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Research on the effects of isotonic strength training on muscular strength improvement of according to lateral preferences

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Abstract

Aim: The purpose of this study is to determine the isotonic knee flexion and extension strengths of students according to their lateral preferences and to compare the increasing ratios of the right-left leg strengths after 12 weeks' strength training.
Methodology: In this study, 18-25 age groups male students who are studying at Faculty of Sports Sciences in were selected as proves.
Results: According to Geschwind scores left-handers (n=12), and right-handers (n=12) were separated into groups. At the first stage "as a pre-test" anthropometric measurements, isometric and dynamic knee flexion and extension, strengths of the test subjects were measured.
After similar to the pre-test measurements were performed 12 weeks post-test measurements. Data were gathered by a questionnaire and were evaluated by percentage values, averages and One-Way ANOVA test.
Conclusion: In the conclusions of this study it is observed that after the 12 weeks' training program meaningful increases occurred on statistical and mathematical (0.05-0.01) level in the whole measurement parameters comparing to the pre-test and post-test of the proves.
Key Words: Lateral Preferences, Lateralization, Leg Strength, Training, Knee Flexion and Extension

Introduction

Nowadays, many physical activities and sports branches require a sufficient strength of the hands and legs (Allsen, 1987). Strength is the ability to withstand a resistance. With respect to sportsmen and sportswomen, the improvement of such strength is an essential goal in order to increase their performances and to achieve success (Ziyagil, Tamer, and Zorba, 1994).

Questionnaires are used to measure hand preferences and to express the results thereof in numbers. The Edinburg questionnaire, which includes 10 questions, is the most updated one thereof (Oldfield, 1971). Hand preference distributions are evaluated with Geschwind scores as followings: 1) Strongly right-handed (between +80 and + 100 points), 2) Weak right-handed (between +20 and +75 points), 3) Ambidextrous (between -15 and + 15 points), 4) Weak left-handed (between -20 and -75 points), and 5) Strongly left-handed (between -80 and -100 points) (Aksu, 1992). It has been reported by Tan (1988) that 90-95% of people are rights handed with respect to their hand preferences, while 3-5% are left handed and approximately 3% are ambidextrous.

The purpose of this study is to determine the isotonic and isometric knee flexion and extension as strengths of male students at the age of 18-25, who at the Faculty of Sports Science , according to their leg preferences and to compare the increasing ratios of the right-left knee strengths after 3-months strength training. The present study also aims at exploring symmetry development in hand preferences.

Materials and Methods

A lateralization questionnaire was applied to 200 voluntary male students studying at the Giresun University Faculty of Sports Sciences. The approval of the institution, in which the study was carried out, was obtained. The written consents of the students concerned were obtained. According to Geschwind scores, right-handed students and while the group of left-handed consisted of 12 students. In the first stage, the anthropometric characteristics and strengths of these 2 groups were measured as a "pre-test".

For the purpose of this measurement, arm strength measurements were carried out by means of a CYBEX isokinetic test device.

Pre-test and post-test measurements were collected as per procedures following the same sequence within three days each. Height, weight, skin fold measurements, peripheral measurements, length measurements, diameter measurements, isometric knee flexion strength (right-left), isometric knee extension strength (right-left), isotonic knee flexion strength (eight-left), isotonic knee extension strength (right-left), were carried out in respective order and Body Fat Percentages (B.F.P %) were calculated.

After the pre-test, a 3-days-a-week training was applied to the test subjects for 12 weeks in accordance with the strength improvement method recommended by Harre (1981). At the end of such trainings, the post-test measurements of the test subjects were carried out by means of the same methods.

In this study, a SPSS statistical package program was used. The groups' Geschwind scores (GS) are presented as arithmetic averages (X), standard deviations (SS), minimum and maximum values.

Within the scope of exploring the differences between the groups during the Pre-test and the Post-test a one-way ANOVA analysis was applied, while in these one-way ANOVA analyses a TURKEY'S HSD test was applied to determine the origin of differences observed between the respective groups. ANOVA analyses were carried out between left handed and right handed. A significance level of 0.05 was adopted for the determination of differences and relations.

Results

Table 1: Lateral Preferences and Geschwind Score Points of all Test Subjects

Subjects:	Left-Handed (n=12)	Right-Handed (n=12)
Mean	- 79.17	90.0
Standard Deviation	17.17	9.53
Minimum-Maximum	-50/-100	+80/+100

Table 1 shows the arithmetic averages, standard deviations, minimum and maximum values of the Geschwind scores belonging to the total of 24 test subjects included into the groups of left- handed, and right-handed.

