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Original/*Deporte y ejercicio*

Comparative analysis between two models of active aging and its influence on body composition, strength levels and quality of life: long-distance runners versus bodybuilders practitioners

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Abstract

Aim: **To analyze the body composition, strength level, and the quality of life related to the health (QoL) in veteran sportsmen (>35 years old) in relation to sedentary ones (S), and to compare the result in the mentioned variables between two models of sports practice, long-distance runners (LDR) and bodybuilding practitioners (BBP).**

Methods: **One hundred forty-eight male participants took part and were distributed into three groups: 47 LDR (age=42.01±6.96 years), 49 BBP (age=45.14±7.04 years), and 47 S (age=43.71±8.75 years). Body composition, upper- and lower-limb strength level, and QoL were assessed.**

Results: **The LDR and BBP obtained better performance in countermovement jump (CMJ) than the S ones (+0.06 m, p<0.001). Significant differences were found in BMI and %fat mass, between BBP and S with relation to LDR (p<0.001). In relation to the effect of aging on body composition, the muscle mass is reduced in all groups controlled (LDR, BBP, and S). Additionally, the %fat mass is increased only in S group (p< 0.05). The CMJ performance is significantly reduced only in S group (-0.07 m, p<0.001).**

Conclusions: **The results suggested that the LDR as a model of active aging showed healthier values in BMI and %fat mass as well as greater results in QoL than BBP and S groups. Nevertheless, the LDR group showed similar values to S ones in muscle mass. The regression analysis performed showed that the sedentary habit predicts the %fat mass and CMJ performance.**

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Key words: *Endurance athletes. Fitness. Health. Gym. Resistance training.*

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ANÁLISIS COMPARATIVO ENTRE DOS MODELOS DE ENVEJECIMIENTO ACTIVO, Y SU INFLUENCIA EN LA COMPOSICIÓN CORPORAL, NIVELES DE FUERZA Y CALIDAD DE VIDA: ATLETAS DE RESISTENCIA Y USUARIOS DE MUSCULACIÓN

Resumen

Objetivo: **Analizar la composición corporal, nivel de fuerza y calidad de vida relacionada con la salud (CdV) en deportistas veteranos (mayores de 35 años) en relación a sedentarios (S), y comparar los resultados obtenidos en las mencionadas variables entre dos modelos de práctica deportiva, corredores de fondo (CF) y usuarios de musculación (UM).**

Método: **Participaron ciento cuarenta y ocho hombres y fueron distribuidos en 3 grupos: 47 CF (edad=42.01±6.96 años), 49 UM (edad=45.14±7.04 años), and 47 S (edad=43.71±8.75 años). Composición corporal, fuerza de extremidades superiores e inferiores y CdV fueron evaluados.**

Resultados: **Diferencias significativas fueron encontradas en IMC y %grasa entre UM y S en relación a CF (p<0.001). En cuanto al efecto del envejecimiento en la composición corporal, todos los grupos controlados (CF, UM y S) reducen la masa muscular con el paso de los años, mientras que el %grasa incrementó únicamente en S (p<0.05). En cuanto al nivel de fuerza, el envejecimiento deterioró el rendimiento en salto vertical (CMJ) sólo en S (p<0.001).**

Conclusiones: **Los resultados señalaron al grupo de CF como modelo de envejecimiento activo que mostró valores más saludables en IMC y %grasa además de mejores resultados en CdV. No obstante, en relación a la masa muscular, CF mostraron valores similares a S. El análisis de regresión ejecutado mostró que el hábito de ser sedentario predice el %grasa y el rendimiento en CMJ.**

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Palabras clave: *Atletas de fondo. Nivel de forma. Salud. Gimnasio. Entrenamiento de fuerza.*

