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Original

Fitness, fatness and cardiovascular profile in South Spanish and North Moroccan women

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Abstract

Introduction: **We studied the differences on physical fitness, fatness and cardiovascular profile in Spanish and Moroccan women.**

Material and methods: **The study comprised 63 and 58 women aged 45-65 years from South of Spain and North of Morocco, respectively. We assessed fitness and body composition using standard procedures. We also assessed resting heart rate (RHR), blood pressure, fasting glucose, total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides.**

Results and discussion: **Moroccan women had a better performance in the main health-related physical fitness components, i.e. higher levels of cardiorespiratory fitness (P = 0.01) and (lower-body) muscular strength (P < 0.001). Diastolic blood pressure (P = 0.004), RHR and total cholesterol (both P = 0.04) were lower in Moroccan women. No differences were observed in the prevalence of metabolic syndrome.**

Conclusions: **The women from Morocco had a healthier fitness and cardiovascular profile than the women from Spain. Further research on physical fitness and other health indicators in understudied populations is needed.**

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Key words: *Body composition. Physical fitness. Cardiovascular profile. Moroccan. Spanish. Women.*

CONDICIÓN FÍSICA, GRASA CORPORAL Y PERFIL CARDIOVASCULAR EN MUJERES DEL SUR DE ESPAÑA Y DEL NORTE DE MARRUECOS

Resumen

Introducción: **Estudiamos las diferencias en la condición física, grasa corporal y perfil cardiovascular en mujeres españolas y marroquís.**

Material y métodos: **El estudio comprendió 63 mujeres del sur de España y 58 del norte de Marruecos con un rango de edad de 45-65 años. Evaluamos la condición física y la composición corporal empleando procedimientos estándar. También evaluamos la frecuencia cardíaca en reposo (FCR), la presión sanguínea, la glucosa en ayunas, el colesterol total, el colesterol LDL, HDL y los triglicéridos.**

Resultados y discusión: **Las mujeres marroquíes obtuvieron mejores resultados en los principales componentes de salud relacionada con la condición física, como son los mayores niveles de capacidad cardiorrespiratoria (P = 0,01) y fuerza muscular (del tren inferior) (P < 0,001). La presión sanguínea diastólica (P = 0,004), la FCR y el colesterol total (ambos P = 0,04) fueron menores en las mujeres marroquíes. No se observaron diferencias en la prevalencia de síndrome metabólico.**

Conclusiones: **Las mujeres marroquíes tenían una condición física y un perfil cardiovascular más saludables que las españolas. Se necesita investigación adicional sobre la condición física y otros indicadores de salud en poblaciones infra estudiadas.**

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Palabras clave: *Condición física. Composición corporal. Perfil cardiovascular. Marroquíes. Españolas. Mujeres.*

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Introduction

North of Morocco and South of Spain are closely located areas, yet with marked socio-economic and cultural differences. Morocco is undergoing a demographic and social transition. Likewise, life expectancy at birth increased 23 years (from 47 to 70 years) from 1962 to 1999.[3] Much less steeply increase has taken place in Spain, where life expectancy increased 6 years (from 73 to 79 years) from 1970 to 1999.[4] Nowadays, Moroccan women life expectancy is 74.6 years,[5] whereas in Spanish women is 84.7 years.[4]

Dietary habits have changed in both Moroccan and Spanish population during the last decades.[8-9] Overweight and obesity have increased considerably in both countries and has become one of the main public health problems.[9-10] Cardiovascular disease is the first cause of mortality in Spain as well as in Morocco,[7,11] and it is related to factors such as obesity and metabolic syndrome.[12] The metabolic syndrome is a constellation of interrelated risk factors of metabolic origin (called metabolic risk factors), that appear to directly promote the development of atherosclerotic cardiovascular disease.[13]

A low physical fitness, particularly cardiorespiratory fitness and muscular strength, is a powerful predictor of all-cause mortality.[1-2] Physical fitness is an indicator of general physical functioning and its accurate assessment is of clinical and social relevance. Despite this, there is a lack of information in adults from Spain and also from developing countries such as Morocco. In fact, to the best of our knowledge, physical fitness has never been studied in African population.

