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(E.M.G) Some muscles and angles performance in the stages of up and down the slopes (8º)

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Abstract*: The aim of the study was to know the muscular activity and the performance angles that are appropriate for uphill and downhill of the slopes at (8°), therefore, the researchers opine to do this study to know the fact of this discussion that they will find through the magnitude of the working muscles' participation during the two stages, that's all by the electrical muscle activity device (EMG) and kinematic analysis, the remaining muscles are involved and used in the research to increase the space of the study to discover other muscles that might participate and have benefit by developing them during the giving of this type of training. The problem of the research came through the questioning of some training specialists, that uphill training improves and develops the step of the runners, while during downhill training the speed and frequency of the runners are developed. This leads us to the training fact of muscles' development by choosing the type of slope training and whether it's uphill or downhill. The research sample represented by (6) speed runners (100) m in Track and field, season (2018-2019), the experiment occurred on one of the slopes that exist in the College of Physical Education and Sports Science/ University of Baghdad. The researchers extracted (Mean) by the program (SPSS) of processing data. The researchers concluded that the training of the uphill slope develops the length of the step of running, while the downhill drill development of the step frequency.*

Keywords*: Impulse, Impact, Runner, Kinematic.*

I. Introduction

The scientific endeavors in the development of scientific equipment remain a fertile field for conducting research and discovering more scientific baffles discussed by specialists and scientists. One of these discussions is the size and type of muscles involved in training or skill. If we want to find out, specialists would resort to general experience, qualitative analysis or the results of the tests are then judged on the type of muscles or paths. However, the presence of the device of

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electrical muscle activity (EMG), facilitated the judgment on these things, and gave readings of the muscular activities that cannot be different by two people if they were for the same skill or the same person.

"EMG raw data can be processed in several ways to calculate a variety of parameters to determine the neuronal and muscular state of a specific muscle in the timeline, changes in (EMG) (RMS) and Muscle waves. This information is of interest to researchers studying the performance and injuries of athletes, for example it's possible to study acute interventions such as deliberate changes in the length of the step that changes the signal of (EMG)[1]. The attention to study the muscular path of this type of exercise because it took a large space in the speed training of the runners "The ability to accelerate and reach the maximum speed of running is effective and necessary for the success of the athlete, the speed of running for athletes is increased by improving the physical, metabolic and nervous components associated with the running[2]. And that methods of assistance such as drag and run down produce a faster running speed than can be achieved in running without assistance[3]. it is possible as a result of increased step length and frequency[4]. although the repetition of slopes training downhill and uphill was served as the mainstay of the rotate exercises for runners for decades, but in fact there's not a lot of academic research on this practice, but new research has changed this so proving they are worth the effort. One of these views was the importance of research by using the device of measurement of electrical muscle activity (EMG), to analyze the muscles working in the running on the slopes during the ups and downs. The problem of the research came through the questioning of some training specialists, that uphill training improve and develop the step of the runners, while during downhill training the speed and frequency of the runners are developed. This leads us to the training fact of muscles' development by choosing the type of slope training and whether it's uphill or downhill. So among all of this, there is scientific discussion and question in this matter? Or conflicting opinions?

Therefore, the researchers opine to do this study to know the fact of this discussion that they will find through the magnitude of the working muscles' participation during the two stages, especially the front and back thigh muscle, that's all by the electrical muscle activity measurement device (EMG) and kinetic analysis in order to prove whether this study is approved or not, the remaining muscles are involved and used in the research to increase the area of the study to discover other muscles that might participate and have benefit by developing them while giving this type of training. The study aimed to know the muscles working in terms of electrical muscle activity and the amount of activity and angles of performance that are appropriate to these activities in the uphill and downhill of the slopes (8°).

II. Materials and Methods:

Participants:

The research sample represented by (6) male speed runners (100)m in Track and field, season (2018-2019), The characteristics of the runners are as follows: their mean ages (24.60) S.D (1.14), mean Weight (74.80) S.D (1.78), mean Length (180.6) S.D (2.88), the experiment occurred on one of the slopes that exist in the College of Physical Education and Sports Science/University of Baghdad.

