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EFECTOS DEL TAE BO RECREATIVO EN LA FUERZA Y EL EQUILIBRIO DE LAS MUJERES

EFFECTS OF TAE BO RECREATIONAL EXERCISE ON STRENGTH AND BALANCE IN WOMEN

Nikić, N.[1]; Milenković, D.[2]

[1] Faculty of Sport and Physical Education Niš, Serbia

[2] Faculty of Sport , University "Union - Nikola Tesla", Belgrade, Serbia

Correspondence to:

Dejan Milenković

E-mail: dejan_milenkovic@yahoo.com

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RESUMEN

La actividad física moderada regular mejora la salud general y la vitalidad. Este ejercicio se debe iniciar lo más pronto posible, en la juventud. Guiados por estos principios, el objetivo de la investigación llevada a cabo fue determinar el efecto de Tae Bo recreativo en la fuerza y el equilibrio de las mujeres.

El estudio incluyó a 60 mujeres participantes, de 18 a 25 años de edad, divididas en un grupo de 30 mujeres que participaron en el programa experimental de Tae Bo recreativo (grupo experimental) y un grupo de 30 mujeres que no participaron en ningún programa de ejercicio físico regular (grupo de control).

Para valorar la fuerza y el equilibrio se utilizaron las siguientes pruebas: Para la fuerza se usaron el test de fuerza general y equilibrio, el test curl up, la sentadilla, el wall sit, soportando la carga con los brazos extendidos y flexionados. Para el equilibrio se usaron la prueba flamingo balance, el test de pie sobre una pierna con los ojos cerrados y el test sobre ambas piernas en el banco de equilibrio con los ojos cerrados.

Los resultados mostraron que el Tae Bo recreativo tuvo un efecto estadísticamente significativo en la fuerza y el equilibrio de las mujeres.

Palabras clave: Tae Bo, fuerza, equilibrio, mujer.

ABSTRACT

Regular moderate physical activity improves general health and vitality. Such exercise should be started as early as possible, in youth. Guided by these principles, the objective of our research was to determine the effect of Tae Bo recreational exercise on strength and balance in women.

The study included 60 female participants, from 18 to 25 years old, divided into a group of 30 women involved in the experimental program of Tae Bo recreational exercise (experimental group) and a group of 30 women who were not involved in any program of regular physical exercise (control group).

Measuring instruments for assessing strength and balance consisted of the following tests: Strength - test of general strength and balance, curl up test, squat test, wall sit, enduring the load with extended arms and enduring the load with flexed arms; Balance – flamingo balance test, stork balance stand test with eyes closed and balance board test with eyes closed.

Results showed that Tae Bo recreational exercise had a statistically significant effect on strength and balance in women.

Keywords: Tae Bo, strength, balance, woman.

INTRODUCTION

In addition to its positive influence on athletic performance and working ability, the effect of muscle training contributes to overall health. This type of training increases total muscle mass, which has a significant influence on fat burning, reducing of bone demineralization, thus it prevents or slows development of osteoporosis. By developing of muscle strength (as a motoric ability), the resistance and stability of body is rising, so back pain and variety of injuries caused by sudden movements is preventing, which contributes to better quality of life and mobility into old age (Sharkey & Gaskill, 2008). As the basic elements of development by reference of muscular training, strength, endurance and flexibility are mentioned, while the second group of priorities is consisted of explosiveness, speed, agility and balance. In older people, strength, endurance, flexibility, explosiveness, agility and balance is decreasing, but studies have confirmed that the pace is slower for active people and training improves the general condition of muscles in later years, too (Fiatarone & al., 1994).

Muscle strength is a very important component of motor status in all age categories. Like everything else, strength should be fostered and it should work on it since youth to have something to use in old age. Strength is required for a person being independent, being able to perform all the ordinary life activities not thinking about until the same strength give out. Due to lack of muscle strength activity is reducing, and therefore the muscles rapidly deteriorate and health is undermining.

There are many factors that affect strength, such as muscle mass, muscle cross-section, the number of contractile fibers, the ratio of bone lever, ie. their mechanical properties, followed by age, sex. There is research (Wilmore, 1983) with conclusion that in terms of relationship between strength training of arms and legs, women use legs as well as men, on the other hand if women would more train their upper body they could achieve the same results as men.

