the Leg from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

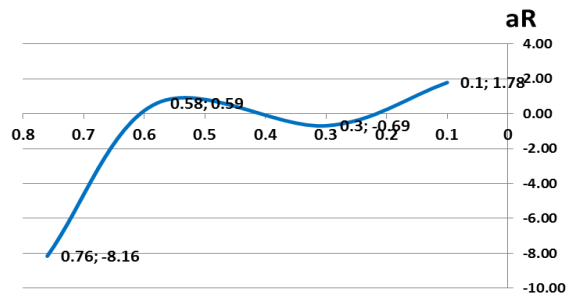


Figure (٨): The Characteristic Curve of the Dynamics of the Resultant Acceleration of the Center of Mass of the Leg from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

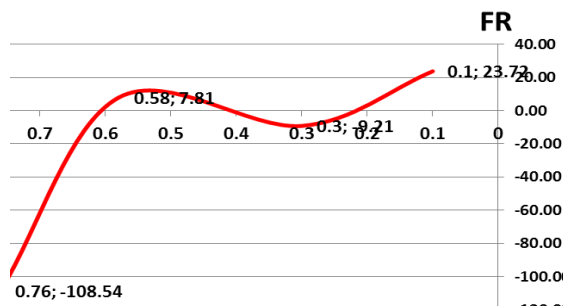


Figure (٤): The Characteristic Curve of the Dynamics of the Resultant Force of the Center of Mass of the Leg from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

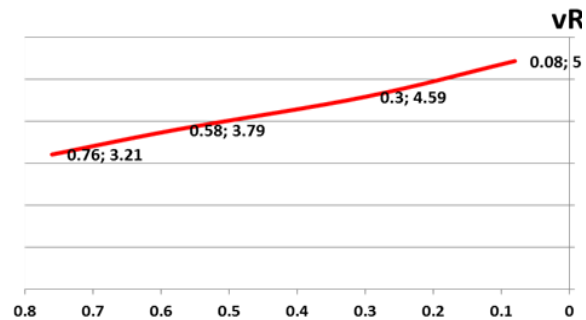


Figure (٥): The Characteristic Curve of the Dynamics of the Resultant Velocity of the Center of Mass of the Body from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground

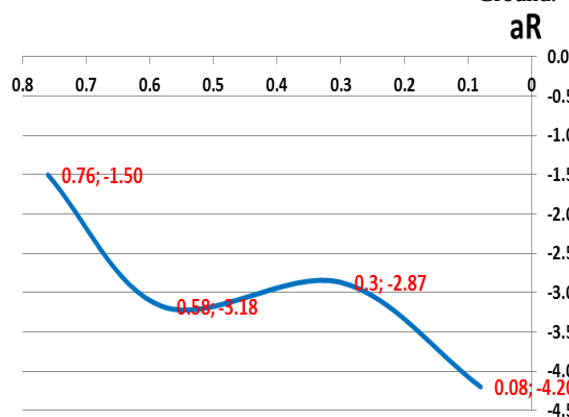


Figure (٦): The Characteristic Curve of the Dynamics of the Resultant Acceleration of the Center of Mass of the Body from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

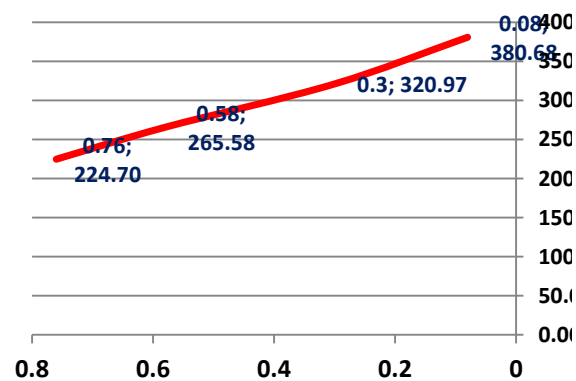


Figure (٧): The Characteristic Curve of the Dynamics of the Momentum of the Center of Mass of the Body from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