Procedures:

Electrical muscle activity measurement device (EMG) (8) electrodes and accessories, a Japanese-made (SONY) camera (25 p/s) (no.1) associated with the (EMG), the program of Kinematic analysis (Kinovea. 0.8.7.), scale, a leather measuring tape length (20) m, slope at an (8°) angle its length (20) m. In this study, two stages of the performance were determined: the first uphill running stage, the second downhill running stage. The angles of the muscle and kinetic work were analyzed. They were the stage of impulse and impact for both, and the electrical muscle activity variables (EMG) were synchronized with only (5) kinetic angles through the camera. The muscles whose activity was extracted and the kinetic parameters of the work angles in the research are as shown in Table (1):

Table (1) the studied muscles, kinetic angles and measurement units

	Muscle	Measurement Unit (EMG)
	(Gastronomies Muscle)	• Peak
	(Biceps Femoris Muscle)	
	(Semitendinosus)	
	(Rectus Femoris Muscle)	
	(M.Vastus Lateralis)	
	(Gluteus Medius)	
	(Lumbar)	
	(Ant Deltoid)	
	Kinematic angles	
	Absolute angle° of leg impact (uphill downhill slope)	
	Absolute angle° of the thigh impact (uphill downhill slope)	
	Absolute angle° of the Torso impact (uphill downhill slope)	

	Shoulder angle° impact (uphill downhill slope)

And was conducted on one of the slopes located in the Faculty of Physical Education and Sports Sciences University of Baghdad, and began to test the downhill slope first and then uphill slope, and the field of photography and analysis were selected for a distance of (4) m, the central distance starting at the meter (8), and ending in the meter (12). In both directions, the test conditions indicated that the whole total distance should be completed even after the area of the specific analysis was exceeded by (4) m.

Statistical analysis:

The researchers extracted (Mean) by the statistical program (SPSS) for data processing, in addition to the law of increasing and decreasing ratio.

III. Results:

Table (2) muscular activity value in impact stage and its angles, and muscular activity value in the impulse stage for uphill slope

	Muscle/uphill slope	(EMG) impact	Angles impact	(EMG) impulse
	Gastronomies Muscle	21.7	83°	88.5
	Biceps Femoris Muscle	220.9	59°	252.3
	Semitendinosus	161.0	59°	373.8
	Rectus Femoris Muscle	633.0	58°	292.6
	M.Vastus Lateralis	24.1	58°	56.8

	Gluteus Medius	93.4	70°	185.2
	Lumbar	196.6	70°	149.2
	Ant Deltoid	44.5	49°	251.5

The maximum value of muscles activity in impact for uphill slope in order was:

Rectus.Femoris.Muscle (633.0), Biceps.Femoris.Muscle (220.9), Lumbar (196.6), Semitendinosus (161.0), Gluteus.medius (93.4), Ant.Deltoid (44.5), M.VastusLateralis (24.1), and Gastronomies.Muscle (21.7).

While in the impulse stage the maximum value of muscles activity in order was:

Semitendinosus (373.8) its activity increased over the stage of impact by (212.8) in the rate of (132.173%). Rectus.Femoris.Muscle (292.6) its activity decreased over the stage of impact by (340.4) in the rate of (116.33%). Biceps.Femoris.Muscle (252.3) its activity increased over the stage of impact by (31.4) in the rate of (14.21%). Ant.Deltoid (251.5) its activity increased over the stage of impact by (207) in the rate of (465.17%). Gluteus.medius (185.2) its activity increased over the stage of impact by (91.8) in the rate of (98.28%). Lumbar (149.2) its activity decreased over the stage of impact by (47.4) in the rate of (31.77%). Gastronomies.Muscle (88.5) its activity increased over the stage of impact by (66.8) in the rate of (135.68%). M.VastusLateralis (56.8) its activity increased over the stage of impact by (32.7) in the rate of (135.68%).

The researchers observed through these results that the average activity of the 8 muscles during the impulse and its value (206.24) is larger than the average of the same muscles activity during the impact stage and its value (174.4) by (31.84) in the rate of (18.26%), while the angular average of the studied parts was (63.25°).

Table (3) muscular activity value in impact stage and its angles, and muscular activity value in the impulse stage for downhill slope.

