International Journal of Food Sciences and Nutrition,
December 2005; 56(8): 561–566

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Relation of smoking, physical activity and living residence to body fat and fat distribution in elderly men in Greece

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Abstract
It is well-documented that body fat and body fat distribution are related to increased risk for cardiovascular disease, hyperinsulinaemia, and diabetes mellitus. The purpose of this study was to investigate the impact of smoking status, physical activity and place of living on body fat and fat distribution of Greek elderly men. The participants were 144 elderly men of mean age 71.78 ± 6.39 years, who were free-living individuals, in Thessaloniki (104 subjects) and in the suburbs (40 subjects). According to our results, 23.9% of men who participated in the study were smokers. No association was found between skinfolds, skinfold ratio and physical activity or smoking. It is worth to mention that a triple percentage of younger elders (60–75 years) smoked, compared to the older ones. This finding could possible explain the absence in anthropometric differences between elderly smokers and non-smokers. Intervention programs aiming to yield information about changing the various modifiable risk factors in the elderly are needed.

Keywords: *Body composition, elderly, fat distribution, smoking*

Introduction

It is well-documented that body fat is related to increased risk for cardiovascular disease (Donahue et al. 1987), hyperinsulinaemia (Bonnadonna et al. 1990), and diabetes mellitus (Berchtold et al. 1981). Also body fat distribution is related to the risk for developing cardiovascular disease (Larsson et al. 1984; Gillium 1987) and diabetes (Ohlson et al. 1985; Gillium 1987). Smoking has a strong and consistent detrimental effect on mortality and function ability, and as a result non-smokers live not only longer but also a shorter time with morbidity and disability (Reed et al. 1998; Nusselder et al. 2000; Östbye et al. 2002). Furthermore, smoking and age were independently linked with ill health and all-cause mortality (Menotti et al. 2001; Östbye et al. 2002). According to Avlund et al. (1998), smoking status was not a predictor of mortality during the next 10 years for men and women aged 70 years.

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ISSN 0963-7486 print/ISSN 1465-3478 online
DOI: 10.1080/09637480500439266

Smoking is associated with smaller weight (Albanes et al. 1987) but with higher central fat distribution (Shimokata et al. 1989; Troisi et al. 1991) and quitting leads to weight gain (Gordon et al. 1975). Lower body weight of smokers might be attributed to the increased metabolic rate, caused by nicotine (Perkins et al. 1989). Sex steroid levels (testosterone and estradiol) were inversely related to smoking, implicating smoking as a risk potent for hormone-related disorders (Hsieh et al. 1998). There is a dispute in opinions referring to the hormone levels among smokers and non-smokers and their role in explaining the relationship between smoking and fat distribution (Troisi et al. 1991). However, quitters did not preferentially deposit fat in the upper body (Troisi et al. 1991; Lissner et al. 1992; Slattery et al. 1992).

Physical activity was negatively associated with central obesity (Troisi et al. 1991; Slattery et al. 1992). Total energy expenditure was positively related with fat-free mass and $VO_{2\max}$ in the elderly (Goran & Poehlman 1992). According to Westerterp & Meijer (2001), PAL values were not associated with body composition in the elderly. However, high level of physical activity, especially resistance training, might be beneficial in muscle function and impaired mobility in the elderly (Fielding 1995; Westerterp & Meijer 2001). Physically active older males and females seemed to be less endomorphic and to have better balance performance than less active subjects and, in turn were less inclined to falls which are related to morbidity and mortality in the elderly (Bulbulian et al. 2000). The institutionalized elderly men below 75 years had higher body fat than their free-living counterparts, possibly due to lower physical activity (Mazariegos et al. 1996). It is worth mentioning that institutionalized elders had poorer nutrition intake both in quality and in quantity compared to free-living and homebound ones. Triceps skinfold thickness did not differ significantly among the institutionalized and the other two groups, although the free-living Greek elders had higher physical activity level, due to their different dietary intakes (Papanikolaou et al. 1999). Nevertheless, smoking was not correlated with a decline in physical function (Seeman et al. 1995) and smoking did not seem to affect PAL levels in the elderly (Papadopoulou et al. 2003). Lower education was related with lower physical ability (Seeman et al. 1995) and with lower physical activity levels (Papadopoulou et al. 2003). Little data is available on body composition of the elderly, especially for the Greek population. This study investigated the impact of smoking status, physical activity and place of living on body fat and fat distribution of Greek elderly men.