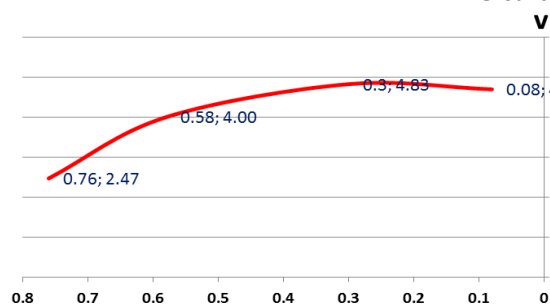


Figure (٨): The Characteristic Curve of the Dynamics of the Resultant Velocity of the Center of Mass of the Arm from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

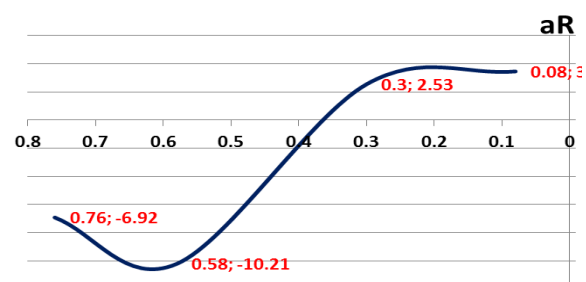


Figure (٩): The Characteristic Curve of the Dynamics of the Resultant Force of the Center of Mass of the Arm from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

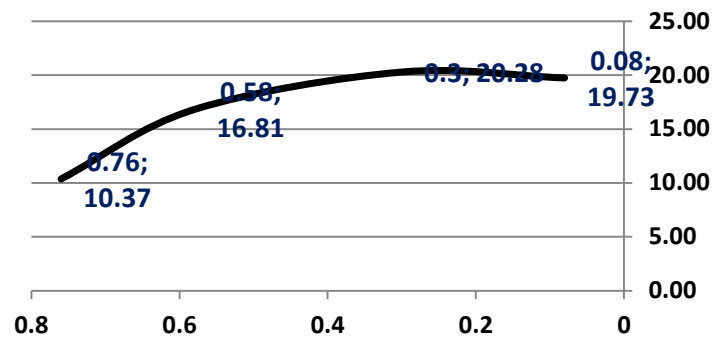


Figure (١٠): The Characteristic Curve of the Dynamics of the Momentum of the Center of Mass of the Arm from the Moment of the Start of the Core Phase to the Moment of the Opponent's First Contact with the Ground.

Table (٨): The Simple Correlation Matrix Between Some Biomechanical Variables at the Center of Mass of the Leg at the Moments of the Start of the Core Phase and the Start of Rotation in Relation to the Performance Level of the Overhead Somersault Skill in Wrestlers (N=١٠).

Moment of the Start of the Rotation to Execute the Movement					Moment of the Start of the Core Phase					Biomechanical variables	
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity		
										Resultant Velocity	Moment of the Start of the core Phase
									.٥١٩	Resultant Acceleration	
								.٥٤٦	.٨٧٥**	Resultant Force	
							-.٧٤٦-*	-.٢٦٨	-.٤٠١	Momentum	
						.٥٤٥	-.٦٣٧-*	-.٣٩٢	-.٥٨٩	Kinetic Energy	
					-.٧٨٧- **	-.٥٨٤	.٧٠. *	.٤٧٣	.٦٨٢*	Resultant Velocity	Moment of the Start of the Rotation to Execute the Movement
				.٦٨٢*	-.٥٤٤	-.٤٩٧	.٦٤٧*	.٥٩٩	.٥٩٦	Resultant Acceleration	
			-.٢١٧	-.٤٧٦	.٣٠٤	-.١٥٤	-.٢٥١	-.٤٠٥	-.٦٢٦	Resultant Force	
		.٠٣٢	.٠٦٩	.٣٣٦	-.٣٩٥	-.٣٣٧	-.١٧٦	-.١٥٠	-.٣٠٧	Momentum	
	-.٣٠٣	-.١٥١	.٠٢٦	-.٠٧٨	.٢٤٥	.١٢٦	-.٠٥٦	.٥٤٧	-.٠٢٣	Kinetic Energy	
-.٢٦٩	-.٠٦٤	-.٥٩٥	.٥٦١	.٨٠٦*	.٦٤٩*	-.٤٦٣	.٨٣٥*	.٤٤٤	.٩٠٣*	Performance level	

