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# The role of experienced weight stigma, self-stigmatization, and food literacy in eating behaviour

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## Abstract

# Background

Experienced weight stigmatization and internalized stigma may contribute to maladaptive eating patterns; however, evidence from Central and Eastern Europe remains scarce despite the region's growing prevalence of overweight and obesity. Moreover, very little is known about protective factors related to health literacy that may help to diminish maladaptive eating behaviours. Thus, we aimed to assess the role of weight stigma and food literacy in restrained, uncontrolled, and emotional eating.

# Methods

A cross-sectional study was conducted in a Slovak adult population. A total of 203 participants with overweight/obesity (52.7% female; mean age 48.47 ± 14.28 years; body-mass index (BMI) 32.63 ± 5.87 kg/$m^2$; waist-to-height ratio (WHtR) 0.62 ± 0.10) completed the Experienced Weight Stigma, Weight Self-Stigma, Self-perceived Food Literacy Scale, and Three Factor Eating Questionnaire. Correlations and multiple linear regressions were used to analyse the data.

# Results

Almost 40% of individuals in our study reported experiencing weight stigma, which was significantly higher in females (48.6%) than in males (30.2%). WHtR was strongly associated ($p \leq 0.001$) with uncontrolled eating and emotional eating; however, these associations attenuated or were no longer significant when weight stigmatization was added to the regression models. Experienced stigma was associated with emotional ($p \leq 0.01$) and uncontrolled eating ($p < 0.05$), but lost its significance when the self-devaluation subscale of weight self-stigmatization was included. Self-devaluation was found to play a role in cognitive restraint ($p < 0.05$), emotional, and uncontrolled eating ($p \leq 0.001$). Correlations showed associations between low food literacy, uncontrolled ($p \leq 0.001$), and emotional eating ($p < 0.05$), while multivariate analysis identified a role of food literacy only in uncontrolled eating ($p \leq 0.01$). The explained variance in the final regression models for cognitive restraint, emotional eating, and uncontrolled eating was 10%, 41%, and 33%, respectively.

# Conclusions

Self-devaluation may be a more significant predictor of dysfunctional eating than experienced and anticipated weight stigmatization, or than body size per se. Interventions targeting weight stigma and food literacy may diminish dysfunctional eating behaviours. Dietary education is needed especially among males, rural populations, and those experiencing self-stigma.

## Introduction

The prevention of weight gain represents a key focus of public health nutrition policies, often with approaches aiming to improve individual eating practices. However, policies emphasizing weight-related behaviour change may have unintended consequences, including increased weight stigma and risk of disordered eating [1]. Many common anti-obesity efforts — particularly ones emphasising individual responsibility for weight control — may inadvertently undermine their intended effect mainly because these weight-centric beliefs support the perception of weight and overeating as being under volitional control [1–3], and easily managed through diet and physical activity [4]. The inability to achieve a desirable body size/shape is therefore often perceived as a moral failure [5]. These approaches are unintentionally complicit in contributing to weight stigma [6–7] and may have unintended consequences for population health [1].

Weight stigma exists on a global scale, including within societies that have historically preferred larger bodies [8]. In Western countries, rates of experienced weight stigmatization were found to vary between 19.2% and 60% [9–11]. Weight stigmatization refers to negative attitudes, beliefs, and norms that devalue individuals based on their body size. It often includes biases, stereotypes, discrimination, and social exclusion of people with larger body sizes [1, 12]. When a person experiences stigma because of body size, this is referred to as experienced weight stigma. A related phenomenon, weight self-stigmatization, is defined as the process of internalized self-devaluation during which an individual accepts stereotypes to be true of oneself [13].

Weight stigmatization is often accepted due to beliefs that inducing shame promotes weight loss [4]. However, weight-related stigmatization was found to have no motivating effects and may, in turn, undermine weight control efforts [14–15]. Negative effects of weight stigma were observed in many settings, including healthcare [16]. Weight stigmatization was found to have the potential to trigger an obesogenic process [2], and it was found to be associated with maladaptive health behaviours, poor mental health [17–18], poor self-regulation, less control in eating [19], or maladaptive eating patterns, including eating disorders [1, 18]. Weight discrimination may increase mortality risk, with estimates suggesting up to a 60% increase even after controlling for health-related factors [18, 20].

