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## THE EMG ACTIVITY OF SELECTED MUSCLES OF LOWER EXTREMITY DURING DIFFERENT SQUATS VARIATION

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### ABSTRACTS

*EMG techniques enable us to record the electrical activity of muscles and therefore constitute an extension of the physical exploration and testing of the integrity of the motor system. In this study researcher tried to know "The EMG activity of selected muscles of the lower extremity during different variations of squats". In this study ten (10) Male sportspersons who are regularly involved in physical activities were selected as subjects for the Study. The activation of the Biceps Femoris, Semi Tendinosus, Gluteus Maximus, Rectus Femoris, Vastus Lateralis, Vastus Medialis muscles in the three squat variations such as Normal halfsquat, Squat jump, and Bulgarian squat for both legs were considered variables. The study can be concluded that the semitendinosus muscle activated less among the hamstring muscles during squats and Bulgarian squats. Squat exercise activates vastus lateralis more whereas squat jump activates vastus medialis muscle among quadriceps muscles. The overall study concludes that the squat jump activated right vastus lateralis muscles and left vastus lateralis activated for about 31.47 % and 25.69 % respectively during the squat jump.*



**KEY WORDS :** EMG, Lower Extremity Muscle, Squat Variation etc.

### INTRODUCTION

Sport helps peoples make healthier choices in modern techno life. It has constantly gained popularity, especially in the fields of sports performance and rehabilitation. Various exercise equipment and test protocols are developed to measure this goal. In this very respect, the Electromyography (EMG) measurements gain significant importance. EMG techniques enable us to record the electrical activity of muscles and therefore constitute an extension of the physical exploration and testing of the integrity of the motor system. This helps to understand the location of the problem in the scheme of movement and find the differential diagnosis of nerve and muscle diseases.

Few studies have been taken on EMG measurement in exercise science and sports. Hence researcher found the need of studying "The EMG activity of selected muscles of the lower extremity during different variations of squats".

The primary objective of the study is to analyze the muscle activation in the lower extremities of male athletes and to identify the contribution of flexors and extensors of the knee in different variations of squats.

Even though all steps will be taken to ensure that the subjects perform the experiments at their optimum level some limitations may creep into the study. The activation levels of the athletes may not be optimum due to personal or professional problems on the given day. The electrical signals may face signal interference on occasions that may force the investigator to repeat the exercise.

### SUBJECTS:

In this study ten (10) Male sportspersons who are regularly involved in physical activities were selected as subjects for the Study.

### VARIABLES:

The activation of the following muscles in the three squat variations such as Normal half squat, Squat jump, and Bulgarian squat for both legs were considered variables. Knee Extensors: Rectus Femoris, Vastus Lateralis, Vastus Medialis Knee Flexors and Hip Extensors: Biceps Femoris, Semi Tendinosus, Gluteus Maximus.

### CONDUCT OF THE EXPERIMENT:

Muscle activation is brought about by the contraction during different variations of squats. The subject will be required to do five trials of every variety of squats. The test is conducted by using surface EMG electrodes which are non-invasive and are placed on rectus femoris (RF), biceps femoris (BF), vastus lateralis (VL), vastus medialis (VM), gluteus maximus (GM), semitendinosus (ST) muscles of both the left and the right leg.

In this Study Delsys system involving cordless electromyographic equipment was used to detect muscle activation. The data is recorded and analyzed using Lab Chart 8 Pro, Data Analysis System from AD Instruments, Australia.

### ANALYSIS AND INTERPRETATION:

The data collected will be analyzed using SPSS and statistical techniques of ANOVA will be used to find the significance of the difference in the Means of the data.

**Table 1**  
**Muscle activation of the left leg during different variation of squats**

Exercise	LRF	LVM	LVL	LBF	LST	LGLUT
Squat	0.152±0.0	0.222±0.0	0.233±0.0		0.049±0.0	
Squat	9	7	8	0.064±0.03	1	0.104±0.02
Squat	0.238±0.1	0.442±0.2	0.367±0.1		0.381±0.6	
Jump	1	0	4	0.168±0.20	3	0.169±0.12
BS-Left	0.217±0.2	0.392±0.2	0.302±0.1		0.091±0.0	
BS-Left	0	3	2	0.077±0.03	6	0.124±0.02
BS-Right	0.109±0.0	0.165±0.0		0.037±0.00		0.094±0.000
BS-Right	6	9	0.15±0.06	5	0.05±0.03	3

*Note.* The values are displayed as mean±standard deviation for six samples each and are expressed in millivolts (mv).

