Papers on Anthropology XXI, 2012, pp. 137–146

COMPARATIVE ANALYSIS OF THE CENTRAL BODY FAT DISTRIBUTION OF WOMEN IN THE URBAN POPULATION IN LATVIA

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ABSTRACT

The aims of this study were to determine and compare the differences between the regional adiposity and some indexes of central body fat distribution of women according to age group categories in the urban population in Latvia. For this purpose 373 women were anthropometrically examined during the period 2001–2005. The body height, body weight, three circumferences (chest, waist, hip) and four skinfolds (biceps, triceps, subscapular, suprailiac) were measured. The four indexes were calculated and studied: the subscapular/triceps (STSR) skinfold ratio and the centripetal fat (CPFR) ratio, the waist-hip ratio (WHR) and the body mass index (BMI). In general, the age values showed an increasing of the central body fat distribution for women in the urban population. The associations of age with all the central body fat distribution indexes were significant. This study provided evidence that there is a significant positive trend of increased central body fat distribution with the increasing age of the women in the urban population in Latvia. Future studies should also investigate whether the same phenomenon exists for women in rural population in Latvia.

Key words: *anthropometric measurements, urban population, age, fat distribution*

INTRODUCTION

Changes in the body weight, the body composition, fat distribution, the relationships between anthropometric and laboratory characteristics have been studied very intensively [14]. The distribution of body fat are the complex traits, which are determined by a combination of genetic and environmental factors. A number of factors have been linked to the changes in the body weight, including age, gender and the socioeconomic status. Today it is estimated that some changes are more prevalent among the urban populations in comparison tō the rural ones [9, 16].

The increase of the body fat content seems to be the most important steps to aging, and it is associated with the transition from the rural to the urban lifestyle. The urban lifestyle has been linked with intensive changes leading to the increased consumption of the high energy dense foods and decrease in physical activity. The trends of fat accumulation in the central region of the body with age could have serious health problems [6, 18].

The aims of the present study were: to determine and compare the differences between the regional adiposity and some indexes of the central body fat distribution of women according to the age group categories in the urban population in Latvia.

MATERIAL AND METHODS

This population study was conducted during the period 2001–2005. The sample of subjects consisted of 373 women aged 18–35 years. All the women were born in urban areas (seven largest cities) in Latvia. Each woman participated voluntarily and the data were used anonymously. In this study women were examined anthropometrically. All the anthropometric measurements were made by trained investigators according to the methodical recommendations by R. Martin and K. Saller [12], using the Swiss company's "Siber-Hegner and Co" anthropometric instruments. The body height, body weight, three circumferences (chest, waist, hip) and four skinfolds were measured. The body height and the body weight were measured to the nearest 0.1 cm and 0.5 kg, respectively, using Martin's anthropometer and the standard weight scale, respectively. The circumferences were measured to the nearest 0.1 cm using a tape measure. Four skinfolds namely, biceps (BSF), triceps (TSF), subscapular (SSF) and suprailiac (SISF) were measured to the nearest 0.2 mm using a skinfold calliper.

Paralelly four indexes were derived to study the central body fat distribution. The indexes were computed using the following formulas [2]:

Waist-hip ratio (WHR) = Waist circumference in cm / hip circumference in cm;

Subscapular-triceps skinfold ratio (STSR) = Subscapular skinfold in mm / triceps skinfold in mm; Centripetal fat ratio (CPFR) = Subscapular skinfold / (subscapular + triceps skinfold) x 100.

The body mass index (BMI) was computed using the following standard equation: BMI (kg/m^2) = weight (kg) / height (m^2) [21]. The women were classified as underweight (≤18.49), normal weight (18.5–24.99), overweight (25.0–29.99) and obese (≥30.0) according to the classification system recomended by the World Health Organization [22].

All the individuals have been categorized into three age group categories, i.e., Groups I, II and III. The individuals belonging to Group I, Group II and Group III were in the age categories of 18–20 years, 21–25 years and 26–35 years, respectively.

