EFFECTS OF COGNITIVE BEHAVIORAL PSYCHOTHERAPY ON BODY COMPOSITION AND CONSTITUTION

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Obesity is a chronic disease of modern times that is not just a cosmetic problem but a bio-social-psychological problem especially, which means that obese individuals have, apart from their medical problems, also social and psychological problems. They often suffer from depression, low self esteem and difficulties in the job market field. The aim of the study was to examine the effect of physical activity and the modification of nutrition patterns on the somatic parameters in STOB courses (the courses for weight loss and obesity reduction) in women at the age of 20–60 years (n = 114).

The standardised anthropometrical methods were used to determine the basic somatic indexes – body weight and height, risk indexes and central obesity indexes, body composition according to Pařízková, and Matiegka and bioelectric impedance methods (QuadScan 4000; Tanita BC 418-MA). Women were divided into the groups according to age decennary. Women were measured at the beginning and at the end of the course, which lasted 12 weeks. STOB courses are led by professionals who are involved not only in physical activity but also in modification of nutrition and food intake patterns. In the groups as a whole, the BMI reached the average values of 31.34 in the initial examination, although the maximal value exceeded the limit of morbid obesity, which is 47.56. On the basis of the BMI categorisation by WHO, only 7.5% of women were in the "standard" category and 57% were obese, of which 5% were morbidly obese. According to the evaluation of subcutaneous adipose tissue using Matiegka methodology, 57.5% had more than 30% fat content, of which 28.75% was in the category of over 40% fat. The values of the centrality index, which are the ratio of the individual skin folds on the trunk and on the extremities and it shows the distribution of fat, reached values from 1.3 to 1.5. These values demonstrate the disproportional distribution of fat, with a dominancy of subcutaneous fat on the trunk. The centrality indexes correlate with WHR values and confirmed the distribution of fat was confirmed, particularly on the trunk part in comparison to the lower extremities – thus we are looking at the abdominal type of obesity. When the course had been completed, all methods used confirmed significant changes – lowering of body weight, BMI and the amount of adipose tissue in all age groups. The evaluation of the average values of circumferential dimensions showed a reduction in waist and hip circumference, in abdominal and gluteal circumferences, and eventually in the lower extremities' circumferences. A significant lowering of the endomorphic component was found in all age categories.

Movement and exercise therapy in combination with changes of dietary regimes within the framework of STOB body weight reduction courses has a nearly 15 year tradition in the Czech Republic and has had significant effects on its clients' somatic condition.

Keywords: Clients of STOB courses, body composition, typology, BMI, overweight, obesity of different grades.

INTRODUCTION

Obesity can be regarded as a chronic disease that is, apart from excesssive body weight and other somatic parameters, accompanied by a range of biochemical, physiological and orthopedic markers (Pikhart et al., 2001; Sammel et al., 2003). According to WHO (BMI, 2004), there is currently more than 1 billion people overweight in the world and more than 300 million are clinically obese. The increasing incidence of excessive weight or obesity among adolescents and children is particularly alarming. In the Czech Republic, every second person is overweight, which is more than 5 million people. The Czechs are one of the most overweight nations in Europe (http://www.merrylinka.cz/nadvaha-a--obezita/obezita-novodoba-epidemie-stoleti.aspx).

Since mid 70s the prevalence of being overweight or obese has been increasing worldwide. In 20 to 74 year old adults, the obesity prevalence grew from 15% in 70s to 32.9% in 2003/2004. The increasing tendency of prevalence has also been observed in children and teenagers: in 2–5 year old from 5.0% to 13.9% and in 6–11 year old children from 6.5% to18.8% and in 12–19 year old from 5.0% to 17.4%.

Obesity is a chronic disease of modern times that is not just a cosmetic problem but also a bio-social-psychological problem especially, which means that obese individuals have, apart from their medical problems, also social and psychological problems. They often suffer from depression, low self esteem and difficulties in the job market field.

Obesity is very often associated with type 2 diabetes mellitus and metabolic syndrome, which is accompanied by insulin resistance, changes in the lipoprotein pattern and elevated blood pressure. Almost all Americans suffering from metabolic syndrome have increased WHR (Stamler, Wentworth, & Neaton, 1986; Folsom, Kushi, & Anderson, 2000).

Obese individuals very often have the following health problems: infertility, pulmonary diseases, hypoventilation, sleep apnea, negative changes in the musculoskeletal system (arthrosis, arthritis, lower joint mobility, changes in the mobility stereotypes, changes in bone architecture), orthopedic disorders, cardiovascular diseases (risk of infarction, ischemic heart disease), blood coagulation disorders, increased risk of cancer, liver problems, and so on (Alexander, Landsman, Teutech, & Haffner, 2003; Ballor & Poehlman, 1994; Craft et al., 1995; Isomaa et al., 2001; Lakka et al., 2002).

Brochu et al. (2001) observed 43 obese post menopausal women with sedentary jobs as to their physiological, physical and metabolic parameters. The women were divided into two groups: 1. metabolically normal (n = 17), 2. metabolically abnormal with insulin resistance (n = 26). These two groups differed in fat free mass, visceral fat, and glucose disposal parameters.