Table 2: Anthropometric Characteristics of all Test Subjects

Variables	Left-Handed (n=12)	Right-Handed (n=12)	**F - Ratio**
Age (Years)	21.25 ± 1.72	22.09 ± 1.32	0.819
Height (cm)	173.09 ± 7.69	174.92 ± 5.30	0.295
Weight (kg)	69.25 ± 7.99	70.92 ± 6.75	0.195
Total of skin fold	59.24 ± 11.41	55.92 ± 10.52	0.276
V.Y. Percent (%)	12.68 ± 1.98	11.56 ± 2.05	0.989

* No significant difference between groups.

Table 3: Comparison of Pre- and Post-Test Measurements of Left legs, and Right Legs

Variables		Left-Handed (n=12)	Right-Handed (n=12)	F - Ratio	Turkey's HSD
Right Knee isometric	**Pre-t**	31.75±2.26	38.04±3.31	13.793 **	G1< G2
Flexion force	**Post-t**	36.79±2.28	42.04±3.52	10.062 **	G1< G2
Left Knee isometric	**Pre-t**	34.50±1.94	34.54±3.17	0.404	No difference
Flexion force	**Post-t**	37.67±1.79	40.96±4.11	3.658 *	G1<G2
Right Knee isometric	**Pre-t**	26.83±2.09	23.79±2.93	19.839 **	G1<G2
Extension force	**Post-t**	31.08±1.73	36.50±3.37	13.162 **	G1<G2
Left Knee isometric	**Pre-t**	29.62±2.63	31.75±3.38	3.553 *	G2<G1
Extension force	**Post-t**	32.42±1.65	35.75±3.54	5.226 *	G1<G2
Right Knee Dynamic	**Pre-t**	35.67±2.14	41.96±4.04	8.226 **	G1<G2
Flexion force	**Post-t**	39.92±2.15	45.79±4.25	8.864 **	G1<G2
Left Knee Dynamic	**Pre-t**	37.50±2.51	39.83±3.11	3.002	No Difference
Flexion force	**Post-t**	40.71±2.49	44.87±3.8	4.936 *	G1<G2
Right Knee Dynamic	**Pre-t**	36.54±3.83	41.62±3.57	6.417 *	G1<G2
Extension force	**Post-t**	40.58±3.48	45.58±3.53	6.86 **	G1<G2

* Significant difference on a level of 0.05
** Significant difference on a level of 0.01

Table 3 shows the pre- and post-test measurements of left- handed, right-handed including the arithmetic averages, standard deviations, F-Ratio differences, and Turkey's HSD results.

A significant difference of 0.01 (F-ratio = 13.793) was observed between the groups regarding the pre-test measurements of right knee isometric flexion. The Turkey's HSD results were significantly lower in left-handed compared to right-handed. Post-test data did not change the tendency of the pre-test, while a decrease in difference was detected.

With respect to left knee isometric flexion, no significant difference could be observed in the pre-test between any of the two groups. The post-test showed a difference of 0.05.

With respect to right knee extension strength, a significant difference of 0.01 was observed between the groups both in the pre- and post-test. Turkey's HSD results were significantly lower in left-handed compared to right handed.

With respect to left knee isometric extension strength, a significant difference of 0.05 was determined between the groups in both of the measurement values.

Between the groups, a statistically significant difference of 0.01 was observed in the pre-test and post-test measurement values with respect to the average dynamic flexion strength of the right knee. According to Turkey's results, both measurements showed lower values for left -handed than right-handed.

No statistically significant difference could be observed between the groups with respect to the average pre-test values of the left knee's dynamic flexion strength. On the other leg, a significant difference of 0.05 was detected in the groups' post-test measurements. Turkey's HSD results were significantly lower for left-handed compared to right-handed.

With respect to the dynamic extension strength of the right knee, a significant difference was observed between the both in the pre-test (0.05) and the post-test (0.01). Turkey's HSD results were significantly lower for left-handed compared to right-handed.

No statistically significant difference could be observed in the groups' pre-test with respect to the average values of the left knee's dynamic extension strength.

Discussion and Conclusion

Within the scope of this study, no statistically significant difference could be observed between the two groups with respect of all measured anthropometric values. However, the study shows that only right-handed sportsman have a low Body Fat Percentage.

