THE EFECT OF A PHYSICAL ACTIVITY PROGRAM ON THE HEALTH RELATED FITNESS AND QUALITY OF LIFE ON A FEMALE STUDENT GROUP FROM ORADEA

EFECTUL UNUI PROGRAM DE ACTIVITATE FIZICĂ ASUPRA CONDIȚIEI FIZICE RAPORTATE LA SĂNĂTATE ȘI A CALITĂȚII VIEȚII LA UN GRUP DE STUDENTE DIN ORADEA

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Key words: health-related quality of life, female students, physical activity program/intervention, health-related fitness

Abstract

Background : There is a huge transversal database showing that health related quality of life (HRQOL) seems to decrease with the increase of body weight. With the increasing enviromental chalanges in relation with healthy lifestyle behaviors, especially between the ages of 18-24 there is a continous search for effective obesity-prevention and promotion of regular PA programs. Therefore, the aim of our study was to assess the effectiveness of a prophylactic exercise program on HRQOL and others parameters measuring health-related fitness (HRF) in young female university students.

Methods : 20 female students (23.1±1.68y, BMI 21.9±2.1kg/m^2) from Oradea participated in this study. HRQOL was assessed using (FS-36) questionnaire. Young female underwent a **s**omatoscopical exam and the following components of the HRF were assessed**:** *Body composition* and the optimum body mass (estimated based on the five skinfolds measures); c*circumferences, BMI, m*uscular strength and endurance, flexibility, $VO_{2max.}$ Subjects participated in an 18 weeks training program (60min, 3/weeks) aiming to enhance the HRQL by ameliorating the cardio-repiratory condition and body composition.

Results: All the parameters improved at follow-up for all the subjects, but only maximum oxygen uptake, arm and core muscles strength, and Self reported scores of HRQOL improved significantly ($p<0.05$).

Conclusions: The preventive PA program on female students for a period of four month showed significant improvements on cardio-repiratory fitness, muscular strength and the perception about own vitality and physical and mental health. The results gives us the right to ascertain that our PA program ameliorated the HRQOL.

Cuvinte cheie: calitatea vieții, studente, program de activitate fizică, condiția fizică raportată la sănătate

Rezumat

Introducere: Există o mare bază de date transversale care arată descreșterea calității vieții raportată la sănătate (CVRS) odată cu creșterea masei corporale. Datorită provocărilor din ce în ce mai crecute ale mediului înconjurător legate de comportamentele unui stil de viață sănătos, în special între 18-23 de ani, există o continua căutare a celor mai eficiente programme de prevenire a obezității și de promovare a activității fizice regulate. De aceea, scopul studiului nostru este de a evalua eficiența unui program de exerciții fizice profilactice asupra CVRS și a altor parametrii care măsoară condiția fizică raporttă la sănătate (CFRS).

Metode : 20 de studente (23.1±1.68ani, IMC 21.9±2.1kg/m^2) din Oradea au făcut parte din acest studiu. Au fost evaluate: CVRS folosind chestionarul (FS-36), postura corporală (somatoscopia), și componente ale condiției fizice raportată la sănătate (*compoziția corporală și masa corporală optimă* - estimate pe baza a cinci plici cutanate; c*ircumferințe, IMC, forța și rezistența musculară*, flexibilitatea, VO_{2max}). Subiecții au participat la un program de antrenament de 18 săptămâni (60min, 3/săptămână) care are ca scop creșterea CVRS prin ameliorarea condiției cardio-respiratorii și a compoziției corporale.

Rezultate: Toți parametrii s-au îmbunătățit la final pentru toți participanții, dar numai consumul maxim de oxigen și forța mușchilor nucleului abdomino-lombo-pelvian, precum și scorurile raportate ale CVRS au crescut semnificativ ($p<0.05$).

Concluzii: Aplicarea programului profilactic de activitate fizică asupra tinerelor studente timp de 4 luni a demonstrat creșteri semnificative ale condiției cardio-respiratorii, a forței musculare și a percepției asupra propriei vitalități și sănătății fizice și mentale. Rezultatele ne dau posibilitatea să afirmăm că programul nostru a ameliorat CVRS.