Both the experience and internalization of weight stigma are considered risk factors in the development and maintenance of eating pathology [21], including disordered eating cognitions and behaviours [18, 22]. However, the studies on the role of stigma in dysfunctional eating behaviours and disorders are still emerging, as some found no association [23] or identified associations that varied depending on one's weight [24]. Moreover, the existence of the associations and their strength do appear to change based on the specific constructs of weight stigma, the sample being assessed [25], or methodological limitations [26]. Despite theoretical support, research linking weight stigma to poor health outcomes rarely includes all — experienced stigma, fear of enacted stigma, and self-stigmatization [27].

Fluctuations in food consumption can be linked to various alterations in different aspects of eating behaviour patterns, such as cognitive restraint – defined as desire/attempts to limit food intake; uncontrolled eating – described as loss of control in the presence of palatable stimuli; and emotional eating – associated with the urge to eat in response to emotional states rather than physiological hunger [28]. Dysfunctional eating is highly prevalent in people with larger body sizes, with a global prevalence of emotional eating of almost 45% [29]. Moreover, approximately two-thirds of patients referred for specialist obesity treatment were found to be affected by emotional eating [30]. The role of the different eating patterns and their interaction is also less clear, with a longstanding lack of consensus on the role of cognitive restraint in eating pathology [31] or body size [32]. Cognitive restraint was found to be associated with healthy lifestyles and eating patterns, but it may be prone to disruptions by episodes of emotional and uncontrolled eating [33], and is further associated with the potential to develop eating disorders and obesity, although the evidence for the causal links remains vague and mixed [34–35].

Although some preliminary research indicated the protective role of health literacy in diminishing maladaptive eating [36–37], little is known about food literacy in eating behaviour. Food literacy can be described as the everyday practicalities associated with navigating the food system and using it to ensure a regular food intake that is consistent with nutrition recommendations while empowering individuals, households, communities, or populations to protect diet quality through change and strengthening dietary resilience [38]. Food literacy was associated with higher self-control efforts, lower impulsiveness, and better diet quality [39–40], including Mediterranean diet adherence [41]. However, to our best knowledge, little is known about the role of food literacy in eating patterns. Validated food literacy tools are only recently available, so only a few studies addressed the impact of food knowledge on eating behaviour [42–43]. Based on available evidence, no studies so far assessed the role of food literacy in cognitive restraint, uncontrolled eating, and emotional eating in adults, while only one study examined the role of nutrition knowledge in emotional eating in adolescents [42]. Applying nutrition knowledge through experiential learning was found to increase healthy eating patterns in young people [42]; however, the evidence for a more age-diverse population is scarce.

It is also important to note that the majority of studies on weight stigma, eating behaviour, and food literacy have been conducted in the USA or Western European countries. Despite the growing burden of obesity [44], health-related challenges, relatively low diet quality [44–45], and lack of health literacy [46] in Central and Eastern Europe (CEE), including Slovakia, data from this region are scarce, derived from small study samples, or omit many disordered eating patterns described in the last three decades [47–48]. At the national level, the highest share of people at risk of poverty unable to afford a proper meal in the EU was recorded in Slovakia (45.7%), followed by Hungary (44.9%) [49]. Behavioural risk factors, including eating patterns, cause 50% of all deaths in Slovakia, which is significantly above the EU average of 39% [45, 50]. Thus, we aimed to assess the role of weight stigma in restrained eating, emotional eating, and uncontrolled eating and to examine the possible protective role of food literacy against dysfunctional eating behaviour, controlling for sociodemographic variables and central adiposity.

