World Journal of Sport Sciences 3 (3): 174-179, 2010
ISSN 2078-4724

Biomechanical Statistical Analysis Entrance to Diagnose the Deficiencies in Low Start from Block Start

[1]M. Aatwaa and [2]M.M. Payomi

[1]Department of Athletics, Faculty of Physical Education, Sadat, Menoufia University, Egypt
[2]Department of Sport Training, Faculty of Physical Education, Helwan University, Egypt

Abstract: Motion Analysis is an important analysis that we get from them variables and too large numeric data is for each part of the body in all the moments and reflect the reality of the movement. Statistical analysis can deal with large data, inventory and give indications of the phenomenon that is studied and that the researcher in this study tried to identify deficiencies in the performance skill objective manner called the biomechanical statistical analysis (BSA), which combines between biomechanical analysis and statistical analysis depending on that the body is a society consists of some parts involved with each other in unison to perform the phenomenon, called motor skill. In order to judge the phenomenon (the skill) if it is normal, the community of this phenomenon should be under the natural curve, which is confined between ± 3.This guides us to examine each part of the body separately through the moments of the movement and to study the parts of the body together in the different moments within the skill, hence we can identify areas of imbalance in skill performance whether in a part of the body or the body parts together in every moment of the movement. The variable we get from the motion analysis in order to be treated statistically is that variable which reflects the movement (such as sprint needs resultant velocity) and this study was carried out by the researchers to diagnose the deficiencies in the low start-up phase of a block start.

Key words: Society of the body % Resultant velocity % Biomechanical Statistical Analysis (BSA) % Horizontal Homogeneity % Vertical Homogeneity % Biomechanical Statistical Variable

INTRODUCTION

Short sprint competitions depend on the low start which requires the presence of block start, so the player can get all the power he needs to get out of the block start in the direction of movement. The good getting out from the block start may result in being the first player in the race from beginning to end, where the players move in a time ranging from 10 sec through 100 meter race and even less than a minute in the 400 meter race and in between, the importance of getting out of a block start appears within halls, where time is less than 10 sec in the 60 meters race. Good skill performance should be characterized by harmony and good motor transport to judge the movement either on a part of the body or on the whole body at a given moment or a few moments during stages of the movement, diagnosis of the error depends on the eye of expert or specialist or coach or player as he suppose that the error is in a certain place in their movement (The true or faulting that guessing) without specific rationale for the part causing the error.

Researchers used the method used by doctors in the diagnosis of diseases which is making MRI (CT) on the body, where this device divides the body into horizontal sections and diagnosis is done by examining each of the segments to locate the disease or the infection that is difficult for the doctor or patient to identify directly and therefore the researchers turned to the same logic followed by the doctors to diagnose the disease by dividing the skill into phases according to images which is extracted from the motion analysis, in addition to reports of the digital variables belonging to each image separately and here the body parts can be studied (horizontally and vertically) to facilitate a simple statistical way to diagnose deficient areas within the technical performance without resorting to guessing.

Corresponding Author: Atwa Mustafa. Athletics Department, Faculty of Physical Education, Menoufia University, Sadat, Egypt. E-mail: aatwaa@yahoo.com

Objectives:

- To identify the parts of the body that cause the deficient of the technical performance in the start of a low block start.
- Diagnosing deficient areas within the technical performance in the start of a low block start.
- Determination of most parts of the body causing deficiencies in the technical start of a low block start.

Search Terms:

- **Society of the Body:** Parts that make up the human body to perform motor skills (head and trunk, arms and legs with their components). (Operational definition)

- **Biomechanical Statistical Variable:** It's the variable extracted from the kinetic analysis and distinguishes the type of activity (such as speed needs to resultant velocity variable).

- **Resultant Velocity:** Is the rate of change of the distance for the time for each part of the body parts through stages of the movement.

