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Social Science Journal

# A comparative analytical study of multiple Electromyography variables of selective upper body muscles working in the Forehand strokes in men's table tennis

**By**

**Omar Fadhil Omar Al-Hamdani**
Physical Education Department, Al-Qalam University college, Iraq
Email: Omer.ph@alqalam.edu.iq

**Wadie Yassin Al-Tikrity**
Physical Education Department, Al-Qalam University college, Iraq
Email: Wadie.ph@alqalam.edu.iq.

## Abstract

The research aims to identify the values of multiple variables of electromyography activity for some of the upper body muscles working in the forehand diagonal and straight strokes of table tennis for men and the difference between them. The descriptive approach was used in both analytical and comparative methods. The sample consisted of (6) advanced players. After reviewing a number of sources that used the ball throwing device, the most frequent test in the diagonal and straight research was chosen which is the front stroke tests (diagonal and straight) in table tennis. EMG was used to following muscles: Wrist Flexor-Biceps-Pectorals Major-Posterior part Deltoid-Trapezius-Rectus Abdominals. The researcher used arithmetic mean, standard deviation, and Wilcoxon matched-paired single range non-parametric statistical test. The following conclusions were reached :1-The significant differences in the Forehand strikes between the diagonal and straight strikes were in (3) variables, as it was in favor of the diagonal frontal strikes. 2-The differences in the Forehand strikes between the diagonal and straight strikes were in (34) variables, as it was in favor of the diagonal frontal strikes (18) variables and in favor of the frontal straight strokes (16) variables.

**Keywords**: comparative analytical; body muscles; multiple Electromyography.

## Introduction

The electrocardiogram is one of the scientific indicators of the efficiency of the nervous and muscular systems and is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). EMG results can reveal nerve dysfunction, muscle dysfunction or problems with nerve-to-muscle signal transmission (Ali.et al. 2019.1) The researchers were interested in studying the EMG variables in table tennis. The EMG specialists in table tennis investigated the muscle activity in the back straight, diagonal, and forehand strokes. The researchers were focused on the muscles of the upper body and studied electrical activity of the muscles in the upper part. In research conducted by (Isabelle Rogowski, et al 2005.1) the researchers dealt with Trunk and Upper Limb muscle activation during flat and topspin forehand drives in young Tennis Players. Similar research work conducted by researchers around the world includes (Kondrič, et al'2006.1-10) "Myoelectric comparison of Table Tennis forehand stroke using different ball sizes " in year 2006, (Chien-Lu Tsai et al) "The surface EMG activity of the upper limb muscle in the table tennis forehand drive" in year 2010, (Chien-Lu Tsai, Isabelle Rogowski, David Rouffet, Frédéric Lambalot, Olivier Brosseau, and Christophe Hautier) ,"Trunk and Upper Limb Muscle Activation During Flat and Topspin Forehand Drives in Young Tennis Players" in the year 2011, (Chien-Lu

Tsai1et al) "The upper limbs EMG activity comparison of different table tennis forehand" drives in the year 2012, (Hsin-Hsueh Huang , Yi-Chang Hsueh , Yu-Yuen Chen , Ting-Jui Chang , Kuang-Min Pan , Kuei-Shu Huang , Chien- Lu Tsai) ,"The dynamical analysis of table tennis forehand and backhand drives" in the year 2013. Yiming Guo; Yingfei Sun; Yi Ren; Zhipei Huang; Jiankang Wu; Zhiqiang Zhang studied "Upper Limb Muscle Force Estimation During Table Tennis Strokes while studying Electrical activity of the muscles in the lower part Lower limb muscle activity during table tennis strokes "(Yann Le Mansec , Sylvain Dorel .2018; Citil & Yurdakul, 2020) and they studied the EMG of whole body "An analysis of whole-body kinematics, muscle strength and activity during cross-step topspin among table tennis players" (Chen; Wang; Chen; Ma ;Malagoli Lanzoni, 2022; Fitriani et al., 2020) and "Electromyography activities of upper and lower extremities in table tennis during forehand topspin and no spin stroke: A Case Study." (Ozsu, I., Simsek, D., Ertan, H.2022; Girgin, 2020)

This study is the first of its kind on table tennis in Iraq. We hope that we have given a clear picture of the nature of electrical muscle activity in table tennis in Iraq.

