



## EMG ANALYSIS OF QUADRICEPS MUSCLES GROUPS DURING KICKING IN FOOTBALL

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### Abstract

The aim of the study was to compare Quadriceps Muscles Groups during kicking in Football. The investigator had selected Eight male soccer players of inter University/national level were selected as subjects for the study. Hence, purposive sampling was considered for selection of subjects. The age of subjects ranged from 18-25 years. All the subjects were selected from Banaras District. These players had represented inter University/national level and had no lower extremity injuries or any bone joint disparities in the past years. The criterion measure adopted for this study was measured by Neuro track Myoplus 2/4 channel. After a brief warm-up, and electrode placement, participants performed the instep kick. The data was analyzed by applying Descriptive statistics and Analysis of variance (ANOVA) to compare the Quadriceps Muscles Groups during Instep kick. The level of significance was set at 0.05. The results of the study revealed that the F- value 4.431 was found to be significant at  $P < 0.05$  among Rectus femoris, Vastus Lateralis, Vastus Intermedius and Vastus Medialis. On the basis of result and finding it may be concluded that every muscles have separate function for the movement while Instep kicking in football so all four quadriceps muscles plays an important role while executing the Instep kick.

**Keywords:** EMG, Rectus femoris, Vastus Lateralis, Vastus Intermedius and Vastus Medialis and Football.

### Introduction

Electromyography is the only method of objectively assessing when a muscles is active. It has been used to establish the roles that muscles fulfil both individually and in group actions. The EMG provides information on the timing, or sequencing, of the activity of various muscles in sports movements. By studying the sequencing of muscle activation, the sports bio mechanist can focus on several factors that relate to the skill, such as any overlap of agonist and antagonist activity and the onset of antagonist activity at the end of a movement. It also allows the sports bio mechanist to study changes in muscular activity during skill acquisition and as a result of training. Electromyography can also be used to validate assumptions about muscle activity that are made when calculating the internal forces in the human musculoskeletal system. It should, however, be noted that the EMG cannot necessarily reveal what a muscle is doing, particularly in fast multi-segment movements that predominate in sport. (Roger Bartlett 2007)

The quadriceps femoris also called simply the quadriceps, quadriceps extensor, or quads, is a large muscle group that includes the four prevailing muscles on the front of the thigh. It is the great extensor muscle of the knee, forming a large fleshy mass which covers the front and sides of the femur. It is subdivided into four separate portions or 'heads', which have received distinctive names: Rectus femoris occupies the middle of the thigh,



covering most of the other three quadriceps muscles. Vastus lateralis is on the lateral side of the femur (i.e. on the outer side of the thigh). Vastus medialis is on the medial side of the femur (i.e. on the inner part thigh). Vastus Intermedius lies between vastus lateralis and vastus medialis on the front of the femur (i.e. on the top or front of the thigh), but deep to the rectus femoris. Typically, it cannot be seen without dissection of the rectus femoris. All four quadriceps are powerful extensors of the knee joint. They are crucial in walking, running, jumping and squatting. Because rectus femoris attaches to the ilium, it is also a flexor of the hip. This action is also crucial to walking or running as it swings the leg forward into the ensuing step.

### Methodology

For the purpose of this study Eight male football player were selected. All the subjects selected were represented inter University/national level football tournament. The age of subjects ranged from 18-25 years. All the subjects were selected from Banaras District. EMG analysis of the subjects was evaluated for their Rectus femoris, Vastus Lateralis, Vastus Intermedius and Vastus Medialis muscles during Instep kick in Football. Tools: For the reason of testing EMG Analysis in this study Neuro track Myoplus 2/4 channel instrument was used. The data was recorded in micro volt ( $\mu\text{v}$ ).

The data for the selected muscles were obtained with the help of the instrument Neuro track Myoplus 2/4, operated by the investigator during the execution of instep kick. Before the actual testing, the subjects were given a complete demonstration of instep kick. After the demonstration and explanation, electrode points was marked in the presence of

specialized persons and physiotherapist, and then subjects were allowed to take practice trials in order to get familiar with the test. The data was collected only for right leg instep kick from penalty spot at football ground (Amphitheater) of Banaras Hindu University, Varanasi. After making all entries of the subject pertaining to his profile on the software, the subject were performed the instep kick and their readings was recorded in microvolt ( $\mu\text{v}$ ).

### Findings and Results

The obtained data thus collected were statistically analyzed by applying Descriptive statistics and Analysis of variance (ANOVA) to compare the Quadriceps Muscles Groups during Instep kick. The level of significance was set at 0.05. The results are depicted with the help of table 1

TABLE 1  
DESCRIPTIVE STATISTICS OF QUADRICEPS MUSCLES GROUPS IN  
RELATION TO EMG ACTIVITY DURING  
INSTEP KICK IN FOOTBALL

Groups	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
				Lower Bound	Upper Bound		
Vastus Medialies	176.24	27.33	9.66	153.39	199.08	125.90	217.40
vastus Lateriles	196.80	37.87	13.39	165.14	228.46	154.90	248.30
Rectus Femories	192.05	34.57	12.22	163.15	220.95	134.60	230.60
Vastus Intermedius	148.06	10.66	3.77	139.15	156.97	134.60	167.60
Total	178.29	34.09	6.03	166.00	190.58	125.90	248.30

The table 1 reveals that the muscular contraction of selected muscles during instep kick in soccer from the penalty spot, the mean and standard deviation of all four quadriceps muscles were following; Vastus lateralis muscles have the highest activation with Mean and SD (196.8000) and (37.87212) followed by



Rectus femoris muscles have Mean and SD (192.0500) and (34.57381) Vastus medialis muscles have (176.2375) and (27.32534) Vastus Intermedius muscles have the lowest activation with Mean and SD (148.0625) and (10.65846) respectively.

