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Original Investigation

# Diet and eating behaviour of university youth in the context of body fat and muscle mass

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***Purpose:*** The aim of the study conducted among students from Poland was to examine the relationship between nutritional behaviors from a psychological perspective (emotional eating, habitual eating, dietary restrictions) and preferred diet (healthy vs. unhealthy), in relation to selected anthropometric variables – body fat and muscle mass.
***Methods:*** A total of 202 participants took part in the study. Including 103 women (age 21.44 ±2.14 years, stature 167.91 ±6.13 cm, body mass 62.08 ±12.11 kg) and 99 men (age 21.48±1.93 years, stature 179.12±7.11 cm, body mass 77.31±15.32 kg). The study used: 1) Eating Behaviour Questionnaire to measure the psychological attitude of an individual towards food and the functions it performs for them, 2) KOMPAN Questionnaire to verify eating habits and choices, 3) the medical scale to measure body mass, the stadiometer to measure stature and to assess the percentage of body fat. In addition, metric data were collected.
***Results:*** Statistical analyses showed that psychologically understood eating behaviors were associated with the percentage of body fat - the higher the intensity of emotional eating, the higher the percentage of body fat ($R$= .382; $P$< .001) and the lower the percentage of muscle in total body mass ($R$=- .202; $P$< .01). Women in the studied sample showed a higher intensity of emotional eating compared to men (Mwomen 5.06±2.16 a.u.; Mmen 3.44±2.26 a.u.; $U$=2992.50; $P$< .001).
***Conclusions:*** The significance of eating behavior in psychological terms for the proportion of body fat in body composition was confirmed. The increase in the intensity of emotional eating increases the proportion of body fat and decreases the proportion of muscle tissue in total body weight.

***Keywords:*** diet, lifestyle, eating behavior, college youth, emerging adulthood

## Introduction

Diet and lifestyle are among the most important factors that have a significant impact on the nutrition and health of humans[1-2]. A reasonable diet supports good physical health[3-4] and mental health[5,6], and also helps a person to utilise the mental and physical capacities of their body to a greater extent. The way in which nutritional needs are satisfied is influenced by a number of external factors, including family dietary environment and culture, as well as internal factors – a person's individual attitudes towards food, gender and the functions that food has and continues to play in the individual's life[7-9]
A group that is particularly vulnerable to poor diet and the resulting adverse health consequences is academic youth. They are still in the so-called emerging adulthood stage. This period, according to Arnett[10], is characterised by instability and intensity, and young people experience the failures associated with this period alone, without the support of family or friends. This often leads to an inappropriate diet, mainly irregular and poorly varied meals and lack of physical activity[11-13]. A significant number of young people, especially women, focus excessively on their silhouette and, feeling dissatisfied with their body, including their weight, either start increasingly restrictive diets or eat because of the emotions caused by their inability to cope with the dissatisfaction with their body. On the other hand, men – instead of going on diets to reduce body fat – often experiment with products aimed at increasing muscle mass[14-16].
Very little is yet known about the relationship between the current diet (the effects of which can be seen, for example, in anthropometric parameters) and the functions performed by food in the population of academic youth. Discovering the correlations between the above variables would make it possible to identify the quality, sources and consequences of diet mistakes made by members of this group, which would simplify the development and adoption of measures that help students make healthier choices.
The main objective of the self-report research was to verify the relationships between the title constructs: diet and behaviour towards food in academic youth in relation to selected anthropometric indices – body fat and muscle mass.
It has been assumed that there is a statistically significant relationship between diet and eating behaviour in psychological terms in the studied individuals. It was expected that the higher the level of abnormal eating behaviours measured with the Eating Behaviour Questionnaire, the more characteristics of abnormality the individuals current eating style and dietary choices would show. It was also expected that the values of selected anthropometric indices (in terms of muscle and fat mass) would be (more) abnormal in those individuals studied who follow an unbalanced diet and exhibit abnormal eating behaviours.

