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The impact of different intensities of exercise on body weight reduction and overactive bladder symptoms- randomised trial

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ABSTRACT

Objectives: to investigate the effect of a 3-month exercise programme with two different intensities on the reduction of body weight and body fat percentage in overweight women with overactive bladder symptoms (OAB).

Study Design: randomised controlled study. The sample consisted of 77 overweight women with OAB symptoms, with an average age of 26.2 years. Body mass index (BMI) measurements confirmed if women were overweight. Participants were split into two groups, as follows: Group 1 (programme with high intensity) (n = 39) and group 2 (programme with low intensity) (n = 38). For evaluation of body composition, we used Bioelectric impedance analysis with assessment of body fat percentage (BFP) and visceral fat area (VFA). OAB symptoms were evaluated using a voiding diary, an overactive bladder questionnaire (OAB-q) and the Patient Perception of Intensity of Urgency Scale (PPIUS). The intervention was a Programme for Reduction of Abdominal Fat, aimed at reducing abdominal fat with elements of aerobic training, strengthening of the surface and deep abdominal muscles and stretching.

Results: Group 1 lost body weight and showed a reduction in Body Fat Percentage (BFP) of more than 5%, whereas group 2 did not. Significant differences in OAB symptoms ($p < 0.01$) were recorded after training in favour of group 1 (number of voiding per 24 h changed from 8.92 ± 1.7 to 6.87 ± 0.40, OAB-q SS from 11.36 ± 8.57 to 1.46 ± 3.4). In the body composition assessment, significant differences ($p < 0.001$) were recorded after training in favour of group 1, in terms of BMI, BFP, WFA and body weight reduction.

Conclusion: The high intensity exercise programme for reducing abdominal fat (PRAF) significantly reduces overweight and mild symptoms of OAB after 12 weeks.

Introduction

Overweight is defined by body mass index (BMI) in the range 25–29.9 [1]. BMI, however, does not distinguish between fat and muscle mass and the body fat percentage is important in the diagnosis of overweight and obesity. Bioelectric impedance analysis (BIA) is the most commonly used method for assessing body composition, including calculating the body fat percentage [2,3].

Overweight and obesity are risk factors for pelvic floor dysfunction, including OAB [4,5]. The International Urogynecology Society (IUGA) and the International Society for Continency (ICS) defined OAB as an urgency commonly associated with frequency and nocturia, with or without urinary urgency incontinence, in the absence of urinary tract infection and other pathologies [6]. If urogynaecological disorders in young, overweight women are mild, they are often on the very edge of attention, so there is no search for specialist diagnostics and treatment. This may result in their gradual deterioration.

In overweight and obese women with urinary incontinence (UI), a reduction in body weight reduces OAB with or without urinary incontinence. Losing weight by 5% or more in overweight women with UI is associated with a reduction in episodes and frequency of incontinence, and an improvement in quality of life [7].

Several authors observed that exercise could reduce body weight and OAB symptoms in older women. These exercises had an aerobic character with force and stretching elements. Some exercise programs included a quick walk (200 min/week), but it is important to set the goals of a weight loss exercise programme

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over 5% in 3 months [8]. It is also appropriate to adapt eating habits [9]. However, the impact of body weight reduction in young overweight women with OAB symptoms by exercise programs was not sufficiently confirmed.

The objective of our study was to find out the effect of a 3-month exercise programme with two different intensities on the reduction of body weight and body fat percentage in overweight women with overactive bladder symptoms (OAB). We subsequently evaluated the impact of exercise on other factors related to OAB symptoms.

Methodology

The study was conducted between March 2018 and September 2018. All the participants signed informed consent. The study was approved by the Ethics Committee of the University Hospital Martin in Slovakia. IRB approval number - 255/2018.

The study group was selected from students of two universities. The sample size of our study was determined considering a power test of 0.80, a significance level alpha of 0.05. The number of women in the group 1 will be 34, in the group 2 will be 34 and we expect a 40% drop out rate. A screening leaflet with information about age, weight and height was completed by 651 university students. All women (in total, 103) defined as overweight (Body Mass Index (BMI) 25–29.9; where BMI = m/h^2, m = body weight in kilograms, h = body height in meters) were included. Of these, 10 were excluded as they did not fulfil the inclusion criteria. The final sample contained 93 women with overweight and OAB. The 93 remaining women were then randomly divided into two groups. Randomization was performed in Microsoft Office Excel 2010 by an independent person who did not participate in further course of the study. These numbers were put into a subsequently sealed envelope. The project manager opened the envelope and informed the participating persons of their assignment to the specific type of intervention.