- **Biomechanical Statistical Analysis (BSA):** A statistical study of human body parts and considering each part of the body as a sample participates in the phenomenon called the technical performance of skill and pass a number of data represent frames of the moments of the movement. (Operational definition)

- **Horizontal Homogeneity:** It is a statistical descriptive to the coefficient of Skewness of the horizontal extent of the curve, which supports the biomechanical statistical analysis (BSA) to follow up the movement of the body parts through the moments of movement (captures) and the homogeneity of each part during performance skill. It must not exceed the limits of the normal curve of skewness, which limited between ± 3. (Operational definition)

- **Vertical Homogeneity:** It's a statistical descriptive to the coefficient of Kurtosis of the horizontal extent of the curve, which supports the biomechanical statistical analysis (BSA) to follow up the movement of body parts through the moments of movement (captures) and that this group of body parts act smoothly during performance skill and do not exceed the limits of the normal curve of kurtosis, which is between ± 3. (Operational definition)

MATERIALS AND METHODS

Methodology: Descriptive method was used relying on the motion analysis and statistical analysis to low block start because of its relevance to the nature of the study.

Sample: Sample was chosen in the manner of intentional class from one of the players of the short sprint in El-Ahly club as he recorded 10.42 sec in the 100 meters, 21.00 sec in the 200 meters in the Republic Competition for Clubs under 20 years old. He is 1.74 meters height and weights 65 kilograms.

Executive Steps:

- The player did six attempts (photographed) during the exit of a cube ahead for a distance of 15 meters and try to choose the best timing.
- Motional Analysis to the player to sit on the block start to go out to a distance of two steps, variables are extracted for different parts of the body and points through the the moments of the movement, cutting shapes stick figures in every moment on the unit.
- Statistical analysis of the body society which has been extracted from the motional analysis data.
- Access to parts of the body of deficient in the performance of motor
- Diagnosis deficient areas within the moments of the technical performance of low block start; estimate more than a repetition of the parts of the body that deficient.

- **Variable Statistical Albyumkaniky:** Hozlk variable extracted from the kinetic analysis, which distinguishes the type of activity an example of speed needs to a variable collected resultant velocity.
- Conclusions, recommendations

Statistical Procedures: They were used for statistical relationships appropriate to address the player included with the data (skewness of coefficient, kurtosis of coefficient and nonparametric correlation) of the variable resultant velocity of the various parts of the body.

RESULTS AND DISCUSSION

Seen from Table 1 that these values resulting from the coefficient of Skewness of each part individually do not outgrowing the curve of natural factor Skewness, which is confined between ± 3 This is an indication of the validity of each part to carry out its technical performance of the moments of skill to start and each respective unit and thus may enable us to achieve the first objective in this study which identified parts of the body that caused the failure in starting the technical performance of a low block start and appeared to us that they do not have shortcomings on this player for each part separately

It is clear from Table 2 for the kurtosis of coefficient that the moments of shortcomings in its performance skills in parts of the body together was in pictures (1 -> 2), (2 -> 3), (17 -> 18) as the values of kurtosis of coefficient were 6.814, 9.695 and 3.217, respectively for these moments. This means that these values exceeded the limits of the natural curve of the kurtosis of coefficient, which is confined between ± 3. This is an indication of the failure in those moments. These moments, which referred to biomechanical statistical analysis (1 -> 2), (2 -> 3) represent the moment of readiness, this position who pointed references to be a shoulder forward a little about the hands on the ground and the angle of knee anterior

Table 1: Biomechanical statistical analysis (skwness of coefficient) to the variable resultant velocity of parts of the body through the individual moments of the movement in the low block start (n=23moments)

Body parts	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Head	23	7.300	0.900	8.200	3.235	1.823	1.066	1.046
Trunk	23	6.800	0.100	6.900	2.891	1.855	0.505	-0.548
RHand	23	13.300	0.300	13.600	5.765	3.708	0.673	-0.240
LHand	23	23.800	0.000	23.800	5.470	4.680	2.800	10.933
RRadius	23	10.700	0.300	11.000	4.461	2.759	0.670	0.121
LRadius	23	20.300	0.000	20.300	4.070	3.940	3.318	13.946
RUpperArm	23	8.100	0.300	8.400	3.200	1.974	0.763	0.877
LUpperArm	23	11.400	0.000	11.400	3.104	2.567	1.608	3.953
RThigh	23	10.200	0.000	10.200	3.104	2.549	1.134	1.254
LThigh	23	5.500	0.000	5.500	2.726	2.034	-0.070	-1.788
RShin	23	14.000	0.000	14.000	3.578	3.504	1.510	2.407
LShin	23	6.800	0.300	7.100	2.700	2.521	0.675	-1.346
RFoot	23	18.400	0.000	18.400	4.461	4.342	1.663	3.685
LFoot	23	8.600	0.000	8.600	2.787	3.161	0.858	-1.066