Data were entered on spreadsheets and performed using the SPSS for Windows, version 17.0. The distributions of the anthropometric variables and indexes were described by their minimum, maximum, means and standard deviations. To test any significant differences between age group categories, the analyses of variance were undertaken. Regression analyses were used to test significant associations between age and all the three central fat distribution indexes.

RESULTS

The means and standard deviations of age, anthropometric and indexes variables of all the women of the urban population are shown in Table 1. The mean age of women was 23.8 ± 1.5 years. The characteristics of the values (minimum and maximum) of the urban population by age group categories are presented in Table 2. The differences between the values for all the variables indicated great ranges for the measurements and indexes.

Table 1. Characteristics of the sample (n = 373)

Variables		**m**	**SD**
age, years		23.8	1.5
body height (cm)		165.6	6.4
body weight (kg)		59.9	9.7
BMI (kg/m^2)		21.8	3.1
circum-ferences (cm)	chest	83.4	18.7
	waist	68.2	7.2
	hip	93.4	7.6
skinfolds (mm)	biceps	6.9	2.5
	triceps	12.2	3.6
	subscapular	12.8	4.2
	suprailiac	13.5	4.7
central body fat distribution indexes	STSR	1.09	0.35
	CPFR	50.90	7.50
	WHR	0.73	0.05

n – number of women; m – mean; SD – standard deviation; STSR – subscapular/triceps skinfold ratio; CPFR – centripetal fat ratio; WHR – waist-hip ratio

Table 2. Minimum and maximum values for anthropometric variables of women according to age group categories in the urban population

		Group 1 (18–20) (n = 220)		Group 2 (21–25) (n = 111)		Group 3 (26–35) (n = 42)	
		min	max	min	max	min	max
body height (cm)		150.9	182.3	151.9	180.6	150.0	179.3
body weight (kg)		41.0	120.1	40.3	79.2	48.0	98.5
BMI (kg/m^2)		16.6	44.4	15.6	31.4	18.3	34.7
circum-ferences (cm)	chest	57.0	117.2	73.8	98.0	60.0	100.8
	waist	53.5	101.0	52.5	87.0	58.2	90.0
	hip	79.8	133.2	57.0	108.0	80.5	126.4
skinfolds (mm)	biceps	2.8	14.2	2.0	14.2	2.6	14.6
	triceps	4.2	25.6	5.2	22.0	6.0	26.0
	subs-capular	7.0	32.0	6.6	27.2	6.8	30.8
	suprailiac	6.0	36.0	5.8	30.0	6.6	27.8
central body fat distribution indexes	STSR	0.50	2.53	0.52	2.37	0.61	1.98
	CPFR	33.33	71.65	34.00	70.29	37.72	66.45
	WHR	0.63	0.84	0.64	1.14	0.63	0.89

n – number of women; min – minimum; max – maximum; STSR – subscapular/triceps skinfold ratio; CPFR – centripetal fat ratio; WHR – waist-hip ratio

The means, standard deviations and the results of the analysis of the variance of the anthropometric variables and indexes are given in Table 3. It is evident from this table that for all the three central body fat distribution indexes (STSR, CPFR, WHR) existed a significant increasing trend from Group I to Group III. As can be seen from the table, between the age group categories significant differences were observed in the mean values for: body height ($p<0.001$), body weight ($p<0.001$), all the three circumferences ($p<0.001$). Significant differences between age groups were found for all the four skinfolds ($p<0.001$) and for all the three indexes: STSR ($p<0.001$), CPFR ($p<0.001$) and WHR ($p<0.001$).

