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ORIGINAL

PERCEIVED QUALITY OF LIFE AND THE SPECIFIC PHYSICAL ACTIVITIES BY THE ELDERLY

CALIDAD DE VIDA PERCIBIDA Y ESFUERZOS ESPECÍFICOS EN PERSONAS MAYORES

Gomez-Piriz, P.T.[1]; Puga González, E.[2]; Jurado Gilabert, R.M.[3] y Pérez Duque, P.[4]

[1]Doctor. Physical Education, University of Seville, Spain
ptgomez@us.es (https://personal.us.es/ptgomez/)
[2] Doctor. Physical Education, University of Granada, Spain. (estherpu@yahoo.com)
[3] Graduate in Sciences of Physical Activity and Sports. Spain (roseliya@hotmail.com)
[4] Graduate in Sciences of Physical Activity and Sports. Spain. (pably86@hotmail.com)

Spanish-English translator: Bridgit McQue,LL.B, email bmcq123@hotmail.com, University of Granada, Spain

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ABSTRACT

Quality of life related to health indicators (QLRH) were analyzed by means of the Short Form-36 Health Survey (SF-36) questionnaire and the specified kinetic parameters of the bench press movement (12 kg) as predictors of the neurophysiological adaptations produced by physical activity. These were the values of power, velocity, acceleration, strength and temporal variables. Two groups were studied: the first group was active, undertaking regular physical activity (12 male; 6 female; 68,4±5,6 years; 1,65±0,074m; 74,57±15,41kg; BMI 26,93±4,02; weekly activity 4,5±1,65h.); the second group was sedentary (16 male; 7 female; 69±7,07 years; 1,67±0,072m; 74,95±7,4kg; BMI 26,84±2,78). Significant differences were found ($p<0,05;df=1,39;dz=0,5$). The group regarded as active considered itself as having a better quality of life and was able to perform the requested movement with greater speed and strength. The conclusions are relevant for future studies that centre on the loss of neuromuscular properties accompanied by a lack of physical activity and the effects of aging.

KEY WORDS: Old people. Health. Physical activity. Aging.

RESUMEN

Se analizaron indicadores de salud con respecto a la percepción de la calidad de vida (CVRS) mediante el cuestionario Short Form-36 Health Survey (SF-36) y parámetros cinemáticos manifestados en el movimiento press banca (12 kilos) como predictores de las adaptaciones neurofisiológicas que se producen con la actividad física. Se trataron valores de potencia, de velocidad, aceleraciones, fuerza y variables temporales. Se utilizaron dos grupos, uno activo, de práctica física habitual (12H, 6M, 68,4±5,6 años, 1,65±0,074m, 74,57±15,41kg, BMI 26,93±4,02; act/sem 4,5±1,65h.), y otro sedentario (16H, 7M, 69 ± 7,07 años, 1,67 ± 0,072m, 74,95 ± 7,4kg, BMI 26,84±2,78) Se encontraron diferencias significativas ($p<0,05;gl=1,39;dz=0,5$). El grupo considerado activo se percibe con mejor calidad de vida y manifiesta de manera más rápida y con mayor fuerza el movimiento solicitado. Las conclusiones son relevantes para posteriores estudios que se centren en la pérdida de propiedades neuromusculares acompañada a la falta de práctica y al efecto del envejecimiento.

PALABRAS CLAVES: Personas mayores. Salud. Actividad física. Envejecimiento.

INTRODUCTION

This research is concerned with old people, a constantly growing social group that urgently demands attention, planning, innovation, programmed education and research. The goal of this attention is simply to better their conditions of life in the future. New perspectives on the health of old people show the need to integrate many aspects of their lives (Muñoz-Mendoza et al, 2010). Public health has established that mental health and functional capacity are the factors that most influence the perception of health status and quality of life of older people (Azpiazu et al, 2002). The development of a multi-disciplinary system to avoid feelings of isolation, depression and insecurity has also been recommended (Guerra, 2009). Quality of life has many aspects: its incidence in personal or group relationships, the cognitive aspects of longevity, as well as the special circumstances in the processes of the neurophysiological aspects of aging.