TABLE 2  
ANALYSIS OF VARIANCE (ANOVA) AMONG RECTUS FEMORIS, VASTUS LATERALIS, VASTUS INTERMEDIUS AND VASTUS MEDIALIS IN RELATION TO EMG ACTIVITY DURING INSTEP KICK IN FOOTBALL.

Source of Variable	Degree of freedom	Sum of Squares	Mean Square	F	Sig.
Between Groups	3	11598.978	3866.326	4.431	.011
Within Groups	28	24429.458	872.481		

F = Ratio needed for significance at 0.05, Level of significance = df (3, 28) = 2.95

Table No.2 revealed that the obtained 'F' value 4.431 was found to be significant at 0.05 level with (3, 28) df as the tabulated value 2.95 required to be significant at 0.05 level in relation to their instep kicking in football.

Since the differences were found to be significant among muscles group while kicking the football, the Least Significant Difference post-hoc test was applied in order to determine the significant of differences between paired means. Further, the L.S.D. analysis for paired means of different muscles have been presented in table no.3

TABLE-3  
LSD POST HOC TEST MEANS DIFFERENCES BETWEEN TWO GROUPS IN RELATION TO EMG ACTIVITY DURING INSTEP KICK IN FOOTBALL

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Vastus Medialies	Vastus lateriles	20.56	14.77	0.18	-50.82	9.69
	Rectus Femories	15.81	14.77	0.29	-46.07	14.44
	Vastus Intermedius	28.18	14.77	0.07	-2.08	58.43
Vastus Lateriles	Vastus Medialies	20.56	14.77	0.18	-9.69	50.82
	Rectus Femories	4.75	14.77	0.75	-25.50	35.00
	Vastus Intermedius	48.74*	14.77	0.00	18.48	78.99
Rectus Femories	Vastus Medialies	15.81	14.77	0.29	-14.44	46.07
	Vastus lateriles	4.75	14.77	0.75	-35.00	25.50
	Vastus Intermedius	43.99*	14.77	0.01	13.73	74.24
Vastus Intermedius	Vastus Medialies	28.18	14.77	0.07	-58.43	2.08
	Vastus lateriles	48.74*	14.77	0.00	-78.99	-18.48
	Rectus Femories	43.99*	14.77	0.01	-74.24	-13.73

\* The mean difference is significant at the 0.05 level.

Significant Mean differences were found between Vastus lateriles and Vastus Intermedius; Rectus Femories and Vastus Intermedius. Whereas insignificant Mean differences were found between Vastus Medialies & Vastus lateriles; Vastus Medialies & Rectus Femories; Vastus Medialies & Vastus Intermedius.

### Discussion of findings

Vastus Lateralis muscles showed the highest activation level of EMG during execution of instep kick in all selected muscles groups. This higher muscular activity is occurred due to the forcefully right leg movement, when executing the instep kick. The major action of Vastus Lateralis is extension and stabilize knee, the vastus lateralis also called the "vastus externus" is the largest and most powerful part of the quadriceps femoris.

Rectus femoris muscles showed the 2<sup>nd</sup> highest activation level of EMG during execution of instep kick in all selected muscles



groups. Its functions are to flex the thigh at the hip joint and to extend the leg at the knee joint. The rectus femoris is a weaker hip flexor when the knee is extended because it is already shortened and thus suffers from active insufficiency.

Vastus Medialis muscles showed the 3<sup>rd</sup> highest activation level of EMG during execution of instep kick in all selected muscles groups. It is involved in knee extension, along with the other muscles which make up the quadriceps muscle. The vastus medialis also contributes to correct tracking of the patella. The vastus medialis muscle is a common center of weakness because it will not become fully strengthened unless the leg is regularly extended fully.

Vastus Intermedius muscles function showed lowest activation level of EMG during execution of instep kick in all selected muscles groups. Due to being the deeper middle-most of the quadriceps muscle group, the intermedius is the most difficult to stretch once maximum knee flexion is attained. It cannot be further stretched by hip extension as the rectus femoris can, nor is it accessible to manipulate with massage therapy to stretch the fibres sideways as the vastus lateralis and vastus medialis.

All four quadriceps are powerful extensors of the knee joint. They are crucial in walking, running, jumping and squatting. Because rectus femoris attaches to the ilium, it is also a flexor of the hip. This action is also crucial to walking or running as it swings the leg forward into the ensuing step. The instep drive uses the quadriceps muscles of the thigh to provide the most powerful kick available in the game, forcing the top of the foot (instep) to propel (drive) the soccer ball forward.

## Conclusion

On the basis of result and finding it may be concluded that every muscles have separate function for the movement while Instep kicking in football so all four quadriceps muscles plays an important role while executing the Instep kick.

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