Rocz Panstw Zakl Hig 2025;76(1):65-73
https://roczniki.pzh.gov.pl/ https://doi.org/10.32394/rpzh/202631

ORIGINAL ARTICLE

EVALUATION OF ANTHROPOMETRIC PARAMETERS BASED ON EMOTIONAL EATING

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ABSTRACT

Background. Emotions and moods are important regulators of food intake. While initially excessive intake, especially of unhealthy foods, was associated with negative emotions, now the emphasis is also on positive ones.

Objective. The aim of the work was to evaluate the emotional behavior of a selected group of the Slovak population in relation to nutritional behavior, as well as in relation to body composition, and to identify correlations between emotional eating and body composition.

Material and Methods. One hundred and eighty volunteers were involved in the study. To assess the emotional aspects of eating, we used a questionnaire developed within the EATMOT project. Body composition was analyzed using a bioimpedance device InBody 970 (multi-frequency bioelectrical impedance/MF-BIA).

Results. The results showed that participants who relieve stress by eating had significantly the lowest values of parameters related to muscle mass (SLM, FFM, SMM, BMR). Participants who consume food that corrects their body weight had significantly the lowest values of fat parameters and in most cases the highest values of parameters related to muscle mass. The analysis showed a strong correlation between question Q_1 and Q_6 ($r = 0.649$; $P < 0.001$), Q_8 ($r = 0.636$; $P < 0.001$) and Q_9 ($r = 0.651$; $P < 0.001$). The questions mentioned form block 1, in which food represents a form of escape. A strong correlation was also confirmed between Q_6 and Q_8 ($r = 0.658$; $P < 0.001$) and a moderate one with Q_7 ($r = 0.488$; $P < 0.001$). A strong correlation was also found in the case of Q_8 and Q_9 ($r = 0.575$; $P < 0.001$) and a moderate one with Q_5 ($r = 0.491$; $P < 0.001$). We did not find any significant differences between block 1 and block 2 (positive emotions) ($P > 0.05$). The values of anthropometric parameters in block 1 were significantly different from the values corresponding to question Q_2. As expected, participants in Q_2 had lower values of fat parameters and higher values related to muscle mass than participants in block 1.

Conclusions. Emotional eating has a significant impact on body composition. However, it should be clearly pointed out that emotional eating is not only associated with negative feelings, but also with positive ones. We can eat not only stress and depressive states, but also feelings of happiness and well-being. The results showed that the values of anthropometric parameters did not differ significantly between those who associate food with negative emotions and those who associate its consumption with positive emotions. However, it was clearly confirmed that those who choose food consciously in relation to the sustainability of adequate body weight also achieved the most optimal values of anthropometric parameters.

Keywords: *emotions, food, weight, obesity, InBody*

INTRODUCTION

An indispensable requirement for life is to satisfy the needs of the organism, especially in terms of energy and nutritional intake. The energy and nutrients that we consume through food are essential for life processes and functions of various structures, organs and the course of metabolic processes. The primary regulator of food intake is the hunger and satiety center, as well as the physiological and nutritional needs of the organism [1]. However, personalized food choice is also influenced by other factors. The relationship between nutrition and health has been described and confirmed by numerous studies [2-7, 8]. For this reason, nutritional recommendations at national and global levels are oriented towards the intake of health-promoting foods, with optimal energy and nutritional content, antioxidant effect, as well as adequate glycemic load [9]. The goal of a rational diet is to ensure the prevention of non-communicable diseases of a civilization nature [10]. Despite this, the health status of the population is constantly deteriorating.

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Publisher: National Institute of Public Health NIH - National Research Institute

This is a consequence of lifestyle and changing conditions for a full life. This is clearly related to our daily diet and the choice of food not only based on the needs of the body, but also based on psychological aspects, economic situation, environmental awareness and other factors [3, 11-13].

Emotions are important regulators of food intake. While initially excessive intake, especially of unhealthy foods (foods high in fat, refined sugars, high in energy or high in glycemic index) was associated with negative emotions, now the emphasis is also on positive ones [14, 15]. Some consumers tend to prefer food according to emotions and the most common consequence of this is overeating related to compensation for negative or positive feelings [14, 16, 17]. Specific emotions such as anger, fear, sadness and joy influence eating responses throughout the entire food intake process [18, 19]. Such food and eating behavior also have a significant impact on our body weight and body composition.

