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Original article

UPPER AND LOWER BODY STRENGTH PROGRESS BETWEEN 2 GROUPS OF MALE AND FEMALE PARTICIPANTS

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Abstract

Aim. The aim of this study is to compare the results between 2 groups of male and female participants for pushups and squats during a 120 trial of a standardized training protocol

Methods. We used 2 groups consisting of 31 female and 18 male subjects, aged 30 to 40 years old that had memberships at the Orhideea Sport center. We applied 3 tests, at day 1, 60 and 120, during which we gathered the data and analyzed it using the Wilcoxon test and Friedman test for repeated measurements.

Results. We recorded an average of 8,07,10,00 and 12,67 repetitions for the first, second and third test of the women group and an average of 10.00, 15.75 and 21.75 repetitions for the men group for the push up test. For the squat test, we recorded an average of 14.13, 20.13 and 25.13 repetitions for the first, second and third test of the men group and an average of 12,00, 15,67 and 19,80 repetitions for the women group for the squat test.

Conclusions. The men group recorded better improvements over the duration of our test for the push up test, but for the squat test the results were similar between the 2 groups. This shows us that men improve the upper body strength faster than women.

Keywords: push up, squat, fitness test.

Introduction

Physical activities are becoming a rarity nowadays in the highly urbanized environment. More and more people have desk jobs that require little to none physical effort to perform. Because of this lack of physical activity, we see more and more people becoming sick from sedentary related illnesses, like obesity, diabetes, cardiovascular issues and so on.

Based on the fact that more and more people become sedentary, we believe that now is more important than ever to focus on physical activities, given the positive results they bring to the individual physically, mentally and socially.

The ultimate goal for us is to help reduce the number of people who end up being affected by health problems caused by the lack of movement of the human body.

In this respect, we aim to develop methods and means to make the impact of exercise programs more efficient on the fitness components, firstly to increase the performance of a workout, and secondly to allow sedentary people to be able to integrate easily into exercise programs so that they can improve their general health and wellbeing.

We strongly believe that if we can find methods to encourage sedentary people to get involved in physical activities, we can reduce the risk of developing sedentary related medical problems. In order to improve the participation in physical activities, we developed a fitness evaluation scale that can return a general fitness score to the participant so that he or she can see what physical activity gives the best result, from case to case.

By assessing the strength in the upper and lower parts of the body, we can establish a base for the physical performance of an individual. General strength at these levels is usually translated into the ease of performing day to day tasks without encountering the risk of injury.

We consider the use of the squat as a standard exercise due to the fact that is a very common exercise, that can be performed with ease by a vast majority of subjects. Also, the fact that the exercise can be performed without any additional equipment represents a huge benefit from our point of view.

We decided to use the push up as a general test for assessing the general strength of the upper body because this is the only upper body exercise that can be performed without the use of other physical equipment.

The objective of our research was to compare how the training program influenced the results between the test groups in order to increase the quality of the training process for both, men and women. We consider that a research in this area can

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be very useful in order to develop future training programs that can better suit the needs of sedentary people that wish to improve their general health.

A more recent study done by Tremblay et al, (2010) pointed out the physiological and health implications of a sedentary lifestyle. This is one of the reasons why we believe that we need to find ways of motivating people to practice more physical activities.

Myers et al, (2004) showed a strong pattern between the fitness level of an individual and his or her mortality rate. This raises a lot of warning signs about how important it can be to live an active lifestyle and to get involved in regular physical activities.

Methods

For the statistic relevance of our data, we used the Wilcoxon non – parametric test to analyze the significance between the first and second test for our subjects and the Friedman non parametric test for repeated measures to analyze the data between the first, second and last test of our test subjects.

We decided to use non parametric tests due to the fact that the data we collected did not follow the normal distribution pattern.

For our test we decided to use a standard p value of 0.05 for our level of significance.

Organizing and conducting research

The research took place at the Orhideea Spa fitness center for a period of 120 days. The facility was well equipped to carry out the testing phase of our paper and also the training aspect.

We tested every subject at the beginning, after 60 days and after 120 days of training.

The test subjects followed a well-designed training routine for the duration of the research and were supervised by a personal trainer at all times.

The test subjects included in the research are 23 adults who carry out relatively static professional activities and sometimes get involved in physical activities., aged between 30 and 40 years, 18 men and 31 women;

In order to assess the individual performance of each subject, we developed a point base evaluation scale.

Table 1. *Push up test ranking*

Result	Very bad	Bad	Good	Very good	Excellent
Men	5/10	15/18	20/25	30/35	40/45
Women	3/7	8/12	16/20	23/26	29-30+

#Women are to perform the push-ups on their knees

In order to assess the upper body pushing force, we chose the push up test due to the fact that it is an easy exercise to perform.