	Muscle/ downhill slope	(EMG) impact	Angles impact	(EMG) impulse
	Gastronomies Muscle	37.2	81°	34.8
	Biceps Femoris Muscle	29.8	63°	125.4

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	Semitendinosus	64.7	63°	310.0
	Rectus Femoris Muscle	246.7	57°	153.6
	M.Vastus Lateralis	17.8	57°	64.4
	Gluteus medius	84.8	60°	185.0
	Lumbar	81.1	60°	219.3
	Ant Deltoid	53.9	14°	118.3

The maximum value of muscles activity in impact for downhill slope in order was:

Rectus.Femoris.Muscle (246.7), Gluteus.medius (84.8), Lumbar (81.1), Semitendinosus (64.7), Ant.Deltoid (53.9), Gastronomies.Muscle (37.2), Biceps.Femoris.Muscle (29.8), and M.VastusLateralis (17.8).

While in the impulse stage the maximum value of muscles activity in order was:

Semitendinosus (310.0) its activity increased over the stage of impact by (138.2) in the rate of (170.41%). Lumbar (219.3) its activity increased over the stage of impact by (138.2) in the rate of (170.41%). Gluteus.medius (185.0) its activity increased over the stage of impact by (100.2) in the rate of (118.3%). Rectus.Femoris.Muscle (153.6) its activity decreased over the stage of impact by (93.1) in the rate of (60.61%). Biceps.Femoris.Muscle (125.4) its activity increased over the stage of impact by (95.6) in the rate of (320.81%). Ant.Deltoid (118.3) its activity increased over the stage of impact by (64.4) in the rate of (119.84%). M.VastusLateralis (64.4) its activity increased over the stage of impact by (46.6) in the rate of (261.80%). Gastronomies.Muscle (34.8) its activity increased over the stage of impact by (2.4) in the rate of (6.90%).

IV. Discussion:

The researchers noticed that the average activity of the 8 muscles during the impulse stage (151.35) was greater than the average activity of the same muscles during the impact stage and its value (77) by (74.35) at the rate of (96.56%), while the angular average of the studied parts was (56.88°).

In comparison with the results of Table (2), we find that the impulse in both stages is having more muscular activity than the impact, in addition to the uphill stage of the slope has more muscular activity than its downhill stage, and the impact activity during the uphill stage is also greater than the impulse activity during the downhill stage, also note that the difference between the impulse and the impact at the downhill stage of the slope is greater than the difference between

them in the uphill stage of the slope. As for the angles, the angular average in the impact stage of the uphill slope stage is greater than the downhill slope stage by (6.37°) at the rate of (11.20%).

What is indicated above shows us the nature of muscle work in slopes running, which is one of the means or the bases of training for the speed runners or most of the arena and field activities, and researchers believe that these exercises are not limited to the players of the arena and the field only, most of the games need rapid movement capabilities and the nature of the runners, the volleyball players, the handball players and the footballers....etc., are all games need speed, it is possible to work on the development of these exercises even in the foundations of some players who suffer from injuries in certain parts of the body repeatedly by knowing the status of this part and try to give him one of the patterns of uphill slope or downhill slope, in order to work on strengthen and protect him from injury, most of these muscles, especially the muscles of the leg are working on two joints, and finding the appropriate exercises to strengthen them help us improve the special paths that belong to playing.

The muscle is very important in both the impulse and jump stages of the volleyball player. The Rectus Femoris Muscle functions as a knee extensor and hip flexor, the Gastronomies Muscle flexes the knee joint and works on the ankle flexion, as well as the femoral muscle function at the beginning of stage in jogging or running is to bend the hip joint at the moment it shortens its length and when the leg is weighted back from the knee joint at the moment of lengthening, contraction of this muscle leads to the movement of the hip flexion (positive work) and the movement of the knee joint to reduce the leg swing (negative work), and the beginning to accelerate the leg forward[5].

The opinion of the researchers in the results that were extracted for tables (2) and (3) shows that any increase in muscle activity during their work between impact and impulse regardless of the value of their activity was greater in the stage of uphill or downhill slope, this means any kind of slopes can be trained to develop muscle or specific muscle groups, this may give another opinion on knowing the direction of muscle injury at sometimes during the uphill and downhill slopes according to the angles of work that was developed in the study and we can thus show the following results:

Uphill slope training develops both the (Gastronomies Muscle) and (Ant Deltoid) more than the downhill slope training.

As for the downhill slope training it develops the muscles (Biceps Femoris Muscle) (Lumbar) (Gluteus Medius) (M Vastus Lateralis) (Semitendinosus) more than the uphill slope.

We noticed that we did not mention (Gastronomies Muscle) because its activity was in the lower stage during downhill slope, as well as (Lumbar) which its activity decreased during the uphill slope stage, while the muscle (Rectus.Femoris.Muscle) activity decreased for the stages of uphill and downhill its decreasing during the uphill slope is greater than its decreasing during the downhill slope.