The critical value of r at a significance level of ٠.٠٥ is ٠.٦٠٢.

Table (٨) presents the correlation matrix between some biomechanical variables at the center of mass of the wrestler during the moments of the start of the initial phase and the start of rotation to complete the movement in the performance of the overhead throw skill for wrestlers. The table shows a statistically significant correlation between the performance level and the variables of resultant velocity, resultant force, and kinetic energy at the moment of the start of the initial phase, and resultant velocity at the moment of the start of rotation to complete the movement. The critical value of r at a significance level of 0.05 is 0.602 , with the correlation values being $(.903, .835, -.649, .806)$ respectively. During this phase, the wrestler attempts to quickly move the center of mass and initiate the preliminary phase of the movement, which requires speed to successfully execute the skill, as confirmed by Mahmoud Al-Matbouly (٢٠١٦).

Table (٩) shows the simple correlation matrix between some biomechanical variables at the center of mass of the wrestler during the moments of the start of the back rotation to the ground and the moment the opponent touches the ground in the performance of the overhead throw skill for wrestlers ($N = 10$).

The moment the opponent's body makes contact with the ground					The moment the player begins to rotate his back to the ground.					Biomechanical variables	
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity		
										Resultant Velocity	The moment the player begins to rotate his back to the ground.
									.864**	Resultant Acceleration	
								-.169	-.160	Resultant Force	
							-.168	1.000**	.864**	Momentum	
						.008	.326	.009	-.118	Kinetic Energy	
					-.109	.950**	-.183	.951**	.954**	Resultant Velocity	The moment the opponent's body makes contact with the ground
				.950**	.014	1.000**	-.165	1.000**	.864**	Resultant Acceleration	
			-.245	-.260	.412	-.247	.626	-.247	-.151	Resultant Force	
		-.116	.377	.211	.210	.376	.359	.375	-.026	Momentum	
	.068	.069	-.181	-.172	.290	-.186	.696*	-.186	-.132	Kinetic Energy	
-.550	-.320	-.569	.014	.655*	-.413	.517	.789*	.518	.660*	Performance Level	

The tabular t-value is at a significant level of $0.05 = 0.602$

Table (٩) of the correlation matrix between some biomechanical variables at the man's center of gravity shows the two moments of the beginning of the player's back turning to the ground, the beginning of the competitor touching the ground at the level of twine skill performance from above for wrestling players at the level of twine skill performance from above for wrestling players, which indicated the emergence of a correlation= 0.602 respectively (0.660 , 0.789 , 0.600), and it was emphasized that the skill in its initial stages needs an increase from the wrestler The pace is the result of speed and strength in the first and second stages mentioned above in the analysis of that skill.

Table (١٠) the simple correlation matrix between some biomechanical variables at the center of gravity of the body for the two moments of the beginning of the basic phase, the beginning of rotation to complete the movement at the level of performance of the twine skill from above for wrestling players $N= 10$.

