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Dominant and Non-Dominant Leg Muscle Electrical Activity Of Soccer Players: A Preliminary Study

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Abstract:- Content: Electromyography (EMG) is a recording of muscles electrical activity and is useful for mechanism study. In Exercise and Sport Science, mechanism of dominance and non-dominance limb activity is recently a focus area. **Objective:** The aim of this study is to observe the muscle electrical activity of soccer players' dominant and non-dominant leg. **Design:** Cross-sectional study. **Setting:** District level soccer championship, Birbhum district, West Bengal, India. **Patients or Other participants:** The total of 10 subjects, 5 right foot dominated and 5 left foot dominated soccer players were selected. **Main outcome measure(s):** Muscle electrical activity was measured by Electromyography (EMG) machine and data were collected during resting standing position from the leg muscles (calf, quadriceps and hamstring). Bipolar, 5 mm diameter surface electrodes were used to collect the data. Each group of muscle electrical activity was recorded after 15 seconds for 5 minutes. Two minutes rest intervals were given between three trials. For analysis of the data mean, SD and independent t-test was used. **Results:** It was observe that in the right leg dominant players and left leg dominant players EMG activity of calf and quadriceps muscles were significantly higher in their dominant leg. Whereas in the hamstring muscle EMG activity of left leg dominant players was significantly higher in their left leg, and insignificant result was found in the right leg dominant players. **Conclusion:** The present research group concluded that dominant leg of soccer players has shown higher level of EMG activity in the resting standing position. This result may create an impact in the mechanism study of dominance limb.

Keywords: Soccer player, Dominant and non-dominant leg, EMG.

I. INTRODUCTION

Electromyography (EMG) is an electrical recording of muscles activity and can determine whether a particular muscle is responding appropriately to stimulation, and whether a muscle remains inactive when not stimulated. EMG can detect electrical activity of muscle in different condition. Patikas et al. [1] (2002) studied electromyography changes of agonist and antagonist during calf muscles activity. Kellies and Katis [2] (2007) investigated the relationship between knee isokinetic strength testing and soccer kick kinematics using EMG. Manolopoulos et al. [3] (2006) studied the effects of a soccer training program (strength and technique) on kinematics and EMG activity during a instep kick. They concluded that training had insignificant effects on EMG values, apart from an increase in the averaged EMG of the vastus medialis. Rahnama et al. [4] (2006) observed electromyography activity of selected lower limb muscle fatigue by exercise at the intensity of soccer match play. Guette et al. [5] (2005) studied neuromuscular properties of dominant and non-dominant quadriceps of femoris and the torque.

For the improvement of soccer performance scientists are searching different type of techniques. Recently the neuro-muscular electrical activity has got tremendous importance. There are many studies on dynamic soccer movement and EMG (Dorge et al. [6] 1993; Kethis and Katis [7], 2007; Rahnama, et al. [8], 2006). But the present research group could not find any study on resting EMG of soccer players and the differences in their dominant and non-dominant legs.

II. AIM

The aim of this study was to observe the soccer player's dominant and non-dominant leg muscle's electrical activity in resting standing condition.

III. METHODOLOGY

Selection of Subjects:

The subjects were selected from Santiniketan and Bolpur area in West Bengal, India. All the subjects were participated at least inter-district competition. Through personal interview the present research group identified left and right foot dominated soccer players. From a total population of 30 soccer players, ten (10) male subjects: five right foot dominated and five left foot dominated soccer players were selected randomly. This project was passed in the departmental academic council and informed consent was taken from the each subject before the test.

Criterion Measures:

Muscle electrical activity was measured by EMG machine (Medicaid system, 389 Ind. Area Phase II, Chandigarh-160002, India). Electromyography (EMG) data were collected during the resting standing position in both dominant and non-dominant leg muscles (calf, quadriceps and hamstring) of the subjects. Before testing, the skin was shaved, abraded, and cleaned with an alcohol preparation pad. Bipolar, 5-mm diameter, surface electrodes were placed over middle of the calf, quadriceps and hamstring muscles. The edges of the surface electrodes were trimmed to reduce the inter-electrode distance to 3 inches. Electrodes were positioned parallel to the direction of the muscle fibers. Before the EMG recording, the subjects were given 10 minutes complete rest. Each group of muscle electrical activity from the surface electrodes was recorded after 15 seconds for 5 minutes. Then the mean of the all tests were used for final data. Rest intervals of 2 minutes were given between trials.