Introduction

Physical function declines with aging, even in people who participate in meticulous and demanding exercise throughout their whole lives[1]. The aging process causes decrease in the muscle mass and bone mass, the strength level and the cardiovascular function with the consequent increase of the visceral fat mass and total fat mass, as well as associate risks[2]. The aging is associated with the frailty and functional limitation due to three main factors: aging as biological irreversible process, a physical deconditioning due a sedentary lifestyle and the effects of co-morbidity[1]. The benefits of physical exercise on health, functional capacity and quality of life related to the health are widely demonstrated in the scientific literature[3,4]. All this allows us to consider the physical exercise as an anti-aging therapy[5]. Hawkins, Wiswell and Marcell[6] have emphasized the role of physical activity in the prevention of the deterioration associated with the aging, being the physical fitness an important predictor of mortality and morbidity[7]. Specifically, the master athlete has been proposed as an ideal model of aging due to his participation in the high intensity exercise[6,8,9]. In the last few years, there has been an important increase in the participation of veteran athletes in endurance races[10]. Parallel to this is the increase in the practice of fitness, especially bodybuilding practitioners (BBP)[11].

The researchers have therefore taking into account the growing interest in these two sports modalities and the benefits for aging people brought about by practicing sports[5]. The aims of the present study are: i) to analyze the body composition, strength level and the quality of life related to the health (QoL) in veteran sportsmen (>35 years old) in relation to sedentary ones (S) and, ii) to compare the result in the mentioned variables between two models of sports practice, the long-distance runner (LDR) and the BBP.

Methods

Participants

One hundred forty-eight males (age=43.58±7.56 years old) distributed into three groups, participated in this study: 53 LDR (age=42.01±6.96 y), 50 BBP (age=45.14±7.04 y), and 45 S (age=43.71±8.75 y). The participants came from different sports clubs of Andalusia (Spain). After receiving detailed information of the study, every subject signed an informed consent. The inclusion criteria for the groups of sportsmen were: i) to belong to the category of veteran athlete (>35 y) (12); ii) to have either any cognitive disease or intellectual disability, being free of injury; iii) to be currently and habitually training with 3 or more trainings per week[13]. The inclusion criterion for the S group was not practicing physical-sports activity or practicing below the standard recommendation (aerobic activity of intensity moderated during at least 30 minutes five days a week or 20 minutes of vigorous physical activity three days a week)[13] and to have neither any cognitive disease nor intellectual disability. The study was done in accordance to the Declaration of Helsinki (version 2008) and followed the directives of the European Community for the Good Clinical Practice (111/3976/88 of July, 1990). The informed consent and the study were approved by Bioethics Committee of the University of Jaen (Spain).

Materials

The body composition was analyzed by means of a portable eight-polar tactile-electrode impedanciometer (InBody R20, Biospace, Gateshead, UK). This device was used to measure weight (kg), fat mass (%) and skeletal muscle mass (kg). BMI was calculated as weight (in kilograms) divided by height squared (in meters). Height (m) was measured with a stadiometer (Seca 222, Hamburg, Germany). The recommendations of the World Health Organization (WHO)[14] have been used to establish the degree of obesity: underweight (BMI<18.5 kg/m^2), normoweight (BMI=18.50-24.99 kg/m^2), overweight (BMI=25.00-29.99 kg/m^2), and obesity (BMI>30 kg/m^2).

The researchers used a hand-held dynamometer (TKK 5101 Grip D; Takey, Tokyo, Japan) to measure handgrip strength (HS). For the adjustment of the ideal grip, Ruiz-Ruiz, Mesa, Gutierrez and Castillo's[15] formula was used. The record of the countermovement jump (CMJ) was done by the FreePower Jump Sensorize (Biocorp, Italy) device.

The analysis of the QoL was obtained by means of Healthy Survey Short-Form 36 (SF-36) in its Spanish version[16]. This survey consists of 36 items grouped in eight dimensions: physical function, physical role, corporal pain, general health, vitality, social function, emotional role, and mental health. Numerical values are given on a scale of 0 to 100 for each item, where the highest scores indicate better health.