## Materials and methods

# Participants

A total of 203 participants with overweight and obesity (52.7% female; mean age 48.47 ± 14.28 years; body-mass index 32.63 ± 5.87 kg/m$^2$; waist-to-height ratio 0.63 ± 0.10) were included. Participants were recruited by general practitioners (GPs) from outpatient clinics which covered all regions of Slovakia. While the presence of comorbidities was not a criterion for exclusion, individuals with severe physical or mental health conditions (e.g., heart failure, psychosis, dementia, or undergoing chemotherapy) were not eligible for participation. The study included people attending routine healthcare visits, such as preventive examinations, routine monitoring, follow-up appointments (e.g., after an acute illness such as influenza, or prescription consultations). In line with the criteria of the European Association for the Study of Obesity (EASO) [51], the participants were included based on overall overweight and obesity scores (using body-mass index (BMI)) and central obesity scores (using waist-to-height ratio (WHtR)). Exclusion criteria were the inability to speak the Slovak language, being < 18 years of age, a BMI of ≤ 24.99, and a WHtR of ≤ 0.49, which is not associated with central obesity or health risks [52–53].

## Procedure

Data collection in this cross-sectional study consisted of self-reported questionnaires and objective measurements of participants' height, weight, and waist circumference. Questionnaires were distributed to participants during a GP visit, and they filled them in at their own pace at home. Objective data were assessed by healthcare professionals. Informed consent was signed by all participants included in the study. Participation in the study was voluntary. Incentives in the form of €5 financial vouchers were offered for participation in the research. The Ethics Committee of Pavol Jozef Safarik University (EK 1 N/2023) approved the study. All procedures performed in studies involving human participants followed the ethical standards of the institutional and/or national research committee and the 1964 Helsinki Declaration and its later amendments or good clinical practice standards. Data were collected between May 2023 and February 2024.

## Measures

# Experienced Weight Stigma

The Experienced Weight Stigma (EWS) Questionnaire [54] consists of three yes/no questions that assess the previous history of experienced stigma, asking participants if they have ever *"been teased/ treated unfairly/discriminated against because of their weight?"* The total score of the experienced stigma scale was obtained by summing individual item responses that ranged from 3 (experienced all three types of stigmatization) to 6 (never experienced stigmatization). To identify individuals who experienced weight stigma, we dichotomized variables based on answering "yes" to at least one of the three items. A higher score indicated a lower level of experienced stigma. Cronbach´s alpha in our sample was 0.79.

### Weight Self-Stigma

The Weight Self-Stigma Questionnaire (WSSQ) is a 12-item measure of weight-related self-stigmatization [55]. Items 1–6 constituted the *self-devaluation subscale* (the internalization of negative weight-related stereotypes), and items 7–12 constituted the *fear of enacted stigma subscale* (the degree to which someone is concerned with the possibility of being the target of bias, mockery, or discrimination because of one's body size). WSSQ items were rated on a scale of 1 (completely agree) to 5 (completely disagree). Sum scores are calculated for the full scale and each subscale [55]. A higher score indicated lower weight self-stigmatization. Cronbach´s alpha in our sample for the self-devaluation subscale was 0.89 and 0.87 for the fear of enacted stigma subscale.

## Food literacy

The Self-perceived Food Literacy Scale (SPFL) [39] was developed to measure adults' food literacy regarding healthy diets, including the level of knowledge, skills, and behaviours required for the ability to plan, manage, select, prepare, and eat food healthfully. The 29-item SPFL scale is a theory-driven, expert-based, and validated tool for measuring self-perceived food literacy concerning healthy eating among adults. Scores ranged from 1 to 5, with higher scores indicating better food literacy. Cronbach´s alpha in our sample for the total scale was 0.86. Cronbach´s alpha for 8 SPFL subscales was 0.82 for *food preparation skills*, 0.63 for *resilience-resistance*, 0.71 for *healthy snacks style*, 0.63 for *social and conscious eating*, 0.91 for *examining food labels*, 0.69 for *healthy budgeting*, 0.82 for *low level of unhealthy food stockpiling*, and 0.91 for *daily food planning*.