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Background

The health-related quality of life (HRQOL) is given by a general status of satisfaction and happiness, including pshycological, emotional, functional and spiritual aspects of the well-being. The level of regulary phyisical activity (PA) have benefit in reducing chronic diseases in the adults. The prevalence of achieving physical activity recommendations declines rapidly between the ages of 18 and 24 when many young people are undertaking university education [1,2] .

The results of the studies underscore the importance of health programs to promote regulary PA with a focus on young adults, a group known to be affected from environmentally associated decline of physical activity, and to promote the continuation of physical exercise from early adulthood into later life in general [3], but little is known on the association between HRQOL and PA levels among young population. Massida et. all found that high level of regular PA are associated with more favorable scores in HRQOL in young Italian men [4]. HRQOL is a particularly important issue among women, as women consistently report worse health than men (71% vs 61%) [5]. Nevertheless, female students are highly preoccupied with their body weight and overweight and obesity are problems in university communities, and they are associated with many health-related lifestyle behaviors [6].

There is a huge transversal database showing a strong relationship between obesity and quality of life, where HRQOL seems to decrease with the increase of body weight [7]. With the increasing enviromental chalanges in relation with healthy lifestyle behaviors, there is a continous search for effective obesity-prevention and promotion of regular PA programs. These interventions should be based on factors that have the potential to influence body weight, body composition, physical fitness and HRQOL. Therefore, the aim of our study was to assess the effectiveness of a prophylactic exercise program on HRQOL and others parameters measuring health-related fitness (muscular strength and endurance, VO_{2max}, body composition, BMI) in young female university students.

Methods

A. Participants

In this study participated 20 female students (23.1±1.68years, 61±8.4kg, 166.5±5.36cm, IMC 21.93±2.14kg/m^2) from the Partium Christian University of Oradea, between 10 February – 10 June 2013. Subjects were included based on their option to participate in a prophylactic PA program, aimed to ameliorate their health-related fitness and to prevent weight gain or to lose weight. Other selection criteria were that the subjects were healthy, aged 18–30 y (young adult) and active during Physical Education (PE) lessons. In particular healthy was defined as having no history of any illness considered likely to affect PA.

Prior to the commencement of the experiment, the young women gave a signed consent. 20 from 34 students were included in PA program and underwent the baseline and final testing (participation rate was established at 80-100%).

B. Assessment of health-related fitness

A. Somatoscopical exam was done upon the international standards.

B. **Anthropometry and Body Composition**/Antropofiziometrical measurements were measured according to the standard procedures described by the International Society for the Advancement of Kinanthropometry: ISAK [8].

Height was measured in duplicate using a wall-mounted stadiometer at baseline to the nearest 0.1 cm. Weight, to the nearest 0.1 kg, was measured using a calibr ated floor scale at baseline and at the end. All of the data were collected by the program provider (physiotherapist and PE teacher).

Skinfold thickness (0.1 mm) were assessed with a caliper, only on the right side of the body, 3 times on each site, and using the mean value at five sites: Triceps, bicepsului brahial (arm hanging by the side, parallel to the long axis of the arm at midpoint), subscapular (relaxed shoulders, the line of the skinfold is determined by the natural fold lines of the skin), abdominal (at 5 cm lateral by the ombilicus, in the longitudinal axis), supraspinale (2-4 cm above the ASIS on the lateral side of the trunk, the fold is oriented anteriorely and inferiorely), thigh (at the

midpoint of the anterior face in the longitudinal axis), medial calf (foot is placed on a box with the calf relaxed, on the most voluminous region).

Circumferences were measured with the subjects in a standing position with a non-elastic measuring tape in following regions: neck (at the midpoint between chin and clavicula) ; brest (under mamelo, on the bra line); arm (at the most voluminous part); waist circumference was measured at the midpoint between highest point of the iliac crest and lowest part of the costal margin in the mid-axillary line with a non-distensible tape measure); hip circumference was measured at the widest part of the hip region, on the pubic symphysis.