The aim of our research work was to evaluate the emotional behavior of a selected group of the Slovak population in relation to food intake and nutritional behavior, as well as in relation to selected anthropometric indicators of body composition, and to identify correlations between answers to individual questions in relation to selected anthropometric parameters.

MATERIAL AND METHODS

Study design

A total of 207 volunteers were included in the study, but twenty-seven of them were excluded due to insufficient or missing data or due to the presence of a serious illness. Exclusion criteria included age < 18 or > 50 years, BMI > 40 kg/m^2, the presence of serious diseases of a physical or psychological nature, use of medications affecting body weight, physiological obstacles such as pregnancy or suspected pregnancy, performance of professional sports, contraindications for bioimpedance measurement, increased physical activity immediately before the measurement, recent weight loss, increased intake of coffee, alcohol or fats ≤ 8 hours before testing and diuretics 7 days before testing. The study was conducted from March to September 2024. The selection of volunteers was random and voluntary. Before inclusion in the study, the volunteers were informed about the research protocol, which contained details about the research carried out with the objectives, methodological procedure, possible risks in the case of withholding important information regarding health status (risks in the case of an electrical device implanted in the body on the heart or in the case of pregnancy) and the volunteer's consent to inclusion in the study.

Body composition

Body composition was analyzed using the InBody 970 (MF-BIA; InBody Corporation, Seoul, South Korea), which measured the impedance of five body segments at 1, 5, 50, 250, and 500 kHz and 1, 2, and 3 MHz. We determined the values of the following anthropometric parameters and indices: Body Mass Index (BMI, kg.m^{-2}), Soft Lean Mass (SLM, kg), Fat Free Mass (FFM, kg), Skeletal Muscle Mass (SMM, kg), Body Fat Mass (BFM, kg), Percentage Body Fat (PBF, %), Waist Circumference (WC, cm), Waist-Hip Ratio (WHR), Visceral Fat Area (VFA, cm^2). Before the measurement, participants were asked to exclude and refrain from drinking large amounts of water, not to consume alcohol 24 hours before testing, to avoid food with a high sugar, salt or fat content for 12 hours before testing, to refrain from intense physical activity for at least 12 hours beforehand. In addition to informed written consent, all participants also signed consent to the processing of personal data. The study was conducted with the approval of the Ethics Committee of the Specialized Hospital of St. Zoerardus Zobor in Nitra, Slovakia (protocol no. 20230512/2) according to the guidelines of the Declaration of Helsinki.

Emotional eating questionnaire

To assess the emotional aspects of the volunteers' eating habits, we used a questionnaire developed within the EATMOT project by Ferrão et al. [20] and modified by Bacârea et al. [18]. The questionnaire consisted of nine questions to which the volunteer could answer with the following five options, namely: 1-totally disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-totally agree. The questions were as follows: Q_1 – food helps me cope with stress; Q_2 – I usually eat food that helps me control my weight; Q_3 – I often consume foods that keep me awake and alert (such as coffee, coke, and energy drinks); Q_4 – I often consume foods that help me relax (such as some teas, and red wine); Q_5 – food makes me feel good; Q_6 – when I feel lonely, I console myself by eating; Q_7 – I eat more when I have nothing to do; Q_8 – for me, food serves as an emotional consolation; Q_9 – I have more cravings for sweets when I am depressed. Questions Q_1, Q_6, Q_8, Q_9 create a block related to food as an escape. Questions Q_4 and Q_5 create a block for which food is typically associated with a sense of well-being [18].

Statistical analysis

We used Microsoft Office Excel 2016 (Los Angeles, CA, USA) in combination with XLSTAT (version 2019.3.1) for data processing. We performed statistical analysis using the computer software STATISTICA 13 (TIBCO Software, Inc., Palo Alto, CA, USA) and MedCalc software (MedCalc® Statistical Software Ltd, Ostend, Belgium, version 23.0.2). The normality

of the variable distribution was checked by the Shapiro-Wilk test. We used the paired t-test if the data were normally distributed, if the distribution was not normal, the Wilcoxon signed rank test was used. We performed descriptive analysis using mean ± standard deviation. To evaluate the relationship between variables, we used Spearman›s correlation analysis and expressed it graphically with color scales through correlograms. The level of statistical significance was set as $P < 0.05$.