Materials and methods

Subjects

The participants were 144 elderly men of mean age 71.78 ± 6.39 years, who were free-living individuals, members of Rehabilitation Centers for the Elderly in Thessaloniki (104 subjects), and in the suburbs (40 subjects). The selection of the sample was made with random sampling. The participants were subjected to anthropometric measurements and they completed a specific questionnaire regarding their physical activity and their smoking status (Papadopoulou et al. 2003).

Anthropometric measurements

Body weight and stature were measured without shoes and in light clothing, with the use of a standing calibrated scale (to the nearest 0.2 kg), with height attachment

(to the nearest 0.5 cm). Skinfolds were measured, on the right side of the body, using a calibrated Lafayette caliper. Waist and hip circumferences were measured at the minimum abdominal and at the maximum buttocks circumference, to the nearest 0.5 cm, respectively. Skinfolds and circumferences were measured in duplicate and the average measurement was used in data analyses.

The waist circumference/hip circumference ratio was used to measure fat distribution and estimate upper-body obesity. The ratio of subscapular to triceps skinfold was used as a measure of body fat distribution (Garn et al. 1982; Duncan et al. 1995).

Statistical analysis

The SPSS (SPSS Inc. Rel. 10.0) computer program was used for the statistical analysis. The methodology tools used was Analysis of Variance (ANOVA) in order to evaluate the differences according to age and to smoking status, physical activity and residence on the weight, BMI, body fat, Waist to hip ratio (WHR) and the subscapular to triceps skinfold ratio, and their intercorrelation. Chi-square (χ^2) test, was also used as to assess the differences between subgroups. Statistical significance was set at $P < 0.05$.

Table I. Characteristics of the participants.

N	144
Age (years)	71.78±6.39
Weight (Kg)	78.39±12.62
Height (m)	1.67±0.06
BMI (Kg/m^2)	27.94±3.88
Overweight (%)	51.0
Obese (%)	30.1
Body fat (%)	29.41±4.91
Smokers (%)	23.9%
Triceps skinfold (mm)	14.23±5.53
Subscapular skinfold (mm)	20.43±6.66
Triceps to subscapular ratio	1.55±0.55
Waist circumferance (cm)	102.45±11.91
Hips circumferance (cm)	103.1±7.82
Waist to hip ratio	0.99±0.07

Table II. Anthropometric characteristics according to age and smoking status.

	Age (years)		Smoking	
	60–75	Above 75	Yes	No
Age (years)	68.40±3.43⋆[a]	78.77±5.33⋆[a]	69.50±6.03⋆[b]	72.51±6.38⋆[b]
Weight (Kg)	78.89±12.20	76.31±13.42	77.56±14.46	78.72±12.09
Height (m)	1.68±0.07	1.66±0.007	1.69±0.07	1.67±0.07
BMI (Kg/m^2)	28.11±3.98	27.49±3.85	26.98±4.29	28.27±3.72
Body fat (%)	29.21±5.05	29.43±4.85	28.42±5.25	29.84±4.63
Triceps skinfold (mm)	14.08±5.62	14.11±5.53	13.48±5.5	14.52±5.49
Subscapular skinfold (mm)	20.23±6.95	20.51±6.27	19.08±6.78	20.97±6.49
Triceps to subscapular ratio	1.55±0.54	1.58±0.62	1.48±0.37	1.57±0.60
Waist circumferance (cm)	102.5±12.0	102.5±12.2	101.4±13.6	102.9±11.4
Hips circumferance (cm)	102.6±7.1	103.6±9.2	101.9±8.1	103.5±7.7
Waist to hip ratio	1.00±0.07	0.99±0.08	0.99±0.09	0.99±0.08

⋆,[a,b]Significant difference between groups, $P < 0.05$.