Data collection consisted of two measurements: one taken at baseline and again after 12 weeks. All data was collected within the scope of the work place. All data collection was anonymous. Those who participated in the data collection did not participate in the statistical processing of the questionnaires or in the interpretation of the study results.

Sixteen women were excluded; twelve women had insufficiently completed questionnaires and four women did not start the exercise programme. The training programme was completed by 77 women, 39 in group 1 (programme with high intensity) and 38 in group 2 (programme with low intensity). All women performed the above exercise programme in two intensities (Fig. 1).

Inclusion criteria: Women aged 18–35, BMI 25–29.9, waist circumference of above 80 cm, OAB - urgency, urination frequency during the day 8 times or more, at night twice or more urination.

Exclusion criteria: Stress urinary incontinence (SUI), surgical treatment of gynaecological and urological diseases, urinary tract infection, oncological and neurological urinary tract disease, incomplete questionnaires, refusal to participate in the study.

Primary outcome measures of overweight

Body composition was measured using direct segmental multi-frequency bioelectric impedance analysis via a body composition analyser with the following assessments: skeletal muscle mass (SMM, kg), body fat mass (BFM, kg), body fat percentage (BFP, %), visceral fat area (VFA, cm^2/level) and WHR circumference index (ratio between the waist and the hip). We used an In Body composition analyser 230 BioSpace [10]. Overweight was determined in terms of body fat percentage; in women this was defined as 32–39%, and in men 23–29%, of the standard.

Secondary outcome measures of overactive bladder symptoms

The International Urogynecology Society (IUGA) and the International Society for Continency (ICS) defined OAB as urination 8 or more times a day, two or more times during the night, with or without urgency urinary incontinence [6].

Voiding diary – we evaluated the following: voided volume over a period of 24 h (ml), number of voiding per 24 h, voided

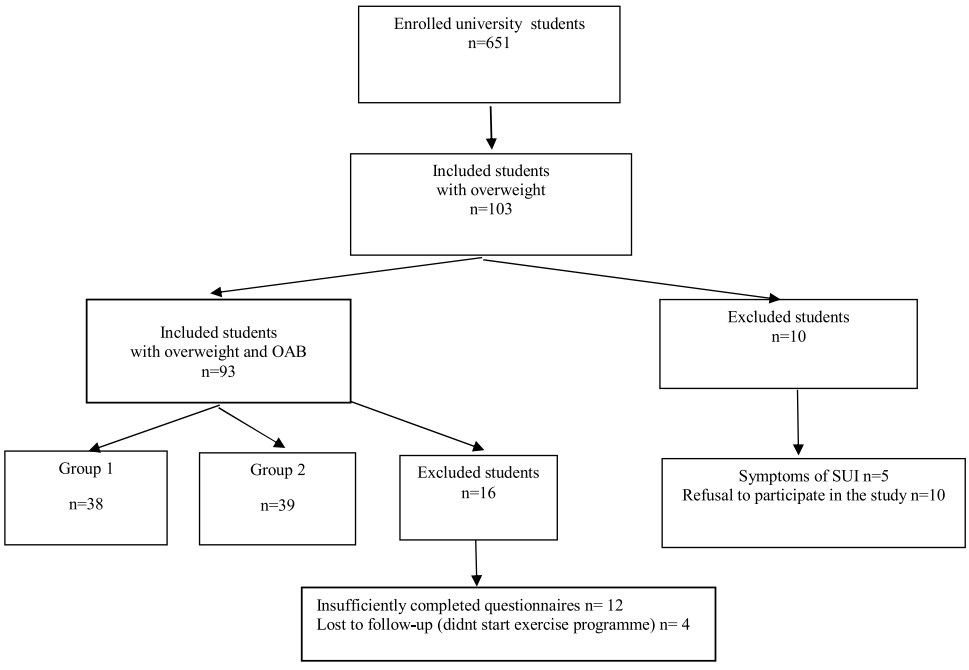

Fig. 1. Enrolment flow diagram.

Table 1
Type of exercise.