The risk of dementia in people with a BMI above 30 is 35% higher than that in individuals of normal weight. This risk increases by up to 75% in obese individuals (Whitmer, Gunderson, Barrett-Connor, Quesenberry, & Yaffe, 2005).

Regular physical activity is an important component of weight reduction programs as it is related to the long term maintenance of reduced body weight. In addition, it has beneficial effects in particular on cardiovascular diseases and diabetes. It prevents the reduction of basal metabolism and fat free mass (Ballor & Poehlman, 1994; Garrow & Summerbell, 1995; Donnelly, Hill, & Jacobsen, 2003; Donnelly, Kirk, Jacobsen, Hill, & Sullivan, 2003; Wadden et al., 1997).

Studies involving body weight reduction by means of movement and exercise programs plus dietary measures were more successful than dietary measures alone. However, significant differences in body weight loss by means of one or the other therapeutic approach have not always been demonstrated (Bertram, Venter, & Stewart, 1990; Jeffery, Wing, Sherwood, & Tate, 2003; Wing, 1999).

AIM

To determine changes in body composition and constitutional changes in clients of STOB courses based on cognitive behavioral psychotherapy.

METHODS

The standardised anthropometrical methods were used to determine the basic somatic indexes – risk indexes of central obesity and body composition as determined by anthropometrical methods according to Pařízková and Matiegka (in Riegerová et al., 2006) and the fractionalisation of body weight by means of the bioelectric impedance method (BIA – Tanita BC 418-MA, segmental analysis; QuadScan 4000, kg and % fat, kg and % fat free mass, total body water, extracellular body water and intracellular body water – l, %). Women were measured at the beginning and at the end of an STOB course of therapy that lasted 12 weeks and was led by professional trainers.

The STOB courses' target is not only physical activity but also it has a theoretical part, because the reduction of body weight involves the modification of food intake stereotypes and lifestyle (cognitively-behavioural psychotherapy).

A cognitive behavioral unit includes guidance in the area of nutrition, psychological consultancy and movement activity. Women learn how to prepare an eating plan in accordance with healthy dietary principles. They check their energy intake and output and learn to eat food regularly and determine the energy of the individual components of the food. They were advised to reduce their energy intake to 4500 kJ/day. The exercise program is arranged as a 60 minute unit comprising an initial phase (warm up), stretching, aerobic strengthening (40–45 minutes), and a compensatory (relaxation) phase (15 minutes).

We measured 136 women from Olomouc and environs in the Czech Republic from 20 to 60 years old in the initial examination. The final measurements were participated in by 114 women; 16.2% (n = 22) of the women did not complete the course.

The measurements were performed between the 6th of February 2006 and the 10th of June, 2008 in 11 courses led by 4 different trainers. The average age of the women was 41.4 years old.

The age and frequency of clients in the separate age groups: from 20 to 30 years of age (20 years old, n = 19), from 30 to 40 years of age (30 years old, n = 28), from 40 to 50 years of age (40 years old, n = 35), and from 50 to 60 years of age (50 years old, n = 32).

ANTROPO and STATISTICA 6.0 programs was used for statistical processing.

RESULTS AND DISCUSSION

The youngest women seem to be the tallest among the age categories, averaging 169.6 cm in height. Other age categories are at least 5.4 cm shorter. The mean body weight during baseline measurements exceeded 80 kg in all age categories. After completion of the therapy, the mean body weight fell to below 80 kg in the 20 and 40 year olds. Maximum values in all age categories reached more than 100 kg. The highest body weight reduction was observed in the oldest age category. Differences between the baseline and final values of the body weight range from 3.3 to 5.1 kg (ascending with age) (TABLE 1).

The comparison of selected somatic parameters with Czech population parameters is shown on Fig. 1.

Circumference parameters on the trunk decreased in all age categories, however a significant decrease in all trunk circumference parameters (abdominal circumference, abdomen; gluteal circumference, glut; waist, chest mesosternal circumference, OTHM and chest xiphos-

ternal circumference, OTHX) was reached only in the oldest age category.

A significant reduction was observed in the gluteal and gluteal thigh circumference in 20 years old, abdominal and gluteal thigh circumference in 30 years old, and abdominal circumference and body waist in 40 years old (Fig. 2).

Mean BMI values at baseline exceeded 30 units which means a classification as grade I obesity (WHO, 2004). The only exception was the youngest category of women who were "only" overweight. Cognitive behavioral therapy resulted in the reduction of mean BMI values in all age categories (differences between MI and MII with increasing age were as follows: 1.16, 1.46, 1.61 and 1.85). The overweight category was the most frequently determined category during the first measurement among 20 and 30 years old women. More than 50% of the women had grade I obesity among the 40 and 50 year old women. After the completion of the therapy, a significant and positive shift into the overweight category was observed in all age categories (Fig. 3, TABLE 2).

