

HOW STRETCHING EXERCISES IMPROVE THE JOINT MOBILITY AND MUSCLE FLEXIBILITY OF STUDENTS FROM NON-PROFFESIONAL STUDY PROGRAMS

Andreea-Aurora-Maria BUGA¹, Andreea-Mihaela ALBINĂ¹, Cătălin POPESCU¹, Alina ALBINĂ¹, Costin NANU¹

¹ University of Craiova, Faculty of Physical Education and Sport, Craiova, Romania

*Correspondence address: andreea.buga@edu.ucv.ro

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Abstract: The aim of this study was to enhance the joint mobility and muscle flexibility of participants by implementing a stretching program, which involved 21 students from the University of Craiova enrolled in economics study programs. The results revealed significant differences ($p < 0.05$) in the SMM, BFM, BMI, and WHR variables among the students following the stretching program. These findings highlight the significance of both dynamic and static stretching for students, as well as their value in terms of long-term physical and mental development. Regular stretching and flexibility exercises should be incorporated into any fitness routine to reap these benefits.

Keywords: physical exercises, stretching, students, physical health.

Introduction

It is well known that populations around the world are in a rapid aging process. As a result, concerns about maintaining the health of both the young and the elderly are on the rise. Flexibility is an essential physical ability of the body, and when it is reduced, it affects the body's balance and functional capacity (De Greff et al., 2018, Cosma et al., 2017).

Improving physical fitness is one strategy to address the importance of an unhealthy lifestyle on mental health (Alam et al., 2019), with a specific impact on adolescents and young adults.

Since the early 1980s, static stretching exercises have been widely promoted as a method to prevent injuries and improve physical performance prior to any type of physical activity (Shrier, 2005).

In terms of muscle performance, the available studies seem to indicate that dynamic stretching exercises are more suitable for warming up the muscles compared to static stretching exercises (Behm et al., 2016).

While the benefits of cardiovascular and strength-based exercise are well known, few people realize that joint mobility and muscle

flexibility are also essential for optimal health and activity.

There are a number of benefits that we can get from practicing a regular stretching routine, such as:

- ✓ injury prevention;
- ✓ improved flexibility and posture;
- ✓ increased of blood circulation;
- ✓ improvement of muscle functions;
- ✓ better physical performance;
- ✓ stress reduction;
- ✓ mental well-being;
- ✓ increased serotonin levels;
- ✓ relaxation of the body;

Specialized studies in the field have mentioned that stretching exercises, whether they are static or dynamic, must be performed correctly and within each individual's own limits, according to their needs and objectives, so that the risk of injuries can be avoided.

When we talk about young fitness enthusiasts, unfortunately, flexibility is not generally a goal for them. In addition, stretching is often approached minimally or even neglected altogether.

While the benefits of cardiovascular and strength-based exercise are well known, few

people realize that joint flexibility and muscle elasticity are also essential for optimal health and activity (Afonso et al., 2021).

Freudenberg et al. (2007) consider that mental health problems are directly associated with low academic performance, which in turn, in the short term, is associated with dropping out of school and with the loss of human capital in the long term.

Numerous studies have proven that physical exercise can generate several changes and physiological mechanisms in the body. They can considerably reduce the level of stress.

Dadvand et al. (2018) believe that exercise has been strongly linked to the functioning of several neurotransmitters in the brain, such as serotonin and dopamine. This suggests that physical exercise, especially dynamic and static stretching, may act in the same way as antidepressant drugs.

As mentioned before, stretching exercises improves the body condition by increasing flexibility, which allows for a greater range of motion in joints and muscles. This can help prevent injuries, improve posture, and enhance overall physical performance.

Increasing flexibility can also improve an individual's quality of life and functional independence (Hidayatullah et al., 2022).

Stretching also helps to reduce muscle tension, improve circulation, and promote relaxation, leading to better overall well-being.

Regular stretching exercises can contribute to overall physical well-being and it can be a great addition to any fitness routine, also can help maintain and improve our body's condition over time (Behm et al., 2021).