The moment of the beginning of the rotation to complete the movement					The moment the basic phase begins					Biomechanical variables	
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity		
										Resultant Velocity	The moment the basic phase begins
									0.632^*	Resultant Acceleration	
								-0.100	-0.431	Resultant Force	
							-0.169	0.898^{**}	0.618	Momentum	
						0.416	-0.133	0.384	0.099	Kinetic Energy	
					0.018	0.300	-0.447	0.302	0.627	Resultant Velocity	The moment of the beginning of the rotation to complete the movement
				-0.443	-0.128	-0.160	1.000^{**}	-0.100	-0.428	Resultant Acceleration	
			1.000^{**}	-0.446	-0.133	-0.169	1.000^{**}	-0.104	-0.430	Resultant Force	
		-0.287	-0.283	0.070	0.762^*	0.098	-0.287	0.096	0.033	Momentum	
	0.417	-0.071	-0.067	0.000	0.473	0.349	-0.072	0.000	-0.120	Kinetic Energy	
0.710^*	0.710^*	-0.291	-0.288	0.862^*	0.432	0.661^*	-0.292	0.601^*	0.798^*	Performance level	

The tabular t-value is at a significant level of $0.05 = 0.602$

Table (١٠) of the correlation matrix between some biomechanical variables at the center of gravity of the body shows the two moments of the beginning of the basic phase, the beginning of rotation to complete the movement at the level of performance of the twine skill from above for

wrestling players, which indicated the emergence of a significant correlation between the level of performance and the variable of the outcome of the speed, the outcome of the wheel, the amount of movement at the moment of the beginning of the basic phase, the variable of the outcome of the speed, the amount of movement and the energy of movement at the moment of the beginning of rotation to complete the movement where the tabular value of T was at a significant level $0.05 = 0.602$, respectively $(.798, .651, .661, .862, .710, .710)$, and this confirms that during the performance of the skill the transition begins to the situation in which Increasing the load and anatomical position on the center of gravity of the body, which follows from the wrestler starting to move to lifting the wrestler off the ground and starting the phase of turning and throwing, and this is consistent with what William mentioned (١٩٩٢), where the wrestler must change the position of his center of gravity to upset the balance of the opponent and in order to be able to control him during the performance of the skill.

Table (١١) the simple correlation matrix between some biomechanical variables at the center of gravity of the body for the two moments of the beginning of the player's back turning to the ground, the beginning of the competitor touching the ground at the level of twine skill performance from above for wrestling players $N = 10$.

The moment the competitor first touched the ground					The moment the player begins to rotate their back towards the ground.					Biomechanical variables	
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity		
										Resultant Velocity	The moment the player begins to rotate their back towards the ground
									.720*	Resultant Acceleration	
								.097	.112	Resultant Force	
							.681*	-.443	-.531	Momentum	
						.930**	.760**	-.401	-.392	Kinetic Energy	
					-.203	-.200	.170	.468	.709*	Resultant Velocity	The moment the competitor first touched the ground
				.220	.071	.106	.090	.309	-.108	Resultant Acceleration	
			.203	-.193	.762*	.794*	.081	-.530	-.423	Resultant Force	
		-.248	.083	.003	-.069	-.004	.281	.780**	.441	Momentum	
	-.209	1.000**	.189	-.198	.764*	.790*	.080	-.543	-.424	Kinetic Energy	
-.366	.368	-.368	-.291	.797*	-.197	-.277	.336	.093	.887*	Performance level	

The tabular t-value is at a significant level of $0.05 = 0.602$

Table (١١) of the correlation matrix between some biomechanical variables at the center of gravity of the body shows the two moments of the beginning of the player's back turning to the ground, the beginning of the competitor touching the ground at the level of twine skill performance from above for wrestling players at the level of twine skill performance from above for wrestling players, which indicated the emergence of a correlation respectively (.٨٨٧ .٦٩٧) this sign is consistent with the nature of the movement in its final stages and the transition of the center of gravity of the body to finish the skill and begin to control the opponent After the throwing phase, this agrees with what is mentioned (Mahmoud al-mutbouly ٢٠١٦ quoting Massad mahmouty ١٩٩٧).