In this respect, there have been major differences between the self-stereotype, which old people show, and the socially analyzed hetero-stereotype (Gómez and León del Barco, 2010). Overall, perceived health, the perceived limitations due to illness, doing physical exercise and satisfaction with one's life have been considered as predictors of the level of dependence in the old (Gázquez et al, 2008). That study showed that a measure that increases life satisfaction and doing physical activity decrease the level of dependence.

In this study we measured the Perceived Quality of Life in Relation to Health (hereinafter QLRH), by using questionnaire SF-36. This is one of the most widely used generic instruments for its good psychometric properties (Garratt et al, 2002), together with the multitude of existing studies that have employed it, so that it has long since become one of the most powerful tools in the field of QLRH. Its scale provides a profile of health status and is applicable both to specific subgroups and the general population, enabling the health status of individual patients to be assessed.

Institutions such as ACSM and the National Institute on Aging, (NIA. U.S) have shown the influence of mild or moderately intense practice of general physical exercise on the health of old people, (Heyward, 2008) while more specific activities, such as practicing martial arts, improved health prospects in old people (Gómez and Vicente, 2009). Improvements in the quality of strength have even been recommended to enable old people to obtain a better quality of life and make their everyday activities easier, avoiding risks, and reducing the number of falls (Lara, Miranda and Moral, 2008; Pizzigalli et al, 2011). The variety of benefits was also evidenced in specific capabilities such as balance and stability (Foschi et al., 2010) or balance and agility (Sampedro, Meléndez and Ruiz, 2010) as well as the use of the aquatic medium to improve maximum strength in old women.

Muscle activation profiles decrease with age, and differences have been shown between younger and older subjects after jumping from a height (Candow and Chilibeck, 2005) or making movements with heavy loads (Hoffrén, Ishikawa & Komi, 2007). These activation patterns reflect a decrease of efficiency in old people in doing different activities, as well as greater joint stiffness (Van Dieen, Cholewicki & Radebold, 2003; Morse et al, 2004).

Muscle fibers innervated by rapid isoforms (type II), designed specifically for actions that require speed, appear to be more vulnerable to aging due to selective atrophy, rather than the disappearance of the number of fibers (Izquierdo and Aguado, 1999) and it has been observed that the loss of the quality of strength can be delayed by the practice of regular physical activity (Carbonell, Aparicio and Delgado, 2009). But the evolution of the neuromuscular system during aging and its adaptation to training is shown not only in matters of strength but also the old person's resources in precision tasks and neural control (Duchateau, Klass and Baudry, 2006). These authors concluded that these processes can be reversed with training in older people.

These neuronal adaptations are demanded in tasks with various requirements: bearing additional weight, responding quickly to a sudden alteration in the immediate surroundings, or in general, whenever preactivation and, especially, control is required for the activity (Gomez-Piriz, 2011). These explain the rapid response in stressful situations, enabling greater ability to apply strength, or do it with a better Rate of Force Development (RFD), that is, with greater force increase per unit of time (González-Badillo and Gorostiaga, 1995). Moreover, the ability to apply more force during the movement or to do it more quickly is improved. The kinematic characteristics with which movement is manifested permit the assessment of these neurophysiologic adaptations that occur with physical activity.

The hypotheses of this research are defined in terms of observable parameters, in this case, based on the variables of the perception of the quality of life (QLRH) as shown through the questionnaire SF-36 on the one hand, and the kinematic variables expressed in a specific *bench press* exercise on the other. To demonstrate such claims, the following hypotheses have been established:

1. Active old people perceive that they enjoy a better quality of life than sedentary old people based on the SF-36 questionnaire.
2. There are statistically significant differences between active and sedentary old people in the kinematic variables expressed in the bench press movement obtained by linear meter positioning.
3. By correlating both these variables, 1, active old people have better neurophysiologic processes under the research conditions imposed; 2, active persons perceive an improved quality of life as indicated by Sf-36. These relationships must be interpreted as indications of a possible cause and-effect relation for future researchers.

OBJECTIVES

The objectives now set out explain the orientation of the present work:
-to assess and analyze the differences in QLRH between active and sedentary old people

-to assess and analyze the differences in the kinematic variables shown in the bench press exercise between active and sedentary old people
-to correlate both variables to confirm that active people demonstrate better neurophysiologic processes in the experimental conditions established.