The test subjects were told to start from a plank position, with their elbows completely locked and their feet together. At the examinator's signal, the test subject would bend the elbows down to 90 degrees and then return to the starting position. The subject would then repeat the move until failure, or until the technique will be out of order and the examinator would say stop.

For women, the exercise will be performed with a variation. They will do kneed push-ups.

The scores for the push up test are as follows:

For men we applied the following scale:

Under 6 repetitions 1 point;

6 - 10 repetitions 2 points;

11 - 15 repetitions 3 points;

16 - 18 repetitions 4 points;

19 - 20 repetitions 5 points;

21 - 25 repetitions 6 points;

26 - 30 repetitions 7 points;

31 - 35 repetitions 8 points;

36 - 40 repetitions 9 points;

Over 41 repetitions, 10 points.

For women, we applied the following scale:

Under 4 repetitions, 1 point;

4 - 7 repetitions, 2 points;

8 repetitions, 3 points;

9 – 12 repetitions, 4 points;

13 - 16 repetitions, 5 points;

17 - 20 repetitions, 6 points;

21 - 23 de repetitions, 7 points;

24 - 26 de repetitions 8 points;

27 - 30 repetitions, 9 points;

Over 31 repetitions, 10 points.

After noting the number of repetitions performed, the subject would then be given a mark ranging from very bad to excellent.

In order to assess the lower body strength and endurance, we decided to use the squat as the reference exercise, the test subjects performed weighted squats with 20% of their body weight.

In order to perform the squat, the subject will start from an upright position, feet shoulder width apart, holding the weight with both hands against the chest. The subject will then descend by bending the knees and hips until the knee angle will reach 90 degrees and then return to the initial position. He will then repeat the move until failure or deterioration of the technique.

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- The scores for the push up test are as follows:
- 0-5 repetitions, 1 point;
- 6 - 10 repetitions, 2 points;
- 11 - 15 repetitions, 6 points;
- 16 - 20 repetitions, 4 points;
- 21 - 23 repetitions, 5 points;
- 24 la 26 repetitions, 6 points;
- 27 - 29 repetitions, 7 points;
- 30 - 32 repetitions, 8 points;
- 33 - 35 repetitions, 9 points;
- Over 35 repetitions, 10 points.

After noting the number of repetitions performed, the subject would then be given a mark ranging from very bad to excellent.

Table 2. Squat test assessment scale

Result	Very bad	Bad	Good	Very good	Excellent
	5/10	15-20	23/26	29/32	35/40

The training protocol for our test subjects required them to visit the fitness center 2 times per week and perform a specific workout, as shown in table 3 and table 4. This sequence was repeated over the course of 60 days.

Table 3. *Workout routine 1*

Exercise	Set number	Repetitions	Rest	Weight
Rowing	2	5 min	1 minute	10
Squats	3	10	2 minutes	free weight
Deadlifts	3	10	2 minutes	10 kg
Push-ups	3	10	2 minutes	free weight
Back extensions	3	10	2 minutes	free weight
TRX Pull-ups	3	10	2 minutes	free weight
Crunches	3	10	2 minutes	free weight

Table 4. *Workout routine 2*

Exercise	Set number	Repetitions	Rest	Weight
Rowing	3	5 min	1 minute	10
Squats	4	12	2 minutes	10kg
Deadlifts	4	12	2 minutes	10 kg
Push-ups	4	12	2 minutes	free weight
Back extensions	4	12	2 minutes	free weight
TRX Pull-ups	4	12	2 minutes	free weight
Crunches	4	15	2 minutes	free weight

The training schedule was followed by the participant over a period of 60 days under the supervision of fitness specialists.

Results

Table 5. *Women push-ups statistics*

	Pushups I	Pushups II
Average	6.84	9.16
Variation coefficient	3.75	4.52
Median	7.00	8.00
Averages difference		2.3
Percentual variation		25.35%
Wilcoxon test result	The result is significant p < .01.	
W value	11.50	
Z value	-4	
Sample size	31	
p value	< .00001.	

For the push up parameter, we recorded an average of 6.84 repetitions for the first test and an average of 9.16 repetitions for the second test. Our coefficient of variation was 3.75 for the first test and 4.52 for the second test, with a median value of 7 and 8 respectively. The difference between averages 2 and 1 was 2.3 repetitions, meaning a percentual variation of 25.35%. We recorded a positive result for the Wilcoxon test, with a p value under 0.05. The W value was 11.5 and the Z value was -4.