Body mass index (BMI) was calculated as weight (kg)/height (m^2). It was used to classify the young university students into categories of Underweight (BMI < 18.5 kg/m^2: ≤ 16.00 Moderate thinness < 16.99; 17.00 ≤ Mild thinness < 18.49), Normal (18.5 kg/m2 ≤ BMI < 25 kg/m2), Overweight (25 kg/m^2 ≤ BMI < 30 kg/m^2; 25.00 ≤ Pre-obese < 27.49), and Obese (BMI ≥ 30 kg/m^2) [9].

Body composition and the optimum body mass were estimated using the formulas of National Centre of Sport Medecine from Romania [10], based on the five mentioned skinfolds measures. Then, based on body fat (%BF), actual body mass (BM)kg, actual fat-free mass (FFM)kg, optimum body mass(kg), optimal active mass(kg) and optimal body mass were calculated: %BF = (5 skinfolds sum(mm) x 0.15) + 5.8 + Body Surface Area (BSA)m^2 was estimated using Du Bois formula [11]; Actual BF (kg) = Actual body mass(kg) x %BF; Actual FFM (kg)=Actual BM (kg)-BF(kg); Optimum FFM (kg)=Actual BM(kg)x75%; FM(kg)=Optimum FFM (kg) + Optimum BF

C. Muscular strength and endurance, flexibility

a. Abdominal muscles: supine position on the mat, knees bent at an angle of approximately 140°, feet flat on the floor, legs slightly apart, arms straight and parallel to the trunk: flexion of the cervico-toracal spine, slow curling of the upper back until the scapulae are not in contact with the mat, the arm crossed on the chest. Number of correct repetion in 60 sec are counted.

b. Upper arm and shoulder girdle strength and endurance : push-up. prone position on the mat with hands placed under or slightly wider than the shoulders, fingers stretched out, legs straight and slightly apart, and toes tucked under. The student pushes up off the mat with the arms until arms are straight, keeping the legs and back straight. The back should be kept in a straight line from head to toes throughout the test. For those who were unable to perform with straight legs, the position on the knee was permited. Number of correct repetion in 20 sec were counted.

c. Sit and Reach test measures the *flexibility* of the lower back and hamstring muscles. The level of the feet was recorded zero, so that any measure that does not reach the toes was negative and any reach past the toes was positive.

D. Cardiovascular Fitness Assessment. Cardiovascular fitness VO_{2max} (mlO2/kg/min) was predicted from the Astrand-Ryhming nomogram, using the cycle ergometer and following the recommended submaximal test protocol [12]. The intensity for untrained women was set between 100-150WATS, depending on the anamnesis data. The normative data were used from the Cooper Institute for Aerobics Research are ranked from very poor to superior [13,14].

D. To assess the HRQOL, students were asked to complete self-administered questionnaires, including (FS-36) [15] short form consisting of 36 items, of the functional health status, a summary of the basic values of physical and mental health, and an index of health.

Training Program

Subjects were enrolled in an 18 weeks training program consisting of 60 min sessions 3 x weeks.

The program was aimed to enhance the HRQL through the major objectives of mentaining/ ameliorate the health-related fitness components: cardio-repiratory condition and body composition. The following primary objectives were settled:

1. Postural correction by correcting the muscular imbalance. Hence, exercises to activate/strengthen weak muscles (major pectoralis, biceps and triceps brachii, sholders muscles, spinal extensors, core muscles, lower limbs muscles) and release/stretch the tight muscles were done to better enable muscle balance.
2. Increase the cardio-respiratory capacity (VO_{2max})

Methods, means and techniques used: dynamic, repetitive exercises, with large muscles groups; hard resistive exercises (fig 1) și balance exercise (Pilates) (fig2), stretching exercises. The intensity of the exercise was moderate to vigorous; it was calculated to be 55% from VO_{2max} in the weeks 1-4 and after one month was 70-85% VO_{2max}.