Objectives

The objectives of this study was to establish the differences in the parameters: SMM (skeletal muscle mass), BFM (body fat mass), BMI (body mass index), WHR (waist-to-hip ratio), fat volume control and muscle volume control, through the InBody720 device before and after the students' participation in the working program. The aim of this study was to improve the quality of life among students by reducing muscle and joint pain, as well as by acquiring an optimal body posture.

The WHR it's an important indicator; his role is to analyze the proportion of fat that is distributed around the waist and hips. It is used as a measure of health status and a risk factor for developing serious health conditions.

Methods

Participants

This research was attended by 21 students of the University of Craiova, aged between 19 and 28 years. They were not in a sport profile faculty.

The subjects were students who had only 2 hours of physical education per week in their school curriculum.

Participation in this study was voluntary.

Procedure

The research subjects were tested before and after the application of the stretching program with the following tests: sit and reach, stand and reach, floor touch, groin flexibility, trunk rotation test.

✓ Sit and reach test: The starting position is sitting with the legs stretched forward, with the soles of the feet pressed against the gym bench. With palms facing down and hands over or side by side, the subject performs a trunk bend forward along the measuring line as far as possible and holds that position for at least one to two seconds while the distance is registered.

The score is recorded to the nearest centimetre as the distance reached by the hand.

✓ Stand and reach test: The subject is in a sitting position on a gym bench (or other similar surface) at its edge. The subject performs a trunk forward bend, reaching the arms toward the toes, hands held flat with fingers extended. Hold the position for two seconds. It measures how far the fingers can reach.

The score is recorded to the nearest centimetre as the distance covered.

✓ Floor touch test: The subject is in a standing position with arms forward. It performs a forward bend of the trunk until the fingertips touch the ground for 10 seconds. The examiner can help by keeping the performers knees straight.

Scoring: The test is passed if the subject holds the position correctly for ten seconds.

- ✓ Groin flexibility test: From the seated position, with bent legs, knees outwards, sole to sole - grasp the ankles with both hands and pull them as close to the body as possible. Measure the distance from the heel to the pelvis.

The lower the score, the better the mobility.

- ✓ Trunk rotation test: The subject is in a standing position with his back to a wall at arm's length. A vertical line is marked on the wall. The subject raises the arms forward and executes a left/right side twist until they touch the wall back. Mark the position where the fingertips touched the wall and measure the distance from the line.

A point before the line is a negative score and a point after the line is a positive score.



Fig. 1. Floor touch test

The working program was structured in categories targeting the main joints, using both dynamic and static exercises, with the aim of improving the quality of life among the students and also by acquiring an optimal body posture.

The stretching program was applied from February until June 2023, twice a week, 50 minutes being allocated to the stretching exercise program among students.

Results

The participants of the work program registered positive developments in all 5 applied tests.

There were significant differences for all variables tested with the Inbody device.

The results obtained were positive and statistically significant, thus, as a result of the

students' participation in the stretching program, their weight decreased ($D=3.7\text{kg}$), SMM index increased, BFM index decreased ($D= 2.34$), BMI index ($D=1.47$), WHR index decreased ($D=.03$), fat volume control decreased ($D= -3.41$), muscle volume control increased ($D= 2.59$).

The differences are statistically significant for all variables tested with the InBody device as follows: - for weight, pretest $M = 72.05$, $AS = 20.88$ was obtained compared to posttest $M = 68.35$, $AS = 19.49$; out of a total of 21 participants, 19 lost weight, two gained, and none remained unchanged, $Z = -3.91$, $p < .01$; - for SMM, pretest $M = 27.40$, $AS = 6.78$ was obtained compared to posttest $M = 28.68$, $AS = 5.89$; out of a total of 21 participants, three had a decrease in SMM, 18 had an increase,