Procedure

The participants were cited of individual form and on one occasion. Subjects were informed to refrain from grueling exercise the 72 hours before the assessment. Initially, the participants filled the SF-36 questionnaire. Then, the body composition was analyzed. Before performing the physical test, a warm-up was performed, consisting of five minutes of low-intensity running, and five minutes of general exercises (high skipping, leg flexion's, repeated jumps, arms rotation, sprints and, CMJ and HS technique familiarization). Immediately afterwards, the HS test was performed: two attempts were performed with each hand, calculating the average of both. Later, vertical jump ability was assessed. For this, three CMJ attempts separated by 20 seconds were performed, and the average was calculated. Participants were encouraged to maximize jump height. The CMJ technique was emphasized during testing session through the use of demonstrations, verbal cues as well as a familiarization during the warm-up.

Statistical analysis

Data were analyzed using SPSS, v.18.0 for Windows, (SPSS Inc, Chicago, USA). The results appear in descriptive statistics of mean, standard deviation (SD), and percentages. Kolmogorov-Smirnov test was used to verify the normal distribution of the information. Comparisons between sports modalities and sedentary subjects as well as between groups of age (three categories were established: ≤40 years, 41-50 years, and ≥50 years) were performed. Analysis of variance (ANOVA) was performed to compare the results obtained by different groups, adjusting by Bonferroni test. A logistic binary regression was executed considering HS, CMJ, BMI, fat mass, and muscle mass as predictors of the habit of sport practice. The predictive efficiency of these variables has been established by means of ROC curves. Finally, Pearson correlations between the analyzed variables were executed. The level of significance was set at $p<0.05$.

Results

Table I shows the results obtained in each of the executed tests, in relation to the groups established (LDR, BBP and S). In BMI and fat mass, LDR group showed lower results that BBP and S group ($p<0.001$). Moreover, the BBP group registered the highest values for muscle mass, with significant differences in relation to LDR ($p<0.01$), and S ($p<0.01$). The LDR and BBP groups obtained better performance in CMJ than the S group (+0.06 m, $p<0.001$). In relation to the effect of aging on body composition, the muscle mass is reduced in all groups controlled (LDR, BBP, and S) ($p<0.05$). Additionally, the %fat mass is increased only in S group ($p< 0.05$). As for HS, only in in LDR group is reduced by the aging effect. Finally, the CMJ performance is significantly reduced only in S group (-0.07 m, $p<0.001$).

The Pearson correlation analysis between the age and the results obtained in the performed test, in each of the established groups is showed in table II. Regarding body composition, the age positively correlates with %fat mass, and in a negative way with muscle mass, in all groups analyzed. The age negatively correlates with HS performance in sports groups (LDR and BBP). The CMJ correlates significantly and in a negative way with the age in LDR and S groups.

In the logistic regression analysis for sedentary habit, the CMJ (Odds Ratio=0.000, I.C. 95%=0.000-0.005, p=0.001) is a protection factor. In contrast, the %fat mass is a risk factor (Odds Ratio=1.164, I.C. 95%=1.089-1.243, $p<0.001$). The figure 1 shows the ROC curve of the sport practitioner habit predicted by the CMJ performance (AUC=0.791, I.C. 95%=0.709-0.873, $p<0.001$) placing the cut-point in 0.32 m (sensibility=0.789, 1-specificity=0.340). In relation to sedentary habit, the figure 2 shows the ROC curve in the one that the %fat mass (AUC=0.826, I.C. 95%=0.759-0.893, $p<0.001$) provides a high power of discrimination, placing the cut-point in 20.45% (sensibility =0.787, 1-specificity=0.302).

In relation to the results obtained in SF-36 (Table III), the LDR presents greater physical function than the S ($p<0.05$), and greater general health, vitality, social function, and mental health that BBP and S ($p<0.001$). Furthermore, LDR shows greater values in emotional role than BBP group ($p<0.05$).