Training of torso muscles (abdominal muscles, back muscles, shoulder, chest and hip muscles) is important for health and work ability (Beachle et al., 2000), because only a strong and balanced torso muscles contribute to better force transfer from one part of the body to another, or an external object. Rhea & al., (2003) on the basis of 140 chosen studies suggest that four series of exercises for each muscle group are the biggest stimulus for development of strength at trained and non-trained persons.

Except strength as the first priority in muscle training, the important component of the second group of priorities is balance. It occurs both in static and dynamic form, when the body needs to maintain a stable position unchanged (static) or by performing some kind of activity (dynamic). This component of motor status can be developed by playing different sports or recreational activities, however, by the influence of other components. Leg strength affects dynamic balance, particularly at elderly (Spirduso, 1995). Practice shows that people who were involved in sports at their youth have a better balance. In favour of that, the fact tells us that the active life is the best way to get good balance maintained in all ages (Lail & al., 2004).

Bad balance can severely limit activities of daily life, but at elderly it also leads to a disruption in performance of basic activities, which can affect their health (Smulders & al., 2010). Maintaining of balance is based on integration and coordination of multiple systems, such as vestibular, visual, auditory, sensory and autonomic (Matsumura & Ambrose, 2006). Several studies indicate that the state of balance ability decreases in old age (Herdman, Tusa & Shubert, 2001; Rogers & Mille, 2003; Whipple, 1993). It is therefore necessary to lead an active life, because the chances of maintaining of this and other skills are lot higher that way.

This study that was dealing with Tae Bo recreational exercise in women with special reference to development of strength and balance was performed in order to propagate a healthy way of life and practice of moderate physical activity. Therefore, the objective of the research was to determine the effect of Tae bo recreational exercise on strength and balance in women.

METHODS

Sample and variables

The study included 60 female participants from 18 to 25 years old (age: 22.3±2.1 years; height: 171.5±6.9 cm.; weight: 58±7.3 kg.; BMI: 21.2±2.7; body fat percentage: 26.5±6.5%), divided into two groups: a group of 30 women involved in the experimental program of Tae Bo recreational exercise (experimental group) and a group of 30 women who were not involved in any program of regular physical exercise (control group). The research was conducted in order to determine the effect of Tae Bo recreational exercise on strength and balance in women. Measuring instruments for assessing the strength and balance consisted of following tests:

Strength:

1. Test of general strength and balance - GENER (starting position is the same as for the push ups, but instead of hands, forearms are touching the floor; the position is maintaining for 30 seconds; after that, in every 30 seconds, both arms (one by one) and both legs (one by one) are leaving the balance position, so that respondent at any time has three points of hold; every arm and leg is rising up as much as possible; this action is repeating until exhaustion).
2. Curl up test - CURL
3. Squat test - SQUAT
4. Wall sit - WSIT
5. Enduring the load with extended arms - EXARM (respondent is in standing position; extended arms with stepper in his/her hands; scoring: time is measuring until exhaustion).
6. Enduring the load with flexed arms - FLEXARM (respondent is in standing position; flexed arms with stepper in his/her hands; scoring: time is measuring until exhaustion).

Balance:

7. Flamingo balance test - FLAM
8. Stork balance stand test with eyes closed - SBST
9. Balance board test with eyes closed - BBOARD

Motoric tests number 2, 3, 4, 7, 8 and 9 were taken from the site TopendSports http://www.topendsports.com/testing/tests/index.htm. Motoric test number 1 was taken from Sudarov, 2007, and number 5 and 6 from Šoše & Rađo, 1998.

The experimental program of Tae bo recreational exercise

The experimental program lasted 3 months (12 weeks) with three training sessions per week. Each training session consisted of the following 3 parts:

1. The introductory part of the training

The purpose of the introductory phase is to prepare the body for further efforts and to increase body temperature and blood flow in the body. Tempo of music in this part of the training was of 120-135 strokes per minute (Brick, 1996). The exercises that were used in this part of the training included: walking, jogging in place and movement, leg curl, step touch, grapevine, V step, simple choreographies consisting of the mentioned steps.

The movement is performed on one beat, kick, with one beat implies a movement. Eight movements makes a figure eight. Four eights form one block. There were 20 blocks per training session (performed to the right and also to the left).

