Relations of Hand Preference, Muscle Power, Lung Function and Reaction Time in Right-Handed Taekwondo Players

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Abstract: In previous studies, it has been suggested that left-handers have innate neurologic advantage for sport. In the present study, it has been investigated relationships between hand preference and some important physical parameters for success in sport such as muscle power, pulmonary capacities and reaction time in taekwondo players. 30 boys and 23 girls being young professional taekwondo athletes in Turkey were included. Handedness was ascertained by using the Edinburgh Handedness Scale. Takei Kiki Kongo Dynamometers were used to measure muscle power. Forced vital capacity was measured by a Pony digital spirometer. Auditory reaction time was assessed by Newtest OY 1000 (kiviharjuisto / Fin 90220/04104). In the present study, as leg and back powers increase, forced vital capacity was increasing and auditory reaction time was decreasing. There were statistically significant correlation between forced vital capacity and auditory reaction time. As hand preference score shifts towards left (from 100 to 0), forced vital capacity was increasing, leg and back powers were increasing and auditory reaction time was decreasing. The results of present study support the notion that the left-handedness or shifts towards left (from 100 to 0) in hand preference may be advantageous for taekwondo sport and more success in left-handed athletes may be result from innate neurologic advantage.

Key words: Hand preference · Muscle power · Lung function · Reaction time · Taekwondo

INTRODUCTION

In a recent study, the rate of left-handedness was higher in wrestlers with medal honors compared to wrestlers without medals for both men and women. The winning numbers and match degrees were higher in the left-handed wrestlers than in both right- and mixed-handed wrestlers in International top wrestlers [1]. It has been suggested that left-handed wrestlers are more successful.

Dane and Erzurumluoglu [2] reported that the left-handers had superiority over the right-handers for the eye-dominant hand and the left eye-left hand visual reaction times in handball players. Also, they reported that there was sex-related difference in right-handers, that is to say, the right-handed women had longer reaction times compared to the left-handed ones, but in the left-handers, there was no sex difference in reaction times. Dane and Erzurumluoglu [2] suggested that a high proportion of left-handers among athletes may be due to the fact that left-handers have an intrinsic neurological advantage over right-handers.

Additionally, it has been reported that there is a high proportion of left-handedness among top athletes in baseball [2], in tennis [4], in fencing [5], in cricket [6] and in boxing [7]. It has been suggested that left-handers have an intrinsic advantage over right-handers due to superior spatio-motor skills and that the relatively high proportion of top left-handed sportsmen is, in part, a reflection of this innate superiority [8, 9]. But, Wood and Aggleton claimed that increased occurrence of left-handers in sports is due to the nature of the game and not to any supposed neurological advantage [6]. Also, Brooks, Bussiere, Jenkinson and Hunt [10] analyzed the batting records from the 2003 cricket World Cup and showed that left-handed batsmen were more successful than right-handers and that the most successful teams had close to 50% left-handed batsmen. Brooks et al. [10] claimed that excess of left-handers in sports is due to their negatively frequency-dependent strategic advantage when rare relative to right-handers.

Therefore, it can be expected some relationships between hand preference and some important physical parameters for success in sport such as muscle power,
pulmonary capacities and reaction time. In the present study, the possible relations among hand preference scores, leg and back powers, forced vital capacity and auditory reaction time were investigated.

**MATERIALS AND METHODS**

Participants were 30 boys and 23 girls who are young professional taekwondo athletes in Turkey. Their ages ranged from 15 to 32 years. All were right-handed as assessed on the Edinburgh Handedness Inventory [11].

Takei Kiki Kongo Dynamometers were used to measure muscle power between 1 and 100 kilograms of participants. They exercised 15 min. prior to these measurements. A grip dynamometer was used to measure hand power and a leg dynamometer was used to measure leg power. Measurements were repeated three times with intervals of two min. between measurements and the highest measurement was used for analysis.

Forced vital capacity was measured by a Pony digital spirometer. The participant first inhales maximally to total lung capacity, then exhales into the spirometer with maximum expiratory effort as rapidly and as completely as possible.

Auditory reaction time was assessed by Newtest OY 1000 (kivihorjuntio / Fin 90220/04104) auditory reaction time device. To measure auditory reaction time, an auditory stimulus was presented to which participant was asked to press a button on device. Participant’s finger tip was about 1 cm from the key. Reaction times shorter than 150 msec and longer than 500 msec were removed from the analyses.

For statistical evaluation, the Pearson correlation test presented in the statistical software SPSS 11.0 for Windows was used.

**RESULTS**

In the present study, as leg power increases, forced vital capacity was increasing (r=0.29, p<0.05) and auditory reaction time was decreasing (r=0.33, p<0.01).

Also, there were statistically significant correlations between back power and forced vital capacity and auditory reaction time. As back power increases, forced vital capacity was increasing (r=0.36, p<0.01) and auditory reaction time was decreasing (r=0.34, p<0.01). Additionally, there were statistically significant correlation between forced vital capacity and auditory reaction time. As forced vital capacity increases, auditory reaction time was decreasing (r=0.38, p<0.005).

Also, there were statistically significant correlations between hand preference score and forced vital capacity, leg and back powers and auditory reaction time. As hand preference score shifts towards left (from 100 to 0), forced vital capacity was increasing (r=0.36, p<0.01), leg (r=0.42, p<0.005) and back (r=0.41, p<0.005) powers were increasing and auditory reaction time was decreasing (r=0.31, p<0.05).

**DISCUSSION**

In the present study, leg and back powers increases, forced vital capacity was increasing and auditory reaction time was decreasing. These results are consistent with a recent study [12]. The positive correlation between muscle power and vital capacity was already well known [13]. The negative correlation between muscle power and auditory reaction time suggests the positive effect of taekwondo sport on brain.

Also, forced vital capacity increases, auditory reaction time was decreasing in the present study. This result supports two studies [13, 14]. Tan, Okuyan, Albayrak and Akgun reported that sex-related differences in cognitive abilities may be associated with bodily measurements such as height, weight and lung volume. Specifically, higher lung volume is associated with higher scores for cognitive abilities [14].

In addition to, in the present study, hand preference score in right-handed taekwondo players shifts towards left (from 100 to 0), forced vital capacity was increasing, leg and back powers were increasing and auditory reaction time was decreasing.

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<tr>
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<th>Forced Vital Capacity</th>
<th>Reaction Time</th>
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<td>r</td>
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<tr>
<td>Leg power</td>
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<td>&lt;0.05</td>
<td>0.33</td>
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<td>Back Power</td>
<td>0.36</td>
<td>&lt;0.01</td>
<td>0.34</td>
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<tr>
<td>Hand Preference Score</td>
<td>0.36</td>
<td>&lt;0.01</td>
<td>0.31</td>
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These results support the notion that left-handedness is the intrinsic neurologic advantage for sport success. Because of the advantage of the shifting toward left-handedness, it can be suggested that professional sport cause the shifting from right-handedness to left-handedness [15, 12, 16].

Akarsu et al. reported that athletes had lower eye-hand visual reaction time and higher visuo-spatial intelligence compared to non-athletes [17]. There was a negative correlation between the number of years of doing sports and eye-hand visual reaction time and a positive correlation with visuo-spatial intelligence. They claimed that sport activities are beneficial to both eye-hand reaction time and visuospatial intelligence. Dane et al. suggested that exercise’s positive effect may be associated with especially the right brain or left hand [16].

In the present study, there was a shifting from right-handedness to mixed- and left-handedness in taekwondo players. These results support the exercise’s positive effect on the right brain or left hand (6).

REFERENCES