METHODS

PARTICIPANTS

The characteristics of the sample are shown in Table 1. To consider a subject to be in the active group he or she had to perform at least three sessions per week of physical activity for a minimum period of 60min (Lara, Miranda y Moral, 2008). The average in the physical activity habits of older people in Spain (Martínez del Castillo et al., 2009) was 3:46 hours weekly in men, and 2:53 hours weekly in women.

Table 1. Sample Characteristics.

Subjects (41[1])	M	F	Age	Height (m)	Weight (kg)	BMI	Weekly activity[2]
Active (18)	12	6	68,40 ± 5,60	1,65 ± 0,074m	74,57 ± 15,41kg	26,93 ± 4,02	4,50 ± 1,65
Sedentary (23)	16	7	69 ± 7,07	1,67 ± 0,072m	74,95 ± 7,4kg	26,84 ± 2,78	0

* 1. Sample size in relation to a population with similar characteristics in the region of Andalusia with an error of 0.05 α, study power of 0.34 (1-β) and an effect size of 0.5, medium / large (Cohen, 1988, 1992). The sample size ratio was 0.78, whereas the hypothesis demonstrates two-tailed test.
[2] Hours of activity a week.

The participants are elderly people from the municipality of Seville. The subjects gave their informed consent for voluntary participation in the study, after the purpose and nature of each test, the associated risks and expected benefits had been detailed and they were assured of the confidentiality of the process. Exclusion criteria for the conduct of the various tests were: suffering pulmonary or cardiovascular disease, hypertension, orthopedic limitations to exercise or use of beta-blockers. This study was approved by the Ethics Committee of the University of Seville, following the rules laid down by the Helsinki Declaration (2004 revision).

INSTRUMENTS

We used the SF-36 for measuring QLRH with 36 items which is organized in the following dimensions in the Spanish version (Table 2).

Table 2. Dimensions of the Questionnaire SF-36 to measure QLRH (adapted from Freire de Oliveira, 2007)

Dimensions	Characteristics evaluated
Physical Function (PF)	Degree to which the lack of health limits the physical activities of daily life, such as personal care, walking, climbing stairs, lifting or carrying weight, and making moderate or intense efforts.
Social function (SF)	Degree to which physical or emotional problems resulting from the lack of health interfere in normal social life.
Role Physical (RP)	Degree to which the lack of health interferes in work and other daily activities, resulting in poorer performance than desired, or limiting the type of activity that can be done, or the difficulty in doing so.
Role Emotional (RE)	Degree to which emotional problems affect work and other daily activities, bearing in mind the reduction of time devoted to them, reduced performance and skill.
Mental Health (MH)	Assessment of general mental health, considering depression, anxiety, self-control and general well-being.
Vitality (VT)	Feelings of energy and vitality as contrasted with tiredness and despondency.
Bodily Pain (BP)	Measure of the intensity of pain suffered and its effect on normal work and household chores.
Salud general (GH)	Personal assessment of health status, including the present situation, future prospects and resistance to illness.
Perception of Physical Component (PCS).	
Change in health over time (MCS).	

To quantify the data we made a linear transformation of scores on a scale from 0 to 100, from 0 (worst health status in that dimension) to 100 (best health status).

For measurement of kinematic variables we used the linear position measuring device (LPM), isoinertial dynamometer (Model TF-100, T-Force System Ergotech, Murcia, Spain) a system that via a cable extension transducer translates movement generated (sampled at a frequency of 1000 Hz) to the linear velocity with which it is displaced by means of calibration constant K= 0,4899 (each device is factory-calibrated). The related software (T-Force, v.2.28) calculates the kinematic variables via invariant statistical methodology obtained from the kinetic variables. A lifting bar (1200mm, 7kg) and two additional discs (2,5 kg) were used to perform the exercise.

The independent research variables were established as the active or sedentary group to which the participants belonged. The dependent research variables, in terms of QLRH, were those measured through SF-36, being the dimensions described in Table 2 below. The following kinematic variables were established: maximum power (W), time to obtain maximum power (ms), time exercise up (ms), average velocity in propulsive phase (cm/s), maximum velocity in exercise (cm/s), time to obtain maximum velocity (ms), average acceleration in propulsive phase (m/s2), maximum acceleration in the exercise (m/s2), propulsive phase duration (ms), maximum strength manifested (N) and time to obtain maximum strength (ms).