Value of skwness of coefficient between (± 3)

Table 2: Biomechanical statistical analysis (kurtosis of coefficient) for a variable resultant velocity of parts of the body together in every moment of the moments of technical performance in the low block start (n=14 parts)

Performance moments	Body parts (n)	Range	min	max	mean	S.D	skewness	kurtosis
1 -> 2	14	4	0.000	3.900	0.607	1.083	2.493	6.814
2 -> 3	14	4	0.000	3.600	0.750	0.881	2.906	9.695
3 -> 4	14	5	0.300	5.600	2.193	1.778	0.501	-1.146
4 -> 5	14	3	0.000	3.300	1.143	0.939	1.556	1.833
5 -> 6	14	3	0.000	2.700	1.271	0.788	0.186	-0.458
6 -> 7	14	6	0.000	6.200	2.421	1.882	1.073	0.812
7 -> 8	14	7	0.600	7.200	2.886	2.092	0.817	-0.349
8 -> 9	14	8	0.600	8.500	3.164	2.320	0.986	0.554
9 -> 10	14	6	0.600	6.500	3.450	1.829	-0.191	-0.611
10 -> 11	14	5	0.400	5.400	2.843	1.478	0.045	-0.835
11 -> 12	14	3	0.300	3.200	1.436	0.873	0.612	-0.333
12 -> 13	14	5	2.000	6.700	4.957	1.285	-0.799	0.532
13 -> 14	14	10	1.000	11.100	4.157	2.963	0.987	0.685
14 -> 15	14	11	0.600	11.600	4.371	3.197	0.875	0.358
15 -> 16	14	13	0.000	12.600	5.007	3.542	0.570	0.027
16 -> 17	14	8	0.800	8.600	4.864	2.315	-0.255	-0.487
17 -> 18	14	7	1.500	8.300	4.357	1.542	0.932	3.217
18 -> 19	14	4	2.300	5.900	4.036	1.024	-0.147	-0.333
19 -> 20	14	8	1.900	9.800	4.600	2.007	1.149	2.492
20 -> 21	14	10	0.500	10.100	4.793	2.960	0.348	-0.730
21 -> 22	14	24	0.200	23.800	10.921	6.759	0.318	-0.294
22 -> 23	14	10	0.900	11.300	5.471	2.500	0.424	1.836
23 -> 24	14	7	1.600	8.400	4.993	1.791	-0.265	0.425

Value of kurtosis of coefficient between (± 3)

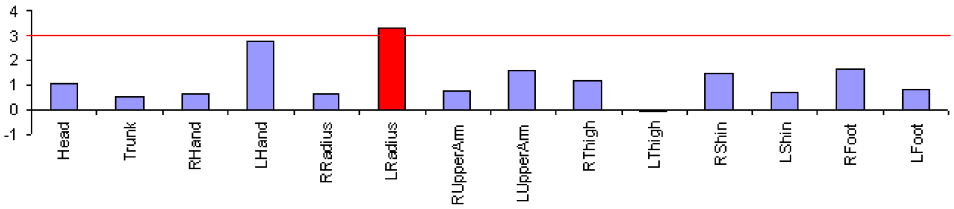


Fig. 1: Skewness of coefficient for resultant velocity to parts of the body of the individual through moments of the movement in the start of a low block start