Table 6. *Women squat statistics*

	Squat I	Squat II
Average	12.00	14.52
Variation coefficient	3.63	3.68
Median	11.00	15.00
Averages difference		2.5
Percentual variation		17.33%
Wilcoxon test result	The result is significant p < .01.	
W value	21.5	

Z value	-4.02
Sample size	31.00
p value	< 0.00001.

For the squat parameter, we recorded an average of 12 repetitions for the first test and an average of 14.52 repetitions for the second test. Our coefficient of variation was 3.63 for the first test and 3.68 for the second test, with a median value of 11 and 15 respectively. The difference between averages 2 and 1 was 2.5 repetitions, meaning a percentual variation of 17.33%. We recorded a positive result for the Wilcoxon test, with a p value under 0.05. The W value was 21.5 and the Z value was -4.02.

Table 7. *Men push-ups statistics*

	Pushups I	Pushups II
Average	20.56	23.28
Variation coefficient	9.41	9.98
Median	20.00	22.50
Averages difference		2.7
Percentual variation		11.69%
Wilcoxon test result	The result is significant p < .05.	
W value	3	
Z value	-3	
Sample size	18	
p value	0.00078	

For the push up parameter, we recorded an average of 20.56 repetitions for the first test and an average of 23.28 repetitions for the second test. Our coefficient of variation was 9.41 for the first test and 9.98 for the second test, with a median value of 20 and 22.5 respectively. The difference between averages 2 and 1 was 2.7 repetitions, meaning a percentual variation of 11.69%. We recorded a positive result for the Wilcoxon test, with a p value under 0.05. The W value was 3 and the Z value was -3.

Table 8. *Men squats statistics*

	Squat I	Squat II
Average	19.89	24.44
Variation coefficient	10.44	11.59
Median	20.00	25.00
Averages difference		4.6
Percentual variation		18.64%
Wilcoxon test result	The result is significant p < .05.	
W value	0	
Z value	-3	
Sample size	18	

For the squat parameter, we recorded an average of 19.89 repetitions for the first test and an average of 24.44 repetitions for the second test. Our coefficient of variation was 10.44 for the first test and 11.59 for the second test, with a median value of 20 and 25 respectively. The difference between averages 2 and 1 was 4.6 repetitions, meaning a percentual variation of 18.64%. We recorded a positive result for the Wilcoxon test, with a p value under 0.05. The W value was 0 and the Z value was -3.

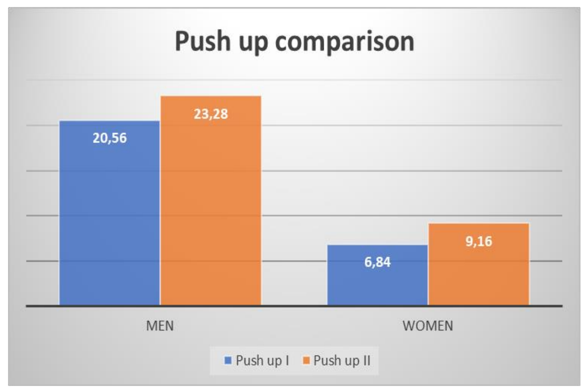

Figure 1. *Push up comparison*

When we compared the results of the 2 groups, we found out that the performances recorded during the push up test saw an increase of 2.72 repetitions for the men group and 2.32 repetitions for the women group. This translates into an increase in the push up performance of 13,11% for the men group and 33,91% for the women group.

Figure 2. *Squat comparison*

When we compared the results of the 2 groups, we found out that the performances recorded during the squat test saw an increase of 4.55 repetitions for the men group and 2.52 repetitions for the women group. This translates into an increase in the push up performance of 22,87% for the men group and 20,9% for the women group.

Conclusions

Physical exercise has a positive effect on the development of muscle strength and endurance, especially in untrained individuals. As it has been previously shown in other studies, the physical benefits of sports represent one of the biggest motives for developing a physical exercise culture among adult population.

Our 2 workouts per week protocol revealed improvements in the push up and squat test of both male and female test groups.

We can say that men improve the lower body strength and endurance faster than women when we analyze the data as a percentual improvement, as our statistics has revealed. Speaking in absolute terms, we saw that men performed more repetitions than the women, by 2 repetitions, on average.

On the other hand, we can say that women improve the upper body strength significantly faster than men do when looking at the percentual improvements, but, in absolute values, the results were very similar, both groups performing better, on average by 2.5 repetitions, but we can notice that the starting points of the 2 groups were very different.

We believe that a big part in our results is played by the previous training that our participants had meaning that our data can be heavily dependent on the self-assessment of our participants when declaring that they are untrained individuals.

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