RESULTS AND DISCUSSION

Based on the above, we had to exclude twenty-seven people from the research group for objective reasons. The final number of volunteers was 180 (135 female, 45 male). The average age of the volunteers was 23.2 ± 4.6 years (min. 20 years, max. 49 years). One hundred and twenty-five participants had urban residence, fifty-five rural, one hundred and forty-seven participants were studying at university at the time of the research, and thirty-three were actively employed. The research group was non-obese in terms of input anthropometric data and average values with optimal values of body mass index, body fat mass, percentage of body fat, waist circumference, waist-to-hip ratio and visceral fat area. However, according to personalized BMI, thirty-three participants were undernourished, forty-two were overweight, and nine were obese grade 1. According to visceral fat area, thirty-two participants had above-limit values, and seventy-five exceeded the optimal waist value. More detailed information is provided in Table 1.

Table 2 shows the absolute and relative frequency of responses to the research questions. In relation to the first question focused on coping with stress through eating, the volunteers answered mostly disagreeing (40%) or neutrally (40%). However, stress eats up to 20%. The sixth question, linking food and loneliness, was answered with a negative response by a relatively

Table 1. Descriptive characteristics of the study group

Parameters N = 180	Mean	SD	Mode	Minimum	Maximum
Age (years)	23.2	4.6	22.0	20.0	49.0
Height (cm)	168.2	8.4	169.3	155.8	190.0
Weight (kg)	65.2	13.2	55.3	48.8	107.7
Body Mass Index (BMI, $kg.m^{-2}$)	22.9	3.2	22.2	18.2	32.8
Basal Metabolic Rate (BMR, kcal)	1433	244	-	1120	2198
Soft Lean Mass (SLM, kg)	46.3	10.7	43.1	32.7	79.8
Fat Free Mass (FFM, kg)	49.2	11.3	39.5	34.7	84.6
Skeletal Muscle Mass (SMM, kg)	27.3	6.9	-	18.8	49.0
Body Fat Mass (BFM, kg)	16.0	6.1	12.0	6.4	42.7
Percentage Body Fat (PBF, %)	24.5	7.5	18.0	9.4	41.8
Waist Circumference (WC, cm)	81.5	10.2	73.3	66.9	129.4
Waist-Hip Ratio (WHR)	0.9	0.1	0.9	0.8	1.2
Visceral Fat Area (VFA, cm^2)	68.2	33.2	51.4	16.9	234.7

Table 2. Absolute and relative frequency of responses

Questions	Totally disagree N (%)	Disagree N (%)	Neither agree nor disagree N (%)	Agree N (%)	Totally agree N (%)
Q_1	27 (15)	45 (25)	72 (40)	27 (15)	9 (5)
Q_2	9 (5)	27 (15)	72 (40)	57 (31.7)	15 (8.3)
Q_3	27 (15)	42 (23.3)	42 (23.3)	54 (30)	15 (8.3)
Q_4	21 (11.7)	57 (31.6)	45 (25)	54 (30)	3 (1.7)
Q_5	0	0	36 (20)	90 (50)	54 (30)
Q_6	36 (20)	63 (35)	57 (31.7)	18 (10)	6 (3.3)
Q_7	12 (6.7)	36 (20)	36 (20)	78 (43.3)	18 (10)
Q_8	33 (18.3)	54 (30)	69 (38.3)	12 (6.7)	12 (6.7)
Q_9	24 (13.3)	48 (26.7)	30 (16.7)	60 (33.3)	18 (10)