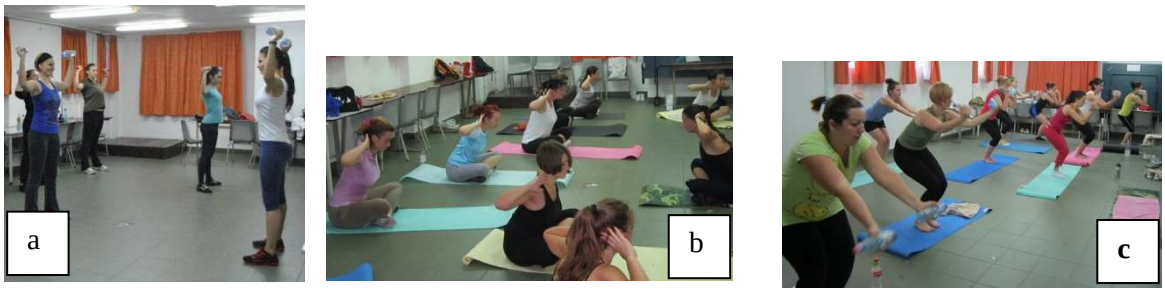

Figure 1 a – Strenthening of scapulae adductors, external arm rotators, dorsal with abdominal-gluteal cocontraction in order to avoid hyperlodosis. **b** Pilates like strengthening of the back muscles, biceps, triple extension chain of the inferior limbs; **c** – exercises to correct the cypholordotic/asymetrical posture, strengthening of the erector spinae and shoulders by statical contraction of trapezius, latissimus dorsi, rhomboid major, levator scapulae, serratus posterior, iliocostalis lumborum, longissimus thoracis, spinalis thoracis) and shouldres, maintaining position 2 x 30-45sec.

Figure 2 a – Ventral Planking – core muscles strength;

b – abdominal and core muscles reinforcement – sitting in balance

Statistical analisys

Mean and standard deviation (SD) are given as descriptive statistics for all parameters: anthropometrical, physiometrical, metrical and psychological. Data were gouped upon the evaluation moment in baseline and follow-up. The net differences were calculated by subtracting the changes from baseline to follow-up. Descriptive data at baseline was analyzed using paired t-tests. Statistical analisys for changes in anthropometrical, physical performances, maximum oxygen uptake and components of HRQOL was done using ANOVA with repeted measures (baseline, after 18 weeks). Statistical significance was set at $p<0.05$. For all statistical analyses we used SPSS version 10.1

Results a. Somatoscopic evaluation

The most frequent faulty postures of the young women participating in our study were: kyphotic-lordotic posture (8 subjects), functional slight lateral thoraco-lumbar 'C' curve (2), sway-back posture (2), head and neck cap forward (9), faulty pelvis posture (ante/ retroversion / translated / inclined (17), thoracic flat back (1).

b. Functional variables Mean values of evaluated parameters for the entire group, at baseline and foloow-up after 18 weeks are presented in table 1. All the parameters improved at follow-up for all the subjects, but only maximum oxygen uptake, arm and core muscles strength, and Self reported scores of HRQOL imporived significantly ($p<0.05$).

Table 1 Changes in anthropometric and functional variables from baseline to final assessment (18 weeks) (n=20)