## Methods

### *Participants*

The final sample size was 202; including 103 women (age 21.44±2.14 years, stature 167.91±6.13 cm, body mass 62.08±12.11 kg) and 99 men (age 21.48±1.93 years, stature

179.12±7.11 cm, body mass 77.31±15.32 kg). The average age of the all the participants was 21.82±2.03 years; women accounted for 50.99% of the sample and men for 40.01%; non-workers accounted for 56.44% and people from urban areas accounted for 71.29%. Participants with mental disorders or chronic somatic illnesses requiring permanent medication were excluded. Individuals identifying as a gender other than male or female were also excluded, as well as those pursuing fields of study other than physical education. The research was carried out between April 2021 and October 2022 among Polish university youth studying full-time. The project was conducted using a face-to-face interview method and the research was carried out by three appropriately trained persons, namely dieticians and a psychologist. The research included all students of the drawn majors who gave their informed consent to participate in the research.

***Experimental design***

Two self-report instruments were used in the self-report research: 1) the validated KomPAN questionnaire[17]. It is used to examine the views and eating habits of individuals from 16 to 65 years of age[18]; 2) *the Eating Behaviour Questionnaire* (EBQ), on the other hand, measures attitudes to eating from a psychological perspective in three areas – emotional eating, habitual eating and dietary restrictions[19].

The following anthropometric measurements were also taken; body weight (kg), stature (cm). The medical scale to measure body mass (producer RADWAG, model C315.100/200.OW-1, Poland) the body composition analyser (producer Tanita, model DC-13C, Japan) to measure height and to assess the percentage of body fat. In addition, metric data were collected. (% *Fat Mass*, %FM). The results obtained were compared to reference values relevant to the studied sample. Measurements were taken in the morning, while wearing light clothing and without shoes.

***Statistical analysis***

Statistical analyses were performed using STATISTICA 13, IBM SPSS Statistics v.25.0.0.1 and G*Power version 3.1.9.7. The significance level *P* was set at .05. All data are reported as mean and standard deviation (SD). Pearson correlations and a set of multivariate linear regression analyses were performed to show the relationship between fat and muscle tissue and the variables. In the multivariate regression analysis, outliers greater than +_ 3 SD were rejected. A test using the Variance Inflation Fact (*VIF*) was performed to avoid collinearity. In none of these models did the obtained level exceed *VIF*>10; it can therefore be concluded that there were weak correlations between the independent variables[20] The Mann-Whitney *U* test was used to determine differences in fat tissue and muscle tissue due to psychological variables related to eating (habitual eating, emotional eating, dietary restrictions) and the unhealthy diet index and the health-promoting diet index. The PROCESS version 3.3 by Hayes (2018) was used to determine the mediating role of eating behaviour between diet and body fat and muscle tissue. We used Model 4, with bootstrapping 5000 samples. We reported 95% confidence intervals for all paths for indirect effect and direct effect.

We determined the required sample size for the regression analysis using G*Power version 3.1.9.7. We assumed five predictors, alpha level = .05, power = .80, and a medium effect size ($f^2$ = .15). It was shown that the sample should consist of at least 92 participants. Because our sample has 202 participants, this is an adequate sample for the regression analyses[21].

## Results

Means and standard deviation refer to the raw scores obtained from: the KomPAN questionnaire and Eating Behavior Questionnaire (EBQ) and from the body composition analyser – body mass (%) and body fat. Habitual overeating 4.79±1.60 a.u.; emotional eating 4.27±2.35 a.u.; dietary restrictions 3.93±1.15 a.u.; eating behaviors-total 12.98±3.32 a.u.; unhealthy diet index 16.66±7.60 a.u. healthy diet index 21.93±10.58 a.u.; diet quality index 5.27±13.66 a.u.; body fat 20.05±9.00 %; muscle mass 52.21±11.33 kg; age 21.82±2.05 years. Pearson coefficient correlations obtained for eating behaviour in psychological terms, indices – health-promoting diet, unhealthy diet and overall diet quality, percentage of body fat and muscle mass in body composition, age and gender in the entire studied sample (Table 1).

**Table 1.** Pearson correlations of variables related to eating behaviors. Indices: healthy diet, unhealthy diet and overall diet quality, percentage of body fat and muscle mass, age and gender (*n*=202).