large number of respondents (55%), neutral by 31.7% and affirmative by 13.3%. As in the previous questions, the vast majority also answered the question regarding the association between food and emotional comfort (Q_8) with a negative response (48.3%) or neutral (38.3%). A total of 13.4% agreed. The last question of the first block associate's food and especially sweets with depressive states (Q_9). In this case, the frequency of answers has changed compared to questions Q_1, Q_6 and Q_8. Forty percent answered with a negative response, 16.7% with a neutral response, but 43.3% with an affirmative response. It follows from the above that depression and similar states cause an increased appetite for sweets in almost half of consumers. Block 2, including questions Q_4 and Q_5, connects food with pleasant feelings and well-being. In the fourth question, participants expressed whether they consume foods that help them relax more often. 43.3% disagreed, 25% were neutral, and 31.7% agreed. The fifth question addresses good feelings related to food consumption. We did not find any disagreeing answers for this question. Twenty percent were neutral, and 80% agreed. The remaining questions Q_2, Q_3, and Q_7, not included in the blocks, were evaluated as follows. Question 2 addresses the issue of choosing foods that help with body weight correction. Twenty percent disagreed, 40% were neutral, and 40% agreed. The next question in order, the third, addresses the issue of using foods that have a stimulating effect. 38.3% disagreed, 23.3% were neutral and 38.3% agreed with their use. The seventh question concerns the issue of increased food consumption when consumers feel bored or do not perform any activity. We recorded the second highest proportion of affirmative responses for this question (53.3%); 26.7% disagreed and 20% were neutral. Based on the above, we can conclude that a relatively large proportion of participants agree with questions regarding food consumption during depressive states or when feeling bored. However, in many cases there was a relatively high proportion of neutral responses, with either affirmative or negative responses prevailing, depending on the question. More details are provided in Table 2.

Table 3 shows the values of anthropometric parameters according to the prevalence of answers. We evaluated each question individually with possible answers and the corresponding values of anthropometric parameters. For the first question regarding food and stress, we found significant associations in relation to body weight, SLM, FFM and SMM. These were mostly differences between the disagreeing and agreeing opinions, with the disagreeing group, which rejects stress eating, achieving higher values of the mentioned parameters. It is possible that the mentioned group consisted of physically and sports-active individuals who respond to stressful situations by increasing physical activity. However, this needs to be examined in more detail. For the second question, we recorded the highest number of anthropometric parameters for which significant differences were observed, mostly in favor of the group that agreed with the relationship between conscious food selection for body weight correction. This was demonstrated by the highest values of parameters related to muscle mass and the lowest values of fat parameters. Statistically significant differences were found in the case of body weight, SLM, FFM, SMM, BFM, PBF, WC, WHR and VFA. In the third question regarding the use of stimulating foods and drinks such as coffee, energy drinks and others, we found significant differences in the case of weight, BMI, BFM, WC and VFA. In the fourth and fifth questions, we did not find significant differences between the answers. In the sixth question, a statistically significant difference was found only in the body weight values, with higher values being found in the disagreeing group compared to the agreeing group. The seventh question related to higher food intake during a feeling of boredom brought more striking results, as we found significant differences in the case of all anthropometric parameters, except for SLM, FFM, SMM. Paradoxically, however, higher values, especially for fat parameters, were achieved by the group of participants who strictly disagreed with the question. Question eight was statistically significant only in the case of body fat percentage and question nine in the WHR index.

In the following section, we were interested in the differences in the values of anthropometric parameters according to the affirmative answers to individual questions. We only considered respondents who answered the questions agree or totally agree. The results showed that participants who stress eat with food (Q_1) had statistically significantly the lowest values of parameters related to muscle mass (SLM, FFM, SMM, BMR). On the contrary, participants who consume food that corrects their body weight (Q_2) had significantly the lowest values of fat parameters and in most cases the highest values of parameters related to muscle mass. Detailed results are presented in Table 4.

Table 5 presents the results of the correlation analysis and the relationships between individual questions. The analysis showed a strong correlation between question Q_1 and Q_6 ($r = 0.649$; $P < 0.001$), Q_8 ($r = 0.636$; $P < 0.001$) and Q_9 ($r = 0.651$; $P < 0.001$). The questions form a block in which food is a form of escape and it is therefore expected that the questions will correlate with each other. Furthermore, we found a strong correlation between Q_6 and Q_8 ($r = 0.658$; $P < 0.001$) and a moderate one with Q_7 ($r = 0.488$; $P < 0.001$). A strong correlation was also found in the

Table 3. Values of anthropometric parameters according to the prevalence of answers