### Three-factor eating questionnaire

The concepts of cognitive restraint, uncontrolled eating, and emotional eating, corresponding to the three factors of the TFEQ-R18, originate from obesity research, but none of the behaviours is characteristic of people with larger body sizes only. TFEQ-R18 consists of three subscales: *1. restrained eating* (6 items) defined as conscious restriction of food intake to control body weight or to promote weight loss; *2. uncontrolled eating* (9 items) which is tendency to eat more than usual due to a loss of control over intake accompanied by subjective feelings of hunger; and *3. emotional eating* (3 items) described as inability to resist emotional cues such as loneliness, anxiety, or depressive symptomatology. The TFEQ-R18 consists of 18 questions on a four-point Likert scale. Before calculating domain scores, items to assess cognitive restraint were reverse-coded, and the last item was recoded from an 8-point Likert scale to a 4-point scale. Domain scores were then calculated as the mean of all items within each domain: cognitive restraint, uncontrolled eating, and emotional eating, with higher scores being indicative of lower cognitive restraint, higher uncontrolled eating, and higher emotional eating. The raw scale scores were transformed to a 0–100 scale [56]. Higher scores indicated less cognitive restraint, higher emotional eating, and higher uncontrolled eating. Cronbach's alphas were 0.86 for emotional eating, 0.85 for uncontrolled eating, and 0.70 for cognitive restraint.

### Sociodemographic and clinical variables

We collected sociodemographic data using a self-reported questionnaire, with some variables assessed as categorical variables (sex, education level, place of residence) and others as continuous variables (age, household income). Objective data on height, weight, and waist circumference were collected by GP or nurse. The measures were taken barefoot in indoor clothes using an electronic scale for body weight, tape, and a wall-mounted stadiometer. Abdominal obesity was assessed using the whe waist-to-height ratio (WHtR). We obtained WHtR for each participant by dividing the waist circumference by height. The BMI was calculated in $kg/m^2$ to assess overall obesity.

## Statistical analyses

Statistical evaluation consisted of descriptive analyses of all key variables under study, followed by correlation analyses, and multiple linear regression analyses (using the enter method) to assess the explained variance of eating behaviour patterns measured as cognitive restraint, emotional eating, and uncontrolled eating. The order of variables included in the regression models was as follows: 1. age, sex; 2. education level, household income, residence; 3. WHtR; 4. experienced weight stigma; 5. fear of enacted stigma and self-devaluation subscale, and 6. food literacy. Power analysis revealed that the statistical power for multiple linear regression analyses exceeded 94% at $\alpha = 0.05$ and a medium effect size ($n = 203$) [57]. The variance inflation factor ($VIF < 2.0$) was used to assess multicollinearity. A p-value of $< 0.05$ was considered statistically significant. All analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS 26).

### Results

## Sample characteristics

A total of 203 participants with abdominal and overall overweight/obesity (52.7% female; mean age 48.47 ± 14.28 years; body-mass index (BMI) 32.63 ± 5.87 $kg/m^2$; waist-to-height ratio (WHtR) 0.62 ± 0.10) were included in the study (Table 1).

Table 1
Baseline characteristics of the study sample (N = 203)