***The research aims*:** The research aims to identify the values of multiple variables of electromyography activity for some of the upper body muscles working in the forehand diagonal and straight strokes of table tennis for men and the difference between them.

***Research hypotheses*:** There are significant differences between a number of variables of electromyography for some muscles of the upper body operating in the straight and diagonal frontal stroke in table tennis for men.

***Research Methodology*:** The researcher used the descriptive approach in both analytical and comparative methods. The sample consisted of (6) advanced player.

***Methods of data collection:*** The researcher used the following data collection methods:

***Test:*** After reviewing a number of sources that used the ball throwing device, the most frequent test in the diagonal and straight research was chosen. Front stroke tests (diagonal and straight) in table tennis.

***The EMG Test:*** following muscles were chosen Wrist Flexor-Biceps-Pectorals Major-Posterior part Deltoid-Trapezius-Rectus Abdominals.

***Devices and tools used in the research***: - Ball Thrower.
***Statistical Treatment:*** The researcher used arithmetic mean, standard deviation, and Wilcoxon matched-paired single range non-parametric statistical test. The data was statistically processed using the statistical package (SPSS).

## Results and discussion

From the table (1) the results of the research indicated that there were no significant differences between the diagonal and straight strokes in the forehand strokes in table tennis in the Biceps muscle.

**Table 1.** *Differences in electromyography variables of the Bicep muscles in the Forehand*

*strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 130.69 | 75.57 | 105.64 | 56.83 | 0.681 | 0.521 |
| 2 | Maximum crowding strength | uV | 294.36 | 181.12 | 390.43 | 131.29 | 1.378 | 0.217 |
| 3 | Lowest crowding strength | uV | 19.63 | 6.47 | 13.92 | 4.74 | 1.647 | 0.151 |
| 4 | Wave time | S | 0.31 | 0.05 | 0.28 | 0.05 | 1.258 | 0.225 |
| 5 | Area under the wave curve | Uv*s | 40.44 | 5.81 | 83.46 | 11.81 | 0.340 | 0.745 |
| 6 | Area under the wave/time curve | Uv*s/s | 132.87 | 37.04 | 151.91 | 59.21 | 0.564 | 0.593 |

From the table (2) the results of the research indicated that there were no significant differences between the diagonal and straight strokes in the forehand strokes in table tennis in the Wrist Flexor muscle.

**Table 2.** *Differences in electromyography variables of the Wrist Flexor muscle in the Forehand strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 516.00 | 159.42 | 310.24 | 178.57 | 2.258 | 0.045* |
| 2 | Maximum crowding strength | uV | 788.56 | 156.87 | 765.43 | 172.35 | 0.398 | 0.704 |
| 3 | Lowest crowding strength | uV | 18.95 | 9.04 | 19.24 | 10.34 | 0.115 | 0.912 |
| 4 | Wave time | S | 0.31 | 0.04 | 0.28 | 0.05 | 1.246 | 0.259 |
| 5 | Area under the wave curve | Uv*s | 142.97 | 128.13 | 132.77 | 94.51 | 0.261 | 0.803 |
| 6 | Area under the wave/time curve | Uv*s/s | 402.75 | 385.21 | 368.57 | 149.16 | 0.243 | 0.818 |

*Significant at level 0.05

From the table (3) the results of the research indicated that there was a significant difference between the diagonal and straight strokes in the forehand strokes in table tennis in the Wrist Flexor muscle in Lowest crowding strength and Area under the wave curve for the sake of Diagonal strokes in Posterior part Deltoid muscle.

**Table 3.** *Differences in electromyography variables of the Posterior part Deltoid muscle in the Forehand strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 106.43 | 20.340 | 91.81 | 25.17 | 1.768 | 0.127 |
| 2 | Maximum crowding strength | uV | 304.11 | 144.02 | 242.43 | 127.03 | 1.750 | 0.131 |
| 3 | Lowest crowding strength | uV | 19.33 | 11.68 | 10.49 | 9.77 | 1.975 | 0.050* |
| 4 | Wave time | S | 0.30 | 0.05 | 0.28 | 0.05 | 0.36 | 0.490 |
| 5 | Area under the wave curve | Uv*s | 41.34 | 11.82 | 33.11 | 11.55 | 2.045 | 0.049* |
| 6 | Area under the wave/time curve | Uv*s/s | 142.04 | 51.11 | 129.98 | 68.45 | 0.403 | 0.701 |

*Significant at level 0.05

From the table (4) the results of the research indicated that there were no significant differences between the diagonal and straight strokes in the forehand strokes in table tennis in the Pectorals Major muscle.