		Totally disagree	Disagree	Neither agree nor disagree	Agree	Totally agree			Totally disagree	Disagree	Neither agree nor disagree	Agree	Totally agree
Weight (kg)	Q_1	64.6	70.9[a]	69.3	59.2[b]	61.3	BFM (kg)	Q_1	15.1	17.0	18.1	16.1	14.2
	Q_2	62.7	57.3[a]	71.1[b]	65.7	71.2[b]		Q_2	20.0	16.3	19.5[a]	13.9[b]	14.6
	Q_3	58.4[a]	72.2[b]	69.0	66.6	62.8		Q_3	13.1[a]	20.5[b]	17.2	16.7	13.2
	Q_4	73.2	68.4	65.0	64.1	74.4		Q_4	16.5	19.2	15.5	15.1	27.8
	Q_5			63.8	67.7	67.7		Q_5			17.5	17.4	15.4
	Q_6	65.6	72.0[a]	64.8	59.3[b]	63.3		Q_6	15.9	19.3	15.9	14.3	14.6
	Q_7	83.6[a]	70.9	67.4[b]	63.2[b]	62.8[b]		Q_7	28.8[a]	16.7[b]	17.3[b]	15.6[b]	14.0[b]
	Q_8	71.6	68.1	66.0	60.5	59.8		Q_8	19.7	14.7	17.7	15.8	14.6
	Q_9	69.0	67.0	63.9	68.8	62.6		Q_9	17.0	15.5	14.6	18.8	17.6
BMI ($kg.m^{-2}$)	Q_1	22.3	24.0	24.1	22.2	21.7	PBF (%)	Q_1	23.1	23.5	26.0	27.1	23.4
	Q_2	22.9	22.1	24.5	22.6	23.6		Q_2	31.3[a]	27.8[a]	27.1[a]	20.9[b]	21.5
	Q_3	20.4[a]	24.8[b]	24.5[b]	23.2[b]	22.1		Q_3	22.8	27.6	24.9	25.1	21.5
	Q_4	23.3	23.8	23.3	22.8	27.6		Q_4	21.5	27.5	23.6	24.2	37.3
	Q_5			23.7	23.7	22.6		Q_5			27.0	25.7	22.5
	Q_6	22.6	24.5	23.3	21.7	21.5		Q_6	23.3	26.7	24.7	23.7	23.4
	Q_7	28.8[a]	23.6[b]	23.5[b]	22.7[b]	21.9[b]		Q_7	34.8[a]	23.3[b]	25.8	24.6[b]	21.9[b]
	Q_8	24.6	23.3	23.5	22.0	21.3		Q_8	26.7	21.2[a]	27.1[b]	25.8	24.7
	Q_9	23.9	22.9	22.7	24.0	22.8		Q_9	23.4	23.2	23.2	27.0	27.9
SLM (kg)	Q_1	46.6	50.7[a]	48.2	40.6[b]	44.3	WC (cm)	Q_1	81.1	85.9	84.5	79.2	77.7
	Q_2	40.1	38.6[a]	48.6[b]	48.8[b]	53.4[b]		Q_2	82.1	78.7[a]	87.9[b]	79.7[a]	82.0
	Q_3	42.6	48.6	48.9	47.0	46.7		Q_3	76.1[a]	88.0[b]	84.1	83.6	78.1
	Q_4	53.5	46.3	46.7	46.1	43.7		Q_4	85.7	85.5	81.3	80.5	93.6
	Q_5			43.5	47.3	49.2		Q_5			82.4	83.9	82.4
	Q_6	46.8	49.7	46.2	42.4	45.8		Q_6	81.3	87.6	81.6	77.4	78.2
	Q_7	51.6	51.1	47.2	44.9	45.9		Q_7	100.5[a]	85.5[b]	83.4[b]	80.1[b]	79.0[b]
	Q_8	48.9	50.3	45.5	42.0	42.5		Q_8	87.1	82.7	83.6	78.2	76.6
	Q_9	49.0	48.5	46.5	47.1	42.3		Q_9	84.1	82.5	78.6	86.4	80.1
FFM (kg)	Q_1	49.5	53.9[a]	51.2	43.1[b]	47.1	WHR	Q_1	0.86	0.88	0.87	0.85	0.84
	Q_2	42.7	41.0[a]	51.6[b]	51.8[b]	56.6[b]		Q_2	0.86	0.86	0.90[a]	0.84[b]	0.84
	Q_3	45.3	51.7	51.9	49.9	49.6		Q_3	0.83	0.89	0.86	0.87	0.83
	Q_4	56.8	49.2	49.5	48.9	46.6		Q_4	0.88	0.88	0.85	0.85	0.92
	Q_5			46.3	50.2	52.3		Q_5			0.86	0.87	0.86
	Q_6	49.7	52.8	49.0	45.0	48.7		Q_6	0.85	0.89	0.86	0.84	0.84
	Q_7	54.8	54.3	50.1	47.6	48.8		Q_7	0.97[a]	0.88[b]	0.87[b]	0.85[b]	0.85[b]
	Q_8	51.9	53.4	48.3	44.6	45.2		Q_8	0.88	0.86	0.87	0.84	0.83
	Q_9	52.0	51.5	49.4	50.0	45.1		Q_9	0.86	0.86	0.83[a]	0.89[b]	0.85
SMM (kg)	Q_1	27.5	30.3[a]	28.4	23.6[b]	26.0	VFA (cm^2)	Q_1	65.0	71.9	80.1	68.7	57.7
	Q_2	23.2	22.3[a]	28.7[b]	28.9[b]	31.8[b]		Q_2	88.3	72.2	87.3[a]	55.6[b]	59.7
	Q_3	24.9	28.7	29.0	27.8	27.6		Q_3	54.0[a]	91.9[b]	73.6	71.8	53.9
	Q_4	31.8	27.2	27.6	27.2	25.6		Q_4	69.3	86.6	62.9	64.3	133.6
	Q_5			25.5	27.9	29.2		Q_5			75.3	76.7	64.6
	Q_6	27.6	29.5	27.2	24.8	27.0		Q_6	65.9	85.6	68.7	59.2	58.3
	Q_7	30.6	30.3	27.9	26.4	27.1		Q_7	135.4[a]	74.7[b]	74.5[b]	65.4[b]	55.4[b]
	Q_8	28.9	30.0	26.7	24.5	24.8		Q_8	85.2	62.7	78.2	66.2	59.5
	Q_9	29.1	28.7	27.5	27.7	24.7		Q_9	70.0	64.2	60.6	85.9	75.7