Statistical Analysis:

To compare the mean differences of EMG between the two leg muscles, mean; standard deviation (SD) and t-test was computed by means of SPSS Software version 17.

IV. RESULTS

Soccer is a very popular game all over the world and played only by the both legs. Other than the exceptional, most of the soccer player either right or left leg dominated. The influence of hereditary and the nature of practice maybe the cause of this dominance. The most important three muscles of soccer players are calf, quadriceps and hamstring. Here in this study the researchers tried to find out the differences of dominant and non-dominant leg muscles electrical activity. All the EMG was recorded in the resting and standing state.

Table 1: Dominant and Non-Dominant Leg Calf Muscle Resting Standing EMG

Calf muscle EMG		Mean (mv)	Standard Deviation (mv)	T-ratio	P-value
Right dominant	**Right leg**	**34.10**	**2.61**	**4.697****	**0.002**
	Left leg	**27.67**	**1.59**		
Left dominant	**Right leg**	**29.37**	**8.92**	**3.153****	**0.014**
	Left leg	**42.36**	**2.27**		
****Significant at 0.01 levels**					

It was observe that the right foot dominated soccer player's calf muscle EMG of right leg and left leg were 34.10±2.61 milivolt and 27.67±1.59 milivolt respectively. Whereas the left foot dominated soccer player's calf EMG recording of right leg was 29.37±8.92 milivolt and left leg 42.36±2.27 milivolt respectively. In both the cases, the dominated foot expressed higher level of EMG than the non-dominated foot and it was significant at 0.01 levels (Table 1).

The graphical representation of calf muscle resting standing EMG was shown in figure 1.

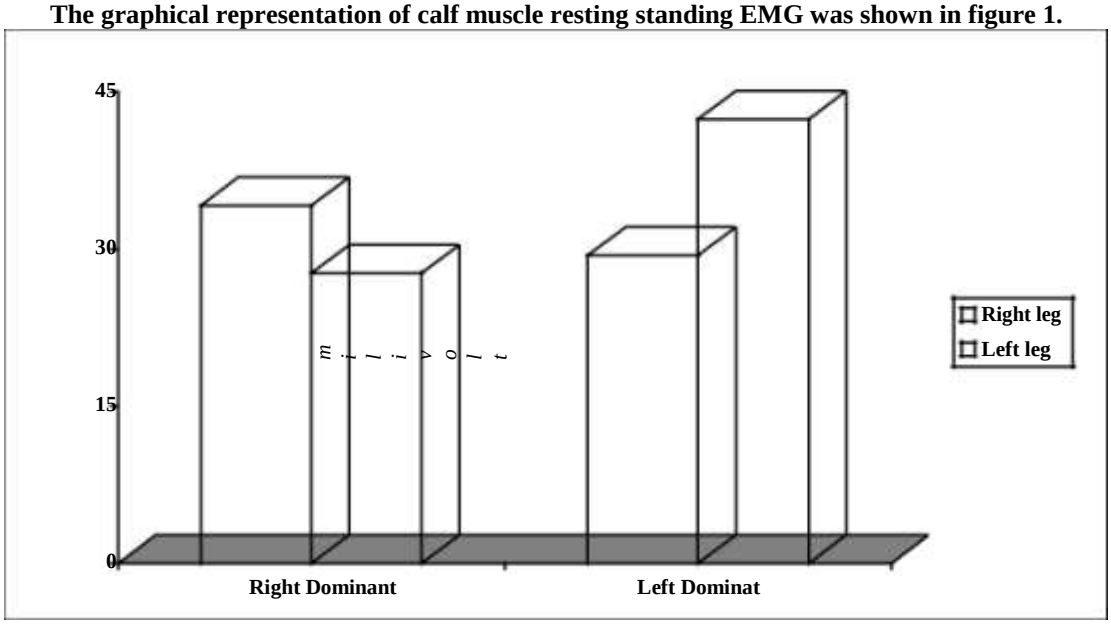

Figure 1: Calf Muscle Resting Standing EMG

Table 2: Dominant and Non-Dominant Leg Quadriceps Muscle Resting Standing EMG

Quadriceps muscle EMG		Mean (mv)	Standard Deviation (mv)	T-ratio	P-value
Right dominant	Right leg	29.21	2.47	2.713*	0.027
	Left leg	33.10	2.03		
Left dominant	Right leg	43.77	2.16		
	Left leg	48.86	3.14	2.977**	0.018
*Significant at 0.05 level; **Significant at 0.01 level					