| Variables | Mean ± SD/% |
|---|---|
| **Age in years; mean ± SD** | 48.47 ± 14.28 |
| **Sex; female (%)** | 107 (52.7%) |
| **Education** | |
| Elementary | 5 (2.5%) |
| Secondary | 106 (53.3%) |
| University | 88 (44.2%) |
| **Ethnicity; white (%)** | 199 (98.1%) |
| **Household income (Euro)** † | 2000 ± 1200 |
| **Individual income** | 1273.12 ± 801 |
| **Place of residence; rural/small town††** | 119 (61%) |
| **Body mass index (BMI); mean ± SD** | 32.63 ± 5.87 |
| overweight (25.00-29.99) | 79 (39.0%) |
| obese (≥ 30.00) | 124 (61.0%) |
| **Waist-to-height-ratio (WHtR)** | 0.63 ± 0.10 |
| WHtR with increased risk of health problems (0.50–0.59) | 78 (39.2%) |
| WHtR with severe risk of health problems (≥ 0.60) | 121 (60.8%) |
| **Experienced Weight Stigma (EWS; 3–6); mean ± SD** | 5.29 ± 1.03 |
| experienced weight stigma (yes) | 80 (39.4%) |
| experienced teasing | 79 (39.1%) |
| experienced unfair treatment | 35 (17.4%) |
| experienced discrimination | 28 (13.9%) |
| **Weight Self-stigma; (WSS; 12–60); mean ± SD** | 42.75 ± 11.11 |
| fear of enacted stigma (6–30) | 23.41 ± 5.86 |
| self-devaluation subscale (6–30) | 19.35 ± 6.50 |
| **Food literacy; (SPFL; 1–5); mean ± SD** | 3.42 ± 0.46 |
| food preparation skills | 3.87 ± 0.77 |
| resilience-resistance | 3.23 ± 0.63 |
| healthy snacks | 3.46 ± 0.70 |
| social and conscious eating | 3.14 ± 0.82 |
| examining food labels | 2.45 ± 1.11 |
| healthy budgeting | 3.58 ± 0.70 |
| low level of unhealthy food stockpiling | 3.81 ± 0.83 |
| daily food planning | 2.84 ± 1.10 |
| **Cognitive restraint (CR; TFEQ; 0-100); mean ± SD** | 53.39 ± 19.10 |
| **Emotional eating (EE; TFEQ; 0-100); mean ± SD** | 30.52 ± 27.34 |
| **Uncontrolled eating (UE; TFEQ; 0-100); mean ± SD** | 32.67 ± 17.64 |

Missing values: age (0.5%), education (2%), household income: (10.3%), place of residence: (3.9%); WtHR: (1.5%); EWS: (0.5%); FL: (29.1%); TFEQ CR: (24.1%); TFEQ EE (18.2%), TFEQ UE: (20.2%); WSS: self-devaluation subscale: (19.2%); WSS: fear of enacted stigma (19.7%). If WHtR was missing (N = 3), only obese participants with a BMI ≥ 30.00 were included. For the lowest number of participants included in the SPFL scale (N = 144), the statistical power for multiple linear regression analyses exceeded 89% at α = 0.05 and medium effect size [57]; † Netto per month; †† Bratislava and Kosice were considered as cities [58]. *p < 0.05; **p ≤ 0.01; ***p ≤ 0.001.

*Correlation analyses of the associations between sociodemographic and clinical variables, weight stigmatization, food literacy and eating behaviour*

Higher cognitive restraint was found to be associated with higher education (r=-0.21; p < 0.05), BMI (r=-0.16; p < 0.05), higher experienced stigmatization (r = 0.18; p < 0.05), and higher self-devaluation (r = 0.23; p ≤ 0.01). No significant association between restraint and food literacy was identified (r=-0.16; p = 0.07). Higher cognitive restraint was associated with a higher level of emotional eating (r=-0.18; p < 0.05) and uncontrolled eating (r=-0.24; p ≤ 0.01).

Emotional eating was higher in female (r = 0.21; p ≤ 0.01), people with higher education (r = 0.23; p ≤ 0.01), central adiposity (WtHR) (r = 0.17; p < 0.05) and BMI (r = 0.23; p ≤ 0.01), in people experiencing stigmatization (r=-0.31; p ≤ 0.001), self-devaluation (r=-0.51; p ≤ 0.001), and fear of enacted stigma (r=-0.36; p ≤ 0.001). Lower food literacy was found to be associated with higher emotional eating (r=-0.18; p < 0.05).

Uncontrolled eating was associated with higher WtHR (r = 0.20; p < 0.05) and BMI (r = 0.26; p ≤ 0.01), higher experienced stigmatization (r=-0.20; p < 0.05), higher self-devaluation (r=-0.43; p ≤ 0.001), higher fear of enacted stigma (r=-0.29; p ≤ 0.001), and lower food literacy (r=-0.34; p ≤ 0.001).

We also found that food literacy may be lower in males (r = 0.28; p ≤ 0.01), people living in rural areas (r = 0.17; p < 0.05), and in people who experience more self-devaluation (r = 0.21; p < 0.05).