[a, b] – different symbols (post-hoc analyses) in a row indicate significant differences between groups; values without a symbol had no statistically significant difference

Table 4. Values of anthropometric parameters depending on the positive answers to the questions

Parameters/Qs	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9
Age (years)	22.4	22.2[a]	23.5	25.3[b]	23.0	22.5	23.9	22.4	23.2
Weight (kg)	59.7	66.8	65.7	64.6	67.7	60.3	63.1	60.1	67.3
Body Mass Index (BMI, $kg.m^{-2}$)	22.1	22.8	23.0	23.1	23.3	21.7	22.5	21.6	23.7
Basal Metabolic Rate (BMR, kcal)	1321[a]	1511[b]	1446	1425	1472[b]	1362	1404	1340	1425
Soft Lean Mass (SLM, kg)	41.4[a]	49.8[b]	46.9	46.0	48.0[b]	43.2	45.1	42.2	46.0
Fat Free Mass (FFM, kg)	44.0[a]	52.8[b]	49.8	48.8	51.0[b]	45.9	47.9	44.9	48.8
Skeletal Muscle Mass (SMM, kg)	24.1[a]	29.5[b]	27.7	27.1	28.4	25.3	26.5	24.7	27.0
Body Fat Mass (BFM, kg)	15.7	14.0[a]	15.9	15.8	16.7	14.4	15.3[a]	15.2	18.5[b]
Percentage Body Fat (PBF, %)	26.3[a]	21.0[b]	24.3	24.9	24.5	23.6	24.1	25.2	27.2[a]
Waist Circumference (WC, cm)	78.8	80.2	82.4	81.2	83.3	77.6	79.9	77.4	84.9
Waist-Hip Ratio (WHR)	0.85	0.84[a]	0.86	0.85	0.87	0.84	0.85[a]	0.83	0.88[b]
Visceral Fat Area (VFA, cm^2)	66.1	56.5[a]	67.9	68.0	72.1	58.9	63.5[a]	62.9	83.5[b]