It was revealed that the right foot dominated soccer player's quadriceps muscle EMG of right leg and left leg were 29.21±2.47 milivolt and 33.10±2.03 milivolt respectively. Whereas the left foot dominated soccer player's quadriceps EMG recording of right leg was 43.77±2.16 milivolt and left leg 48.86±3.14 milivolt respectively. In first case, the dominated foot expressed lower level of EMG than the non-dominated foot, was significant at 0.05 levels and in second case, the dominated foot expressed higher level of EMG than the non-dominated foot and it was significant at 0.01 levels (Table 2).

The graphical representation of quadricep muscle resting standing EMG was shown in figure 2.

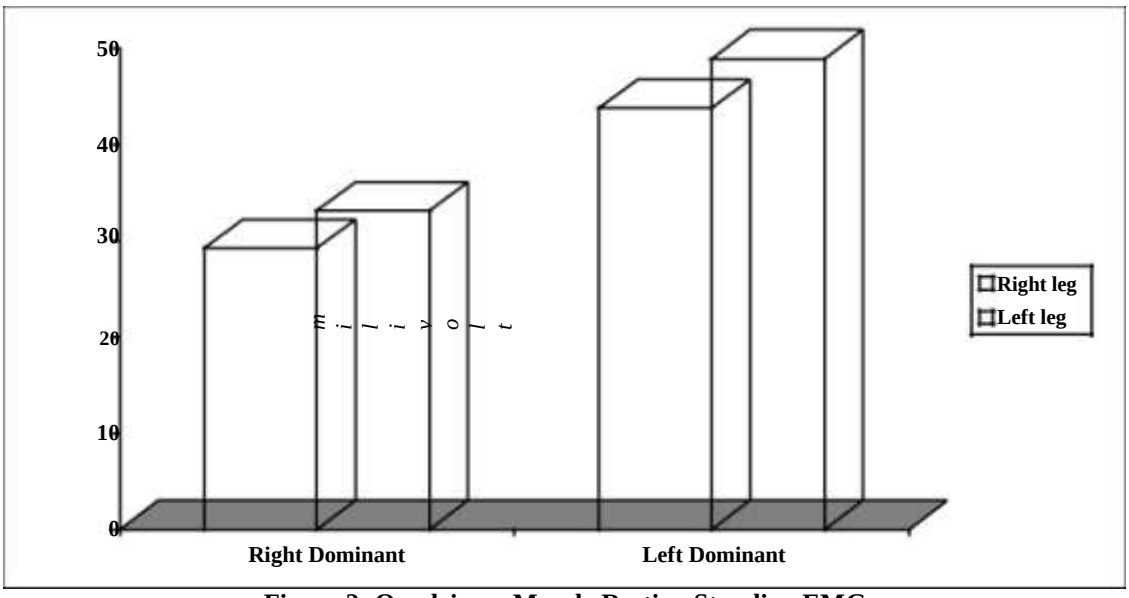

Figure 2: Quadriceps Muscle Resting Standing EMG

Table 3: Dominant and Non-Dominant Leg Hamstring Muscle Resting Standing EMG

Hamstring muscle EMG		Mean (mv)	Standard Deviation (mv)	T-ratio	P-value
Right footer	Right leg	14.07	2.10	0.089	0.931
	Left leg	13.72	8.61		
Left footer	Right leg	34.07	1.82	8.241**	0.001
	Left leg	47.59	3.18		
**Significant at 0.01 level					

It was shown that the right foot dominated soccer player's hamstring muscle EMG of right leg and left leg were 14.07±2.10 milivolt and 13.72±8.61 milivolt respectively. Whereas the left foot dominated soccer player's hamstring EMG recording of right leg was 34.07±1.82 milivolt and left leg 47.59±3.18 milivolt respectively. In the second case, the dominated foot expressed higher level of EMG than the non-dominated foot and it was significant at 0.01 levels. But in the first case, the dominated foot expressed insignificant difference between two legs, though the mean value was higher in the dominated leg (Table 3).
The graphical representation of quadricep muscle resting standing EMG was shown in figure 3.