Table 3. Oneway analysis of variance of anthropometric characteristics of women by age group categories in the urban population

		Group 1 (18–20) (n = 220)		Group 2 (21–25) (n = 111)		Group 3 (26–35) (n = 42)		F value
		m	SD	m	SD	m	SD	
body height (cm)		166.6	6.6	165.5	6.0	164.6	6.6	8.557**
body weight (kg)		60.2	9.4	57.6	7.9	62.0	11.7	27.375**
BMI (kg/m^2)		21.6	3.0	21.0	2.6	22.8	3.7	51.241**
circum-ferences (cm)	chest	83.1	5.9	82.4	5.0	84.8	7.8	38.099**
	waist	67.0	6.6	66.2	6.5	71.4	8.6	62.201**
	hip	93.4	6.6	92.1	6.8	94.8	9.5	30.348**
skinfolds (mm)	biceps	6.8	2.3	6.7	2.2	7.1	2.9	9.986**
	triceps	12.5	3.8	11.5	3.0	12.7	3.9	10.308**
	subscapular	12.5	3.9	11.9	3.7	14.0	4.9	32.787**
	suprailiac	13.6	4.6	12.7	4.5	14.2	5.0	25.328**
central body fat distribution indexes	STSR	1.06	0.36	1.07	0.34	1.14	0.35	6.380**
	CPFR	50.07	7.87	50.55	7.39	52.07	7.25	6.207**
	WHR	0.72	0.04	0.72	0.06	0.75	0.06	36.389**

** $p<0.001$
m – mean; SD – standard deviation; STSR – subscapular/triceps skinfold ratio; CPFR – centripetal fat ratio; WHR – waist-hip ratio

The regression analyses of age with STSR, CPFR and WHR showed that age had significant associations with all the three indixes of the central body fat distribution (STSR, $p<0.001$; CPFR, $p<0.001$; WHR, $p<0.001$) (Table 4).

In this study population the mean BMI was 21.8 ± 3.1 kg/m^2. Women in Groups 1 and 2 had a lower BMI than the individuals in Group 3 (Table 3).

78.3% (n = 292) of the subjects were found to be of normal body weight and 9.7% (n = 36) of women were overweight, but the prevalence of underweight for all the women was 10.2% (n = 38), and the prevalence of obesity was only 1.8% (n = 7) (results not presented). Overall percentages of underweight, normal weight, overweight and obesity according to age groups categories are shown in Table 5.

Table 4. Regression analysis of age and central body fat distribution indexes of women in the urban population

Dependent variable	B	SEB	Beta	t	R^2
STSR	0.058	0.012	0.214	4.721**	0.046
CPFR	1.215	0.264	0.209	4.611**	0.044
WHR	0.020	0.002	0.473	11.577**	0.224

** p<0.001
STSR – subscapular/triceps skinfold ratio; CPFR – centripetal fat ratio; WHR – waist-hip ratio

Table 5. Prevalence of underweight, normal weight, overweight and obesity of women according to age group categories in the urban population

	Group 1 (18–20) (n = 220)		Group 2 (21–25) (n = 111)		Group 3 (26–35) (n = 42)	
	n	%	n	%	n	%
underweight (≤18.49)	19	8.7	16	14.5	3	7.1
normal weight (18.5–24.99)	177	80.8	85	77.3	30	71.4
overweight (25.0–29.99)	21	9.6	8	7.3	7	16.7
obesity (≥30.0)	3	0.9	2	0.9	2	4.8

n – number of women

Next, there were significant age group differences in the BMI and weight (results not presented).

Table 6 shows correlation coefficients of STSR, CPFR and WHR with the BMI and age. WHR showed the strongest significant (p<0.01) correlation with the BMI and age. CPFR and STSR were also found to be significantly correlated with the BMI (r = 0.343; p<0.01 and r = 0.342; p<0.01) and age (r = 0.227; p<0.01 and r = 0.230; p<0.01).