Discussion

The main aims of this study were to analyze the body composition, strength level and the QoL in veteran athletes (over 35 y) in relation to sedentary peers, and secondly, to compare the result in the mentioned variables between two models of sports practice of great popularity at present: LDR and BBP, leading a further understanding about what sport modality is associated to an active healthy aging. The results obtained in the present study support the rationale of previous studies, concluding that the practice of physical activity diminishes the physical deterioration consequence of the aging[5]. Regarding the comparison between two models of sports practice analyzed, the LDR group shows healthier values in body composition (BMI and fat mass), and higher values in different dimensions of the SF-36 (in physical function, general health, vitality, social function, emotional role, and mental health) than BBP and S groups. Furthermore, the sport practitioners groups (LDR and BBP) showed maintenance in their strength levels (CMJ) throughout aging, despite muscle mass lost.

The veteran athlete represents an interesting model for studying pure aging, without the pollutant effects of a sedentary way of life and the lack of physical condition that accentuate the aging process[8]. Carbonell, Aparicio and Delgado[17] indicated aging causes the deterioration of strength levels and this reduction is greater in the legs than in the arms. Larsson, Grimby and Karlsson[18] emphasized that the isometric and dynamic force increases up to the third decade and is kept almost constant up to the fifth decade when it diminishes with age. The data obtained in the present study show that, from age 50 and on, the S group start to suffer significant changes in their body composition (increase in %fat mass and muscle mass reduc-

Table I
Results obtained in tests performed (mean, SD) by participants from established groups (long-distance runner, bodybuilding practitioner and sedentary ones), according to decade of aging

	Age's group	*n*	*LDR Mean (SD)*	*n*	*BBP Mean (SD)*	*n*	*S Mean (SD)*	*p-value intergroup*	*Post-hoc*
Age (years)	(a) ≤40 y	31	37.06 (1.74)	13	36.92 (1.75)	23	36.60 (1.75)	0.635	
	(b) 41-50 y	12	44.83 (2.94)	26	45.38 (3.17)	10	45.40 (2.31)	0.854	
	(c) 51-60 y	10	54.00 (2.16)	11	54.27 (5.86)	12	55.91 (3.42)	0.499	
	Total	53	42.01 (6.96)	50	45.14 (7.04)	45	43.71 (8.55)	0.111	
	p-value intragroup		<0.001		<0.001		<0.001		
	Post-hoc		a<b***, a<c***, b<c***		a<b***, a<c***, b<c***		a<b***, a<c***, b<c***		
Body mass index (kg/m^2)	(a) ≤40 y	31	23.45 (2.18)	13	27.07 (2.60)	23	27.16 (3.68)	<0.001	LDR<S***, LDR<BPP**
	(b) 41-50 y	12	24.36 (2.59)	26	26.14 (2.53)	10	27.77(3.31)	0.019	LDR<S*
	(c) 51-60 y	10	24.55 (2.42)	11	27.41 (3.50)	12	29.05 (2.90)	0.005	LDR<S**
	Total	53	23.87 (2.33)	50	26.66 (2.78)	45	27.80 (3.43)	<0.001	LDR<BBP***, LDR<S***
	p-value intragroup		0.313		0.377		0.310		
	Post-hoc								
Muscle mass (kg)	(a) ≤40 y	31	35.14 (2.36)	13	39.31 (4.99)	23	35.30 (5.08)	0.006	BBP>LDR**. BBP>S*
	(b) 41-50 y	12	32.14 (3.17)	26	35.53 (3.10)	10	35.57 (3.47)	0.010	BBP > LDR*, LDR<S*
	(c) 51-60 y	10	31.03 (2.74)	11	36.33(4.86)	12	30.50 (3.47)	0.002	BBP>LDR*, BBP>S**
	Total	53	33.68 (3.13)	50	36.69 (4.29)	45	34.08 (4.81)	0.001	BBP>LDR**, BBP>S**
	p-value intragroup		<0.001		0.030		0.008		
	Post-hoc		a>b**, a>c***		a>b*		a>c*, b>c*		