Because of cultural differences, it could be that women in Morocco had fewer opportunities to get involved in sport activities and its unknown to what extent this could result in a lower fitness level and/or higher metabolic risk. In order to test this hypothesis, the present study aimed to study the differences on physical fitness, body composition and cardiovascular profile in Spanish and Moroccan adult women.

Methods

Participants

The study comprised an age-ranged matched sample (range 45-65 years) of 63 Spanish (51.9 ± 3.9 years old) and 58 Moroccan adult women (49.6 ± 3.8 years old). Participants were informed about the study aims and procedures and signed a written informed consent to participate. All the measurements were performed in a single day for both groups and by the same trained researchers to reduce inter-examiners error. The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Procedures

Physical fitness

A detailed description of the methods and procedures for fitness testing has previously described.[16] Briefly, the main physical fitness components studied were: Lower and upper-body muscular strength, as measured by the "*30-s chair stand*" and "*handgrip strength*" tests, respectively; lower and upper-body flexibility, assessed by the "*back saver sit and reach*", "*chair sit and reach*" and the "*back scratch*" tests, respectively; static balance, assessed by the "*blind flamingo*" test; motor agility/dynamic balance, measured with the "*8-feet up&go*" test, and cardiorespiratory fitness, assessed with the "*6-min walking*" test.

Anthropometry and body composition

We used a portable eight-polar tactile-electrode impedanciometer (InBody 340, Biospace) to measure weight (kg), body fat (%) and skeletal muscle mass (kg). Height (cm) was measured using a stadiometer (Seca 22, Hamburg). Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared and categorized using the international criteria. Waist circumference (cm) was measured with the participant standing at the middle point between the ribs and ileac crest (Harpenden anthropometric tape Holtain Ltd).

Bone mineral density was measured by means of a quantitative portable ultrasound scanner (CUBA Clinical™, Sunlight Omnisense™) which measures broadband ultrasound attenuation (BUA). BUA is an indirect marker of bone mineral density, so that higher BUA values indicate higher bone mineral density. Measurements were performed at the calcaneos, which has shown a good validity to predict bone mineral density[14].

Resting blood pressure and heart rate

Systolic and diastolic blood pressure, as well as resting heart rate, were measured after 5 minutes of rest, two times 2 minutes apart, with the person sit down (Omron Health Care Europe B.V. Hoolddorp). The lowest value of two trials was selected for the analysis.

Biochemical analysis

Glucose, triglycerides, total cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL)-cholesterol were measured using commercials kits (Biosystems S.A. Barcelona) for the Moroccan sample, and using a HITACHI Roche p800 autoanalyzer for the Spanish sample. The following atherogenic indexes

were calculated: total cholesterol/HDL-cholesterol, total cholesterol-HDL-cholesterol, and (total cholesterol-HDL-cholesterol)/HDL-cholesterol.

Metabolic syndrome

We used the criteria recommended by the American Heart Association/National Heart, Lung, and Blood Institute.[15] Presence of metabolic syndrome was considered when women met the 3 or more criteria: waist circumference ≥ 88 cm, triglycerides ≥ 150 mg/dL, HDL-cholesterol < 50 mg/dL, systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85mmHg, and fasting glucose ≥ 100 mg/dL.

Statistical analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS, version 16.0 for Windows; SPSS Inc., Chicago, IL), and the level of significance was set at $P \leq 0.05$.

Due to the fact that Moroccan group was significantly younger and taller than the Spanish group, we adjusted all the models by age and height (except for those including those variables). Comparisons between Spanish and Moroccan women were performed using one-way analysis of co-variance (ANCOVA) adjusted for age and height. Nominal variables were analysed using Chi-squared tests. Binary logistic regression was used to analyze the differences in metabolic syndrome between Spanish and Moroccan women.