2. The main part of the training

Aerobic part - tempo of music ranged from 135-155 beats per minute and duration was 30-35 minutes. Choreography consisted of the following steps: walking (walk, march), running in place and movement (jogging), leg curl, step touch, grapevine, V step, knee up, squat, jab, kick, uppercut and hook. Movements were performed to the right, and then to the left.

Basic steps of choreography

Walk, march - is carried out in place, in which body weight is transferred from the front part of the foot to the whole foot.

Jogging - running in place.

Step touch – from position foot by foot, right foot to the right, pull left to right with no weight shift and touch the ground.

Leg Curl - from straddle position, right step to the right, shriveled left foot behind, left step to the left, a shriveled right foot behind.

Knee up - from straddle position, right step to the right, shriveled left foot forward, left step to the left, shriveled right foot forward.

Grapevine - from straddle position, right step to the right, crossed left step behind the right, right step to the right, pulling left to right.

V step - from straddle position, right step to the right forward with transfering of body weight, the left half-step forward with transfering of body weight, a step in the right half-back to the starting position and the left half-back to the starting position.

Squat - from an initial position (closely parallel straddle position, parallel or to the outside open straddle position in the width of the hips or even wider straddle position) perform squat.

Kick (front, side, back) - from an initial position (parallel and closely parallel straddle position) perform a kick.

Jab - from narrow paralel straddle position, right step forward and punch with the same-side hand.

Hook - from narrow paralel position foot off foot, right step forward and semi-circular (roundhouse) punch with the same-side hand.

Uppercut - from narrow paralel position foot off foot, right step forward and punch with the same-side hand bent at the elbow upwards.

Table 1. Protocol for week I, II, III and IV

Blocks	Eights	Leg and arm movements	Direction	Total number of movements
1	4	Walk 16x	in place	32
2	4	Jogging 16x	in place	32
3	2	Walk 8x	in place	16
	2	Jogging 8x	in place	16
4	4	Step touch 8x	sideways	32
5	2	Walk 8x	in place	16
	2	Grapevine 2x	sideways	16
6	2	Step touch 4x	sideways	16
	2	Grapevine 2x	sideways	16
7	2	Marsh 8x	in place	16
	2	Knee up 4x	forward	16
8	2	Marsh 8x	in place	16
	1	Front kick 2x	forward	8
	1	Side kick 2x	sideways	8
9	2	Walk 8x	in place	16
	2	V step 4x	forward	16
10	2	Grapevine 2x	sideways	16
	1	Back kick 2x	backwards	8
	1	Side kick 2x	sideways	8
11	2	Marsh 8x	in place	16
	2	Side kick 4x	sideways	16
12	2	Squat 8x	in place	16
	2	Walk 8x	in place	16
13	2	Step touch 4x	sideways	16
	2	Jab 8x	forward	16
14	2	Grapevine 2x	sideways	16
	2	Hook 8x	forward	16
15	2	Step touch 4x	forward	16
	2	Leg curl 4x	in place	16
16	2	Step touch 4x	forward	16
	2	Uppercut 8x	forward	16
17	2	Walk 8x	in place	16
	1	Squat 8x	in place	8
	1	Step touch 2x	sideways	8
18	1	Step touch 2x	sideways	8
	1	Front kick 2x	forward	8
	1	Back kick 2x	backwards	8
	1	Side kick 2x	sideways	8
19	2	Step touch 4x	sideways	16
	1	Jab 4x	forward	8
	1	Uppercut 4x	forward	8
20	1	Step touch 2x	sideways	8
	2	Grapevine 2x	sideways	16
	1	Walk 4x	in place	8