TABLE 1
Average values of body weight and height

AGE	Weight MI (kg)				Weight MII (kg)				Height (cm)			
	M	**Min.**	**Max.**	**SD**	**M**	**Min.**	**Max.**	**SD**	**M**	**Min.**	**Max.**	**SD**
20 years (n = 19)	82.2	69.0	109.3	12.2	78.9	65.0	105.0	11.9	169.6	157.0	185.5	6.6
30 years (n = 28)	85.4	62.0	147.0	18.3	81.5	57.5	135.6	17.7	164.2	152.6	177.4	6.5
40 years (n = 35)	84.1	59.0	106.0	11.5	79.6	57.1	100.3	10.9	163.1	153.0	175.2	5.4
50 years (n = 32)	87.0	68.7	106.4	10.6	81.9	63.8	99.5	9.9	163.6	153.0	173.8	5.2

Legend: MI – 1st measurement, MII – 2nd measurement.

Fig. 1
Standardized indexes (z-score) of selected somatic parameters in comparison to the Czech population (Bláha et al., 1986)
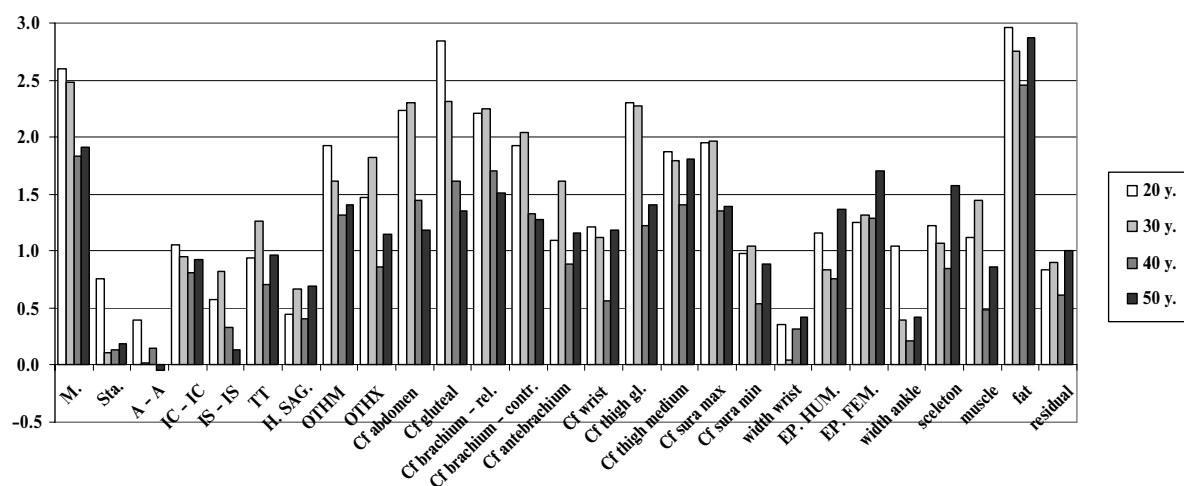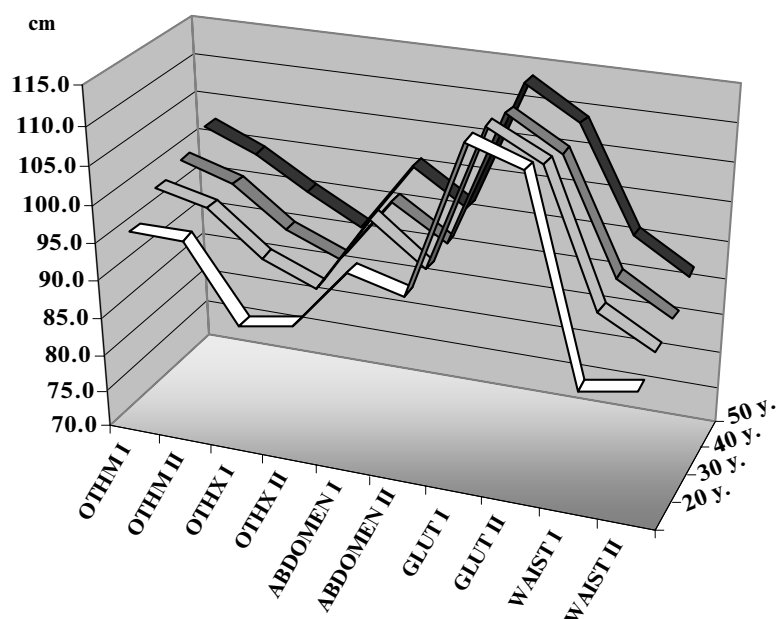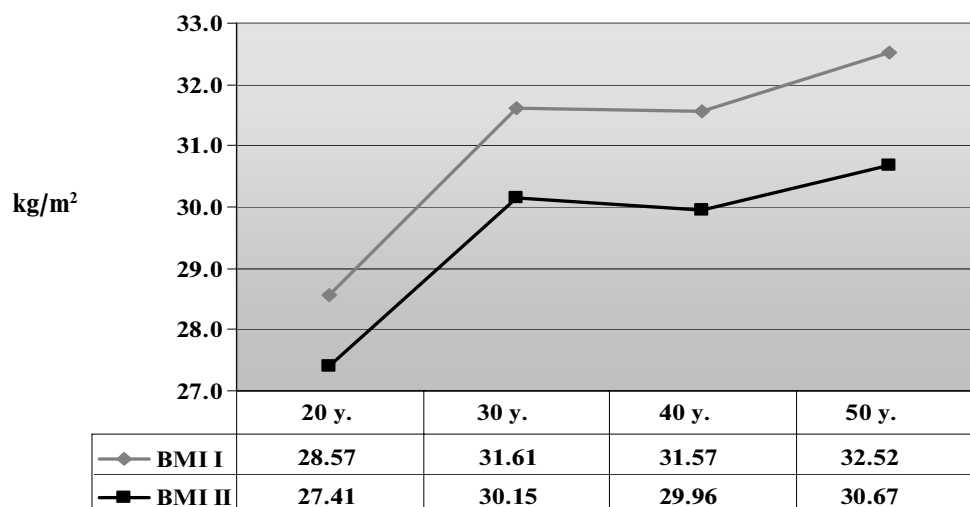
Fig. 2
The changes in the average values of selected circumferential parameters on the trunk

