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LEISURE-TIME PHYSICAL ACTIVITIES AND EATING HABITS IN RELATION TO ABDOMINAL OBESITY IN WOMEN OF CHILDBEARING AGE

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Abstract
The development of abdominal obesity has been associated with potentially modifiable lifestyle factors. This study aims to determine relation between leisure-time physical activities, eating habits and abdominal obesity in women of childbearing age. The study included 300 respondents who were divided into two groups: non-abdominal obesity (n=150) and abdominal obesity (n=150). Abdominal obesity was estimated measuring waist circumference. Data concerning leisure-time physical activities and eating habits were collected using a designed questionnaire. There were almost two times as many physically inactive respondents in the non-abdominal obesity group, 76 (50.7%), then in abdominal obesity group, 39 (26.0%). Physical activity during leisure-time was a potential risk factor for abdominal obesity, especially physical activity of 30 minutes per day (OR=4.87, 95%CI=2.24-10.55; p<0.001). Eating less than 3 meals a day (OR=0.44, 95%CI=0.15-1.25; p=0.08) and eating last meal before 20 hours, especially before 17 hours (OR=0.45, 95%CI=0.08-2.59; p=0.51) protect from abdominal obesity. If women consume more calories than are used for metabolic and physical activities, the extra energy is stored as body fat. The prevention and reduction of abdominal obesity depend on individual lifestyle change.

Key words: **abdomen, adipose tissue, female, lifestyle**

Introduction

World Health Organization defines 'overweight and obesity' as abnormal or excessive fat accumulation that may impair health (World Health Organization, 2000). Abdominal obesity is an excess of intra-abdominal fat (WHO Expert Consultation, 2011) and is sometimes referred to as central adiposity or visceral obesity. It is found in the spaces surrounding the liver, intestines, and other organs. It's also stored in the omentum, an apron-like flap of tissue that lies under the belly muscles and blankets the intestines. The omentum gets harder and thicker as it fills with fat (Divella et al., 2011).

Studies have shown that the prevalence of obesity and abdominal obesity among women is higher than men (Beigh and Jain, 2012). Women generally have higher percentage of body fat than men, and there are indications that the basal fat oxidation is lower in females as compared to men, thereby contributing to a higher fat storage in women (Gentile et al., 2015). This explains why women have a more difficult time losing fat in general, and from the hips and thighs in particular. Furthermore, women rely on fat stores more than men for reproduction. Essential body fat in women may account for 12% of total body weight versus 3% for men (Jeukendrup and Gleeson, 2010; American council on exercise, 2010). Essential body fat in women may account for 12% of total body weight versus 3% for men (Jeukendrup and Gleeson, 2010; American council on exercise, 2010). In addition, females have a predisposition to channel extra energy into fat storage while males use more of this energy for protein synthesis (Galgani and Ravussin, 2008).

The age range of 25–44 years is the time when women tend to gain the greatest amount of weight. Among women of childbearing age, one potential pathway for the development of abdominal obesity has been through the retention of gestational weight gain (Gilmore, Klempel-Donchenko and Redman, 2015).

Although visceral fat makes up only a small proportion of body fat, it is a key player in a variety of health problems. Among women, abdominal obesity is a risk factor for cardiovascular disease, but increases the risk of the metabolic

syndrome, type 2 diabetes mellitus, depression, polycystic ovarian syndrome (Schienkiewitz, Mensink and Scheidt-Nave, 2012) infertility and adverse pregnancy outcomes such as gestational diabetes mellitus, hypertensive disorders, and newborn macrosomia, among other perinatal complications (Stupin and Arabin, 2014).

There are various risk factors, which are responsible for abdominal obesity (Kurspahić-Mujčić and Zećo, 2017). Key among them is individual's eating behavior and physical activity (Chan and Woo, 2010). The environment exposes people to an abundance of high calorie, high fat foods, and people eat more than they need. Studies have demonstrated that activity alone does not necessarily burn extra calories. Exercise accounts for a small portion of daily calorie burn and it's hard to create a significant calorie deficit through exercise (Hill, Wyatt and Peters, 2012).

This study aims to determine relation between leisure-time physical activities, eating habits and abdominal obesity in women of childbearing age.

Methods

Sample subjects

This cross-sectional study was carried out in family medicine outpatient departments of the Public Institution Primary Health Care Center of Canton Sarajevo, Bosnia and Herzegovina (B&H) in period 15 February– 31 March 2015.