PROCEDURES

The tests were carried out on the bench press by an exercise that works the upper limbs. The subjects adopted the following starting position: lying supine on the bench, knees flexed and feet resting on the bench, elbows bent to 90º and shoulders abducted to 90º. Grip width was assessed previously and enabled the aforementioned joint angles to be maintained at the starting position (Chulvi and Cantalejo, 2008).

The subjects were trained to perform the exercise correctly. They moved the bar up vertically, freely, in a concentric movement, seeking to do so at maximum velocity. Each subject performed 3 tests, with 30s rest between them and the trial with the greatest power was selected. The measurement device (LPM) was placed at the side of the bar. After completing the tests, the participants answered questionnaire SF-36.

STATISTICAL ANALYSIS

For the descriptive statistics, the Mann-Whitney U test for hypothesis contrast, with power, degrees of freedom, and effect size found (software G*Power 3.1.0 Universität Kiel, Germany) was used. Correlation tests were performed using Spearman's Rho for a statistical significance level set at $p < 0.05$ for all tests. The effect size obtained in each concurring case was evaluated in accordance with levels proposed by Cohen (1988; 1992). The data were smoothed using the software supplied as part of each device Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS Inc., Chicago18).

RESULTS

The descriptions of each variable, the value of the statistics, the significance, degrees of freedom and size effect can be seen in Table 3, with respect to the variable Quality of Life Related to Health (QLRH.) in active and sedentary old people and the kinematic group variables are set out in Table 4. Figures 1, 2 and 3 show these variables.

Table 3. Results of Quality of Life Related to Health (QLRH.) in Active and Sedentary old people.

QLHR	Active	Sedentary	Mann-Whitney*U test*	p
PF	91,39 ± 8,37*	72,61 ± 26,33	130	0,039
RP	93,05 ± 18,8	67,39 ± 43,59	150	0,062
BP	85,11 ± 22,16*	70,65 ± 18,87	131,5	0,04
GH	85,89 ± 11,03*	60,26 ± 16,12	39,5	0,000
VT	84,72 ± 12,42	80,65 ± 16,87	185	0,559
SF	91,66 ± 10,50	72,83 ± 30,77	139	0,059
RE	90,74 ± 25,06*	60,87 ± 41,02	119,5	0,009
MH	84,44 ± 16,8	74,26 ± 22,5	155	0,169
PCS	54,07 ± 5,67*	46,67 ± 10,65	110	0,011
MCS	55,84 ± 7,94	50,08 ± 13,31	163	0,248

* Statistically significant differences (p<0.05; df=1.39. dz=0.5)

There were statistically significant differences for the group considered active for the dependent variables relating to QLRH (Table 3 and Figure 1), in the following dimensions: PF (physical function), BP (bodily pain), GH (General Health), RE (Role Emotional) and GHP (General Health Perception). Similarly, statistically significant differences, with high or medium effect size, were found in favor of the group considered active for the dependent variable of kinematic variables (Table 4), specifically: duration of exercise (exercise time up), propulsive phase duration, time to obtain maximum velocity, phase propulsive), propulsive phase duration maximum strength manifested and time to obtain maximum power (Figure 2), average velocity in propulsive phase, average acceleration in propulsive phase and maximum acceleration in the exercise (Figure 3). All differences were in the medium to high range.

We would mention that although there was an absence of statistical significance in the variables of maximum velocity in the exercise and maximum power they are, nevertheless, very close to it (p = 0,055 and p = 0,098 respectively).

Table 4. Results of Kinematic Variables in Bench Press in Active and Sedentary Old People.

Kinematic Variables	Active	Sedentary	Mann-Whitney *U* Test	p
Time exercise up (ms)	500,33 ± 158,49*	777,26 ± 391,11	111,50	0,012
Speed average phase propulsive (cm/s)	1,10 ± 0,40*	0,68 ± 0,36	89	0,002
Speed max. (cm/s)	1,60 ± 0,46	1,24 ± 0,61	134	0,055
Time speed max. (ms)	274,66 ± 102,04*	413 ± 137,27	77,50	0,001
Aceleration average phase propulsive (cm/s^2)	4,21 ± 3,53*	2,01 ± 2,25	121	0,024
Aceleration max. (cm/s^2)	15,46 ± 9,52*	6,06 ± 3,44	74	0,000
Time phase propulsive (ms)	402,05 ± 200,41*	725,22 ± 430,22	103	0,006
Strenght max. (N)	303,21 ± 114,29*	190,45 ± 41,34	74	0,000
Time strenght max. (ms)	25,55 ± 44,23*	190,61 ± 149,29	32	0,000
Power máximum (w)	256,35 ± 105,11	193,74 ± 115,21	144	0,098
Time power max. (ms)	196,39 ± 123,24*	357,87 ± 138,74	70,50	0,000