Table 2. Protocol for week V, VI, VII and VIII

Blocks	Eights	Leg and arm movements	Direction	Total number of movements
1	4	Walk 16x	in place	32
2	4	Jogging 16x	in place	32
3	4	Walk 16x	in place	32
4	4	Jogging 8x Step touch 4x	in place sideways	16 16
5	2 2	Walk 8x Grapevine 2x	in place sideways	16 16
6	1 3	Marsh 4x Grapevine 4x	in place sideways	8 32
7	2 2	Step touch 4x Knee up 4x	sideways forward	16 16
8	2 2	Marsh 8x Side kick 8x	in place sideways	16 16
9	4	V step 4x	forward	32
10	1 1 1 1	Grapevine 1x Back kick 2x Side kick 2x Front kick 2x	sideways backwards sideways forward	8 8 8 8
11	2 2	Marsh 8x Side kick 4x	in place sideways	16 16
12	2 2	Walk 8x Squat 8x	in place in place	16 16
13	2 1 1	Step touch 4x Jab 4x Hook 4x	sideways forward forward	16 8 8
14	2 2	Grapevine 2x Hook 8x	sideways forward	16 16
15	2 2	Grapevine 2x Leg curl 4x	sideways in place	16 16
16	1 2 1	Step touch 2x Uppercut 8x Hook 8x	sideways forward forward	8 16 8
17	2 1 1	Walk 8x Squat 8x Step touch 2x	in place in place sideways	16 8 8
18	2 1 1	Front kick 4x Back kick 2x Side kick 2x	forward backwards sideways	16 8 8
19	1 1 1 1	Step touch 2x Hook 8x Jab 4x Uppercut 4x	sideways forward forward forward	8 8 8 8
20	1 2 1	Step touch 2x Grapevine 2x Walk 4x	sideways sideways in place	8 16 8

Table 3. Protocol for week IX, X, XI and XII

Blocks	Eights	Leg and arm movements	Direction	Total number of movements
1	4	Walk 16x	in place	32
2	4	Jogging 16x	in place	32
3	4	Walk 16x	in place	32
4	4	Step touch 8x	sideways	32
5	4	Grapevine 2x	sideways	32
6	2 2	Step touch 4x Grapevine 2x	sideways sideways	16 16
7	2 2	Marsh 8x Knee up 4x	in place forward	16 16
8	2 2	Front kick 4x Side kick 4x	forward sideways	16 16
9	2 2	Walk 8x V step 4x	in place forward	16 16
10	4	Grapevine 4x	sideways	32
11	2 2	Marsh 8x Side kick 4x	in place sideways	16 16
12	2 2	Squat 8x Walk 8x	in place in place	16 16
13	2 2	Step touch 4x Jab 8x	sideways forward	16 16
14	2 2	Grapevine 2x Hook 8x	sideways forward	16 16
15	2 2	Knee up 4x Leg curl 4x	forward in place	16 16
16	2 2	Step touch 4x Uppercut 8x	sideways forward	16 16
17	2 1 1	Walk 8x Squat 8x Step touch 2x	in place in place sideways	16 8 8
18	1 1 1 1	Step touch 2x Front kick 2x Back kick 2x Side kick 2x	sideways forward backwards sideways	8 8 8 8
19	1 1 1 1	Step touch 4x Jab 4x Uppercut 4x Hook 4x	sideways forward forward forward	8 8 8 8
20	1 1 1 1	Marsh 4x Step touch 2x Grapevine 1x Walk 4x	in place sideways sideways in place	8 8 8 8

Body shaping exercises

In this part of the training the following body regions were treated:

- Arms and shoulder muscles
- Abdominal muscles
- Back muscles
- Muscles of the gluteal region
- Leg muscles

3. The final part of the training

Stretching exercises are used to calm the organism:

- Turkish sitting position, right arm next to body, left arm up, shift to the right, hold.
- Turkish sitting position, left arm flexed up and placed at the neck, right arm next to body, hold with left hand.
- Lying on the stomach, forearms flexed in front of the body, raise the chest and shoulders off the floor.
- Lying on the back with knees bent, feet on the ground, one leg flexed in the hip joint and knee pulled toward body with both hands, the other foot remains on the ground.

Statistical analyses

Analysing of obtained data was performed using the statistical package Statistica 7.0. In addition to parameters of descriptive statistics (Mean and standard deviation - Std. Dev), T-test, canonical discriminant analysis and analysis of covariance were calculated. T-test was used in order to determine the differences between two testings (initial and final) for both groups on univariate level, to see if there were any changes after experimental treatment. Canonical discriminant analysis was used in order to define characteristics of two testings (initial and final), to see if there was any separation in groups of data. Analysis of covariance was used to determine the effects of experimental treatments.

RESULTS

Table 4 shows that there are no differences between two testings of control group at variables for strength and balance assessing.