Table (١٢) simple correlation matrix between some biomechanical variables at the center of gravity of the arm for the two moments of the beginning of the basic phase, the beginning of rotation at the level of twine skill performance from above for wrestling players N= ١٠

The moment of the beginning of the rotation to complete the movement					The moment of the beginning of the basic stage					Biomechanical variables		
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity			
										Resultant Velocity	The moment of the beginning of the basic stage	
									.۳۱۷	Resultant Acceleration		
								-.۲۱۳	.۳۶۸	Resultant Force		
								.۴۰۴	-.۱۸۷	.۳۲۴		Momentum
							-.۰۶۹	-.۰۷۲	-.۰۰۸	-.۱۴۶		Kinetic Energy
					-.۱۴۴	.۳۲۳	.۳۶۴	.۳۱۶	۱.۰۰.***	Resultant Velocity	The moment of the beginning of the rotation to complete the movement	
				.۴۳۹	-.۶۱۴	.۳۷۲	.۲۰۶	.۰۲۹	.۴۴۱	Resultant Acceleration		
			-.۰۰۶	.۰۰۱	-.۱۴۰	.۳۰۰	-.۰۳۲	-.۳۶۶	.۰۴۴	Resultant Force		
		.۰۰۸	.۳۱۹	-.۲۹۲	-.۳۲۴	-.۱۹۴	-.۲۹۰	.۰۶۸	-.۲۹۱	Momentum		
	.۲۲۷	.۴۴۰	-.۱۹۰	.۰۸۴	-.۱۹۰	-.۰۲۲	.۰۹۷	-.۶۳۷-*	.۰۸۲	Kinetic Energy		
-.۳۶۸	-.۰۰۱	-.۳۹۶	.۷۲.*	.۷۳.*	-.۲۳۱	.۰۲۱	.۱۱۴	.۷۸۲*	.۷۳۲*	Performance level		

The tabular t-value is at a significant level of $٠,٠٥ = ٠,٦٠٢$

Table (١٢) of the correlation matrix between some biomechanical variables at the center of gravity of the arm shows the two moments of the beginning of the basic phase, the beginning of rotation to complete the movement at the level of performance of the twine skill from above for wrestling players, which indicated the emergence of a significant correlation between

the level of performance and the speed output variable, the wheel output moment of the beginning of the basic phase, the variable speed output and the wheel output at the moment of the beginning of rotation to complete the movement where the tabular value T was at a significant level $0.05=0.602$, respectively ($0.732, 0.782, 0.730, 0.720$)

Table (١٣) the simple correlation matrix between some biomechanical variables at the center of gravity of the arm for the two moments of the beginning of the player's back turning to the ground, the beginning of the competitor touching the ground at the level of twine skill performance from above for wrestling players $N=10$

The moment the competitor first touched the ground					The moment of the start, the player's back turned to the ground					Biomechanical variables	
Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity	Kinetic Energy	Momentum	Resultant Force	Resultant Acceleration	Resultant Velocity		
										Resultant Velocity	The moment of the start, the player's back turned to the ground
									.299	Resultant Acceleration	
								-340	-307	Resultant Force	
							.038	-400	.120	Momentum	
						.343	.764*	-290	.034	Kinetic Energy	
					-109	.321	-200	.361	.692*	Resultant Velocity	The moment the competitor first touched the ground
				.381	-.692*	-.188	-.720*	.203	.344	Resultant Acceleration	
			-.780**	-.287	.783**	.468	.990**	-.301	-.391	Resultant Force	
		-.140	.171	.327	-.038	-.401	-.190	.793**	.443	Momentum	
	-.206	-.223	.069	-.303	-.141	-.346	-.201	.130	-.206	Kinetic Energy	
-.119	.904*	-.370	.317	.049	-.209	-.392	-.396	.886*	.627*	Performance level	

The tabular t-value is at a significant level of $0.05=0.602$

Table (١٣) of the correlation matrix between some biomechanical variables at the center of gravity of the arm shows the two moments of the beginning of the player's back turning to the ground, the beginning of the competitor touching the ground at the level of twine skill performance from above for wrestling players at the level of twine skill performance from above for wrestling players, which indicated the appearance of a significant correlation $0.05=0.602$ respectively ($0.627, 0.886, 0.904$)