* Statistically significant differences (p<0.05; df=1,39, dz=0.5)

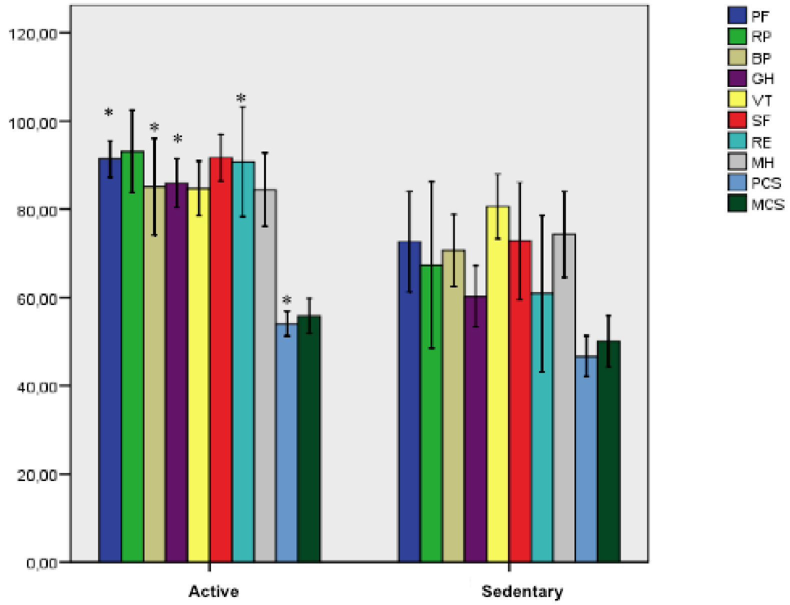

Figure 1. Variable of Quality of Life Related to Health (QLRH) in active and sedentary old people (* Sig.Dif).

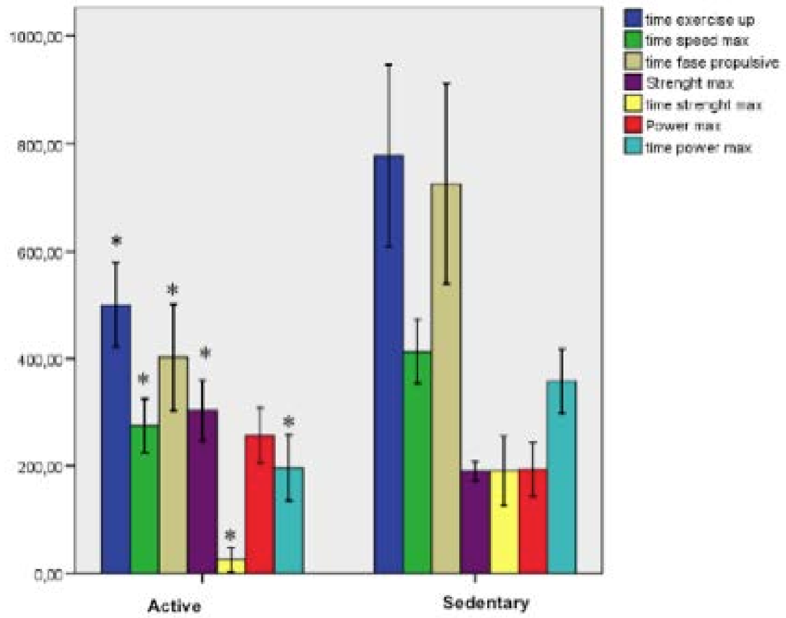

Figure 2. Kinematic Variables in Bench Press (1) in active and sedentary old people (* Sig.Dif).