Table 4. Differences between two testings of the control group (T-test)

	Mean (initial)	Std.Dev (initial)	Mean (final)	Std.Dev (final)	t-value	P-level
GENER	90.11	14.00	90.80	14.84	-0.05	.970
CURL	46.52	5.83	46.16	5.33	0.23	.821
SQUAT	45.68	5.77	46.32	5.12	-0.41	.680
WSIT	26.28	4.91	26.20	3.93	0.06	.950
EXARM	90.60	19.81	89.80	15.44	0.16	.874
FLEXARM	127.80	20.92	125.40	20.46	0.41	.684
FLAM	67.20	3.85	67.36	3.63	-0.15	.880
SBST	42.04	7.68	42.32	7.41	-0.13	.896
BBOARD	44.76	7.75	44.52	7.56	0.11	.912

Table 5 shows the difference between two testings of experimental group at variables for strength and balance assessing. By comparison of means (Figure 1 and 3) using the T-test, statistically significant differences in the final testing of all variables were found. Level of significance is different: squat test (SQUAT .002) and wall sit (WSIT .001) are significant at the level of .01 (99% confidence level).

Table 5. Differences between two testings of the experimental group (T-test)

	Mean (initial)	Std.Dev (initial)	Mean (final)	Std.Dev (final)	t-value	P-level
GENER	137.60	33.82	155.48	21.84	-2.22	.031*
CURL	65.08	16.38	75.04	16.25	-2.16	.036*
SQUAT	54.12	8.75	61.56	6.91	-3.34	.002**
WSIT	35.32	14.99	49.88	12.98	-3.67	.001**
EXARM	137.60	42.38	163.28	40.34	-2.19	.033*
FLEXARM	155.68	41.30	183.12	32.31	-2.62	.012*
FLAM	61.12	1.92	60.24	0.60	2.19	.034*
SBST	48.12	9.23	53.04	3.80	-2.46	.017*
BBOARD	45.28	17.47	55.64	11.10	-2.50	.016*

In all other tests: test of general strength and balance (GENER .031), curl up test (CURL .036), enduring the load with extended arms (IZDPR .033), enduring the load with flected arms (FLEXARM .012), flamingo balance test (FLAM .034), stork balance stand test with eyes closed (SBST .017) and balance board test with eyes closed (BBOARD .016), are significant at the .05 level (95% confidence level).

Discriminant function (Table 6) indicates a statistically significant difference between two testings of the experimental group (P-level = .001) at the level of .01 (99% confidence level).

The coefficients of the factor structure of individual tests show that the largest contribution to discriminant function is given by wall sit (WSIT 0.568) and squat test (SQUAT 0.516), while the lowest contribution is recorded for flamingo balance test (FLAM -0.339) and curl up test (CURL 0.334).

Table 6. Discriminant analysis[1] of diferences between two testings of the experimental group

P-level	.001**
Variable	**Root 1**
WSIT	0.568
SQUAT	0.516
FLEXARM	0.405
BBOARD	0.387
SBST	0.381
GENER	0.344
EXARM	0.340
FLAM	-0.339
CURL	0.334
Group	**Root 1**
G_1:1	-0.913
G_2:2	0.913

Discriminant function of centroids on the basis of strength and balance tests is -0.913 and 0.913. Taking into account the sign of the group centroids and test coefficients of strength and balance in the discriminant function, it can be said that the numerical difference in all tests except flamingo balance test (FLAM) is in favor of final testing which is a better result. In flamingo balance test (FLAM), the numerical difference is in favor of the initial testing, but it is worse result. On this basis, it can be concluded that in the final testing participants had better results in all tests of strength and balance.

Table 7 shows the analysis of covariance on the level of the whole set of tests of strength and balance to determine the actual effects of Tae Bo recreational exercise reached at final testing with neutralization of recorded differences in initial testing.

It can be concluded that there was a statistically significant effect of exercise on experimental group at the significance level .01 (P-level = .000).

Looking at the individual values of analysis of covariance between the experimental and control groups, there was a statistically significant effect in all tests of strength and balance at significance level of .01 (99% confidence level). Therefore, it can be concluded that Tae Bo recreational exercise has positive impact on development of strength and balance at experimental group of women.