[a, b] – different symbols (post-hoc analyses) in a row indicate significant differences between groups; values without a symbol had no statistically significant difference

Table 5. Correlogram of mutual associations between questions

	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9
Q_1		P = 0.9059	P = 0.0002	P = 0.4108	P < 0.0001	P < 0.0001	P < 0.0001	P < 0.0001	P < 0.0001
Q_2	-0.008		P = 0.0055	P < 0.0001	P = 0.2701	P = 0.2285	P = 0.1765	P = 0.8904	P = 0.5958
Q_3	0.256	0.195		P = 0.4519	P = 0.1412	P < 0.0001	P = 0.4700	P = 0.0012	P < 0.0001
Q_4	0.058	-0.287	-0.053		P = 0.0186	P = 0.0390	P = 0.9571	P = 0.9470	P = 0.1052
Q_5	0.298	0.078	-0.104	-0.166		P < 0.0001	P < 0.0001	P < 0.0001	P = 0.0122
Q_6	0.649	-0.085	0.365	0.146	0.383		P < 0.0001	P < 0.0001	P < 0.0001
Q_7	0.424	0.096	0.051	0.004	0.286	0.488		P < 0.0001	P = 0.0010
Q_8	0.636	0.01	0.227	-0.005	0.491	0.658	0.386		P < 0.0001
Q_9	0.651	-0.038	0.29	-0.115	0.176	0.388	0.231	0.575	

Table 6. Values of anthropometric parameters depending on blocks and unclassified questions

Parameters/Blocks	Block 1	Block 2	Q_2	Q_3	Q_7
Age (years)	22.8	23.6	22.2	23.5	23.9
Weight (kg)	63.5	66.8	66.8	65.7	63.1
Body Mass Index (BMI, $kg.m^{-2}$)	22.7	23.2	22.8	23.0	22.5
Basal Metabolic Rate (BMR, kcal)	1379[a]	1458	1511[b]	1446	1404
Soft Lean Mass (SLM, kg)	43.9[a]	47.5	49.8[b]	46.9	45.1
Fat Free Mass (FFM, kg)	46.7[a]	50.4	52.8[b]	49.8	47.9
Skeletal Muscle Mass (SMM, kg)	25.7[a]	28.0	29.5[b]	27.7	26.5
Body Fat Mass (BFM, kg)	16.8	16.4	14.0	15.9	15.3
Percentage Body Fat (PBF, %)	26.2[a]	24.6[a]	21.0[b]	24.3	24.1
Waist Circumference (WC, cm)	81.3	82.7	80.2	82.4	79.9
Waist-Hip Ratio (WHR)	0.86	0.86	0.84	0.86	0.85
Visceral Fat Area (VFA, cm^2)	72.8[a]	71.0	56.5[b]	67.9	63.5

[a, b] – different symbols (post-hoc analyses) in a row indicate significant differences between groups; values without a symbol had no statistically significant difference

case of Q_8 and Q_9 ($r = 0.575$; $P < 0.001$) and a moderate one with Q_5 ($r = 0.491$; $P < 0.001$).

We were also interested in whether there were differences in the values of anthropometric parameters between the questions when they were combined into block 1 and block 2 and questions Q_2, Q_3 and Q_7. As can be seen in Table 6, we found some significant differences, but in most cases the values of the parameters in block 1 were statistically significantly different from the values belonging to question Q_2. As expected, Q_2 participants had lower values of fat parameters and higher values related to muscle mass than participants from block 1. However, we did not find statistically significant differences between block 1 and block 2 ($P > 0.05$).

As studies indicate, this issue is highly topical, and they bring diverse results depending on the factors monitored. When monitoring the mutual relationships between individual items, we have in several cases recorded the same results as other authors. Ferrão et al. [20] found a strong correlation between question Q_1 (food helps me cope with stress) and Q_6 (eating helps me with feelings of loneliness) with a score of 0.62, which is consistent with our findings. We also agree with the strong relationship between item Q_1 and item Q_9 (depression). Unlike the authors, we also found a strong correlation in the case of items Q_1 and Q_8 (emotional comfort). Our results also agree with the positive moderate correlation found between Q_1 and Q_7 (eating when bored).