Fig. 3
Average values of BMI (kg/m^2) in first (BMI I) and second measurements (BMI II)

	20 y.	30 y.	40 y.	50 y.
BMI I	28.57	31.61	31.57	32.52
BMI II	27.41	30.15	29.96	30.67

TABLE 2
The shift among categories BMI (frequency, %)

Age	Measurement I.					Measurement II.				
	BMI I	BMI II	BMI III	BMI IV	BMI V	BMI I	BMI II	BMI III	BMI IV	BMI V
20 year	15.8	52.6	21.1	10.5	0.0	21.1	63.2	5.3	10.5	0.0
30 year	10.7	35.7	28.6	17.9	7.1	17.9	39.3	17.9	17.9	7.1
40 year	2.9	25.7	54.3	14.3	2.9	8.6	45.7	34.3	8.6	2.9
50 year	0.0	28.1	50.0	18.8	3.1	0.0	50.0	34.4	15.6	0.0

Legend: I. 18.5–24.99 – normal range; II. 25.0–29.99 – overweight – pre-obese; III. 30.0–39.99 – obese of I. and II. degreses; > 40.0 – obese class III (WHO, 2004).

Mean WHR values exceeded the value of 80.0 in both measurements and in all age categories; this value suggests the risk of abdominal obesity which is associated with a higher occurrence of cardiovascular disease. Among 40 and 50 year old women, the mean WHR value exceeded the high risk limit of abdominal obesity in both measurements. More than 90% of the 30, 40 and 50 year old women ranked in the category above 80 WHR units (Fig. 4).

The average somatotypes were localized in the mesomorph-endomorphic category, markedly outside the borders of the somatogram. The only exception was the category of 20 year old women, who ranked in the mesomorphic-endomorphs category. A shift in the somatogram of the youngest women means that a statistically significant decrease occurs not only in endomorphy but also in mesomorphy, which seems to be a negative effect. The biggest shifting of the constitution was found in 20 year old women.

Endomorphy was a dominant mean somatotype at baseline measurements in all age categories. During final measurements the values of the endomorphic and mesomorphic component were equalized in 30 year old women. On Fig. 5 we can also observe shifts in the individual somatotypes (denoted by identical numbers), which seemed to be extreme (Fig. 5 and 6).

Based on the analysis of variations (ANOVA, LSD Fischer's test) it was found that significant differences are seen in the determined quantity of the percentage fat fraction in consideration of the respective methods and respective repeated measurements ($p < 0.001$). The quantity of the fat component significantly increases according to the method used in the sequence as follows: % fat Pařízková → % fat Matiegka → % fat QuadScan,

and shows a significant reduction in the relative fat quantity between the two measurements (Fig. 7).

The representation of the fat component quantity in the particular BMI categories during the 1st and 2nd measurements shows an almost identical trend of an increased quantity of subcutaneous fat, according to the method of Matiegka and Pařízková. For the Quad-Scan method, the representation of the fat fraction is different, with the highest variation being in the 1st and 5th BMI category (Fig. 8 and 9).

The analysis of body composition according to the method of Matiegka revealed a high representation of the fat component in all age categories, which exceeds the representation of the muscle fraction, in relative values, during the first measurement. In the second measurement after the application of the therapy, we observed at least comparable muscle and fat fractions, or more precisely growth of the muscle component, in relative values, in all age categories. The effects of therapy resulted in, a reduced average subcutaneous fat quantity and a relative increase in the muscle fraction in all our groups (Fig. 10).

The quantity of fat component determined by bioelectrical impedance using the Tanita device was the highest, when compared to the other methods, and reached 40.43% in the consolidated group. The quantity of the fat fraction determined by this method showed the lowest reduction – only to 38.4% (SD = 5.02, MAX = 49.0%, MIN = 26.7%). Segmental analysis using the Tanita device showed an almost identical quantity of the fat component on the extremities, exceeding the 40% limit, with a slightly increased share of fat on the left arm. Paradoxically was recorded the lowest quantity of fat on the trunk, where the mean values reached 37.15% (TABLE 3).