Characteristics of the subjects (n=20)	Baseline Mean±SD*			Follow-up Mean±SD			Mean difference	*P*-Value
Age (years)	23.1±1.68			-			-	-
Weight and BMI								
Weight (kg)	60.85±8.12			59.88±8.09			- 0.98	ns
BMI for age(kg/m²)	21.88±2.06			21.53±2.08			- 0,35	ns
Prevalence of BMI (BMI categories) (n)	Under weight	Normal	Over weight	Under weight	Normal	Over weight	-	-
	1	18	1	1	19	-		
Body composition								
Skinfold sum (mm)	112.3±39.98			103±36.63			- 9,3	Ns
Body Fat (kg)	15.38±6.14			13.99±5.30			- 1,39	Ns
Fat Free mass (kg)	45.92±4.04			45.4±3.66			- 0,52	Ns
Circumferences (cm)								
Neck	32.25±2.14			32±2.05			- 0,25	ns
Chest	79.55±8.3			78±7.52			- 1,55	ns
Arm	26.5±2.38			26.45±2.08			- 0,05	ns
Waist	73.6±6.63			72.25±6.63			- 1,35	ns
Pelvis	100.4±12.35			99.05±11.85			- 1,35	ns
Tight	50.05±5.2			49.55±5.27			- 0,5	ns
Calf	34.9±2.98			34.79±4.7			- 0,1	ns
Cardivascular fitness								
VO2max (mlO2/kg/min)	31.68±5.17			34.79±4.7			+3,11	<0.05
Motric parameters								
Strenght-endurance abdomen (n)	34.8±7.19			37.5±6.78			+2.7	ns
Arm strength & core muscles (n)	5.9±2.4			8.5±1.24			+2.6	<0.0001
Sit and reach - flexibility test (cm)	9.9±11.57			14.9±11.38			+5	ns
Self-report of HRQOL scores (SF 36)								
Physical functioning	77.60±14.68			88.37±8.66			+10,77	<0.005
Mental Health functioning	69.03±13.64			85.76±7.16			+16,73	<.0001

*SD Standard deviation, BMI Body mass index,

BMI mean value was into the normal range, the light decreasing at follow up was not significant (table 1)**.**

The baseline and follow up actual values of body weight, as well the skinfolds based estimated optimum weight, body fat and fat free mass values are shown in table 2.

Table 2 Mean values of body weight, fat mass and fat free mass at baseline and followup and the difference between the two moments, and the optimum estimated values.

Parameter	Actual			Optimum (O)	Diff B-O
	Baseline (B)	Followup (F)	Diff B-F		
Weight (kg)	61.3±8.12	59.4±8.09	-1.9	57.46±8.85	-3.84
Fat mass (kg)	15.37±6.14	13.99±5.30	-1,38	11.48±1.77	-3,89
Fat free mass (kg)	45.92±4.04	45.4±3.66	-0,52	45.96±7.09	+0,04

Discussion

At baseline the mean weight was 61.3 kg (table 2) and the mean optimum weight was estimated at 57.46 kg, which means a target of mean weight loss of 3.84 kg during the 18 weeks.

At follow up the entire group lost a mean of 1.9 kg.

It is well known that physical activity alone has a limited capacity of weight loss; training programs are reported to loss a mean of 70-90 gr/week, and for women even less or at all. The result of a program aimed to reduce the fat mass based only on physical activity, like our study, is a slight increase in muscular mass, obtaining a slender silhouette with an increased muscular tone, and all these without a substantial loss in kilogram number [16]. Our subjects achieved after 18 weeks to lose a mean of 105.5 gr/week.

There are numerous studies indicating the same tendencies in the evolution of the studied parameters like in our study after similar PA training program. Hereby, after a 3 month PA program (endurance and/or strengthening) (60 min, de 3x/week), 44 women with abdominal fat decreased significantly body mass, BMI, total fat mass, waist and tight and VO_{2max}. A marked increase in the total fat free mass had the group who underwent endurance and strength muscular training [17].

In our study at baseline mean fat free mass of the group had optimum values. Young participants have not increased fat free mass, on the contrary, they had a decrease of 0.52 kg.

This could be explained by a low level of the work load. Thus, from 1.9 kg of lost body mass, only 1.38 kg were lost from fat mass, the rest (0.52kg) being lost from the fat free mass. Probably cardiovascular training was in optimum dose, as the VO_{2max} values increased significantly.

Optimum mean fat mass indicate that a decrease of 3.9 kg for the whole group is recommendable (table 2). But in our study, after 18 weeks, fat mass decreased with a mean value of only 1.38 kg. However, fat mass and body mass decrease had the same tendencies with the skinfolds and circumferences, which decreased as well.