| | Correlations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **1 Habitual overeating** | 1.00 | | | | | | | | | |
| **2 Emotional eating** | .367*** | 1.00 | | | | | | | | |
| **3 Dietary restrictions** | - .028 | - .186** | 1.00 | | | | | | | |
| **4 Eating behaviors - total** | .730*** | .819*** | .202** | 1.00 | | | | | | |
| **5 Unhealthy Diet Index** | -.021 | - .119 | - .104 | - .130 | 1.00 | | | | | |
| **6 Healthy Diet Index** | .118 | .033 | .082 | .108 | - .106 | 1.00 | | | | |
| **7 Diet Quality Index** | .103 | .092 | .121 | .156* | - .638*** | .833*** | 1.00 | | | |
| **8 Body fat** | .124 | .382*** | - .123 | .287*** | - .141* | - .045 | .044 | 1.00 | | |
| **9 Muscle mass** | - .040 | - .202** | .084 | - .133 | - .006 | .106 | .086 | - .239** | 1.00 | |
| **10 Age** | - .068 | - .055 | - .035 | - .084 | -.019 | .089 | .079 | .192** | - .036 | 1.00 |
| **11 Gender** | - .105 | - .344*** | .124 | - .251*** | .085 | .072 | .009 | -.585*** | .837*** | - .147* |

Note: Gender was coded: 1 - woman; 2 – man. "*" - *P*< .05; "**" - *P*< .01; "***" - *P*< .001.

Pearson correlation analysis indicates the relevance of eating behaviour in psychological terms to the percentage of fat in body composition. It appears that as emotional eating increases, the percentage of body fat increases (R= .381; *P*< .001; medium size correlation) - and muscle tissue decreases (R=- .202; *P*= .004; small size correlation) in total body weight. It should be noted that dietary restrictions, related to food restriction or diets, are not related to levels of body fat and muscle. Several trends were noted but were statistically insignificant. For instance, the healthy diet index was not statistically significantly positively correlated with muscle mass (R= .106; *P*= .132). Detailed results are presented in Table 1.

Significant gender differences in the highlighted variables were also revealed. Women, compared to men, show: 1) higher intensity of emotional eating ($M_{women}$ 5.06±2.16 a.u,.; $M_{men}$ 3.44±2.26 a.u.; *U*=2992.50; *P*< .05), 2) lower percentage body fat ($M_{women}$ 25.19±7.78 a.u.; $M_{men}$14.70±6.80 a.u.; *U*=1392.00; *P*< .001) and 3) lower percentage of muscle tissue ($M_{Women}$ 42.93±4.46 a.u.; $M_{men}$ 61.85±7.64 a.u.; *U*=106.50; *P*< .001). It was also proven that as emotional eating increased, the proportion of body fat increased (*R*= .382; *P*< .001; medium size correlation) and the proportion of muscle tissue decreased (R=- .202; *P*= .004; small size correlation) in total body weight.

This was followed by a multiple linear regression analysis (Table 2), in which the independent variables were habitual overeating, emotional eating and dietary restriction, as well as unhealthy and healthy diet indices. The independent variables were body fat (model 1) and muscle tissue (model 2).

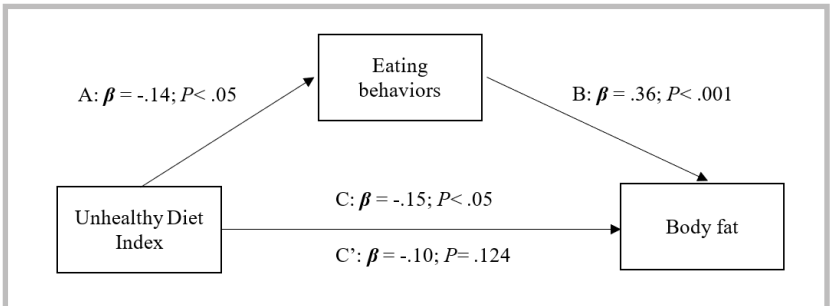
**Table 2.** Results of multiple linear regression analysis for predicting body fat (model 1) and muscle mass (model 2)

| Variables | **Model 1 – Dependent variable: body fat** $R^2$ = .20; *Adjusted* $R^2$= .18 *F*(5.194)=9.47; *P*< .001 *VIF*=5.53 | | | | **Model 2 – Dependent variable: muscle mass** $R^2$ = .09; *Adjusted* $R^2$= .07 *F*(5.193)=3.79; *P*= .003 *VIF*=5.53 | | | |
|---|---|---|---|---|---|---|---|---|
| | ***β*** | ***SE β*** | ***t*** | ***P*** | ***β*** | ***SE β*** | ***t*** | ***P*** |
| Absolute term | | | 18.51 | < .001 | | | 10.37 | < .001 |
| Habitual overeating | - .01 | .07 | - .10 | .792 | .08 | .07 | 1.05 | .296 |
| Emotional eating | .41 | .07 | 1.58 | < .001 | - .23 | .08 | -3.04 | .003 |
| Dietary restrictions | - .04 | .07 | - .34 | .516 | .11 | .07 | 1.56 | .121 |
| Unhealthy Diet Index | - .13 | .07 | - .16 | .046 | .01 | .07 | .12 | .905 |
| Healthy Diet Index | - .03 | .07 | - .03 | .635 | .14 | .07 | 2.00 | .047 |