Fig. 4
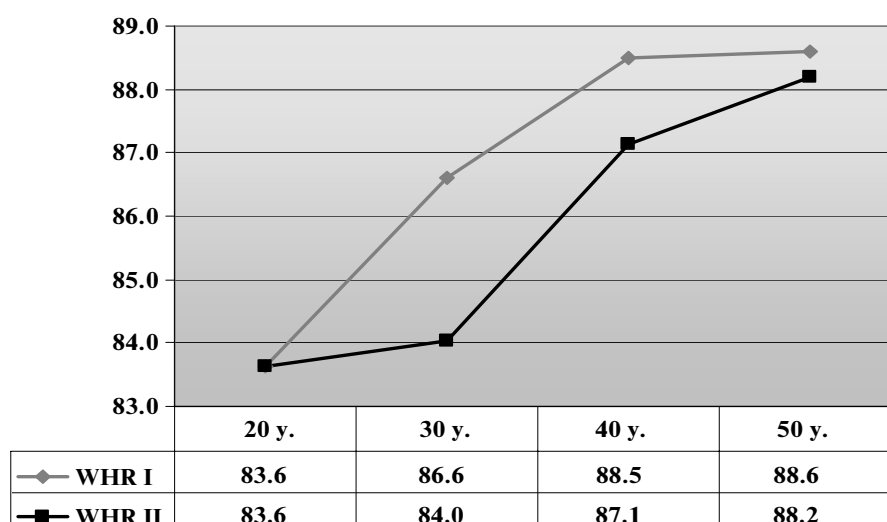The changes of average values WHR in measured groups

	20 y.	30 y.	40 y.	50 y.
WHR I	83.6	86.6	88.5	88.6
WHR II	83.6	84.0	87.1	88.2

Fig. 5
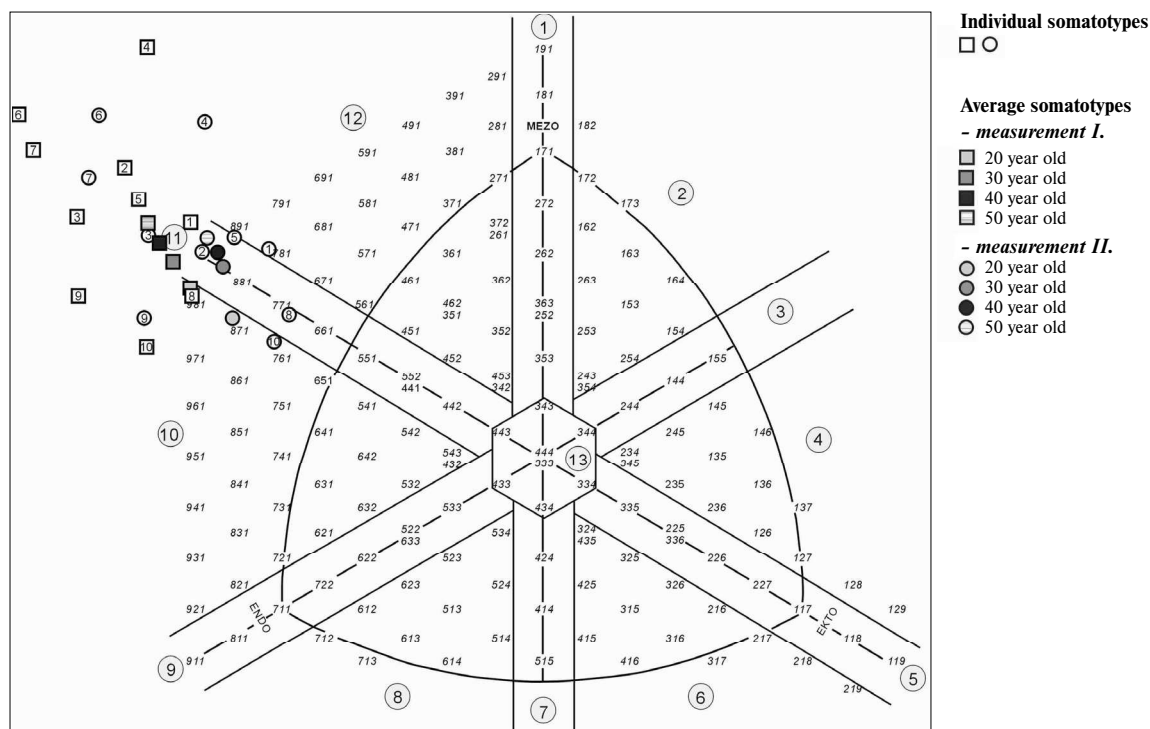Individual and average somatotypes in the observed groups