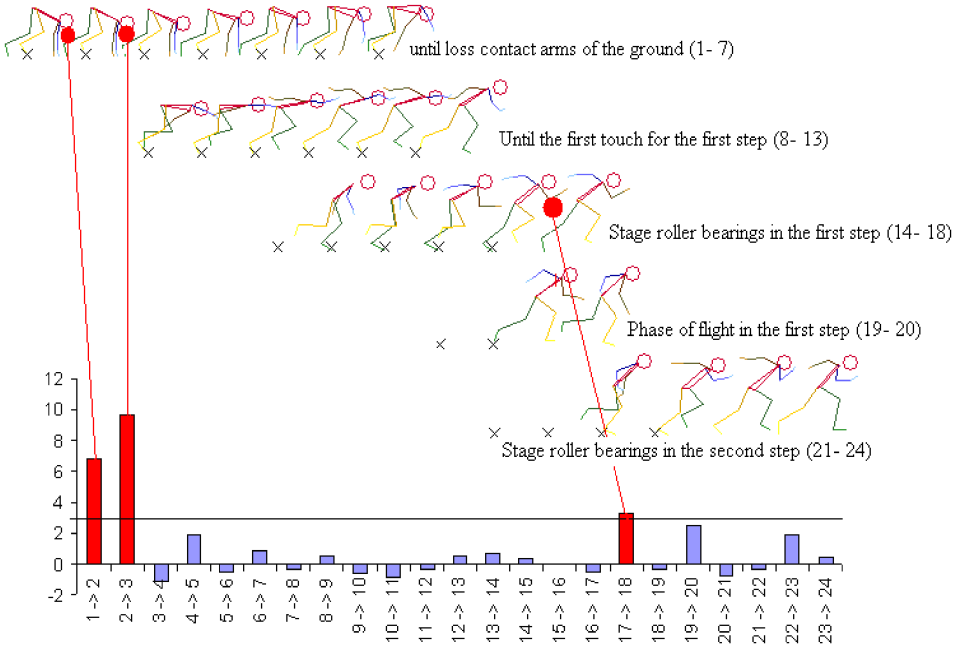


Fig. 2: Kurtosis to the variable resultant velocity of the parts of the body together within moments, the moments of the movement in the beginning of a low block start

Table 3: Status of the player in the correct readiness position

Player status	knee angle anterior (degree)	knee angle background (degree)	shoulder forward a little about the hands (cm)
What should the player be	90	120	15 to 21
What the player is	101	117	0.04
Difference	11	-3	14.96 to 20.96

(90 degrees) and knee background (120 degrees) and when matching these specifications with the player's status in Figure 3a, differences in Table 3 are noticed.

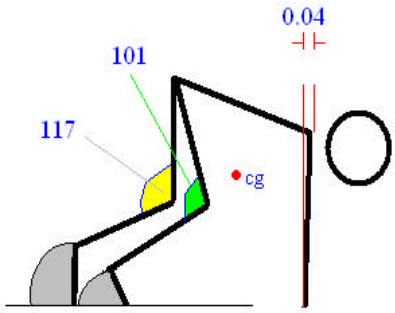
The model of low starting from block start helped to identify the causal deficiencies at the moment because of the prior information about it. But the moment (from 17 to 18) is in end-stage roller bearings background in the end of the first step. References pointed out that the body parts should be in alignment of any one (head and trunk, a man roller bearings) very near from the push vertical imaginary line and when you match those specs on what the player is in Fig. 3b. It is noted that the body parts that have been mentioned are away from the vertical imaginary line to push and this negatively affects the movement outcome of pushing the body forward to the increased speed. So, it is possible to study any skill deficiencies without our prior knowledge about the causation.

Table 4 showed that the correlation between each part of the body and the body parts as a whole through the moments of the movement in every moment of starting low according to kurtosis factor was 1 to 2, 2 to 3, 9 to 10, 10 to 11, 22 to 23. It became clear that the parts causing deficiencies were the parts which their values connectivity were weak because it is less than (0.3) while

Table 4: Correlation between each part of the body through the moments of the movement and parts of the body as a whole combined in each moment of the low block start

Body parts	1 -> 2	2 -> 3	17 -> 18	Deficiencies repetition
Head	0.189	-0.102	0.111	3
Trunk	-0.254	-0.509	-0.092	2
RHand	-0.157	-0.316	0.138	2
LHand	-0.153	-0.259	0.205	3
RRadius	-0.129	-0.363	-0.002	2
LRadius	-0.042	-0.200	0.209	3
RUpperArm	-0.411	-0.644	-0.042	1
LUpperArm	-0.087	-0.315	-0.101	2
RThigh	-0.486	-0.448	-0.191	1
LThigh	-0.118	-0.053	-0.093	3
RShin	-0.395	-0.42	-0.089	1
LShin	-0.111	-0.357	-0.033	2
RFoot	-0.357	-0.385	0.204	1
LFoot	-0.017	-0.244	0.363	2