Key: $R^2$ – the coefficient of determination; *Adjusted* $R^2$ – the adjusted coefficient of determination; *β* – the standardized regression coefficient, *SE β* – the standard error for the standardized beta; *VIF* – Variance Inflation Fact.

The multiple regression model for body fat revealed that the statistically significant variables were emotional eating (*β*= .41; *P*< .001) and the unhealthy diet index (*β*=- .13; *P*< .05). Model 1 explained 18% of the variance in the variable body fat and was a good fit to the data [*F*(5.194)=9.47; *P*< .001]. In the multiple regression model for muscle tissue (model 2), the variables emotional eating and healthy diet index were statistically significant (*β* =- .23; *P*< .05; *β* = .14; *P*< .05, respectively). This model explained 7% of the variance in the muscle tissue variable and was a good fit to the data [*F*(5.193)=3.79; *P*= .003]. It is important to note that, of the three psychological variables associated with eating behaviour, only emotional eating explains the variability in body fat ($R^2$= .17), while for muscle tissue it accounts for 5% of the variance in the results. It appears that the unhealthy diet index explained 2% of the variance in body fat results, but it is not significant for muscle tissue. As for muscle tissue the healthy diet index is significant and explained 2% of the variance in this variable.

In order to determine the relationship between psychological factors related to eating, diet and body fat and muscle tissue, the mediating role of eating behaviour between dietary indices and body fat and muscle tissue was tested. The dependent variables were body fat and muscle tissue. The independent variable for body fat was the unhealthy diet index, while for muscle tissue it was the healthy diet index. The mediator was eating behaviour (total). Figure 1 below shows the mediating role of eating behaviour between diet (unhealthy diet index) and body fat [*F*(2.198)=9.87; *P*< .001]. The mediating role of eating behavior between the unhealthy diet index and body fat




Key: *β* – the standardized regression coefficient, A - linear regression between Unhealthy Diet Index and Eating behaviors; B – linear regression between Eating behaviors and Body fat; C - linear regression between Unhealthy Diet Index and Body fat; C' - linear regression between Unhealthy Diet Index and Body fat including the role of mediator Eating behaviors

**Figure 1**. The mediating role of eating behavior between the unhealthy diet index and body fat

In the regression model the unhealthy diet index was a statistically significant predictor for eating behaviour [A: $\beta$ = - .14; $P$< .05; 95%; CI (- .122; - .002)] and for body fat [C: $\beta$ = - .15; $P$< .05; 95%; *CI* (- .337; - .010)] and eating behaviour was a statistically significant predictor for body fat [B: $\beta$ = .27; $P$< .001; 95%; CI (.357; 1.095)]. When eating behaviour is added as a second predictor, the unhealthy diet index is no longer statistically significant for the explanatory variable body fat [C': $\beta$ = - .10; $P$=.124; 95%, *CI* (- .287; .031)]. The bootstrap method (95%, bootstrap sample = 5000) showed that the indirect effect of eating behaviour was .045 [95%, CI (- .106; - .001)], partially standardized indirect effect was - .005 [95%, CI (- .012; - .001)] and the completely standardized indirect effect was - .038 [95%, CI (- .087; - .001)]. The above data indicate total mediation of eating behaviour between unhealthy diet index and body fat.

Further analysis identified a specific mediator of eating behaviour, that is emotional eating – between diet (unhealthy diet index) and body fat [$F$(2.194)=16.98; $P$< .05]. In the regression model the unhealthy diet index was a statistically significant predictor for emotional eating [A: $\beta$ = - .14; $P$< .05; 95%; *CI* (- .083; - .001)], for body fat [C: $\beta$ = - .15; $P$< .05; 95%; *CI* (- .034; - .017)] and emotional eating was a statistically significant predictor for body fat [B: $\beta$ = .36; $P$< .001; 95%; CI (.882; 1.915)]. When emotional eating was added as a second predictor, the unhealthy diet index was no longer statistically significant for the explanatory variable body fat [C': $\beta$ = - .10; $P$= .124; 95%, *CI* (- .273; .033)]. The bootstrap method (95%, bootstrap sample = 5000) showed that the indirect effect of eating behaviour was - .059 [95%, CI (- .125; - .001)], the partially standardized indirect effect was - .007 [95%, CI (- .014; - .001)] and the completely standardized indirect effect was - .051 [95%, CI (- .010; - .001)]. The above data indicate total mediation of emotional eating between unhealthy diet index and body fat.

