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Anthropometric, functional capacity, and oxidative stress changes in Brazilian community-living elderly subjects. A longitudinal study☆

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ABSTRACT

Objective: To examine the changes and relationships among anthropometric, functional and plasma oxidative stress markers in elderly.
Design: longitudinal study.
Setting: measurements in 2008 and 2010.
Participants: 103 community-dwelling men and women aged 67–92.
Measurements: Anthropometric parameters [waist, hip, arm and calf circumferences; waist-hip ratio, triceps skinfold thickness and others], basic (ADL) and instrumental activities of daily living (IADL)] and plasma oxidative stress markers (α-tocopherol, β-carotene and malondialdehyde) were assessed in 2008 and 2010.
Results: ADL, IADL, body weight, skinfold thickness and circumferences of calf and arm decreased and waist and waist-hip ratio increased from 2008 to 2010. α-Tocopherol decreased and malondialdehyde plasma levels increased during the study period. In multiple logistic regression analyses, increased age (OR = 1.12; IC: 1.02–1.23; p = 0.02), female gender (OR = 8.43; IC: 1.23–57.58; p = 0.03), hypertension (OR = 0.22; IC: 0.06–0.79; p = 0.02), arthritis/arthrosis (OR = 0.09; IC: 0.009–0.87; p = 0.04) and depression (OR = 0.20; IC: 0.04–1.03; p = 0.05) were independent risk factors for functional decline.
Conclusion: Fat reduction, muscle loss, central obesity increase, functional decline and worsening of plasma oxidative stress were observed during 2-year follow-up. Some of the risk factors that were identified could be modified to help prevent functional decline in elderly. The factors deserving attention include hypertension, arthritis/arthrosis and depression.

1. Introduction

The Brazilian aging population has increased rapidly and is expected to reach the rank of the sixth country most elderly populous by 2025 (WHO, 2005). Aging process is characterized by reducing both lean mass (muscle, bone and water) as the fat mass (Marucci, Alves & Gomes, 2011). The process is also accompanied by occurrence of chronic diseases and progressive limitations in functional performance (Alves et al., 2007; Ramirez-Tortosa et al., 2004). Due to the dramatic increase in number of elderly, the prevalence of dependence is expected to increases as well. The prevention or even delay of the independence loss has significant implications in cost to the state and in the quality of old individuals's lives (Guralnik, Alecxih, Branch, & Wiener, 2002). Therefore, it is important to identified modifiable risk factors to avoid functional decline.

Disability is defined as 'any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered for a human being' (WHO, 1980). Functional disability is often measured by self-reports from people who either need help or have difficulty with basic activities (ADL)

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(Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963) and instrumental activities of daily living (IADL) (Freedman, Martin & Schoeni, 2002; Lawton & Brody, 1969). These validated scales allow exploring a wide range of physical, biological and psychological functions and reflect the level of dependence (Gallucci et al., 2011).

Functional incapacity has been associated with various factors, such as specific chronic diseases (Balzi et al., 2010; Nascimento et al., 2012), sociodemographic characteristics (Nascimento et al., 2012), changes in body composition (Larrieu et al., 2004; Moreira & Boas, 2011; Nam, Kuo, Markides, & Al Snih, 2012) and blood oxidative stress markers (Alipanah et al., 2009; Bartali et al., 2008; Cesari et al., 2006; Saito et al., 2012).

Smoking (Stuck et al., 1999), low education (Rodrigues, Facchini, Thume, & Maia, 2013), age (Balzi et al., 2010; den Ouden, Schuurmans, Mueller-Schotte et al., 2013; Rodrigues et al., 2009), female gender (den Ouden et al., 2013), depression symptoms (Lêng & Wang, 2013; Rodríguez López, Montero, Carmenate, & Avendano, 2013; Stuck et al., 1999), hypertension (Balzi et al., 2010; Rodríguez López et al., 2013) and arthritis (den Ouden et al., 2013) are factors that have also been linked to functional decline in follow-up studies. However, to the best of our knowledge, the present study is the first to investigate the relationship among anthropometric measurements, functional capacity scores, socioeconomic status, medical conditions and blood oxidative stress markers in community-dwelling elderly. Therefore, the aim of the present study was to examine the changes and relationships among anthropometric, functional capacity (ADL and IADL), plasma oxidative stress markers (β-carotene, α-tocopherol and malondialdehyde), medical conditions, sociodemographic characteristics of elderly from a Brazilian city in 2-year follow-up study.

2. Participants and methods

The study was conducted in Botucatu (130,201 inhabitants) (IBGE, 2012) located (22°53′09" south latitude, 48°26′42" west longitude) in the Sao Paulo state, Brazil. The study consisted in a reevaluation in 2010 (Moment 2010) of a community-living elderly group assessed in 2008 (Moment 2008) (Moreira, Corrente, Boas, & Ferreira, 2014). Two-year follow-up was chosen according to previous study with elderly people (Enoki et al., 2007; Ramos, Simoes, & Albert, 2001) whose results showed that functional decline, anthropometric changes and mortality were correlated in a 2-year period.