Thus, could be noticed that circumferences mean values at neck, chest, waist, pelvis (table 1) had a decreasing tendencies, the same with the skinfolds measured in the same areas (subscapular, abdominal, supraspinale), whilst the strength values in the same areas augmented as well. We could say that fat mass in the central region decreased, but without an increase in the fat free mass. Previous studies conducted in well-controlled exercise testing laboratories have demonstrated significant reductions in central obesity (waist circumference) following resistance training in individuals with or not at risk of type 2 diabetes[18,19,20].

Another study done on healthy women but older than in our group (39-64years) shows an increase of the muscular strength and in fat free mass but a decrease in fat mass after a 21 weeks endurance and strength training program[21]. But, it is necessary to precise that these studies used dual-energy X-Ray absorptiometry to evaluate the body-composition.

18 students in our study had BMI in the normal category; one female was underweight/mild thinness and one overweight/preobese. After WHO (2009) the percentage of women having a normal BMI (18,5-24,99) in our country was 57,2% [22].

We should disscuss the evolution of the extremes, minimal amd maximal value.

One participant had at baseline a BMI in the pre-obese categorie, who lost 6 kg of her body mass from which 4.55 kg was fat mass. At followup BMI was in normal categorie, skinfolds sum decreased with 22 mm, circumeferences of chest with 6 cm, waist (5 cm) and pelvis (3 cm). The subject enhanced her motor performances (strength and endurance, flexibility), cardiovascular fitness and HRQOL scores.

On the opposite position is the young woman who was in the underweight/mild thinness BMI categorie (18.49 kg/m²) at baseline and at followup went evan lower, at the underweight/moderate thinness categorie (18.11kg/m²). Taking into account the HRQOL results shows a decrease of the physical health score, we assume that an inapropiate stress management could create such a result.

At the HRQOL questionnaire mean values show a significant increase (table 1) at both components, physical and mental health (fig1).

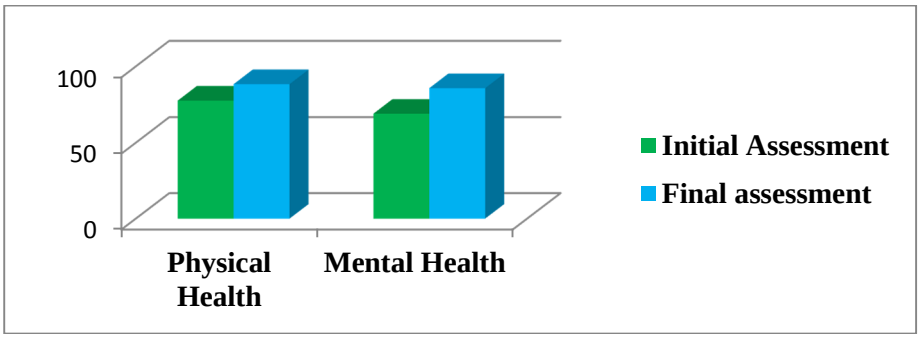

Figure1 Mean values of the two components of the HRQOL at baseline and followup

Our results sustain what was previously found: evan small reduction in weight could conduct many times in significant increase of the HRQOL [23].

Moreover, Bajer et al shows that the reduction of intraabdominal fat and an increase of cardiorespiratory capacity, by improved quality of nutrition, sedentary reduction and an enhanced active participation to physical activity/exercises could be associated with clinical benefits, sometimes, evan without weight reduction [24].

Conclusions

Our study demonstrates the importance of the preventive physical activity programs aimed to enhance the HRQOL. The four month PA program ameliorated all physical, motor, functional psychical parameters of all 20 participants.

The preventive physiotherapy PA program for female students for a period of four month realised a decrease in many of the health-related fitness: weight, body composition, muscular strength and endurance, flexibility. Significant improuvment showed cardio-repirator fitness, muscular strength evaluated by push-ups, and the perception about own vitality, physical and mental health, HRQOL.

Maybe a longer period of time of the PA program would have alowed to increase evan more all the parameters, and also to attain the target values (optimum body mass and fat mass).

Evanthough, the results gives us the right to ascertain that our PA program ameliorate the HRQOL.

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