The respondents were patients who used health care services at the Primary Health Care Center during the course of the study period. The study included 300 respondents on the principle of systematic random sampling. The respondents divided into two groups in relation to the measured values of waist circumference: the respondents with waist circumference less than 80 cm (non- abdominal obesity; n=150) and those with waist circumference of 80 cm or more (abdominal obesity n=150). The inclusion criteria were females aged 18-49 years who have a medical record in the Primary Health Care Center of the Sarajevo Canton. The exclusion criteria were male gender, persons younger than 18 or older than 49 years, persons who do not have medical records at the Primary Health Care Center of the Sarajevo Canton, pregnant women and women who had given birth within twelve months before the date of inclusion in the study. The focus of study meant to exclude individual differences.

Sample variables

In the study is used specially designed and structured questionnaire. It consisted of two parts: the part that was completed by the nurse and a part that was completed by the respondent.

The part that was completed by nurse contained general information about the respondent (initials, date of birth) and data on waist circumference.

Waist circumference was measured at midpoint between the lower rib and the iliac crest using a flexible tape measure. During the measurement, participants stood in an upright position, with arms relaxed at the side, feet evenly spread apart, and body weight evenly distributed in accordance with the World Health Organization (WHO) expert consultation report on waist circumference and waist-to-hip ratio (WHO Expert Consultation, 2011).

Part that was completed by the respondent contained information on levels of physical activity during leisure-time, number of daily meals and last episode of eating. Levels of physical activity during leisure-time was categorized as no physical activity, 15 minutes per day, 30 minutes per day, 1 hour per day and longer than 1 hour per day. Number of daily meals was categorized as less than 3, 3-5 and more than 6. Last episode of eating was categorized as before 17 hours, between 17 and 20 hours and after 20 hours.

Abdominal obesity was defined as waist circumference $\geq$80 cm (the criteria of abdominal obesity given by International Diabetes Federation) (Alberti, Zimmet and Shaw, 2006). Respondent with measured waist circumference less than 80 cm were considered as respondent who does not have abdominal obesity. Respondent with measured waist circumference $\geq$80 cm were considered as respondent who has abdominal obesity.

Leisure-time physical activities were defined as exercise, sports, recreation, or hobbies that are not associated with regular job-, household-, or transportation-related activities.

Statistical analysis

Testing of the difference in levels of physical activity during leisure-time, number of daily meals and last episode of eating between non-abdominal obesity group and abdominal obesity group was performed by $\chi 2$ test. The individual effects of categorical predictors' variables, levels of physical activity during leisure-time, number of daily meals and last episode of eating on the presence of abdominal obesity were obtained by logistic univariate regression analysis. Categorical variables are depicted as frequency and percentages. The results of univariate regression analysis are shown with the values of odds ratio (OR) and 95% confidence interval. Level of significance set at $p<0.001$.

Results

The study evaluated 300 respondents in two groups of 150 (i.e., non-abdominal obesity and abdominal obesity). Levels of physical activity during leisure-time in the abdominal obesity group and non-abdominal obesity group was significantly different ($p=0.00$). There were almost two times as many physically inactive respondents in the non-abdominal obesity group, 76 (50.7%), then in abdominal obesity group, 39 (26.0%) (Table1).

Table 1. Levels of physical activity during leisure-time in women of childbearing age

Levels of physical activity during leisure-time		Abdominal obesity		Total
		yes	no	
No physical activity	N	39	76	115
	%	*26.0*	*50.7*	*38.3*
15 minutes per day	N	11	8	19
	%	*7.3*	*5.3*	*6.3*
30 minutes per day	N	30	12	42
	%	*20.0*	*8.0*	*14.0*
1 hour per day	N	30	26	56
	%	*20.0*	*17.3*	*18.7*
Longer than 1 hour per day	N	40	28	68
	%	*26.7*	*18.7*	*22.7*
Total	N	150	150	300
	%	*100.0*	*100.0*	*100.0*
$\chi^2=22.49$; $p=0.00$				

There was an interdependence that existed between abdominal obesity and levels of physical activity during leisure-time, e. g., physical activity during leisure-time was a risk for abdominal obesity, especially physical activity of 30 minutes per day (OR=4.87, 95%CI=2.24-10.55; p=0.00) (Table 4).

Meal frequency in the abdominal obesity group and non-abdominal obesity group was not significantly different (p=0.09). In the non-abdominal obesity group was more respondents who consumed less than 3 meals a day, 38 (25.3%), than in abdominal obesity group, 23 (15.3%) (Table 2).