- Thus, the biomechanical characteristics of four moments during the twine skill from above in wrestling (the moment of the beginning of the basic stage, the moment of the beginning of the rotation to execute the

movement, the moment the player's back turned to the ground, the moment the opponent touched the ground) were determined for points: the center of

gravity of the man, the center of gravity of the body, the center of gravity of the arm, for each of (the result of speed, the result of the wheel, the result of force, the amount of movement, the energy of movement), through its correlation with the level of performance of the player during the performance of the twine movement from above, and biomechanics and twine skill performance level of the highest for wrestling players.

Conclusions:

- There is a significant correlation between the level of performance and the variable of the speed output, the force output, the energy of movement at the moment of the beginning of the basic phase, and the variable of the speed output at the moment of the beginning of rotation to complete the movement where the value was respectively (.٩٠٣ ، .٨٣٥، .٦٤٩ ،.٨٠٦)
- There is a significant correlation between the level of performance and the speed output variable, the force output the moment the player's back first turned to the ground, and the speed output variable the moment the competitor first touched the ground where the value was respectively (.٦٦٠ ،.٧٨٩ ،.٦٥٥).
- There is a significant correlation between the level of performance and the variable of the speed output, the wheel output, the amount of movement at the moment of the start of the base phase, and the variable of the speed output, the amount of movement and the energy of movement at the moment of the start of rotation to complete the movement where the value was, respectively (.٧٩٨ ،.٦٥١،.٦٦١ ،.٨٦٢ ،.٧١٠ ،.٧١٠)
- There is a significant correlation between the performance level and the speed outcome variable at the moment when the player's back first turned to the ground, and at the moment when the opponent first touched the ground, where the value was ٠,٦٠٢, respectively (.٨٨٧ ، .٦٩٧).
- There is a significant correlation between the level of performance and the variable of the speed output, the wheel output at the moment of the start of the basic stage, and the variable of the speed output and the wheel output at the moment of the start of rotation to complete the movement where the value was respectively (.٧٣٢ ،.٧٨٢،.٧٣٠ ،.٧٢٠).

- There is a significant correlation between the level of performance and the variable of the speed output, the wheel output at the moment of the beginning of the player's back turned to the ground, and the variable of the amount of movement output at the moment of the competitor's beginning to touch the ground where the value was respectively (.٦٢٧ ،.٨٨٦ ،.٩٠٤)
- The presence of a graphical network of biomechanical indicators of the moments of performing the twine skill from above in the sport of wrestling (the moment of the beginning of the basic stage, the moment of the beginning of rotation to perform the movement, the moment of the beginning of the player's back turned to the ground, the moment of the beginning of the competitor touching the ground) for points: the center of gravity of the man, the center of gravity of the body, the center of gravity of the arm through which it is possible to clarify the level of the player in each of the variables under consideration during the moments of performance.
- Determination of biomechanical indicators (speed output, wheel output, force output, amount of movement, movement energy) for each of the man's center of gravity, the center of gravity of the body, the center of gravity of the arm during the moments of the performance under study through their correlation with the level of skill performance of the twine skill from above.

Recommendations:

In view of the conclusions, the researchers recommend the following:

- When training players, focus on increasing the result of speed and strength the moment the rotation begins to complete the movement the moment the player's back turns to the ground, it is one of the important stages for the successful implementation of the skill.
- Using the biomechanical characteristic curve of twine skill from above for wrestling players with the following biomechanical indicators (speed yield, wheel yield, force yield, amount of movement, movement energy) in evaluating the performance level.
- Propose the application of biomechanical indicators to other skills in the sport of wrestling, and urge coaches to use them.
- The application of this study in other sports as an objective means of assessing the level of performance.