In the comparison of the results of the hand preference lateralization questionnaire, the arithmetic average, standard deviation, minimum and maximum values of the total of 24 test subjects (GS) took shape as followings: left-handed (GS) -79.17 with an average standard deviation of 17.17; minimum and maximum values change between -50 and -100. It has been also seen that right-handed people have an arithmetic average of 90.0 (± 9.53) and a minimum and maximum point of +80/+100. Aksu (1992) reported the same values in his study carried out on test subjects consisting of 614 males 388 females at the age of 11-15.

During the duration of this 12-weeks study, a linear increase was observed in the overall strength of the knee. Besides, a significant difference of 0.01 was detected in the flexion and extension strength of the right knee. No significant difference could be observed in the pre-tests regarding the left knee's isometric and dynamic flexion and extension strengths. However, post-test measurements showed a significant difference of 0.05 in the isometric and dynamic flexion and extension strength of the left knee. McDonagh et al. (1983) reported in a study that a five-weeks training results in an increase of the voluntary maximal contraction strength (20%). The proportional improvement observed in the dominant hand preference was lower than the respective other handed. The asymmetry difference between the values of all groups measured in the pre-test converged towards each other and developed towards symmetry in the post-test. It is recommended by scientists to carry out trainings in positions, to which sportsmen/sportswomen are not accustomed to, and with the respective opposite arm and leg in order to improve coordination skills that essential for sports activities. (Hirtz, 1978; Petchl, 1981)

In a study comparing the right and left arm isometric and isokinetic strengths of 10 wrestlers at an average of 21.7, who qualified themselves as the champion of Turkey at different times, Ziyagil et al. reported in (1994) that there is no significant difference between the right and left arm strengths of those wrestlers.

This study shows that the same type of strength trainings conducted by sportsmen with different hand preferences result in a lateral tendency from asymmetric formation to symmetric formation. In a similar study carried out by Tapley and Bryden (1985) in England on 1556 students, a pointing test on hand preferences showed a significant difference between left and right handers. Besides (1986), the EMG reaction times of left and right handers' biceps brachii muscle in bilateral movements were measured and it was reported that the reaction of the not-preferred hand in asymmetric movements differed from symmetric movements, while it was put forward that such reaction times differed from left handers to right handers.

In this study, it has been determined that the group preferring their right hands are stronger with regard to the elbow flexion and extension strength and that their dominantly used hands are stronger with regard to the hand grasping strength. Along with a mathematical increase observed in the improvement of the hand grasping strength, a statistical difference was detected in the strength improvement ratios. A muscle improves in consequence of a strength training program (Margonato 1994).

Parallel to our study, Tan et al. (1992) measured the eight and left hand grasp-reflexes of male and female newborn babies defined within two days after birth and reported that the right hand's grasp-reflex strength was significantly different from the left hand and that a linear relation existed between the right to left grasp-reflex strength and the body weight of newborns.

Within the scope of one-hand and both-hand tests applied to left handed subgroups and right handed people, Peters and Servos (1989) measured skill, speed, and strength capabilities as well as speech fluency.

Between the groups, it was detected that in left- handers the increase of strength improvement achieved in the right knee was higher, while such increase was lower in the left knee. In the group of right-handers, a higher increase was achieved in the left knee, while such increase was lower in the right knee. Overall considered, this means that a higher increase is achieved in the not-dominant knee, while such increase is lower in the dominant knee.

The comparison of the hand preference, leg strength, ratios in the right and left legs plays a very important role in sports skill researches. Moreover, a comparison of the strength improvement ratios achieved in the right and left legs of right and left-handers at the end of the 3-months strength training may help trainers to identify skilled sportsmen/sportswomen. Accordingly, the symmetric development of athletes has to be increased by bilateral trainings that have to be applied beginning from the very first age, in which the respective athletes gets involved in sports.

This study needs to be complemented with normative information by carrying out researches on more test subjects and different age groups. In order to establish preliminary information that would be helpful for sports scientists in talent selection, strength trainings need to be applied to groups of younger ages and the speed, skill, and reflex developments of children need to be analyzed.

Along with the effects of hand preferences on strength improvement potentials, its effects on other parameters such as skill, speed, elasticity, endurance, and reflex development necessitate further research.

To achieve a decrease in the asymmetric ratios of athletes trainers are required to attach priority to trainings, which improve the strength of the respective weak leg of athletes. It should be reminded that the use of both legs always provides an important advantage in sports activities.

Conflict of interest

The authors declare no conflict of interest

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