Results

The physical fitness, anthropometric and body composition characteristics of the study participants by country are shown in table I. Moroccan women scored better in cardiorespiratory fitness ($P < 0.05$), lower body strength and lower body flexibility (both $P < 0.001$). Moroccan women scored worse on upper body flexibility ($P < 0.05$) and in static balance ($P = 0.05$). Not significant differences were observed in weight, BMI, weight status, bone mineral density and muscle mass after adjusting for age and height, whereas body fat percentage was higher in the Moroccan group ($P = 0.036$). Eighty-two percent of the Spanish group and 74% of the Moroccan group were overweight or obese.

Table I
Physical fitness, anthropometric and body composition outcomes by country

Variable	*Spanish women (n = 63)*	*Moroccan women (n = 58)*	*P adjusted by age*	*P adjusted by age and height*
Age (years)	51.9 (3.9)	49.6 (3.8)	<0.001	–
Physical Fitness				
Cardiorespiratory fitness: 6-min walking (m)	506.2 (6.1)	536.9 (7.0)	0.002	0.014
Muscular fitness				
Upper-body: Handgrip strength (kg)	25.3 (1.8)	29.1 (2.0)	0.176	0.358
Lower-body: 30-s chair stand (no. stands)	14.1 (0.4)	16.2 (0.5)	0.003	<0.001
Flexibility				
Upper-body: Back scratch (cm)	-6.1 (1.3)	-11.1 (1.5)	0.019	0.013
Lower-body: Chair sit&reach (cm)	0.9 (1.7)	3.5 (1.8)	0.287	0.225
Lower-body: Back saver sit&reach (cm)	20.2 (1.1)	27.3 (1.1)	<0.001	<0.001
Balance				
Static: 30-s blind flamingo (failures)*	6.3 (0.6)	8.6 (0.7)	0.010	0.052
Dynamic/agility: 8-feet up&go (s)*	5.8 (0.1)	5.7 (0.1)	0.568	0.353
Body composition				
Weight (kg)	70.8 (1.6)	74.6 (1.8)	0.119	0.417
Height (cm)	155.7 (0.6)	159.1 (0.7)	0.001	–
Waist circumference (cm)	89.3 (1.3)	93.0 (1.5)	0.084	0.061
Body fat percentage	38.8 (0.7)	41.3 (0.8)	0.036	–
Muscle mass (kg)	22.5 (0.5)	23.8 (0.4)	0.062	0.647
Body mass index (kg/m²)	29.2 (0.6)	29.6 (0.7)	0.740	–
Weight status % (UW,NW,OW,OB)	0/17/44/38	0/26/38/36	0.410	–
Muscle mass (kg)	23.1 (0.4)	23.3 (0.4)	0.647	0.062
BMD measured by BUA (dB/MHz)#	69.3 (2.2)	68.2 (2.3)	0.737	0.556

Values expressed as mean (standard error) otherwise indicated; UW, underweight; NW, normal-weight; OW, overweight; OB, obese; BMD, bone mineral density; BUA, broadband ultrasound attenuation; #Higher values indicates higher BMD. *Lower scores indicate better performance.

Table II
Metabolic risk factors of the study participants by country

Variable	*Spanish women (n = 63)*	*Moroccan women (n = 58)*	*P adjusted by age*	*P adjusted by age and height*
Systolic blood pressure (mmHg)	126.5 (2.4)	128.7 (2.7)	0.548	0.505
Diastolic blood pressure (mmHg)	77.2 (1.0)	72.9 (1.2)	0.010	0.004
Resting heart rate (beats per min)	75.9 (1.3)	69.7 (1.5)	0.004	0.039
Glucose (mg/dL)	92.4 (2.1)	98.1 (2.3)	0.080	0.398
Total cholesterol (mg/dL)	210.8 (5.3)	190.8 (6.0)	0.020	0.044
HDL cholesterol (mg/dL)	61.5 (2.2)	49.2 (2.4)	<0.001	0.001
LDL cholesterol (mg/dL)	123.2 (4.4)	124.0 (4.9)	0.905	0.070
Total cholesterol/HDL cholesterol	3.6 (0.2)	4.2 (0.2)	0.090	0.080
Total cholesterol-HDL cholesterol	148.2 (5.1)	144.8 (5.6)	0.610	0.341
(Total cholesterol-HDL cholesterol)/HDL-cholesterol	2.63 (0.2)	3.20 (0.2)	0.080	0.090
Triglycerides (mg/dL)	113.1 (9.7)	97.7 (10.9)	0.322	0.442

Values expressed as mean (standard error); HDL, high density lipoprotein; LDL, low density lipoprotein.