Type of exercise	Description	Intensity	1st month Duration (min.)	Progress 2nd month (min.)	Progress 3rd month (min.)
1) Aerobic warm-up	Cardio training: Stationary bicycle, Orbitrack, Treadmill	60% HR max.	20	30	40
2) Dynamic warm-up	Stretching muscles by slow and controlled movements	50% HR max.	10	10	10
3) Strength training-abdominal fat reduction	Deep abdominal muscle activation (m.transversus abdominis, m.obliquus abdominis internus) Strengthening of superficial abdominal muscles (m. obliquus abdominis externus, m. rectus abdominis),	40%-60% HR max	20	25	30
4) Static stretching	Passive stretching: lower limbs and abdominal muscles	30% HR max.	10	10	10

volume during day (ml), voided volume during night (ml), nighttime frequency (nocturia) and mean voided volume per 24 h (measured during day and night (ml) for three days, and mean values were used).

OAB-q – overactive bladder questionnaire – short form. This questionnaire focuses on the symptoms of overactive bladder in the last 4 weeks. It contains 6 questions – symptom score (0, without symptoms; 100, most symptoms) and 13 questions that assess the quality of life (100, best quality of life; 0, the worst quality of life). Cronbach's alpha OAB-q is 0.90 [11,12].

Patient Perception of Intensity of Urgency Scale (PPIUS) was used for the severity of symptoms of overactivity of the bladder: 0 = no urgency, retaining urination for a very long time, without fear of voiding; 1 = moderate urgency, able to hold urine as long as necessary, without fear of voiding; 2 = moderate urgency, able to hold urination for a short while, without fear of voiding; 3 = serious urgency, unable to hold urine; 4 = urgency urinary incontinence, urine leakage occurs before reaching the toilet. Reliability and validity 0.95 and Spearman correlation 0.89 [13,14].

Intervention

PRAF - Program for reduction of abdominal fat with elements of aerobic training, strengthening of superficial and deep abdominal muscles and stretching

We applied weight reduction exercises with elements of aerobic training and stretching. An important element included exercises for strengthening the surface and deep abdominal muscles. During this study, women did not change their everyday life activity. During the participation in the study, the dietary habits of the participants were not altered or modified.

1 Group (programme with high intensity): Training was carried out for a duration of 12 weeks. Exercises were completed 3 times a week for 60–90 minutes, under the supervision of a sports trainer and physiotherapist.

2 Group (programme with low intensity): Training was carried out for a duration of 12 weeks. Exercises were completed once a week for 60–90 minutes, under the supervision of a sports trainer and physiotherapist.

The training programme with elements of:

1. Aerobic training - stationary bicycle.
2. Dynamic warm-up - stretching muscles by slow and controlled movements.
3. Strength training - for reduction of abdominal fat - deep abdominal muscle activation (m.transversus abdominis, m. obliquus abdominis internus), strengthening of superficial abdominal muscles (m. obliquus abdominis externus, m. rectus abdominis.
4. Static stretching - passive stretching of lower limbs and abdominal muscles (Tables 1 and 2).

Treatment protocol

Statistical analysis

In data processing, descriptive and analytical statistics were used. Data were presented with mean values and standard deviation (SD). Since the data did not have normal distribution, the p-values were obtained by The Wilcoxon and Mann-Whitney U nonparametric tests. The significance level was $p < 0.05$. Effect size (ES) was calculated based on the Cohen d. ES reports the following intervals for r: 0.1 to .3: small effect; .3 to .5: intermediate effect; .5 and higher: strong effect. The calculations were performed in IBM SPSS 22.0 Windows (IBM, Chicago, Illinois, USA).

Results

Demographic characteristics

The sample consisted of 77 overweight women with OAB symptoms and an average age of 26.2 years. Of these, 38 women were assigned to group 1 (programme with high intensity) and 39

Table 2
Description of exercise - Strength training- abdominal fat reduction.