Table I *(cont.)*
Results obtained in tests performed (mean, SD) by participants from established groups (long-distance runner, bodybuilding practitioner and sedentary ones), according to decade of aging

	Age's group	*n*	*LDR Mean (SD)*	*n*	*BBP Mean (SD)*	*n*	*S Mean (SD)*	*p-value intergroup*	*Post-hoc*
%Fat mass	(a) ≤40 y	31	11.58 (4.87)	13	21.04 (3.80)	23	24.32 (5.78)	<0.001	LDR<BBP***, LDR< S ***
	(b) 41-50 y	12	14.68 (4.84)	26	20.57 (6.83)	10	24.50 (5.20)	0.002	LDR<BBP*, LDR<S**
	(c) 51-60 y	10	16.05 (9.15)	11	24.23 (7.45)	12	30.66 (7.71)	0.001	LDR<S**
	Total	53	13.12 (6.06)	50	21.50 (6.39)	45	26.05 (6.71)	<0.001	LDR <BBP***, LDR<S***, BBP<S**
	p-value intragroup		0.075		0.274		0.017		
	Post-hoc						a<c*		
HS (kg)	(a) ≤40 y	31	46.47 (6.51)	13	45.89 (6.72)	23	42.80 (7.84)	0.159	
	(b) 41-50 y	12	41.35 (6.51)	26	40.75 (5.91)	10	43.89 (5.84)	0.382	
	(c) 51-60 y	10	41.03 (5.56)	11	41.42 (6.88)	12	39.09 (4.81)	0.591	
	Total	53	44.34 (6.75)	50	42.24 (6.59)	45	42.05 (6.85)	0.171	
	p-value intragroup		0.019		0.062		0.202		
	Post-hoc								
CMJ (m)	(a) ≤40 y	31	0.37 (0.08)	13	0.37 (0.03)	23	0.31 (0.05)	0.007	LDR>S*
	(b) 41-50 y	12	0.34 (0.04)	26	0.36 (0.05)	10	0.30 (0.04)	0.018	BBP>S*
	(c) 51-60 y	10	0.32 (0.05)	11	0.32 (0.11)	12	0.24 (0.03)	0.024	BBP>S*
	Total	53	0.35 (0.07)	50	0.35 (0.06)	45	0.29 (0.05)	<0.001	LDR>S***, BBP>S***
	p-value intragroup		0.112		0.219		<0.001		
	Post-hoc						a>c***, b>c**		

SD: standard deviation; y: years; LDR: long-distance runner; BBP: bodybuilding practitioner; S: sedentary; HS: handgrip strength test; CMJ: Countermovement jump; BMI: Body mass index; %Fat mass: fat mass percentage; letters a, b, and c mean different age's range: ≤40, 41-50, 51-60 years old, respectively.

Table II
Pearson correlation analysis between age of participants and the rest of variables, according to established groups (long-distance runner, bodybuilding practitioner and sedentary ones)

	LDR	*BBP*	*S*
BMI	0.267	0.197	0.217
%Fat mass	0.338*	0.357*	0.401**
Muscle mass	-0.510**	-0.335*	-0.468**
HS	-0.343*	-0.354*	-0.269
CMJ	-0.304*	-0.197	-0.589**

*p <0.05, **p <0.01; LDR: long-distance runner; BBP: bodybuilding practitioner; S: sedentary; HS: handgrip strength test; CMJ: Countermovement jump; BMI: Body mass index; %Fat mass: fat mass percentage.

tion), as well as a significant loss of dynamic strength of legs. Moreover, Zaragoza, Serrano and Generelo[19] found significant impairments in CMJ between 35-44 and 50-64 years old in healthy adults. Therefore, the maintenance or increase of muscle mass from this age would prevent the decrease in muscle strength related to aging[20].