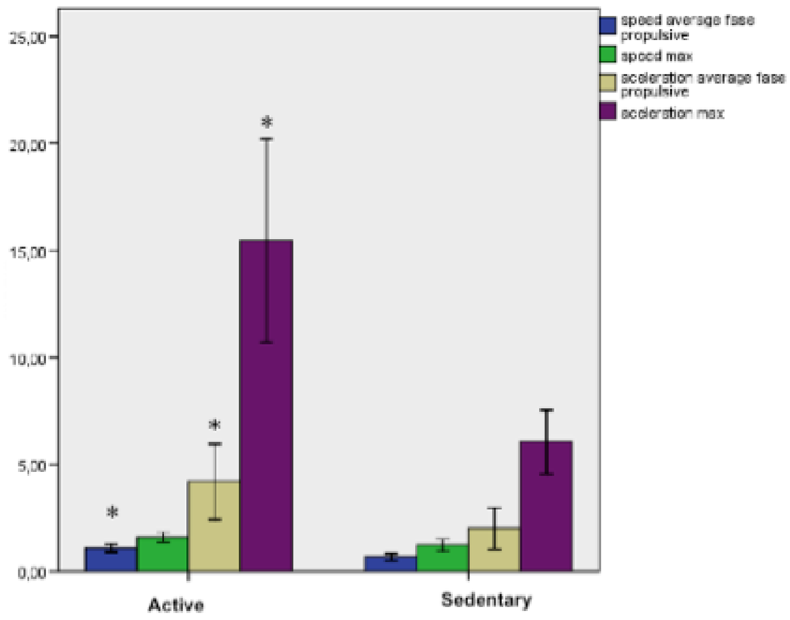

Figure 3. Kinematic Variables in Bench Press (and 2) in active and sedentary old people (* Sig.Dif)

The correlations are as follows: the dimension Physical Function (PF) correlates with all the kinematic variables obtained with a medium to low significance (Cohen, 1992) and with a moderate to high significance for maximum velocity in the exercise (Rho = 0,601, p = 0,000). The personal assessment of general health status (GH) correlates with maximum strength (Rho = 0,621, p = 0,000) and the general Perception of Health (GPH) with all variables, albeit weakly, and more strongly with the time to obtain maximum force (Rho= 0,461, p= 0,002).

DISCUSSION

The results of both research variables have generally been higher in active than in sedentary people. Compared with other studies they are much higher for QLRH, in which the values of the different dimensions narrowly exceeded the value of 50 (Kimura et al., 2010). For example, the highest value obtained in that study corresponded to the dimension Vitality (VT), with 57,1 ± 8,4, while in our study the value of this dimension was 84,72 ± 12,42 in active old people and 80,65 ± 16,87 in sedentary. The Social Function (SF) in the active subjects of our sample obtained values of 91,66 ± 10,50, compared to 53,6 ± 6,3 in the study mentioned above. Such differences shown in QLHR may be due, among other things, to the age difference of the samples used, being 73,6 ± 4,7 years in active subjects in that study, compared to 68,4 ± 5,6 in our study. All this confirms that age and the aging process is a determining factor for perception of QLHR (Guerra, 2009; Gázquez et al., 2008).

The testing of the hypothesis demonstrates that active old people perceive a better quality of life than those who are sedentary, based on the SF-36 questionnaire (hypothesis 1), specifically in the following dimensions: Physical Function (the factor limiting physical activities in daily life, including slight, moderate and intense efforts), Bodily Pain (perception of pain suffered and its effect on normal activities), General Health (mental health evaluation and general well-being), Role Emotional (relating emotional problems with performance) and Perception of Physical Component (PCS). These elements were considered predictors of the level of dependence in the old (Gázquez et al., 2008), and thus active old people are able to obtain a higher level of independence than those considered sedentary.

This study also confirms the existence of differences between active and sedentary old people in the kinematic variables expressed in the bench press movement (hypothesis 2). The data obtained show that active older people reduce the execution time of the exercise, apply more strength to the same external load and perform the movement with greater acceleration.

Two aspects can be considered relevant here. On one hand, the variables that explain the whole movement can be affected by a slowdown implicit in the movement itself, especially in the short kinetic chain of the bench press (González-Badillo and Ribas, 2002). Moreover, the differences were statistically significant for all variables related to the propulsive phase, where the deceleration that best explains the kinematic characteristics that have occurred is obvious (Sánchez-Medina, Pérez and González-Badillo, 2010). For this reason it can be said as a general rule that the existence of such differences favors the active group in all kinematic variables measures (hypothesis 2).