none remained unchanged, $Z = -3.18$, $p < .01$; - for BFM, pretest $M = 22.69$, $AS = 11.71$ was obtained compared to posttest $M = 20.35$, $AS = 8.89$; out of a total of 21 participants, 15 had a decrease in BFM, six an increase, none remained unchanged, $Z = -3.22$, $p < .01$; - for BMI, pretest $M = 24.84$, $AS = 5.68$ was obtained compared to posttest $M = 23.37$, $AS = 4.26$; out of a total of 21 participants, 15 had a decrease in BMI, six an increase, none remained unchanged, $Z = -3.06$, $p < .01$; - for WHR, pretest $M = .84$, $AS = .08$ was obtained compared to posttest $M = .81$, $AS = .05$; from the total of 21 participants, 14 had a decrease

in WHR, one an increase, six remained unchanged, $Z = -3.36$, $p < .01$; - for fat control, pretest $M = -8.37$, $AS = 11.78$ was obtained compared to posttest $M = -4.96$, $AS = 7.98$; from the total of 21 participants, one experienced a decrease, 19 an increase, one remained unchanged, $Z = -3.48$, $p < .01$; - for muscle control, pretest $M = 3.70$, $AS = 3.39$ was obtained compared to posttest $M = 1.11$, $AS = 1.30$; from the total of 21 participants, in 19 there was a decrease, in none it increased, in two it remained unchanged, $Z = -3.83$, $p < .01$;

Table 1 Ranks of variables measured with the InBody device

		Medium		
		N	rank	The sum of ranks
weight Post –	Negative	19	12.00	228.00
weight Pre	ranks			
	Positive ranks	2	1.50	3.00
	Equal ranks	0		
SMMPost	- Negative	3	8.00	24.00
SMMPre	ranks			
	Positive ranks	18	11.50	207.00
	Equal ranks	0		
BFMPost - BFMPre	Negative	15	13.87	208.00
	ranks			
	Positive ranks	6	3.83	23.00
	Equal ranks	0		
BMIPost - BMIPre	Negative	15	13.57	203.50
	ranks			
	Positive ranks	6	4.58	27.50
	Equal ranks	0		
WHRPost - WHRPre	Negative	14	8.50	119.00
	ranks			
	Positive ranks	1	1.00	1.00
	Equal ranks	6		
WeightControlPost -	Negative	1	12.00	12.00
WeightControlPre	ranks			

MuscleControlPost - MuscleControlPre	Positive ranks	19	10.42	198.00
	Equal ranks	1		
	Negative	19	10.00	190.00
	ranks			
	Positive ranks	0	.00	.00
	Equal ranks	2		

Table 2 Mean pretest and posttest scores for InBody variables (N = 21)

Pretest	M	AS	Posttest	M	AS
weightPre	72.05	20.88	weightPost	68.35	19.49
SMMPre	27.40	6.78	SMMPost	28.68	5.89
BFMPre	22.69	11.71	BFMPost	20.35	8.89
BMIPre	24.84	5.68	BMIPost	23.37	4.26
WHRPre	.84	.08	WHRPost	.81	.05
weightControlPre	-8.37	11.78	weightControlPost	-4.86	7.98
muscleControlPre	3.70	3.39	muscleControlPost	1.11	1.30

Discussions and conclusions

According to previous studies, researchers believe that mobility and flexibility are a complicated concept to define due to the large number of terms and components they encompass and there are many stretching techniques we can use. Also, researchers conclude that, the knowledge and use of

stretching techniques was low for both university and Master's students (Reguero et al., 2023).

Considering that mental health is a combination of psychological and emotional well-being, studies prove that applying stretching exercises on educational content can improve mental health which results in

increased performance and the achievement of academic goals (Sharififar et al., 2017).

The aim of this study was to demonstrate the importance that a stretching program can have on the physical and emotional development of the students.

The results of the study show the positive changes that physical education brings in improving the body shape of people who practice a sustained and continuous form of physical activity. Also, it is important to mention that stretching exercises, whether static or dynamic, must be performed correctly and within each individual's own limits, according to their needs and goals, in order to avoid the risk of injuries.

The data obtained from the final evaluations led to the validation of the applied working program, based on dynamic and static stretching exercises.

Thus, the validation of a working program included in physical education and sports classes, at the university level, could have positive and long-term implications in the physical and mental development of students and, last but not least, in increasing the quality of their lives.

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