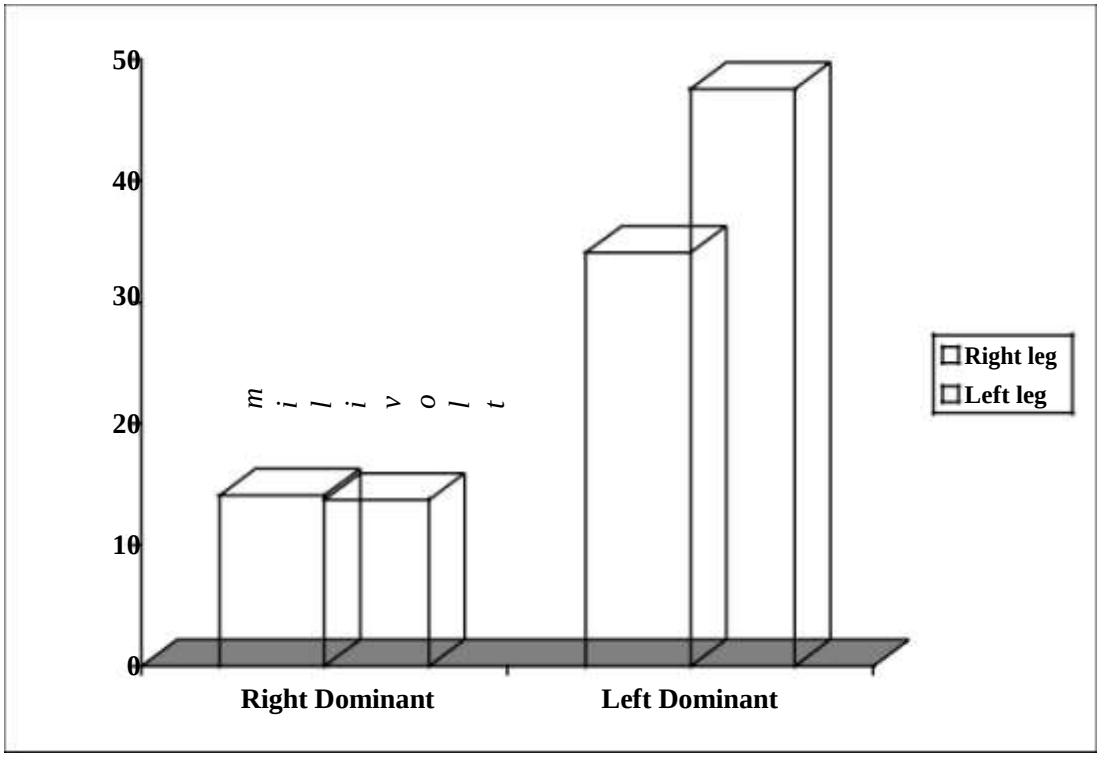

Figure 3: Hamstring Muscle Resting Standing EMG

V. DISCUSSIONS

The concept of limb dominance in the upper extremity has long been accepted. The researchers are also searching the lower extremities dominance mechanism. Hoffman et al. [7] (1998) and other researchers address the idea of leg dominance as it relates to both strength and function. Conversely, epidemiologic studies have shown not only those imbalances exist but they may result in increased injury rates for athletes with side to side strength differentials greater than 10% (Nadlere et. al. [8] 2002). Leg dominance differences at the hip and knee have been revealed during function task, such as landing from a jump (Jacobs and Mattacola, [9] 2004). In the present study, the research group tried to find out whether there is a difference in the resting EMG level of dominance and non-dominance leg muscle of soccer players. As per the available data sources this group could not find any authentic report in this area. It is established that dominant leg has better strength and muscular endurance than the non-dominant of one. But the mechanism behind it is yet to be established. This report may throw a light to understand the dominance and non-dominance limbs mechanism, which may further be added value in the sports performance development research areas. However, a large number of sample size and more critical analysis of EMG be recommended for further research.

VI. CONCLUSIONS

The calf and quadriceps muscle resting standing EMG of dominant leg was higher. But in hamstring muscle EMG activity was found higher only in the left leg dominant soccer players. This research may create a new idea in the searching of mechanism of sport limb dominancy.

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