Description	1st month	Progress 2nd month	Progress 3rd month
1) Sit-ups with legs extended/crunches	repetitions/sets 10 x/4	repetitions/sets 20 x/4	repetitions/sets 25x/4
2) Sitting up twists with knees bent, trunk bending backward, feet planted on the floor	repetitions/sets 10 x/4	repetitions/sets 20 x/4	repetitions/sets 25x/4
3) Sit-ups with legs stretched forward, knees bent at a right angle	repetitions/sets 10 x/4	repetitions/sets 20 x/4	repetitions/sets 25x/4
4) Static core plank	hold position 45 s/ 2 sets	hold position 50 s/ 3 sets	hold position 60 s/3 sets
5) Push-up plank T-rotation – trunk rotation from standing push-up position to one arm support, second arm extended to T-position above the torso	hold position 30 s/ 2 sets/ side	hold position 45 s/ 3 sets/ side	hold position 50 s/3 sets/ side
6) Bicycle crunches – reaching right elbow to left knee and left elbow to right knee alternately	repetitions/sets 20 x/3	repetitions/sets 20 x/4	repetitions/sets 20x/5
7) Supine double-leg extensions, legs crossed	repetitions/sets 10 x/4	repetitions/sets 20 x/4	repetitions/sets 25x/4
8) Diaphragmatic breathing and activation of m. transversus abdominis.	20 x	40 x	50 x

women were assigned to group 2 (programme with low intensity). The OAB symptoms were confirmed by the parameters of voiding diary and OAB-q questionnaire. Symptoms of urinary urgency, classified according to the PPIUS scale, were mild. The BMI values confirmed the lower limit of overweight. As part of body composition analysis, the body fat percentage also confirmed overweight. There were no significant differences in the observed parameters recorded before the intervention between the monitored groups. (Table 3).

After 12 weeks of training, Group 1 (n = 39) lost body weight and showed a reduction in Body Fat Percentage (BFP) of more than 5%; group 2 (n = 38) did not lose body weight or show a change in BFP of more than 5%. In group 1, 7.7% cases (3 out of 39 women) and in group 2, 89.5% cases (34 out of 38 women) still had persistent OAB symptoms. There were significant differences ($p < 0.01$) in nearly all parameters from voiding diaries and OAB-q after the training in favour of group 1, with low-to-moderate effect size, and a high effect size in nocturia. Similarly, in the intensity of the symptoms of urinary urgency evaluated by the PPIUS scale, after training significant differences ($p < 0.01$) were noted in favour of group 1, with a moderate effect size.

In the body composition analysis, significant differences ($p < 0.01$) were noted after training in favour of group 1: in BMI and in BFP, with a large effect size; and in WFA, WHR index, waist circumference and body weight, with a small to moderate effect size. In the SMM no significant differences were noted between the groups (Table 4).

Discussion

The objective of our study was to investigate the effect of a 3-month exercise programme, with two different intensities, on the reduction of body weight and body fat percentage in overweight women with overactive bladder symptoms (OAB). The aim of the exercise programme was to reduce body weight and BFP by 5%. The average weight of women before exercise was 65 kg, therefore, 5% weight loss was 3.25 kg. The average body fat percentage was 70%; a reduction of 5% was 3.50%. We subsequently evaluated the impact of exercise on other factors related to OAB symptoms.

All women completed a 12-week PRAF exercise programme with two different intensities, aimed at reducing abdominal fat. After 12 weeks of training, group 1 lost body weight and showed a reduction in Body Fat Percentage (BFP) of more than 5%, whereas group 2 did not lose body weight or experience a change in BFP of more than 5%.

In the body composition assessment, significant differences were noted after training in favour of group 1 in the reduction of BMI, BFP, WFA, WHR index and waist circumference. In SMM, there were no significant differences noted between the groups.

Significant differences were recorded after training in favour of group 1 in almost all the parameters of the voiding diary and OAB symptoms and their intensity, as evaluated through (OAB-q) and the PPIUS scale.

The precise mechanisms explaining the relationship between obesity, overweight and OAB are not well understood. Some authors report that excess body weight increases intra-abdominal pressure, which in turn increases bladder pressure and intravesical pressure, leading to excessive activity of the urinary bladder [15–17]. Grady et al. [18] demonstrated that increased BMI was a significant predictor of combined urgency urinary incontinence and stress urinary incontinence.

The results reported in the present study complement previously published findings from other authors [19–22]. Pinto et al [9]. Evaluated the effect of weight reduction through diet and physical activity (which was a 200-minute fast walk weekly) for 388 overweight and obese women with urinary leakage, and an average age of 53 years. Measurements were performed after 6 months and 18 months. This study showed a small reduction in voiding over a 24-h period. It is therefore appropriate to develop and test new combinations of motion programmes. However, in our study we had younger women with average age of 26 years and who were overweight according to BMI, so we evaluated the effect of the exercise programme after 12 weeks. In our study, in the group 1, all OAB symptoms were also significantly reduced.