LDR group presents lower values in muscle mass along aging. Likewise, Michaelis et al.[9] showed significant impairments in CMJ of master athletes with aging. Moreover, Korhonen[21] found an impairment of 11% in CMJ in each decade of aging. In this regard Marcell, Hawkins and Wiswell[22] indicated that endurance training must take part of any physical conditioning program in older adults, but the authors also notice that it is not sufficient to avoid the loss of muscle strength (dynapenia) due to aging. These previous studies support the rationale that year of practice in endurance sports with a high volume of low intensity work is not a sufficient stimulus to maintain proper musculature[23]. Recent studies have also indicated that elite, veteran long-distance runners had a lower CMJ performance (-14.8%) compared to similarly aged untrained men, remarking these differences decreased as age increased[9]. Slowing of contractile properties and loss of power in veteran athletes may be linked to reduced expression of fast fiber [24] and small diameters of type I and II fibers [25]. Nevertheless, the results obtained in this study do not support this rationale, obtaining higher CMJ performance in athletes (both groups: LDR and BBP) than S, in addition to do not experience impairments in CMJ performance with the aging, while the S ones significantly reduce CMJ. This finding further support the conclusion by McCrory, Salacinski, Hunt and Greenspan[26], indicated that high level athletes who participate in the competitive exercise have more strength than age-matched healthy subjects who do not train.

As for HS performance, several studies have indicated that HS in men and women is reduced as age increases[27] and that this reduction is linear[1]. Recently, Forrest et al.[28] have shown that HS performance is maintained in males up to 50 years of age. In this study, aging has produced a reduction in HS from 40 years of age in LDR. Moreover, similar values were found in all age's groups established between LDR, BBP and S, which support the results obtained previously by Schlüssel et al.[29].

In relation to the body composition and following the normative references of the WHO[14], the LDR present values of normoweight, placing BBP and S values

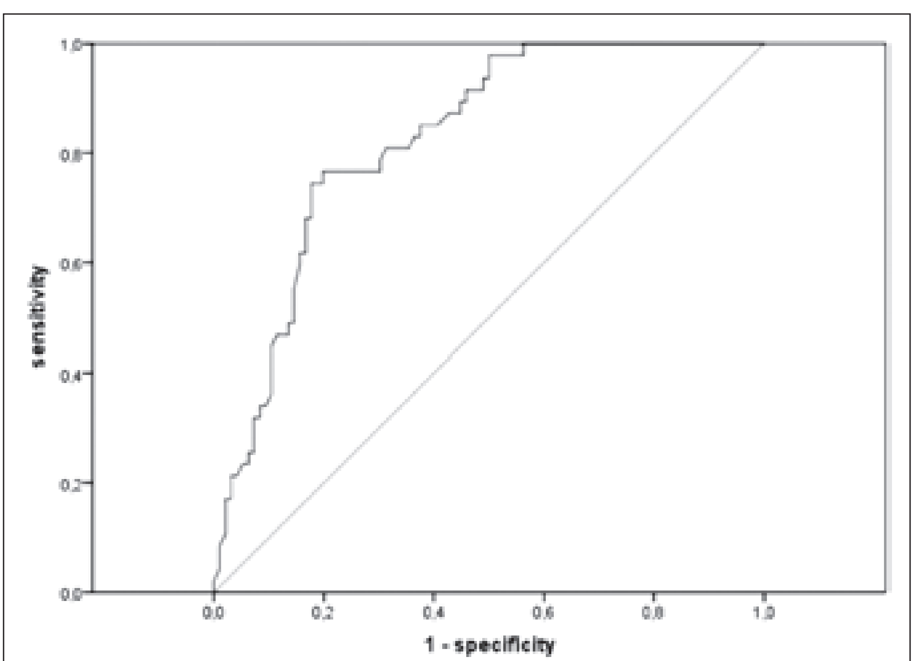

Fig. 1.—ROC curve of the sportsman's habit predicted by the CMJ performance.