These neuronal adaptations that enable the kinematic variables of the exercise to be improved were also found in old people in tasks requiring improvement in response reaction times, which were lower in older people undergoing training (Kimura et al., 2010). These findings revealed that, in addition to improvements in the time required, the percentage of correct responses was also higher in older people who had been trained.

The usual activities aimed at old people do not traditionally demand accuracy, velocity and control as a basis for the quality of movements (Duchateau, Klass & Baudry, 2006). They are given easy-to-perform tasks with minimal physical demands (González and Vaquero, 2000), which are generally oriented towards the cardio-respiratory system and with mild or moderate intensity of energy expenditure, which decreases with age (Aoyagi & Shephard, 2010). Based on the results obtained in this study, tasks that include neuromuscular commitment slow the loss of efficiency for performing work requiring this activation pattern (Morse et al., 2004).

There were positive correlations between the group of variables measuring QLRH, through SF-36, and the kinematic variables analyzed (hypothesis 3), confirming that a better perception of the quality of life resulted in more effective movement in the bench press. We would highlight the correlation between the variable PF (physical function) and all the kinematic variables, especially with maximum velocity (Rho: 0,601), because this dimension brings together the old person's perceptions that most directly link the lack of health to limiting the physical activities of daily living. There is also a correlation between the data obtained in the variable of maximum strength achieved in the movement and the variable referring to the personal assessment of health status (GH, Rho = 0,621). Something similar happens with PCS values, determined by the perception of all aspects of health at the general level, and the values of the kinematic variables, although less strongly than with the in previous cases.

The results obtained lead us to think that the tasks that should be proposed to old people should also provide activation patterns of rapid, precise movements requiring orientation to control the movement, subjecting them to situations that gradually enable them to adapt and be prepared for situations that may occur, making quick responses to changing environments, avoiding falls, etc. These correlations between the amount of physical activity, the degree of physical autonomy and SF-36 dimensions were found in all age groups (Prados et al., 2011). These findings also revealed that not only were the times improved but that the percentage of correct responses was higher in trained old people. The improvements in all capacities, due to multiple effects, obtained in older people because of undertaking physical activity on a regular basis should not be an obstacle to obviate the need to produce adaptations to these other stimuli. Similarly, it is necessary to synchronize self-perceived quality of life (self-stereotype) with their individual neuromuscular adaptations, in an attempt to strengthen links between perceived good health and carrying out habitual tasks while feeling capable of doing so.

CONCLUSSIONS

The direct consequences of this research are relevant for further studies that focus on the loss of neuromuscular properties accompanied by a lack of practice or the effects of aging. The results show that active older people perceive a better quality of life (QLRH) than sedentary ones; the differences were statistically significant for the dimensions that are directly related to their daily lives: to daily physical activities (personal care, walking, climbing stairs, carrying loads and moderate and intense efforts), for pain perception and its impact on usual activities, for the perception of general health, mental health and general well-being and even differences in dealing with their emotional problems.

Active old people demonstrated better neurophysiological processes which were expressed in the kinematic characteristics in performing the bench press that have been demonstrated by abstracting the results of the propulsive phase of the movement. The data also show that the execution times are lower in the active group than in the sedentary. Similarly, active people applied more force, with greater acceleration and displayed more velocity during the execution of the movement studied. These benefits have a cause and effect relationship when carrying out general physical activities but at the same time they give key information on possible modifications of tasks, oriented toward a greater commitment in terms of neuromuscular control, speed and accuracy of movement required, provided that they are adapted to the particular characteristics of this population.

The self-stereotype shown by active and sedentary old people in this research should be taken into account in the various programs provided for them. The demonstrated correlations between perception of quality of life and the kinematic variables in older people confirm the inevitable connection of two relevant aspects of their lives: that they enjoy better perceived health status and feel that they have capacities for movement.

Finally, the objectives achieved enable us to state that, in the assessment of physical activity programs involving older people, both the perception of quality of life using the SF-36, and kinematic parameters monitored should be established as indicators in the control and monitoring of the adaptations that occur.

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