Table 2. Number of daily meals according to the presence of abdominal obesity

Number of daily meals		Abdominal obesity		Total
		yes	no	
Less than 3	N	23	38	61
	%	*15.3*	*25.3*	*20.3*
3-5	N	116	104	220
	%	*77.3*	*69.3*	*73.3*
More than 6	N	11	8	19
	%	*7.4*	*5.4*	*6.4*
Total	N	150	150	300
	%	*100.0*	*100.0*	*100.0*
$\chi^2=4.81$; $p=0.09$				

Eating less than 3 meals a day in total protect from abdominal obesity (OR=0.44, 95%CI=0.15-1.25; p=0.08) (Table 4).

Last episode of eating in the abdominal obesity group and non-abdominal obesity group was not significantly different (p=0.51). In the non-abdominal obesity group was more respondents who consumed last meal before 20 hours, 70 (46.6%) than in the abdominal obesity group, 62 (41.3%) (Table 3).

Table 3. Last episode of eating according to the presence of abdominal obesity

Last episode of eating		Abdominal obesity		Total
		yes	no	
Before 17 hours	N	2	4	6
	%	*1.3*	*2.6*	*2.0*
Between 17 and 20 hours	N	60	66	126
	%	40.0	44.0	42.0
After 20 hours	N	88	80	168
	%	*58.7*	53.4	56.0
Total	N	150	150	300
	%	*100.0*	*100.0*	*100.0*
$\chi^2=1.33$; $p=0.51$				

Eating last meal before 20 hours, especially before 17 hours in total protect from abdominal obesity (OR=0.45, 95%CI=0.08-2.54; p=0.51) (Table 4).

Table 4. The individual effects of categorical predictors variables for the presence of abdominal obesity obtained by logistic regression analysis

Categorical predictor	p	OR (95% CI)
Levels of physical activity during leisure-time	0.00	
15 minutes vs. no physical activity		2.67 (0.99-7.20)
30 minutes vs. no physical activity		4.87 (2.24-10.55)
1 hour vs. no physical activity		2.24 (1.17-4.31)
Longer than 1 hour vs. no physical activity		2.78 (1.50-5.16)
Number of daily meals	0.08	
Less than 3 vs. more than 6		0.44 (0.15-1.25)
3-5 vs. more than 6		0.81 (0.31-2.09)
Last episode of eating	0.51	
Before 17 hours vs. after 20 hours		0.45 (0.08-2.54)
Between 17 and 20 hours vs. after 20 hours		0.82 (0.52-1.31)

OR, Odds Ratio; CI, confidence interval

Discussion

This study evaluated relation between leisure-time physical activities, eating habits and abdominal obesity in women of childbearing age.

The results revealed that physical activity during leisure-time was a potential risk factor for abdominal obesity. Eating less than 3 meals a day and eating last meal before 20 hours, especially before 17 hours protect from abdominal obesity.

Overall, normal weight women and overweight women have become more "abdominally obese." It is possible that women of childbearing age will be particularly vulnerable to weight gain. Physical activity can protect against weight gain. However, an ideal level of physical activity does not by itself ensure a normal weight (Hankinson et al., 2010; Ladabaum et al., 2014).

In this study, there were almost two times as many physically inactive respondents in the non-abdominal obesity group than in abdominal obesity group. Respondents from abdominal obesity group reported high physical activity compared to the non-abdominal obesity group. Physical activity during leisure-time was a risk for abdominal obesity; more active respondents had a higher risk of becoming obese. Similarly, the Copenhagen City Heart Study by Petersen, Schnohr and Sorensen (2004) indicated that high leisure-time physical activity increased the risk of becoming obese in the following ten years.

Body weight is regulated through the balance between energy intake and energy expenditure. For weight control, many researchers recommend regular exercise to increase energy expenditure (Westerterp, 2017). Some researchers suggest that exercise not only has a direct effect on energy balance through energy expenditure, but also has an indirect effect through its impact on energy intake. It was reported that short-term exercise increased energy intake in women (Stubbs et al., 2002). Similarly, women were shown to increase their energy consumption after an intensive bout of exercise (Pomerleau et al., 2004).

Recent studies show that exercise can modify energy intake through the adjustment of the energy-regulating hormones indirectly (Hagobian and Braun, 2010). Hickey et al. (1997) found that serum insulin and leptin after 12 weeks of exercise decreased in women. Hagobian and Braun, (2010) found that, in women, exercise altered energy-regulating hormones and increased energy intake, regardless of energy status.