Table 3
Mean scores and statistical comparison of groups before the training.

	1 mean ± SD	2 mean ± SD	t-test;	p-value[a]
N	39	38		
Age (years)	26.28 ± 4.89	26.24 ± 5.06	0.040	0.96
Voiding diary parameters Voided volume during 24 hours (mL)	1303.8 ± 302.7	1231.7 ± 583.9	0.682	0.49
Number of voiding per 24 hours	8.92 ± 1.7	9.11 ± 2.4	−0.377	0.70
Voided volume during day (mL)	1056.03 ± 277.9	1007.92 ± 559.8	−0.470	0.28
Daytime frequency	6.87 ± 1.5	7.03 ± 2.1	−1.031	0.30
Voided volume during night (mL)	247.7 ± 116.0	223.8 ± 112.7	0.919	0.36
Nighttime frequency(nocturia)	2.05 ± 0.3	2.08 ± 0.4	−0.275	0.78
Mean voided volume per 24 hours (mL)	148.2 ± 33.0	136.3 ± 60.13	−0.275	0.28
Mean voided volume during day (mL)	156.77 ± 40.18	142.86 ± 66.28	−1.422	0.15
Mean voided volume during night (mL)	118.82 ± 51.32	107.86 ± 45.99	−1.331	0.18
PPIUS - Patient Perception of Intensity of Urgency Scale	1.51 ± 0.72	1.71 ± 1.03	−0.574	0.56
OAB-q				
SS-symptom score OAB-q	11.36 ± 8.57	11.22 ± 10.91	0.062	0.95
HR-quality of life OAB-q	93.41 ± 6.51	93.60 ± 7.01	−0.124	0.90
Body Composition Analysis				
Body mass index (kg/m^2)	25.00 ± 1.92	26.16 ± 3.80	−1.686	0.09
Skeletal muscle mass (kg)	24.17 ± 2.24	25.10 ± 2.99	−1.538	0.12
Body fat mass (kg)	20.30 ± 4.42	21.71 ± 4.15	−1.538	0.15
Body fat percentage (%)	31.93 ± 5.14	32.83 ± 6.39	−0.682	0.49
Visceral fat area (cm^2/level)	71.15 ± 21.71	69.89 ± 20.51	0.261	0.79
WHR circumference index (cm)/hips (cm)	0.87 ± 0.44	0.88 ± 0.06	−0.844	0.40
Waist (cm)	82.27 ± 7.29	83.67 ± 5.13	−0.970	0.33
Weight (kg)	65.06 ± 8.45	66.69 ± 12.06	−0.687	0.49

Abbreviations: 1 – Group (programme with high intensity): 2 – Group (programme with low intensity).
[a] p-values are based on independent *t*-test for continuous and chi–square test for categorical variables.

Table 4
Mean scores and statistical comparison of groups after the training (12 weeks).