References:

١. Umaima Ibrahim al-Ajmi: Building an evaluative system using the most appropriate characteristic curve for the dynamics of the triple shot from the jump in basketball, Journal of the Faculty of physical education for boys, Alexandria University, , No. ٥٢, ٢٠٠٤.
٢. Drage, A : Directing some biomechanical indicators to establish a calendar basis using the characteristic curve of high jumpers. Scientific journal of Sports Science, ٣(٤), ٢٠٤-٢٢٥, ٢٠٢٢. Doi [10.21608/MKOD.2022.110661.1092](https://doi.org/10.21608/MKOD.2022.110661.1092)
٣. Ehab Adel Abdul Basir: The graphical network for diagnosing the kinematics of shot put, Journal of the Faculty of Physical Education, Port Said University, ٢٠١٠.
٤. Elliot, b.h: Measurements concepts in human kinetics champing, California, ١٩٩٢.
٥. Andrew Little: Biomechanics Western Australian Institut of sport, ٢٠٠١.
٦. Branko, Skof & Stanko: Kinematic analysis of golando ceplak's running teaching new studies in athletics by laaf, ٢٠٠٤.
٧. Burnett. A. Bruce Abernethvy, Vaughank, Margusg& Laurel M.,:Biophysical foundations of human movement, Human Kinetics, United States of America, ٢٠١٣.
٨. Tsai, F. J., Liu, Y., Chen, S. H., & Huang, Y. C.: Biomechanical Characteristics and EMG Activities of Weighted Countermovement Jump. In ISBS-Conference Proceedings Archive, ٢٠٠٤.
٩. Tülin Atan, Osman İmamoğlu: Competition analysis of World Greco Roman and World free- style wrestling championships" , ١٩ Mayıs University, Physical Education and Sports Department, Samsun-Türkiye, ٢٠٢٢.
١٠. Tunnemann: Acquisition «Installation, and Implementation of a Gut Wrench" Testing System for Wrestlers", International Journal of Wrestling science, Vol١, ٢٠١١.
١١. Carr,c :Mechanics of sport practitioners Guides, Human Kinetics, ١٩٩٧.
١٢. Cicchella, Antonoio: Kinematic analysis of selected rhythmic leaps,jounal of human sport and exeriseon line (j.hum.sport exc), an international electroic journal , ial sport , faculty of education university of alicantey.,vol١.٤-no ١ oc, ٢٠٠٥.

١٣. Jamal Mohammed Aladdin, Nahed Anwar Sabbagh: Metrological bases for assessing the level of skilled and planned physical performance of athletes, knowledge facility, Alexandria, ٢٠٠٧.
١٤. David La Valle: Biomechanical analysis of sport teaching use, universities of GiF, ٢٠٠٢.
١٥. Renger. R: Preview of the profile of mood states (POMS) in the prediction of athletic success, ١٩٩٦.
١٦. Sabry GE, Hassan TA, and Saad G.M.: The effect of bridge exercises on the postural deviations and spinal cervical vertebrae deformities among wrestlers. International Journal of Advanced and Applied Sciences, ٢٠٢٢, ٩(٨): ٢١-٢٧.; DOI. /١٠.٢١٨٣٣/ijaas.٢٠٢٢.٠٨.٠٠٣
١٧. Sabry G.E., El-Bedewy FE :Enhancing physical abilities in junior wrestlers through virtual reality training: An experimental study." ; International Journal of Advanced and Applied Sciences, Volume ١٠, Issue ١٢ (December), Pages: ٢١١ ٢١٩, ٢٠٢٣; DOI .org/١٠.٢١٨٣٣/ijaas.٢٠٢٣.١٢.٠٢٣
١٨. Schubin, m. and schustin, b: Approaching heights. Some model parameters of the high jump, modern athlete and coach, journal article, Australia, apr, ٢٠٠٠.
١٩. Samiha Najah Mohamed Youssef : Its topic is " building an evaluative system using the characteristic curve of the dynamics of long jump performance, master thesis, unpublished, Faculty of physical education, Kafr el Sheikh University, ٢٠١٨.
٢٠. Shaima Hassan : Directing some biomechanical indicators to establish a calendar basis in the light of the characteristic curve of the discus throwing skill. Sports Science magazine, Faculty of sports education, Minya university, September ٢٠٢٢ DOI: ١٠.٢١٦٠٨/ssj.٢٠٢٢.١٥٦٧٢١.١٢٨٩
٢١. Sosen Abdel Moneim, Mohamed Sabry Omar, Mohamed Abdeslam Ragheb : Biomechanics in the mathematical field, Part I. biodynamics, Maarif facility, Alexandria, Egypt, ١٩٩١.
٢٢. Adil Mustafa Kemal, Islam Adil Mustafa: Mechanics of kinetic performance, ١st version, Book Center for publishing, Cairo, ٢٠٢٠.
٢٣. Aways Ali Jebali : Sports Training - Theory and Practice, ١st Edition, G.M.S Publishing House, Cairo, Egypt, ٢٠٠١.