For the first question regarding food and stress, we found significant associations with body weight, soft lean mass, fat-free mass and skeletal muscle mass. The group that refused to eat stress achieved higher values for the above parameters. As we have already mentioned above, we believe that the above group consisted of sports-active individuals who respond to stressful situations by increasing physical activity. These hypotheses are in line with the findings of other authors, according to whom physical activity is a beneficial association for emotional eaters [21, 22]. However, despite our findings, stressful situations can also influence consumer behavior in the opposite direction and can lead to overeating. The recent global Covid-19 pandemic has caused extensive changes in lifestyle and socio-economic areas. This has been manifested in isolation, limited movement and deterioration of diet. Several studies have provided evidence of the negative impact of the pandemic and its management on the body composition of the population, especially with an emphasis on the increase in the prevalence of overweight and obesity [23-25].

For question Q_2 (weight control), we recorded the highest number of anthropometric parameters for which significant differences were observed, mostly in favor of the group that agreed with the relationship between conscious and mindful food choices for body weight correction. This was demonstrated by the highest values of parameters related to muscle mass and the lowest values of fat parameters. Mindful eating expresses maximum physical attention to food consumption and emotional experience of food in a certain way, intentionally and in the present moment [26]. Such consumers are fully aware of feelings of satiety and adequately regulate food intake, avoiding inappropriate stimuli to eat, such as advertisements or emotions. However, in line with the results of Ferrão et al. [20], we found that item Q_2 had very weak correlations with all other items.

The question related to eating out of boredom (Q_7) yielded more striking results, as significant differences were found for all anthropometric parameters, except for soft lean mass, fat-free mass and skeletal muscle mass. Paradoxically, higher values, especially for fat parameters, were achieved by the group of participants who strongly disagreed with the question. Crockett et al. [27] found that inappropriate eating habits occurred in those with a tendency to boredom and emotional difficulties.

In relation to body weight, weight gain, unhealthy body composition (in favor of fat components) and overeating, not only negative emotions should be considered, but also positive emotions related to mood improvement. A meta-analysis by Evers et al. [28] showed that positive emotions led to increased eating. The fact is that emotional eaters can respond to both negative and positive emotions, but weight gain is mostly associated only with negative emotions [11, 29, 30]. Bacârea et al. [18] found that people who answered yes to questions Q_1, Q_6, Q_8 and Q_9 (block 1) had significantly higher BMI. However, when examining BMI in relation to the questions included in block 2 (Q_4 and Q_5) or in relation to item Q_2, they did not observe any significant associations. According to their results, weight gain was associated with block 1, but not with block 2 or Q_2. However, this does not match our findings. We did not find statistically significant differences between block 1 and block 2 ($P > 0.05$). In our case, we only found statistically significant differences in parameter values in block 1 compared to the values corresponding to question Q_2. As expected, participants in Q_2 had lower values of fat parameters and higher values related to muscle mass than participants in block 1.

According to our findings, participants who stress eat with food (Q_1) had statistically significant lowest values of parameters related to muscle mass (SLM, FFM, SMM, BMR). Conversely, participants who consume food that corrects their body weight (Q_2) had significantly lowest values of fat parameters and in most cases highest values of parameters related to

muscle mass. This is in line with the findings of authors Keller et al. [31], according to which consumers who choose food that regulates their body weight do not tend to increase their body mass index. Another study confirms that emotional overeating is associated with increased body mass index, overweight and obesity [32].

The limitations of our study lie in the low representation of older people and male participants. However, this is a pilot publication that focuses on the relationship between the components of emotional eating and selected indicators of body composition in the Slovak population.

CONCLUSIONS

Based on the results obtained, we can conclude that our emotions and emotional eating have a significant impact on the body composition of consumers. Our results showed that the values of anthropometric parameters did not differ significantly between those who associate food with negative emotions and those who associate its consumption with positive emotions. However, it was clearly confirmed that those who choose food consciously in relation to maintaining adequate body weight also achieved the most optimal values of anthropometric parameters.

Acknowledgements

The study was supported by the Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic (KEGA 003SPU-4/2022).

Conflict of interest

There were no conflicts of interest.

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Received: 19.11.2024
Revised: 20.01.2025
Accepted: 05.03.2025
Published online first: 17.04.2025