Further analysis attempted to demonstrate a mediating role of eating behaviour between diet (healthy diet index) and muscle tissue [$F$(2.190)=6.05; $P$< .05]. In the regression model healthy diet index was a statistically significant predictor for eating behaviour [A: $\beta$ = .14; $P$< .05; 95%; *CI* ( .001; .097)] and for muscle tissue [C: $\beta$ = .14; $P$< .05; 95%; *CI* ( .004; .309)]. When eating behaviour was added as a second predictor, the healthy diet index was still statistically significant for the explanatory variable muscle tissue [C': $\beta$ = .19; $P$< .05; 95%, *CI* ( .036; .339)]. The bootstrap method (95%, bootstrap sample = 5000) also showed no mediating effect of eating behaviour: indirect effect - .031 [95%, *CI* (- .077; .001)], partially standardized indirect effect - .003 [95%, *CI* (- .007; .001)] and completely standardized indirect effect - .029 [95%, *CI* (- .070; .001)].

An attempt to demonstrate the mediating role of emotional eating between diet (healthy diet index) and muscle mass [model 4: $F$(2.195)=7.64; $P$< .001] began with analysis of the following multiple regression model: healthy diet index was a statistically significant predictor for muscle tissue [C: $\beta$ = .16; $P$< .05; 95%; *CI* ( .023; .300)], but was not a predictor for emotional eating [A: $\beta$ = .02; $P$= .80; 95%; *CI* (- .027; .035)]. After including emotional eating in the regression model, there was no change in the standardised coefficient $\beta$ of the healthy diet index [C': $\beta$ = .16; $P$< .05; 95%, *CI* ( .029; .301)] as a predictor of muscle tissue. These results exclude a moderating effect of emotional eating between the healthy diet index and muscle tissue. The bootstrap method (95%, bootstrap sample = 5000) also showed a lack of mediating effect of emotional eating: indirect effect - .004 [95%, *CI* (- .039; .028)], partially standardized indirect effect < - .001 [95%, *CI* (- .004; .003)] and completely standardized indirect effect - .004 [95%, *CI* (- .038; .028)].

## Discussion

The objective of the self-report research project was to test the associations between diet and eating behaviour in academic youth with selected anthropometric indices. It was empirically proven that as the intensity of emotional eating increases, the proportion of body fat increases and muscle tissue decreases.

This result is in agreement with findings of other researchers. Emotional eating, that is eating caused by emotions, can lead to excessive calorie intake, which results in excessive weight gain and increased body fat in the total body weight[22]. According to emotional eating creates a serious risk of recurrent weight gain, among others due to the accompanying tendency to choose fast food. It has been proven[23]that the so-called comfort food, i.e. food chosen to improve mood, is most often high in calories, therefore it causes weight gain, especially if it is a permanent strategy for coping with affect or stress and is associated with a limitation of physical activity[24]. Hilde Bruch[25], the author of the term 'emotional eating', and other researchers[26-28] believe that emotional eating results from an inability to properly distinguish between physiological and emotional hunger. This results in excessive food consumption intended to relieve unpleasant emotions and an increase in body weight[29,30].