Table 7. Effect of experimental treatment (analysis of covariance)

MANCOVA	F-test	P-level
	19.01	.000**
ANCOVA	**F-test**	**P-level**
GENER	50.01	.000**
CURL	136.13	.000**
SQUAT	58.88	.000**
WSIT	34.27	.000**
EXARM	128.35	.000**
FLEXARM	104.73	.000**
FLAM	30.93	.000**
SBST	24.41	.000**
BBOARD	26.08	.000**

DISCUSSION

In accordance with the objective of our research which was organized in order to determine the effect of Tae bo recreational exercise on strength and balance in women from 18 to 25 years old, a group of women were engaged in Tae bo recreational exercise during the period of three

[1] Canonical discriminant analysis was not calculated for control group, because there were no differences between two testings in any test of strength and balance.

months (three times a week), with aerobic training as the basic content. Aerobic training was performed through choreography with different forms of walking and running as the basic content. With the support of body shaping exercises, it was expected that this exercise program positively effected two mentioned components of motor status. The results showed that the experimental group had significant changes in strength and balance after treatment ($p = .001$). In addition, applied program showed a statistically significant effect on strength and a balance in women comparing to control group with sedentary lifestyle that had not any form of recreational exercise (F test = 19.01; $p = .000$). Considering success of conducted program of recreational exercise and complexity of its performing, it is assumed that it could have effects on other parts of the motor status at the first priority and the one at the second as well.

Previous studies are indicating that moderate physical activity contributes to better body condition indicators for all age categories at the entire anthropological space. Moderate physical activity in the form of dance aerobics positively effects on psychological health (stress) among working women having sedentary way of life (Mastura & al., 2012), and it can be also said for practicing yoga on the positive and negative emotions (Narasimhanet al., 2011) and the work of cardiovascular system (Cheema & al., 2011). Positive effect of combined aerobics, aqua aerobics and swimming program on speed development of hand movements, coordination and flexibility in older women is also noted (Torlaković & al., 2010).

Studies of recreational forms of moderate physical activity also gave results at students population, where certain types of aerobics (high-low and step aerobics) among other things, seemed to improve repetitive strength, coordination and endurance (Cvetković, 2007), but also other forms of strength by using traditional weight training and plyometric training for explosiveness (Pojskić & Muratović, 2008), and the secondary school population, too (Stojanović-Tošić et al, 2011).

Tsang & HuiChan (2004) came to conclusion that those elderly people who practice tai-chi have better proprioreceptive joint control and balance than their sedentary peers, and compared with active golfers, they had a similar dynamic and static balance. Tae Bo training in women has shown excellent results in coordination development (Milenković & Veselinović, 2010), also at changes that students had on the functional abilities after six months of Tae Bo fitness program (Mikić & al., 2009).

Otherwise, when it is talking about the frequency of moderate physical activity practice on development of strength, researches suggest that minimum three trainings per week for each muscle group to maximize strength is required (Fleck & Kraemer, 1997). According to recent research of Rhea & al. (2003), the results show that untrained people need to develop its maximum if they practice each muscle group three times a week, while the trained ones would achieve those results with two times per week.

All the above studies, as well as the results of this study indicate that individuals who are not engaged in physical activity are in the poorer physical condition than physically active people. Also, it has an impact on health status, both physically and psychologically. The human who moves is a healthy human, healthy human is a happy human.

CONCLUSION

As a confirmation of what this study has shown, and that is to moderate recreational physical exercise has a positive effect on human motoric and health status, U.S. Centers for Disease Control and Prevention and the American College of Sports Medicine published the fact that each year at the territory of the United States, 250 000 lives is lost due to irregular moderate physical activity (USDHHS, 1996, taken over from Sharkey & Gaskill, 2008, p. 3). Regarding this, epidemiologist Dr. Steven Blair (2000) also characterize a low level of physical fitness as a result of sedentary life style, as our biggest problem in the field of health. The author states that moderate physical activity is sufficient to achieve positive effects and protection against many chronic diseases. Otherwise, inactivity, combined with nervous tension, overweight due to

malnutrition and poor relationship with its natural needs, leads to disturbances in the functioning of organs and organic systems.

What to do to mitigate this disturbing information, which is not only an indicator of a poor condition of one nation, but this also is considered for many countries whose societies have fallen into a trap of modern life? This paper was written in order to highlight the need to improve the quality of life through use of daily moderate physical activity. It is need to effect on people's minds and to point that striving for complacency through dense and fatty food, alcohol, drugs, tobacco and inactivity, sooner or later leads to weakness, illness and premature death. It is also necessary to explain that moderate physical activity does not mean uncomfortable or involves pain and sacrifice, but a properly programmed exercise leads to strengthening and improving health, it strengthens the will for living and it is a very pleasant and irreplaceable experience. Because, quality of life, and the very life itself depends on movement.

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