٢٤. E
mad Sabri Salib Saad Salib :The influence of physiological strength training on some biomechanical indicators and the effectiveness of performing the skill of the back throw with the back facing the wrestler, volume and issue: volume ٠٣٩, issue ٠٣٩, October, pp. ١٥١-١٧٠, ٢٠٢٠. DOI ١٠.٢١٦٠٨/ijssaa.٢٠٢٠.٤٥١١١.١٣٢٤
٢٥. Fr
ank Pyke : Coaching excellence, Human Kintetics , United State of America, ٢٠١٣.
٢٦. Mohammed Jaber burqa, charity Ibrahim al-Sukkari : Basic principles of Biomechanics in the mathematical field, part I Maarif facility, Alexandria, Egypt, ٢٠٠٢.
٢٧. Mohammad Reza Al-Rubi : Principles of training in the sport of wrestling technical performance of movements in Greco-Roman wrestling, scientific conference, elementary printer, Mahi-computer services, ٢٠٠٥.
٢٨. Mahmoud Ibrahim al-mutbouli : Comparison of the curve of biomechanical characteristics of the skill of bending backwards (front and rear center) in wrestling Sport, published research, Assiut Journal of Science and arts of Physical Education, Vol. ٤٢, No. ٣, pp. ٦٢٩-٦٥٧, March ٢٠١٦. Doi ١٠.٢١٦٠٨/JPRR.٢٠١٦.٧٣٢٧٦
٢٩. William, A. Martell: Greco-roman wrestling, Human Kinetics Publishing, England, ١٩٩٢.

Directing certain biomechanical indicators to establish an evaluative framework using the characteristic curve for the top spinning skill in wrestlers.

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Abstract

To establish an evaluative framework using the characteristic curve for the top spinning skill in wrestlers, certain biomechanical indicators can be guided by identifying the correlation between selected biomechanical variables and the performance level of the top spinning skill in wrestling. The descriptive method was employed due to its suitability for the nature of the research. The study sample consisted of ١٢ wrestlers selected intentionally, with ٢ participants for the pilot study and ١٠ participants for the main experiment. These athletes are among the top wrestlers at the national level. The players' performances were recorded and analyzed to extract biomechanical variables and measure the performance level of the top spinning skill for the sample. Through statistical analysis, the following results were obtained: there is a significant correlation between the biomechanical characteristics during the key moments of executing the top spinning skill in wrestling—namely, (the start of the primary phase, the beginning of rotation to perform the movement, the beginning of the back turning towards the ground, and the moment the opponent touches the ground). These correlations involve the center of gravity of the leg, body, and arm in terms of (velocity, acceleration, force, momentum, and kinetic energy). This correlation allows the evaluation of a wrestler's level across these variables and the determination of biomechanical characteristics during performance moments based on their correlation with performance level.

Keywords: biomechanical indicators, characteristic curve.