The results also confirmed differences between genders about emotional eating, finding it to be more intense among women than men. Similar results were obtained by Stetkiewicz-Lewandowicz et al.[31], who proved that female students, irrespective of their major are more prone than men to experience a lack of control overeating, including emotional eating. Thomson and his team[32] also prove that women are more likely than men to eat because of the emotions they are experiencing, which may be because they are more likely to display dissatisfaction with their bodies and symptoms of depression, and experience stress more frequently/intensely. Saccaro and his team[33], while conducting research among a group of people suffering from obesity (with an above-normal body fat content in total body weight), proved that the studied women were significantly more likely to have an emotional eating style, while men were more likely to have a volumetric eating style. It also turns out that while eating as a result of experiencing boredom is not related to gender, sadness, depression, and worry trigger the need to eat significantly more often in women than in men[34]. The mechanisms underlying this association are neurobiological, including those related to cortisol levels. In humans, as in animals, cortisol stress is associated with stress-induced food seeking in emotional eaters[35]. In a study conducted in a group of young adults, it was proven that emotional eating moderates the relationship between stress and snacking. It also turned out that as the level of cortisol reactivity increased from lower to higher, the impact of stress on eating decreased. Moreover, the self-report research found that the unhealthy diet index is a predictor of emotional eating and body fat, while the healthy diet index is a predictor of total eating behaviour and muscle tissue. This finding is in line with reports from other researchers. For example, emotional eating means the consumption of fast food[36,37], salty snacks[31], sweet foods high in fat[38] or foods high in energy[39] and sweetened beverages[40]. According to psychosomatic theory the relationship between the propensity to emotional eating and the dietary index may be attributable to the fact that the greater a person's propensity to emotional eating, the greater the tendency to choose products rich in sugar and/or fat[41,42]. As mentioned before emotional eating, apart from a higher unhealthy diet index, is also accompanied by a higher BMI and a higher body fat content in body weight. This has been confirmed by many researchers[43,.44,45]. Limitation of this

study concerns the use of BMI-derived body fat percentages, which may not accurately reflect body composition, particularly in athletic individuals or those with higher muscle mass, where BMI can misrepresent body fat levels. More precise methods, such as DEXA scans, could be considered in future research to provide a more accurate assessment of body composition by distinguishing between fat, lean mass, and bone density. The use of DEXA or similar technologies would enhance the validity and reliability of findings, allowing for a more nuanced understanding of body composition within diverse populations. Furthermore, this study did not include an assessment of energy expenditure or physical activity levels, which could significantly impact the observed relationships between diet, eating behaviors, and body composition. Given that physical activity and energy expenditure are critical factors influencing body composition, future studies should incorporate these variables to better understand their role in moderating or mediating the effects of diet and eating behaviors.

## Practical Applications

The results of the self-report research project – in the opinion of the authors – offer application potential. First, since the proportion of body fat in the studied sample is related to emotional eating, it is necessary in (psycho)dietary work with overweight people to check whether they tend to eat due to stress and emotions. Not taking this variable into account can render the weight loss diet (permanently) ineffective. The lack of association between dietary restrictions and body composition could stem from measurement limitations, such as potential variability in self-reported intake or BIA sensitivity. Additionally, unique characteristics of our sample, such as lifestyle factors or baseline health differences, may also have influenced the results.

Second, preventive measures aiming to counteract abnormal body weight should not only incorporate nutritional education, but also equip recipients with strategies for recognising emotions and dealing with them in a constructive way (e.g. through meditation, physical activity).

Finally, it is worth emphasising that the highest possible index of a healthy diet, that is a properly balanced diet, and not just a reduction in the calorie intake, serves this purpose as part of efforts aimed at supporting individuals in building muscle mass. This is because the index of an unhealthy diet is directly related to the increase in fat mass in the overall body weight.

## Conclusions

1. The significance of eating behaviour in psychological terms for the proportion of body fat in body composition was confirmed. The increase in the intensity of emotional eating increases the proportion of body fat and decreases the proportion of muscle tissue in total body weight.
2. When compared to men women show: a higher intensity of emotional eating, a lower percentage of body fat and muscle tissue in total body weight.
3. Emotional eating explains the fluctuation of body fat, while the healthy diet index is important in terms of muscle tissue.
4. The unhealthy diet index is a predictor of emotional eating and body fat, while the healthy diet index is a predictor of total eating behaviour and muscle tissue.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## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

## Ethical Committee approval

Permission from the Research Ethics Committee at the University of Economy in Bydgoszcz (permission no.: ZP/1/2024).


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## Topic

Sport Nutrition

## Conflicts of interest

The authors have no conflicts of interest to declare.


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## Author-s contribution

Conceptualization, D.Ł. and B.Z.; methodology, D.Ł.; software, B.Z.; validation, B.Z. and J.O.; formal analysis, J.O.; investigation, D.Ł.; resources, D.Ł. and J.O.; data curation, D.Ł. J-O.; writing—original draft preparation, D.Ł. and B.Z. D-Ł.; writing—review and editing, S.K.; visualization, J.O. and S.K.; supervision, S.K.; project administration, D.Ł. All authors have read and agreed to the published version of the manuscript.

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