The 2008 sample (base sample) was obtained from a database of a previous study conducted in Botucatu (Joia, Ruiz & Donalisio, 2007). From the database sample of 365 elderly, 185 subjects were randomly selected to be part of the current study database. Fifty-nine subjects were excluded due to several reasons (refusal to participate in the study, 34; unanswered phone, 13; death, 3; use of vitamins, 3; absence of records on their medical conditions, 3; hospitalization, 2; absence, 1), and therefore, 126 remained in Moment 2008. In Moment 2010, 23 subjects were excluded (refusal to participate in the study, 12; unanswered phone, 7; death, 4) and therefore, 103 subjects were reassessed. Inclusion criteria were pre-defined as follow: residing in a community (city of Botucatu, SP, Brazil), ≥60 years old and agreeing to participate in the study. Data were collected from May to November 2008 (Moment 2008) and from August 2010 to February 2011 (Moment 2010). The initial contact occurred by telephone, followed by a household interview, anthropometric measurements and blood draw. Data collections were done by an only trained interviewer in both moments. All procedures were in accordance with the Helsinki Declaration for human rights, and the study was approved (#374/2009) by the Research Ethics Committee of the Botucatu Medical School at Sao Paulo State University (UNESP). All patients or their legal guardians signed a Free-Consent form.

2.1. Laboratorial analyses

Fasting fresh serum was collected for determination of albumin (g/dL), glucose (mg/dL), triglycerides (mg/dL), total cholesterol and its fractions (mg/dL). The analyses were performed on automated equipment by standard dry chemistry methodology (Vitros 950, Johnson & Johnson, Raritan, NJ, USA).

Fasting plasma was obtained and storage at −80 °C until analyses (maximum 6 months) of oxidative stress biomarkers. Alpha-tocopherol and β-carotene (Ferreira et al., 2000; Yeum et al., 1995) and malondialdehyde (MDA) (Karatas, Karatepe & Baysar, 2002; Nielsen, Mikkelsen, Nielsen, Andersen, & Grandjean, 1997) were determined according to previous studies by high performance liquid chromatography (Waters Alliance 2695, Waters, Wilmington, MA, USA). Every procedure was done protected from light. The α-tocopherol, β-carotene and MDA were analyzed in two moments (2008 and 2010). The samples from the two moments were compared using values as a percentage relative to the maximum value (μmol/L) obtained in each moment (Table 1). This procedure was adopted due to the fact that different HPLC systems were used in the two moments. The results from Moment 2008 are presented as real value (μmol/L) (Tables 3 and 4).

2.2. Anthropometric indicators and dietary intakes

Weight and height were measured and BMI was calculated as weight/height^2 (kg/m^2) and classified as low weight (≤23), ideal (23–28) and overweight (≥28) (OPAS, 2003). For bedridden, weight and height were estimated according to established formulas (Chumlea, Guo, Roche, & Steinbaugh, 1988; Chumlea & Guo, 1992). Triceps (TSF) and subscapular skinfold thickness (SSF), Waist (WC), hip (HC), arm (AC) and calf (CC) circumferences were measured according to previous reports (Lohman, Roche & Martorell, 1998). The waist-to-hip ratio (WHR) was calculated and the values were utilized to define elevated risk criteria for cardiovascular complication (1.00 for men and 0.85 for women), as suggested by the World Health Organization (WHO, 1997). The

Table 1
Anthropometric indicators, functional capacity and oxidative stress markers variation between 2008 and 2010.

Variables[a]	2008 Mean (±SD)	2010	*p*-value
Weight (kg)	71.05 (14.96)	70.59 (15.66)	0.04
Height (m)	1.61 (0.09)	1.61 (0.09)	0.77
BMI (kg/m^2)	27.21 (4.90)	27.10 (4.89)	0.30
CC (cm)	36.82 (3.38)	35.99 (3.41)	<0.0001
WC (cm)	93.85 (12.77)	95.82 (12.49)	0.0002
HC (cm)	104.85 (10.89)	104.79 (11.26)	0.77
WHR	0.90 (0.09)	0.92 (0.09)	<0.0001
AC (cm)	32.01 (4.01)	31.40 (4.19)	0.004
TSF (mm)	17.07 (7.17)	15.67 (6.37)	0.002
SSF (mm)	14.86 (3.96)	14.43 (3.89)	0.56
AMAc (cm^2)	48.65 (11.96)	47.55 (12.34)	0.11
ADL	5.73 (0.82)	5.52 (0.89)	0.0001
IADL	22.74 (2.68)	22.10 (3.46)	0.002
β-carotene (%)[b]	28.90 (19.96)	29.79 (22.36)	0.58
α-tocopherol (%)[b]	52.74 (18.82)	26.87 (16.80)	<0.0001
MDA (%)[b]	31.87 (18.05)	54.56 (19.70)	<0.0001

BMI: body mass index; CC: calf circunference; WC: waist circunference; HC: hip circumference; WHR: waist-to-hip ratio; AC: arm circunference; TSF: triceps skinfold thickness; SSF: subscapular skinfold thickness; AMAc: corrected arm muscle area; ADL: basic activities of daily living; IADL: instrumental activities of daily living; MDA: malondialdehyde

[a]Comparisons between 2008 and 2010 were analyzed by Paired t-Student test.

[b] Percentage relative to the maximum value obtained in 2008 and in 2010.