During different variations of squats Left vastus medialis (LVM)(0.442±0.2mv) is more active than all other muscles. In squats when compare Gluteus Maximus(LGlu) is 46%. In Bulgarian squats (Left) Biceps Femoris and Semitendinosus muscle is working less when compared to the other 4

muscles with a percentage of 8.8% only.in squats. All the muscles are more active during the squat jump.

**Table 2**  
Muscle activation of the right leg during different variation of squats

	RRF	RVM	RVL	RBF	RST	RGLUT
Squat	0.189±0.0	0.207±0.1	0.238±0.0	0.053±0.0	0.04±0.0	0.059±0.0
Squat Jump	0.266±0.1	0.425±0.4	0.331±0.1	0.128±0.0	0.105±0.0	0.108±0.0
BS-Left	0.207±0.5	0.197±0.1	0.308±0.2	0.113±0.1	0.032±0.0	0.099±0.0
BS-Right	0.228±0.3	0.259±0.1	0.289±0.1	0.059±0.0	0.222±0.3	0.092±0.0

*Note.* The values are displayed as mean±standard deviation for six samples each and are expressed in millivolts (mv).

In the above table, the right vastus medialis(RVM) is more active other than all other muscles. During squats, right leg rectus femoris (RRF)79%of right vastus lateralis. Semitendinosus muscle(ST) is less active in the squat jump90.105±0.0 ). Semitendinosus muscles (ST) are very less active in squats(0.04±0.0).

**Table 3**  
Muscle activation of the right leg during different variation of balgerain squats

Muscle	Left						Right					
	LR F	LV M	LV L	LB F	LS T	LGLU T	RV RRF	RV M	RV L	RBF	RST	RGLU T
Squat	0.15	0.22	0.23	0.06	5	0.10	0.19	0.21	0.24	0.05	0.04	0.06
Squat Jump	0.24	0.44	0.37	0.17	8	0.17	0.27	0.43	0.33	0.13	0.11	0.11
BS-Left	0.22	0.39	0.30	0.08	9	0.12	0.21	0.20	0.31	0.11	0.03	0.10
BS-Right	0.11	0.17	0.15	0.04	5	0.09	0.23	0.26	0.29	0.06	0.22	0.09

Table 3 shows that balgerain squats right leg low activated muscles is left biceps femioris(0.04mv). Table 3 clearly shows all the percentages of activation during different times.

**Table 4**  
Muscle activation of the left leg and right leg during different variation of squats

	LRF	RRF	LV M	RV M	LVL	RVL	LB F	RB F	LST	RST	LGLU T	RGLU T
Squat	17.3	24.8	26.8	24.1	28.0	30.6						
Squat Jump	8	2	6	0	3	7	8.23	6.01	6.09	5.43	13.41	8.38
BS-Left	15.2	19.6	26.6	29.3	25.2	24.8			13.3			
BS-Right	7	5	5	7	1	4	9.28	9.06	9	8.40	10.19	8.58
BS-Left	16.3	24.3	32.3	21.0	25.6	31.4						
BS-Right	1	0	3	8	9	7	6.50	8.02	8.34	2.81	10.84	11.73
BS-Right	17.2	21.1	25.4	21.4	24.2	25.7			16.7			
BS-Right	2	9	8	5	0	8	6.72	5.82	8.85	9	17.54	8.98

Table 4 shows the percentage of all the muscles during different variations of squats in squats RVL activation is more(30.67mv).

**DISCUSSION:**

The results of the investigation depicted that squat exercise activates vastus lateralis more due to the fact that during the squat exercise, the knee extension occurs, which leads to activating vastus lateralis more on comparing with other muscles. The squat and Bulgarian squat resulted in less activation of semitendinosus in the hamstring muscles. The reason for this could be the less usage of the semitendinosus muscle during the knee flexion. In conclusion, the overall muscle activation is higher in the jump squat on comparing with the other squat exercises. Therefore it is advisable to do a jump squat to obtain the best result. However, it is advisable that extensive studies should be carried out on this issue.

**CONCLUSION:**

The study can be concluded that the semitendinosus muscle activated less among the hamstring muscles during squats and Bulgarian squats. Squat exercise activates vastus lateralis more whereas squat jump activates vastus medialis muscle among quadriceps muscles. The overall study concludes that the squat jump activated right vastus lateralis muscles and left vastus lateralis activated for about 31.47 % and 25.69 % respectively during the squat jump. It can be recommended that the same study may conduct on professional sports persons and non-sports persons of different age groups on the activation of other muscle groups.

During different variations of squats Left vastus medialis (LVM)(0.442±0.2mv) is more active than all other muscles. In squats when compare Gluteus Maximus(LG) is 46%. In Bulgarian squats (Left) Biceps Femoris and Semitendinosus muscle is working less when compared to the other 4 muscles with a percentage of 8.8% only.in squats. All the muscles are more active during the squat jump.

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