Cardiovascular profile parameters are presented in table II. Diastolic blood pressure, resting heart rate, total cholesterol and HDL-cholesterol were lower in the Moroccan group (all $P<0.05$). There were no differences in the studied atherogenic indexes, i.e. total cholesterol/HDL-cholesterol, total cholesterol-HDL-cholesterol and (total cholesterol-HDL-cholesterol)/HDL-cholesterol.

The prevalence of having elevated metabolic risk factors in Spanish women was no significantly higher compared with women from Morocco (data not shown). Likewise, the prevalence of having metabolic syndrome was similar in both groups.

Discussion

The findings of this study should be taken with caution due to the fact that the study sample was relatively small, of convenience, and not representative of the studied countries. On the other hand, this is the first study examining a large range of physical fitness components, body composition and metabolic syndrome risk factors parameters in Moroccan women, and does it in a single report, which allows us to draw a global picture of the health status of the participants studied. The present study should stimulate further research, involving larger sample sizes, on physical fitness and other health indicators in understudied populations.

The "6-min walking" test is a good marker of cardiorespiratory fitness.[17] Muscular strength is also a predictor of functional capacity, morbidity and mortality.[18] We observed higher cardiorespiratory fitness and muscular strength in Moroccan compared with Spanish women. This finding together with the lower diastolic blood pressure and resting heart rate observed in the Moroccan women group, indicates a better cardiovascular functioning and health status.[19] In fact, resting heart rate has been also shown to be an important predictor of mortality in cardiovascular disorders.[19] This is not contradictory with the lower life expectancy at birth observed in Morocco compared to Spain, since many other factors affect life expectancy such as health system availability. The results are nevertheless interesting and should be further studied in larger sample sizes.

Flexibility is important in adult people, and it is related with lower back pain or scoliosis, and is an important outcome to maintaining and restoring mobility.[20] The results observed in this study regarding flexibility are mixed. The Moroccan group performed better in lower-body flexibility test but worse in upper-body flexibility test. The reasons explaining this funding are unknown, but in our opinion might be due to the different cultural daily tasks.

A good body balance, coordination and agility are another important fitness components and have shown to be preventive against the falls risk in old people.[21] Moroccan women displayed worse score in the static balance test employed ("30-s blind flamingo"), whereas dynamic balance and motor agility (as measured by "8-feet up&go" test) was similar in both groups. Coordinative parameters may influence daily life functioning. It has also been shown that decline of the basic coordinative parameters can be driven by neurodegenerative processes and environmental factors such as high calorie intake, physical and mental inactivity, toxins and/or infectious agents.[21]

Atherogenic indexes were similar in both samples. Likewise no significant differences were observed in the prevalence of metabolic syndrome between Moroccan and Spanish women. There are no data from metabolic syndrome prevalence in Moroccan population, whereas, to note is that the prevalence among Spanish women aged 35-64 years is around 30.7-33.6%[12] and thus, higher than the prevalence observed in both samples.

In the present study, both groups showed an overweight and obesity status around 80%. This value is extremely high, and superior to the epidemiologic reference values previously found in Spanish[10] and Moroccan[9] studies. The same phenomenon was observed for the fat mass percentage obtained. Bone mineral density from both groups, as measured by ultrasound in the calcaneus area, was lower than those reported from normative data for the Spanish population of the same age and gender[22] (we have not found reference data referred to Moroccan population).

In summary, Moroccan women had better cardiorespiratory fitness, muscle strength and a lower resting heart rate and diastolic blood pressure than Spanish women, which is indicative of a healthier cardiovascular profile. Further research is needed in African countries, in which data in health outcomes are scarce or non-existing.

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