There are studies that reported contrary results. Staten (1991) reported that there was no significant change in energy intake in women after five days of intense exercise, compared with five controls days (without exercise). Whybrow et al. (2008) found similar results after 14 days of exercise.

However, a recent review by Cook and Schoeller (2011) concluded that supporting evidence for physical activity for weight control is still inconclusive.

Results from previous studies suggest that eating frequency may be causally associated with body weight and weight changes. In this study in the non-abdominal obesity group was more, but not significantly, respondents who consumed less than 3 meals a day, 38 (25.3%), than in abdominal obesity group, 23 (15.3%) The majority (66%) of the adult population of the Paris metropolitan area still eats three meals per day (Riou et al., 2015). The proportion of three-meal eaters was 44% in Finns (Roos and Prattala, 1997).

In this study eating less than 3 meals a day in total protect from abdominal obesity. Some studies have demonstrated that three meals a day pattern has been linked to several health benefits, such as a lower prevalence of obesity and a higher consumption of fruits and vegetables (Tavoularis and Mathé, 2010; Fulkerson et al., 2014; Sobal and Hanson, 2011; Hammons and Fiese, 2011). Observational trials in humans indicate that eating more often than three times a day may play a role in overweight and obesity (Howarth et al., 2007) and that frequent eating predisposes to a higher energy intake by increasing food stimuli and difficulty controlling energy balance (Duval et al., 2008).

On the other hand, some studies have demonstrated that low meal frequency is associated with higher 24-hour insulin concentrations when compared with high meal frequency. Eating multiple, small meals may suppress hunger and overall serum insulin concentrations (Bellisle, McDevitt and Prentice, 1997). Insulin inhibits lipase enzyme activity and increases fat deposition. Since insulin is related to fatty acid storage, meal frequency may be one of the factors affecting body weight.

Well-controlled intervention studies do not support an association between eating frequency and body weight (Palmer, Capra and Baines, 2009).

Some studies have suggested that eating patterns, which describe the temporal distribution of eating events across the day, may be related to obesity. Berg et al. (2009) reported that being obese was associated with a meal pattern shifted to later in the day.

In this study in the non-abdominal obesity group was more respondents who consumed last meal before 20 hours, 70 (46.6%) than in the abdominal obesity group, 62 (41.3%). Eating last meal before 20 hours, especially before 17 hours in total protect from abdominal obesity.

De Castro (2004) has indicated that greater consumption of carbohydrate at breakfast is associated with lower energy and carbohydrate intake over the day whereas greater intake in the evening is associated with higher daily energy and macronutrient intake. Limiting and/or avoiding food before nighttime sleep has been proposed as a weight loss strategy. Contrary, Waller et al. (2004) demonstrated that having a structured, post-dinner snack resulted in lower total daily caloric intake, evening caloric intake and modest weight. Recent studies investigating the impact of pre-sleep nutrient intake have reported positive physiological outcomes (Kinsey and Ormsbee, 2015). Less food was consumed at dinner when it was known that an evening snack would be available.

Our study has limitations. While waist circumference is measured, levels of physical activity during leisure-time, number of daily meals and last episode of eating are self-reported. Number of daily meals may be under-reported and physical activity overestimated, but this cannot explain the high rates of no leisure-time physical activity in our study.

Given the limitations of this study, there is a particular need for studies that have long periods of follow-up and objective assessment of physical activity.

Conclusion

Abdominal obesity is a chronic metabolic disease resulting from an imbalance between energy intake and energy output. Genetic and environmental factors play a major role in the development of abdominal obesity. Among these factors are excessive caloric and food intake, insufficient physical activity, individual metabolism, genetic predisposition, family history of obesity and behavioral factors. The defining feature is excess body fat. High-fat foods are energy dense and generally considered palatable, which encourages overconsumption. This study suggests that physical activity during leisure-time alone does not necessarily burn extra calories. Physical activity acutely increases fat oxidation. Recent studies showed that exercise intensity and duration are important determinants of fat oxidation. Fat oxidation rates increase from low to moderate intensities and then decrease when the intensity becomes high. The mode of exercise can also affect fat oxidation, with fat oxidation being higher during running than cycling. Combination exercise training, aerobic and resistance training, gave great benefits for weight loss (Kang et al., 2009). Increasing fat metabolism could potentially reduce the abdominal obesity in women of childbearing age.

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