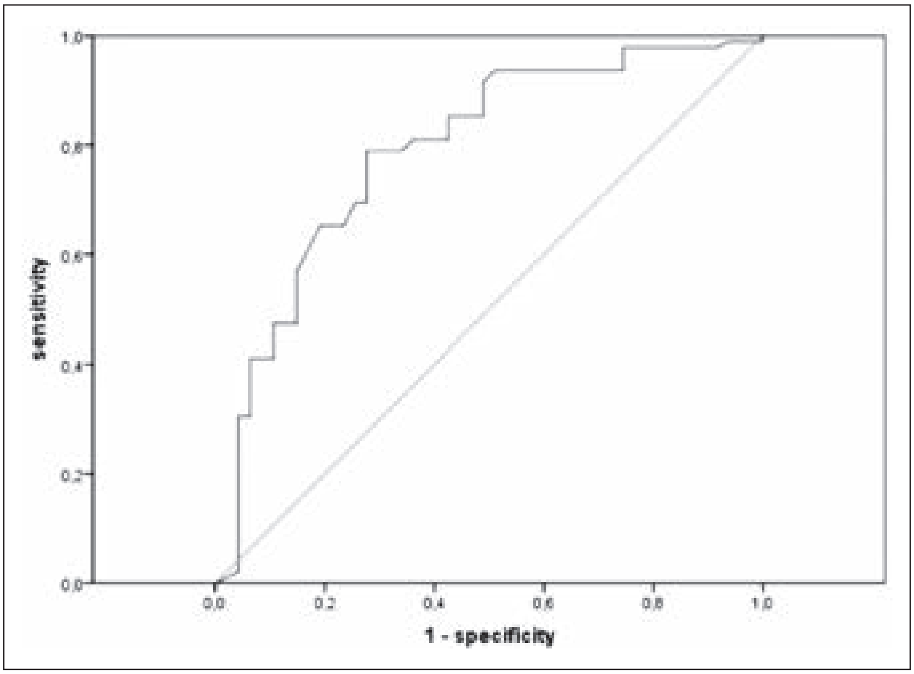

Fig. 2.—Curve ROC of the sedentary's habit predicted by the fat mass percentage.

at overweight, near the standard references of healthy Andalusian adults of similar age (27.3 ± 3.67 kg/m^2)[30]. Additionally, in this study, the age does not correlate with the BMI in any group analyzed. In contrast, Williams[31] found that BMI increases with age in athletes and, in the same line, Williams and Pate[32] concluded that the vigorous physical activity must increase with aging to prevent an increase in body mass, due to the vigorous physical activity interacting and altering the adiposity of the subjects.

In relation to the %fat mass, it is well known that increases with aging[33]. In this study the %fat mass correlates significantly with the age in the three groups analyzed. Obese subjects are defined as those who present percentages over 25% in the males and of 33% in the women. The normal values should be about 12-20% in males and 20-30% in the women[34]. The LDR present values lower than Spanish adults[35] and lower than adult population of similar age in Andalusia[30]. The S ones present similar values to normal or reference values for people from Andalusia[30], placing at obese level. The BBP obtain a %fat mass lower than the normal Spanish[35] and Andalusian references[30], with values at the limit of normal intervals[34].