Fig. 6
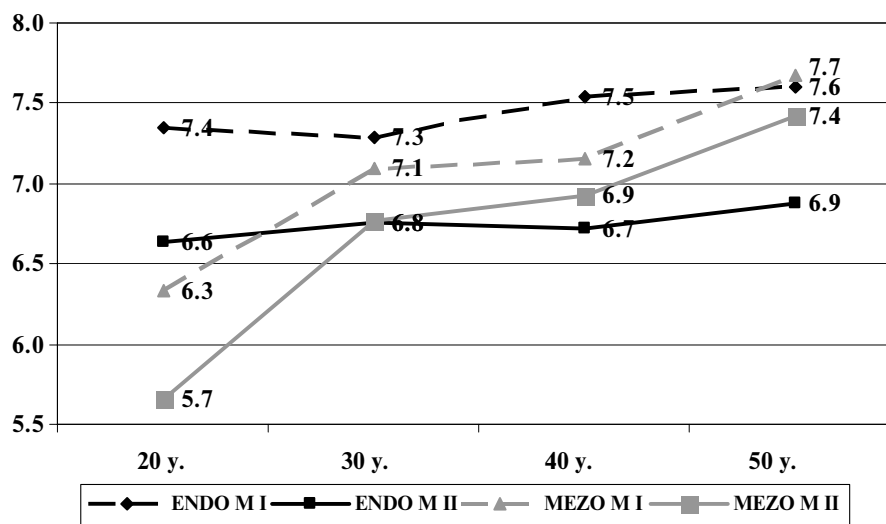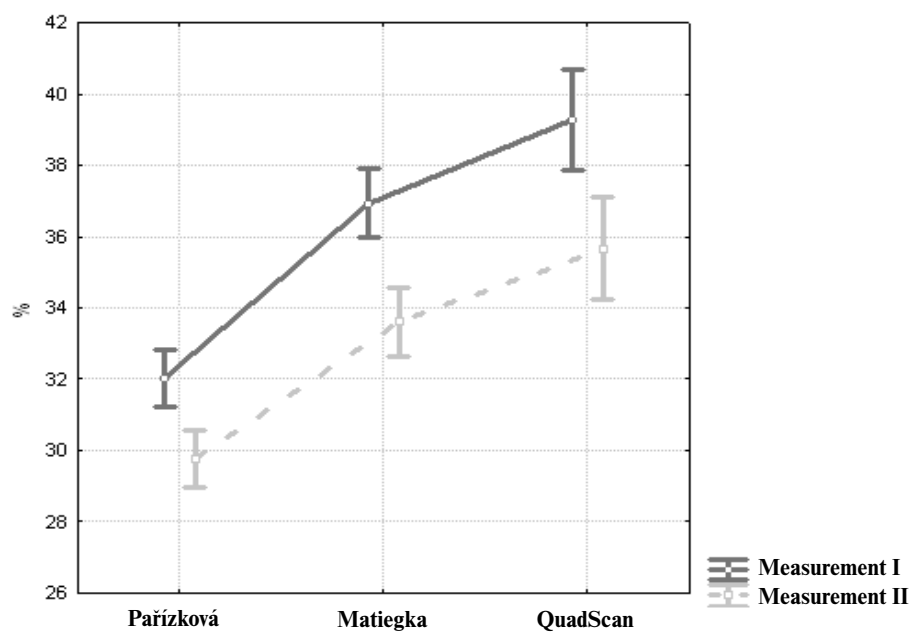The changes in average values of mesomorphy and endomorphy

Fig. 7
Average values of percentage fat according to different methods

Fig. 8
Dependence of the fat fraction quantity on the BMI category during the first measurement
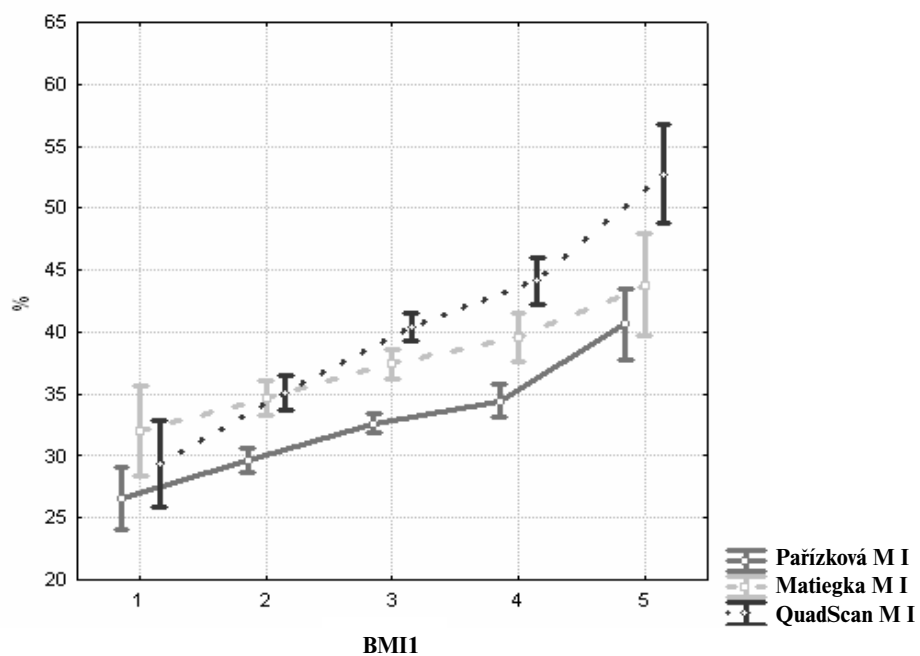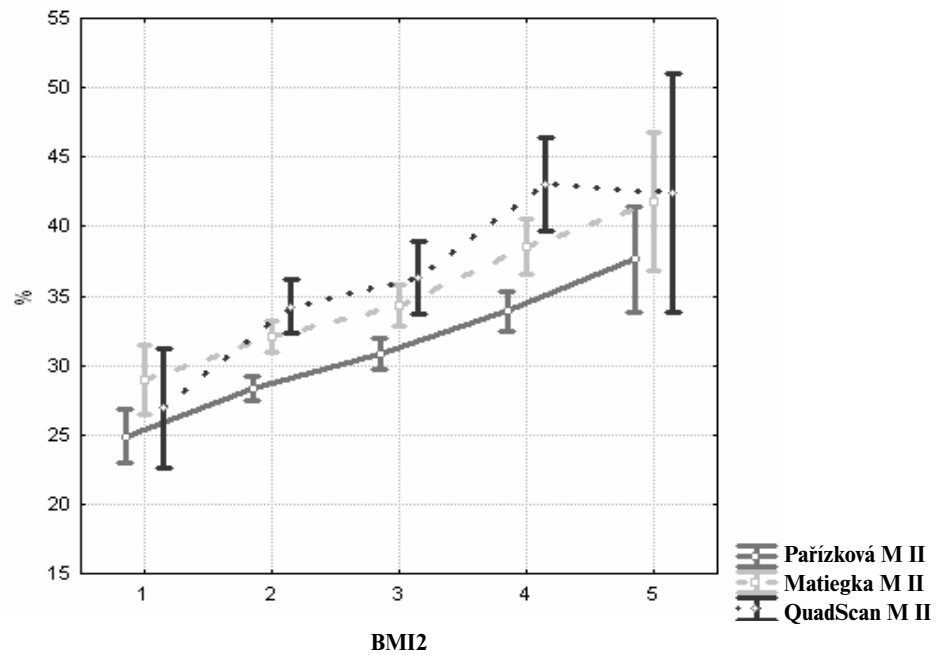
Fig. 9
Dependence of the fat fraction quantity on the BMI category during the second measurement