Results

The characteristics of our subjects are set forth in Table I. Elderly smokers were significantly younger than non-smokers. There was no significant difference found in anthropometric characteristics, according to age and smoking status, as shown in Table II. Thirty percent of the elders between 60 and 75 years smoked, while the corresponding percentage for the elders above 75 years was 11.4%, $P < 0.05$. There was no significant relation between physical activity, smoking status, residence and age.

Discussion

A significant part of our northern Greek elderly men was found to smoke (23.9%). According to studies that were conducted in Athens, 28.7% (Papanikolaou et al. 1999) and 36.5% (Hsieh et al. 1998) of the older men were smokers. In Denmark, 53% of the 70 years old men were smokers while the respective percentage in women was 37% (Avlund et al. 1998). The respective percentages were lower in USA. In four areas in USA, only 7.9% of the elderly women were current smokers (Cappuccio et al. 1999). According to a longitudinal study, 10% of the elderly Americans were current smokers and 42% were former smokers (Östbye et al. 2002).

Our sample had lower BMI and body fat values compared to the older Americans, while our subjects showed higher body fat values than the Chinese elders (Slattery et al. 1992; Woo et al. 1997). According to our results, no association was found between skinfolds, skinfold ratio and physical activity or smoking. This finding is in agreement with the study of Slattery et al. (1992). In our study, WHR was also not related to smoking, while in other studies smoking was directly associated with WHR (Haffner et al. 1986; Shimokata et al. 1989; Slattery et al. 1992) and abdomen to hip ratio (Troisi et al. 1991).

A triple percentage of younger elderly men (60–75 years) smoked compared to the older ones. This finding could possible explain the absence in anthropometric differences between elderly smokers and non-smokers. During the aging process, significant changes in body composition occur, like a decrease in lean mass and an increase in fat mass (Vaughan et al. 1991; Aloia et al. 1996; Woo et al. 1997; Nguyen et al. 1998; Gillette-Guyonnet et al. 2003). Gillette-Guyonnet et al. (2003) marked a decrease in BMI values and an increase in WHR values probably due to a decrease in hip circumference (Gillette-Guyonnet et al. 2003), while another study referred that elderly subjects had lower weight and height compared to young adults (Vaughan et al. 1991). The prevalence of sarcopenia increases with age and leads to decrease in muscle mass and impaired physical capacity and performance and it is correlated with increased risk of morbidity and mortality (Baumgartner et al. 1998; Gillette-Guyonnet et al. 2003). From this point of view, smoking is a co-factor with sarcopenia. As a result the advantage of smaller body size in young smokers turn out to be a risk factor for incapability, morbidity and mortality in the elderly men. Muscle mass was higher while fat mass was lower in younger elderly men (below 75 years) compared to older elders (above 75 years) in institutionalized and free-living population as well (Mazariegos et al. 1996). Fat-free mass reduction is associated with aging and morbidity and mortality, as well (Waaler 1987). Tobacco is a main contributant to men's higher mortality, as smoking is attributant to half of the gender differences in mortality (Waldron 1986).

Intervention programs aiming to ameliorate adverse changes in body composition of the elderly should be developed and applied (Gillette-Guyonnet et al. 2003). Public health officials should encourage healthy life styles for controlling central adiposity (Duncan et al. 1995). The effect of smoking and physical activity on body composition and fat distribution is of critical importance because these environmental–behavioral factors can be altered (Troisi et al. 1991). Further intervention programs are needed to yield information about changing the various modifiable risk factors in the elderly individuals. Smoking cessation and increase in physical activity should be emphasized in order to achieve 'successful aging'.

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