**Table 4.** *Differences in electromyography variables of the Pectorals Major muscle in the*

*Forehand strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 167.83 | 95.63 | 200.67 | 115.56 | 1.404 | 0.210 |
| 2 | Maximum crowding strength | uV | 490.27 | 277.45 | 538.69 | 211.14 | 0.549 | 0.603 |
| 3 | Lowest crowding strength | uV | 11.91 | 3.86 | 14.40 | 13.08 | 0.500 | 0.635 |
| 4 | wave time | S | 0.31 | 0.04 | 0.28 | 0.05 | 1.246 | 0.295 |
| 5 | area under the wave curve | Uv*s | 58.34 | 23.47 | 52.24 | 26.17 | 0.898 | 0.404 |
| 6 | area under the wave/time curve | Uv*s/s | 186.97 | 67.77 | 191.96 | 117.67 | 0.151 | 0.858 |

From the table (5) the results of the research indicated that there were no significant differences between the diagonal and straight strokes in the forehand strokes in table tennis in the Rectus Abdominals muscle**.**

**Table 5.** *Differences in electromyography variables of the Rectus Abdominals muscle in the Forehand strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 153.06 | 95.61 | 160.99 | 138.00 | 0.197 | 0.851 |
| 2 | Maximum crowding strength | uV | 409.99 | 182.44 | 467.60 | 360.48 | 0.457 | 0.663 |
| 3 | Lowest crowding strength | uV | 12.17 | 8.03 | 12.73 | 5.86 | 0.141 | 0.893 |
| 4 | Wave time | S | 0.31 | 0.04 | 0.28 | 0.05 | 1.246 | 0.259 |
| 5 | Area under the wave curve | Uv*s | 50.17 | 17.51 | 32.60 | 11.53 | 1.866 | 0.111 |
| 6 | Area under the wave/time curve | Uv*s/s | 167.75 | 79.92 | 118.25 | 33.46 | 1.422 | 0.205 |

*Significant at level 0.05

From the table (6) the results of the research indicated that there were no significant differences between the diagonal and straight strokes in the forehand strokes in table tennis in the Trapezius muscle

**Table 6.** *Differences in electromyography variables of the Trapezius muscle in the Forehand strokes*

| | Variable | Measuring unit | Diagonal strokes | | straight strokes | | t. test | sin |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | sd | Mean | sd | | |
| 1 | Average crowding strength | uV | 92.41 | 13.85 | 81.97 | 23.16 | 1.456 | 0.196 |
| 2 | Maximum crowding strength | uV | 236.14 | 50.08 | 165.37 | 68.94 | 1.825 | 0.118 |
| 3 | Lowest crowding strength | uV | 13.23 | 12.43 | 8.94 | 6.02 | 0.733 | 0.491 |
| 4 | Wave time | S | 0.31 | 0.04 | 0.28 | 0.05 | 1.246 | 0.259 |
| 5 | Area under the wave curve | Uv*s | 37.53 | 15.37 | 31.17 | 13.91 | 0.648 | 0.541 |
| 6 | Area under the wave/time curve | Uv*s/s | 120.64 | 44.55 | 119.48 | 59.11 | 0.039 | 0.970 |

It is the same muscle groups that work in the diagonal and straight strikes with some slight difference due to changing the direction of the ball towards the target, as the moral differences did not appear in five muscles, and the Posterior part Deltoid muscle was unique in the differences in two variables, Lowest crowding strength and Area under the wave curve In the interest of the diagonal strike, the fact that the forehand stroke is in line with the direction

of movement of the arm and is mainly responsible for the deltoid muscle, so we draw the following conclusions:

1- The significant differences in the Forehand strikes between the diagonal and straight strikes were in (3) variables, as it was in favor of the diagonal frontal strikes.
2- The differences in the Forehand strikes between the diagonal and straight strikes were in (34) variables, as it was in favor of the diagonal frontal strikes (18) variables

and in favor of the frontal straight strokes (16) variables.

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