	Group	T1 - baseline Estimated Marginal Means	T2 – follow up SD	p-value Estimated Marginal Means	Effect Size SD		Cohen d Effect size r
Voiding diary parameters							
Voided volume during 24 hours (mL)	*1*	1303.82	302.71	1360.00	322.62	0.040	0.47
	2	1231.76	583.96	1151.76	530.86		0.23*
Number of voiding per 24 hours	*1*	8.92	1.79	6.87	0.40	0.001	−1.16
	2	9.11	2.40	8.32	1.71		−0.50**
Voided volume during day (mL)	*1*	1056.0	277.9	1275.38	342.90	0.001	0.64
	2	1007.92	559.8	999.32	499.94		0.30*
Daytime frequency	*1*	6.87	1.5	6.28	0.75	0.855	−0.28
	2	7.03	2.1	6.61	1.46		−0.14
Voided volume during night (mL)	*1*	247.79	116.02	184.62	80.42	0.013	0.27
	2	223.84	223.84	152.45	144.90		0.13*
Nighttime frequency(nocturia)	*1*	2.05	0.39	0.59	0.54	0.001	−1.78
	2	2.08	0.48	1.71	0.69		−0.66***
Mean voided volume per 24 hours (mL)	*1*	148.2	33.0	197.81	45.44	0.001	1.01
	2	136.3	60.13	140.47	65.69		0.45**
Mean voided volume during day (mL)	*1*	156.77	40.18	203.43	50.64	0.001	0.84
	2	142.86	66.28	152.09	69.80		0.38**
Mean voided volume during night (mL)	*1*	118.82	51.32	125.00	40.08	0.01	0.34
	2	107.86	45.99	90.53	62.33		0.17*
Patient Perception of Intensity of Urgency Scale	*1*	1.51	0.72	0.46	0.50	0.001	−0.85
	2	1.71	1.03	1.13	0.99		−0.39**
OAB-q							
SS-symptom score OAB-q	*1*	11.36	8.57	1.45	3.40	0.001	−0.96
	2	11.22	10.91	9.56	11.42		−0.43**
HR-quality of life OAB-q	*1*	93.41	6.51	98.18	3.54	0.001	0.82
	2	93.60	7.01	93.60	7.01		0.38**
Body Composition Analysis							
Body mass index (kg/m^2)	*1*	25.00	1.92	21.97	2.43	0.001	−1.23
	2	26.16	3.80	25.92	3.79		−0.52***
Skeletal muscle mass (kg)	*1*	24.17	2.24	24.35	2.35	0.223	−0.28
	2	25.10	2.99	25.09	2.91		−0.13
Body fat mass (kg)	*1*	20.30	4.42	16.02	4.29	0.001	−1.40
	2	21.71	4.15	24.45	7.29		−0.57***
Body fat percentage (%)	*1*	31.93	5.14	23.50	4.26	0.001	−1.67
	2	32.83	6.39	32.73	6.51		−0.64***
Visceral fat area (cm^2/level)	*1*	71.15	21.71	63.09	21.21	0.05	−0.30
	2	69.89	20.51	69.54	20.52		−0.15*
WHR circumference index (cm)/hips (cm)	*1*	0.87	0.04	0.82	0.06	0.001	−1.37
	2	0.88	0.06	0.91	0.05		−0.56***
Waist (cm)	*1*	82.27	7.29	79.08	5.70	0.001	−0.78
	2	83.67	5.13	83.50	5.55		−0.36**
Weight (kg)	*1*	65.06	8.45	61.93	8.18	0.05	−0.42
	2	66.69	12.06	66.26	11.86	0.040	−0.20*

T1, T2; Time 1 – baseline, Time 2 – after 10 weeks.
p-values are based on Mann Whitney – U test.
Abbreviations: 1 – Group (programme with high intensity): 2 – Group (programme with low intensity).
Cohen (1988) reports the following intervals for r: 0.1 to .3: small effect*; .3 to .5: intermediate effect**; .5 and higher: strong effect***.

In a secondary analysis of a randomised study, Breyer et al [8]. Monitored the effect of the PRIDE programme on the reduction of weight by diet and exercise. He analysed 338 overweight and obese women with OAB, with an average age of 53 years, for a duration of 6 months. He found that body weight reduction (up to 5% and over 5%) through diet and exercise, as well as physical activity (1500 kcal and more or 1500 kcal or less), did not have any effect on the improvement of lower urinary tract symptoms. Despite his findings, we are of the opinion that correctly performed and controlled exercises for abdominal fat reduction also influence OAB symptoms in young women.

Strengths and limitations of the study

The strong aspect of the study was a high control of exercise interventions in women.

However, we must interpret the results cautiously, because the intake of calories in all women was not exactly controlled. Secondly, there are differences in metabolism between the women in the study that could also affect the results.

The strength of this study is that 12 weeks of exercise with high intensity was sufficient to reduce mild OAB symptoms and overweight.

Conclusion

The objective of our study was to investigate the effect of a 3-month exercise programme with two different intensities on the reduction of body weight and body fat percentage in overweight women with overactive bladder symptoms (OAB). The exercise programme with high intensity for reducing abdominal fat (PRAF) significantly reduces overweight and mild symptoms of OAB after 12 weeks.

Authors' contribution

Protocol/project development – Hagovska M; data collection or management Bukova A, Horbacz A, Drackova D; data analysis – Svihra J, manuscript writing/editing - Hagovska M, Svihra J.

Compliance with ethical standards

The study was approved by the Ethics Committee at University Hospital, Martin, Slovakia. The research involving human participants. All probands enrolled signed an informed consent. Our study had been conducted in accordance with recognized ethical standards and national/international laws.

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Declaration of Competing Interest

All authors have no conflicts of interest to declare.

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