Considering the effect of age, the S ones increase the %fat mass, reaching values of obesity and reducing the muscle mass. Hayes et al.[36] indicate that physical exercise practiced throughout a subject's whole life ac-

Table III
Results obtained in the different dimensions of SF-36 questionnaire, according to established groups (long-distance runner, bodybuilding practitioner and sedentary ones)

	LDR *Mean (SD)*	*BBP* *Mean (SD)*	*S* *Mean (SD)*	p-value	Post-hoc
Physical function	99.31 (2.04)	91.50 (17.20)	89.61 (23.39)	0.018	LDR>S*
Physic role	96.02 (14.20)	90.42 (23.05)	95.00 (18.91)	0.332	
Corporal pain#	86.25 (17.50)	85.46 (27.05)	91.85 (24.77)	0.374	
General health	71.90(20.68)	33.12 (10.79)	31.11 (14.05)	<0.001	LDR>BBP***, LDR>S***
Vitality	69.36 (23.48)	29.16 (15.03)	29.95 (13.52)	<0.001	LDR>BBP***, LDR>S***
Social function	89.77 (16.45)	53.57 (18.57)	55.27 (10.82)	<0.001	LDR>BBP***, LDR>S***
Emotional role	91.31(23.68)	78.59 (20.25)	87.16 (19.46)	0.015	LDR>BBP*
Mental health	71.93 (25.02)	28.60(14.63)	30.72 (14.71)	<0.001	LDR>BBP***, LDR>S***

*p <0.05, ***p <0.001; SD: standard deviation; NA: Not applicable; # High values indicate minor pain; LDR: long-distance runner; BBP: bodybuilding practitioner; S: sedentary.

companies an adequate body composition, finding minor %fat in sportsmen when they are compared to their sedentary peers. With aging, despite the atrophy of the skeletal muscle in humans is inevitable, the degree of atrophy will depend on the habitual level of physical activity[37]. The results obtained in the current study support these findings, showing that the LDR and BBP groups did not experience changes in the %fat mass with the aging, although muscle mass decreases when age is increased.

Wroblewski et al.[38] indicate that the reduction of the strength levels and muscle mass does not depend only on aging, but also in the detraining, which is a key factor. In this respect, these authors emphasize that the maintenance of the muscle mass and the force can diminish or eliminate the falls, the functional deterioration and the loss of independence and autonomy that takes place commonly in the adults of advanced age. In this study, in spite of the fact that the LDR lose muscle mass with aging, they present similar strength values to the BBP and maintain the strength level of the lower extremities despite the aging.

Finally, regarding the data obtained in QoL, the results reported in the current study are in consonance with the data obtained by Jürgens[39], who revealed the improvement of the QoL in physically active subjects in relation to sedentary ones. Furthermore, this study reinforces this finding adding a comparison between two of the most popular sport modalities such as endurance running and bodybuilding, concluding that LDR show better results in QoL than BBP.

Conclusions

The main limitation of this study is the age range considered (35-60 years old). Although it is true that master athlete category starts at 35 years of age and the number of athletes over 60 years old is reduced, could be interesting to take into account a greater age range. Furthermore, women were not included in the present study. Finally, this study presents a cross sectional design so that caution must be exercised in the interpretation of the observed associations.

The LDR as a model of active aging shows healthier values in BMI, %fat mass than BBP, as well as greater results in QoL than BBP group. Nevertheless the LDR group shows similar values to S ones in muscle mass. Therefore, in order to avoid the above mentioned circumstance, would be convenient to incorporate activities oriented to muscle tonification. The results obtained suggest that the practice of long-distance running might be considered a model of active exercise and, therefore, advisable for veteran athletes. However, this exercise must incorporate a regular strengthening training program to prevent the reduction of muscle mass. Finally, the regression analysis performed shows that the %fat mass and CMJ performance predict the sedentary habit.

Practical applications

From a practical point of view, the information obtained from this study, besides contributing to the actual knowledge about the effects of aging in adults, can be applied in the personal trainers' program. Running or endurance training may be recommended as part of physical preparation from adulthood in order to prevent the increase in %fat mass and the strength loss as critical changes in aging, which contributes substantially to the maintenance of personal autonomy, avoiding falls, fractures, and impairing the cardiovascular risk factors. However, incorporating muscle tonification workouts is recommended to reduce the loss of muscle mass in these veteran athletes.

Conflict of interest

None.

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