Table 6. Correlation coefficients of central body fat distribution indexes with the BMI and age

Variables	BMI	age
STSR	0.342*	0.230*
CPFR	0.343*	0.227*
WHR	0.505*	0.502*

* $p<0.01$
STSR – subscapular/triceps skinfold ratio; CPFR – centripetal fat ratio; WHR – waist-hip ratio

DISCUSSION

The use of anthropometric measures is one of the most common ways of assessing body composition. Of the methods used to measure body fat and its distributions, anthropometric measurements play an important role in clinical practice [11]. Many aspects of the theory and practice of human life need the anthropometric characteristics of the human body. This necessity determines the interest of the scientists of the 20th century and nowadays in the form and variations. During aging changes occur in the body proportion and structure. A numeric difference in many of the parameters can be found between the sub-samples, as well as great intragroup differences, which determine the variability of the groups in terms of the evaluated characteristics [3].

Several factors, such as changes in lifestyle, feeding and stress increase, associated to the technological, economic and social advance over the last periods, led to an increase in body weight worldwide, representing public health problems [13]. Recent studies show the trend of obesity and abdominal obesity to be increasing, in both developed and developing countries [10].

The nature of excess body weight may be changing to one of greater central adiposity. Explanations for the upward trend in abdominal obesity in comparison with fewer changes in obesity may be related to the changes in health over time. Cardiovascular diseases and other diseases of civilisation have increased dramatically due to the changes in the lifestyle, and several studies have shown lifestyle factors to be associated with the body fat distribution [4, 15].

The present study investigated age-related trends of the central body fat distribution of 373 women aged 18–35 years in the urban population in Latvia. By analyzing the data for the anthropometric characteristics and indexes of the women, we can conclude that the great ranges of the differences between the minimum and maximum values for all the variables can be the result of the influence of outside factors, but also of great intra-group differences.

Significant differences were found in the mean values for all the anthropometric variables between the age group categories. In our sample fat distribution was determined thoroughly by four skinfolds, and the differences between the results increased with age.

Anthropometric indexes, such as the body mass index (BMI) and the waist-hip ratio (WHR), remain the most commonly used tools for assessing the body composition because of their simplicity and low cost. The body mass index (BMI) is a measure of overall adiposity, whereas, waist circumference (WC) and waist-hip ratio (WHR) are reliable proxy measures of abdominal fat [1, 2, 7]. In Latvia this was the first study of women in the urban population, to describe central body fat distribution including two new indexes, namely the subscapular/triceps skinfold ratio (STSR) and the centripetal fat ratio (CPFR). In general, the analysis of our data further demonstrated that age had significant positive association with all the three determined indexes of the central body fat distribution (STSR, CPFR and WHR). The correlation between the BMI and body weight was strong for women of all age groups. We found that WHR had a better correlation with the BMI as well as with age.

The changes related to gains in visceral or subcutaneous fat associated with aging may be affected by both the initial amount of fat and by the increases in body weight [8, 17]. These transformations occur differently in men and women, and genetic characteristics are the predisposition factors for fat centralization. Some authors in an analysis of fat distribution in women from different age groups by computerized tomography, showed that aging leads to the redistribution and internalization of abdominal fat [19].

There is a significant positive trend of increased central adiposity and fat distribution with increasing age in women in the urban population in Latvia. Our results support earlier studies showing that considerable differences are observed in the total and the regional body composition with age in women [5, 20].

The correct understanding of the trends of fat accumulation in the central regions of the body of women can limit serious health problems in different age groups in Latvia. In conclusion we propose that further studies are therefore needed to explain whether similar age-related trends of increasing the central body fat distribution are observed among women who were born in the rural areas in Latvia.

ACKNOWLEDGEMENTS

This study was undertaken as a part of investigation "Appreciation of biological status of women in Latvia". It was funded by the European Union Structural Funds for Scientific Research. In addition, acknowledgements are given to the following institutions: Riga Stradiņš University, the Institute of Anatomy and Anthropology, the Department of Anthropology and Physics Department. The authors wish to thank medical nurses of the anthropology unit for helping during anthropometric measurements of women.

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