That could be proof for how positive the downhill training is. Some evidence suggests that running on the downhill slopes has a strong, chronic and positive effect on running time, speed, and step[6,7,8].

The purpose of the slope training is to influence the athlete to do more than what is required, especially in the maximum speed training, "training of the highest speeds may have positive effects on the adaptation of the human muscular and nervous system"[3].

And this will affect the length of the step and its frequency and this puts the working muscles under the influence of the type of slope training and each direction to uphill or downhill will have a specificity and muscle activities may occur in the uphill more than the downhill, but at the same time will be a significant increase in the level of activity of the downhill stage, even if its value is smaller than the uphill, so the length and frequency of each has a specific effect on muscle activity. Some studies suggest that downhill slope training leads to the development of a player's step frequency. Running down has severe and chronic effects on running time and speed[9].

According to other studies the distance reduction between the imaginary line of the impulse foot and the line of the body mass center (MRS) and the step length average and its frequency during training at gradients ranging between (4°-5°), but have positive effects in horizontal running. The reductions in (MRS), step average, and step length at the rate of (15.6%), (7.4%) and (14.2%) respectively while running (4.9°) uphill slope, positive claims were made for the effects of training on slopes and uphill on movement characteristics of horizontal running[10].

In another study on a slope (8°), which is identical to the current study showed increasing distance of (MRS), in other words decreasing body tendency during running, and showed an increase in step length. After (12) weeks of training on a downhill slope (8°), MRS increased at a rate of (2.1%) and the step length increased at a rate of (1.4%) while the step average did not change[11].

In another study but a different slope degree (3°) and a training period of (6) wk. Proved that after the mentioned period of training on the slope of the (3°) (MRS) increased by (1.1%) and step rate\average increased by (2.3%), while the step length did not change[12].

What we conclude from these Studies is that running the slopes in different directions leads to changes in the path of the movement of the runner and strength and time of contact with the ground will be a positive return on horizontal running, the uphill slope, which leads to excessive burdens on the responsible muscles, and downhill slope which leads to the rapid step frequency and results in the way to reduce the time of contact with the ground which are all serve to increase the strength of the muscles responsible for performance, Shortening the cyclic period with united center and effectively can be interpreted as shortening the duration of communication as improving muscle strength[13].

References also show the training that contains a combination of the components of the uphill and downhill of the slope gives better results in the development of the movement path for speed runners or in other words to increase and improve the strength of legs for all sports. and therefore a combination of training methods (up and down) should be done for better results than any other training method and suggest that a combination of training up and down would result in significant improvements in all kinematic characteristics in the fast running[13].

The present study is distinguished from the other studies because of how important the training of the slopes is for the running mechanism, so our current research took into consideration the amount of muscular activity of the working muscles while working on the slopes, where it gives a more accurate analysis.

The researchers said that the results of the study were not limited to the muscles of the legs only, but took into consideration the muscles of other parts such as the muscles of the back and shoulder and noticed the difference in the activity of these muscles according to the nature of the slope and gives us further evidence in its movement path and the amount of strength that are made within the angles of muscle work, by training and special exercises it is possible to find out why certain parts develop and other parts don't.

Studying the effects of slopes and running on them gives us the information needed for the muscle and joint load. This may give us new ways and ideas to protect these parts during special exercises or sometimes reasons that cause injuries to them. A study suggests that knowing the changes in mechanics and common kinetics during (UR) and (DR) operation is important to understand the adaptive mechanisms resulting from running slope, and can provide additional information on the risk factors of lower limb injuries in the following sections, we discussed how progressive running may affect the mechanics and common kinetics, Summary for the studies that study the effect of (UR) and (DR) on movement parameters and principle movement of the joints of the ankle, knee and hip[14].

V. Conclusion:

The researchers concluded that the downhill of the slope develops muscle groups more than the uphill of the slope, and the average of muscular activity of the muscles studied at the stage of the uphill of slopes greater than the average of muscle activity in the downhill of the slope, and the amount of muscle activity during the impulse is greater than the impact in both stages, The angular average of the uphill of the slope is greater than the downhill of the slope, and through the video filming which showed the running mechanism of the runner, we see that the uphill training slopes may lead to the development of the length of the step of the runner, while downhill of the slope leads to the development of step frequency.

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