Fig. 10
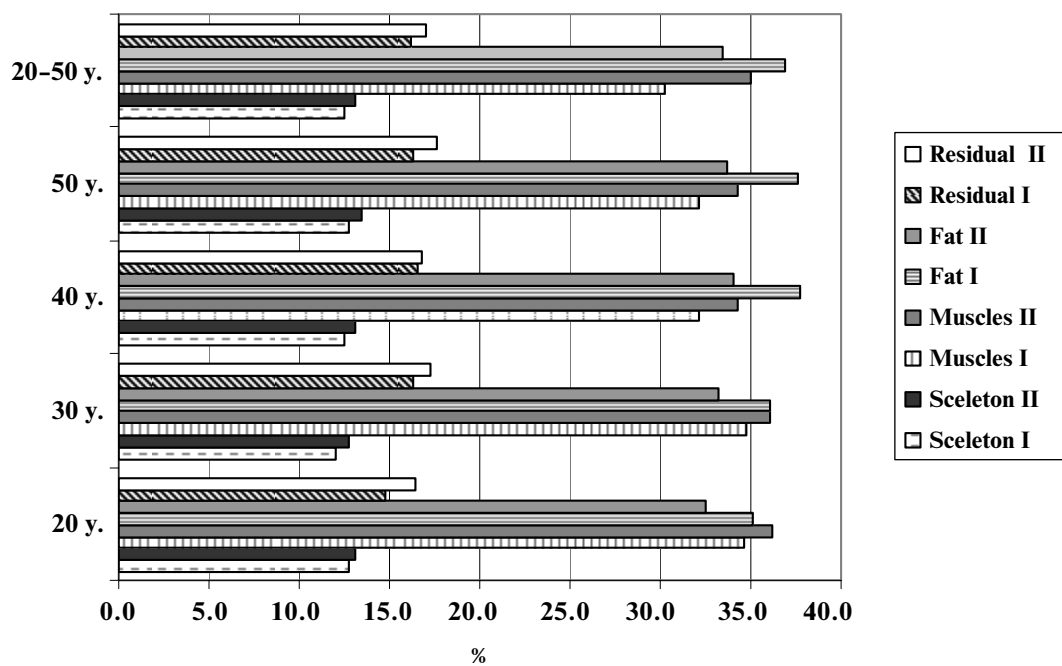Body composition according to the method of Matiegka

TABLE 3
The analysis of body composition on segments

SEGMENTS	RIGHT EXTREMITY				LEFT EXTREMITY			
	M	SD	X_{min}	X_{max}	M	SD	X_{min}	X_{max}
UPPER EXT.								
Fat (%)	41.56	6.42	26.70	53.60	42.43	6.43	28.90	54.80
Fat (kg)	1.90	0.63	0.80	3.50	2.05	0.72	0.90	3.90
FFM (kg)	2.55	0.29	1.90	3.40	2.65	0.32	2.00	3.60
Muscle m. (kg)	2.38	0.27	1.80	3.20	2.45	0.31	1.80	3.30
LOWER EXT.								
Fat (%)	41.74	4.22	32.10	50.40	41.79	4.17	31.70	49.90
Fat (kg)	6.40	1.49	3.70	9.70	6.31	1.46	3.70	9.50
FFM (kg)	8.76	0.96	8.00	12.00	8.61	0.92	7.00	11.40
Muscle m. (kg)	8.25	0.90	6.60	11.30	8.12	0.86	6.60	10.80
TRUNK								
Fat (%)	37.15	5.85	22.70	48.70				
Fat (kg)	17.03	4.72	7.50	29.80				
FFM (kg)	28.06	2.81	23.10	36.00				
Muscle m. (kg)	26.82	2.39	20.60	30.90				

Legend: Muscle m. (kg) – predicted muscle mass, FFM – fat free mass.