The correlation Value is low at less than (± 0.3), medium between (± 0.3 and ± 0.49), high at greater than (± 0. 5)



(A)- moment (1 to 2), (2 to 3) represent the steady state readiness to start

B) - moment (17 to 18) represents the state of the player in Rear roller bearings

Fig 3: shows the status of the player in moments of deficiencies.

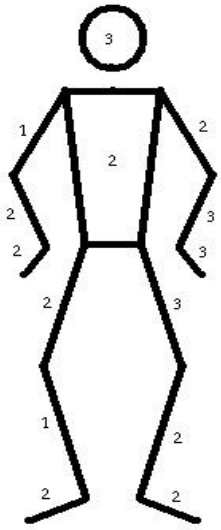


Fig 4: The volume of repeating of body parts to the deficiencies in different moments

the other parts are considered related medium, (more than 0.3) or a strong relationship (over 0.5). This is why we should direct physical or skill training to the moments of failure of those parts that caused the impedance performance of the parts of the body together in those moments. Deficiencies in skill performance are identified in Table 2, while deficiencies in the physical side are identified in the Table 4.

It is seen from Table 4 and Fig. 4 that the individual body parts of which hinder the body parts together has been repeated in deficiencies moments in descending order as follows: head, left hand, left forearm, left thigh (three repeats) trunk, hand right, low arm right,, left shin, left foot(two repeats), upper arm left, right thigh, right shin, right foot(repeated once).So, you can draw attention in training to those parts according to number of repeating deficiencies for skills performance in different moments. The areas which should be focused on

the physical side was detected and thus may enable us to achieve the third goal in this study which is estimating the body parts of the body which cause more deficiencies in skill at the block-start of low of the body parts as a whole in specific moments.

CONCLUSION

- The researchers concluded that parts of the body represent a society act a phenomenon which represents the technical performance of the skill through the moments of movement and data of this community is the output of motional analysis.
- The possibility of studying each part of the individual parts of the body statistically and giving statistical significance or non significance for normal functioning within the skill through stages of the movement.
- The possibility of doing statistical studies on the parts of the body together in every moment of the performance and giving statistical significant or non significant for the performance at the moment within the skill through stages of the movement.
- The possibility of statistical studies on each part of the body and repeating the reasons for recurrence impedance technical performance and giving statistical significance or non significance of the nature of Impedance for the body parts together within the skill through the moments of movement.

Recommendation:

- Ability to disseminate biomechanical statistical analysis on all single motor skills.
- Ability to do other studies in the biomechanical statistical analysis as it is a new field in studying sports movements

REFERENCES

1. Schot, P.K. and K.M. Knutzen, 1992. Biomechanical analysis of four sprint start position. R.Q.E.S., 63: 137-147.
2. Knudson, D.V. and C. Morrison, 1997. Qualitative Analysis Human Movement. Human Kinetics, U.S.A., pp: 122-125.
3. Hamilton, N. and K. Luttgens, 2002. Kinesology scientific basic of human Motion, Mc Grow-Hill Companies, New York, 10th Ed., pp: 310-315.
4. Linthorne, N.P., 2001. Optimum Release Angles in the shot put. J. Sports Sci., 19: 359-372.
5. Zalsiorsky,V.M., 1998. Kinematics of Human Motion, Human Kinetics, U.S.A., 73(81): 94.
6. Brown, N., A. Finch and G. Ariel, 1999. Effects of an angled starting block on sprint start kinematics. Ariel Dynamics, San Diego, California, U.S.A., pp: 1-2.
7. Ozolin, E., 1986. The technique of the sprint start. Modern Athlete and Coach, 26: 38-39.
8. „oh, M., K. Toma_in and S. Štuhec, 2006. The biomechanical models of the sprint start and block acceleration. Physical Education and Sport, 4: 103-114.