CONCLUSION

- Movement and exercise therapy in combination with changes of dietary regimes within STOB body weight reduction courses has a nearly 15 year tradition in the Czech Republic and has had significant effects on clients' somatic condition.
- We recorded changes in somatic parameters, not only for body weight but also circumference parameters, especially on the trunk, lower extremities, and significant positive changes in the fractionation of the body weight (according to all methods).
- Redistribution within the respective bodily fractions can be considered positive, as the quantity of the fat component decreases while the muscle component increases.
- The reduction of BMI and WHR is less significant, but a positive redistribution shift can also be observed in these categories.
- The segmental analysis of body weight distribution using the bioelectric impedance technique demonstrated excess fat not only on the trunk, but in particular on the lower extremities, even though a predominance of abdominal obesity can be expected in terms of circumference parameters.
- Strong willpower is an important feature and an integral part of intervention but not every woman owns it. So there is always some small percentage of women who neither lose weight nor circumferential parameters and subcutaneous fat.

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PŮSOBENÍ KOGNITIVNĚ-BEHAVIORÁLNÍ PSYCHOTERAPIE NA TĚLESNÉ SLOŽENÍ A KONSTITUCI
(Souhrn anglického textu)

Obezita je chronické onemocnění moderní doby, které není pouze kosmetickým problémem, ale problémem bio-sociálně-psychologickým, tzn., že obézní lidé mají kromě zdravotních problémů i problémy sociální a psychické. Vyskytují se u nich deprese, často mají sníženou sebedůvěru a problémy při uplatnění v zaměstnání. Hlavním cíle studie bylo sledování změn somatických parametrů pod vlivem působení fyzické aktivity a modifikace nutričních zvyklostí u klientek STOB kurzů (kurzy pro snižování nadváhy a obezity) u žen ve věku 20–60 let (n = 114).

Byly použity standardizované antropometrické metody pro stanovení základních somatických indexů – hmotnostně-výškových, indexů rizikovosti a indexů centrality, tělesného složení dle metody Pařízkové (1962) a Matiegky (1927) a frakcionace tělesné hmotnosti dle metody bioelektrické impedance, s ohledem na segmentální analýzu (QuadScan 4000; Tanita BC 418-MA). Ženy byly rozděleny do souborů dle decénií. Ženy byly měřeny na začátku a na konci kurzu, který trval 12 týdnů. Kurzy STOB jsou realizovány profesionálními pracovníky, kteří se věnují nejen pohybové aktivitě, ale také úpravě výživových a stravovacích stereotypů.

Ve sloučeném souboru při vstupním vyšetření dosáhl BMI průměrné hodnoty 31,34; maximální hodnota však přesáhla hranici těžké obezity 47,56. Na základě kategorizace BMI dle WHO bylo do kategorie normy zařazeno pouze 7,5 % žen, v kategorii nadváhy se vyskytovalo 33,3 % souboru a 57 % souboru bylo obézních, z toho morbidní obezity dosáhlo 5 % žen. Nejnižší hodnoty BMI se vyskytovaly u nejmladších žen (20–30letých), nejvyšší naopak v nejstarší věkové kategorii, avšak v ostatních věkových kategoriích se vzájemně signifikantně neodlišovaly. Průměrná hodnota WHR byla 87,25, z toho 85,6 % klientek přesáhlo hranici rizikovosti. Nejnižší průměrná hodnota se opět nacházela u skupiny nejmladších žen (83,6), nejvyšší (88,6) u skupiny nejstarších žen. Na

základě hodnocení množství podkožního tuku dle metodiky Matiegky 57,5 % žen disponovalo více než 30 % tuku, z toho v kategorii nad 40 % podkožního tuku se nacházelo 28,75 % souboru. Hodnoty indexů centrality (1,3–1,5), které dokumentují rozložení podkožního tuku v jednotlivých oblastech těla, korespondují s vyššími hodnotami WHR a potvrdily především uložení tuku na trupu vzhledem ke končetinám. Byl tedy potvrzen výskyt abdominálního typu obezity. Na základě segmentální analýzy realizované metodou bioelektrické impedance bylo nejvíce tuku determinováno na dolních končetinách.

Intervence prostřednictvím pohybové aktivity a změny výživových zvyklostí má především individuální dopad. Na základě hodnocení průměrných hodnot obvodových parametrů došlo ke snížení především obvodu pasu, břicha a boků, případně ke snížení obvodových parametrů na dolních končetinách (obvody gluteálního a středního stehna). Snížily se také průměrné hodnoty tělesné hmotnosti, BMI a WHR a zastoupení množství tukové složky v absolutních i relativních hodnotách. Ve všech kategoriích jsme zaznamenali signifikantní snížení endomorfie. Velmi významnou vlastností je silná vůle, která je nedílnou součástí intervence a kterou ne každá žena disponuje. Takže vždy v kurzech nacházíme i malé procento žen, které nesníží ani hmotnost, ani nedojde ke snížení obvodových parametrů a množství podkožního tuku zůstane stejné jako před nástupem na terapii.

Klíčová slova: klienti STOB kurzů, tělesné složení, typologie, BMI, nadváha, obezita různého typu.

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