Additionally, women, younger people, people with higher education, and larger body sizes experienced more weight stigmatization. Self-devaluation was higher in women, people with larger body sizes, and people experiencing stigmatization. Fear of stigma was associated with larger body size, experienced stigma, and self-devaluation. For more detailed information, see Table 2. For more detailed information, see Table 2.

Table 2
Correlation analyses of the associations between sociodemographic and clinical variables, weight stigmatization, food literacy and eating behaviour

| | Age | Sex | Age | Res. | Edu. | Income | WHtR | BMI | EWS | S.Dev | F.Stig | Food Lit. | CR | EE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age** | | **0.08** | | | | | | | | | | | | |
| **Res.** | 0.06 | 0.08 | | | | | | | | | | | | |
| **Edu.** | **0.15*** | **-0.24**** | **0.23**** | | | | | | | | | | | |
| **Income** | **-0.22*** | **-0.18*** | -0.05 | **0.26***** | | | | | | | | | | |
| **WHtR** | 0.07 | **0.25***** | -0.05 | -0.14 | -0.11 | | | | | | | | | |
| **BMI** | 0.11 | 0.05 | 0.01 | -0.10 | -0.04 | **0.68***** | | | | | | | | |
| **EWS** | **-0.17*** | **0.27***** | -0.10 | **-0.15*** | 0.09 | **-0.15*** | **-0.36***** | | | | | | | |
| **Self dev.** | **-0.17*** | 0.01 | -0.01 | -0.00 | -0.03 | **-0.18*** | **-0.39***** | **0.40***** | | | | | | |
| **Fear stig.** | -0.09 | 0.06 | -0.07 | 0.09 | 0.10 | **-0.30***** | **-0.45***** | **0.55***** | **0.62***** | | | | | |
| **Food lit.** | **0.28**** | 0.07 | **0.17*** | 0.06 | -0.04 | -0.07 | -0.04 | 0.09 | **0.21*** | 0.15 | | | | |
| **CR** | -0.12 | -0.06 | 0.13 | **-0.21*** | -0.14 | -0.13 | **-0.16*** | **0.18*** | **0.23**** | 0.09 | -0.16 | | | |
| **EE** | **0.21**** | -0.14 | 0.04 | **0.23**** | 0.12 | **0.17*** | **0.23**** | **-0.31***** | **-0.51***** | **-0.36***** | **-0.18*** | **-0.18*** | | |
| **UE** | -0.04 | -0.01 | 0.04 | 0.06 | 0.14 | **0.20*** | **0.26**** | **-0.20*** | **-0.43***** | **-0.29***** | **-0.34***** | **-0.24**** | **0.68***** | |

Res. – Place of residence, either rural area or city; Edu. – Education; Income – Household income; WHtR – Waist to Height Ratio; BMI – Body Mass Index; EWS – Experienced Weight Stigma; Self dev. – Self Devaluation subscale of Weight Self Stigma Scale; Fear stig. – Fear of Enacted Stigma subscale of Weight Self Stigma Scale; Food lit. – Food literacy; CR – Cognitive restraint, EE – Emotional eating; UE – Uncontrolled eating; male sex and residence in a rural area/small town were sent as reference; *p < 0.05; **p ≤ 0.01; ***p ≤ 0.001.

*Regression analyses of the associations between weight stigmatization, food literacy, and eating behaviour controlled for sociodemographic and clinical variables*

Out of sociodemographic and clinical variables, we identified a role of lower age (β=-0.19; p < 0.05), female sex (β = 0.22; p ≤ 0.01), and higher central adiposity (β = 0.37; p ≤ 0.001) in emotional eating. Regression analyses also showed an association between central adiposity (β = 0.45; p ≤ 0.001) and uncontrolled eating. After adding variables related to weight stigma into the models, the associations between WtHR and eating patterns attenuated or were no longer significant.

Experienced stigma was associated with emotional eating (β=-0.32; p ≤ 0.01) and uncontrolled eating (β=-0.23; p < 0.05). Self-devaluation was found to play a role in higher cognitive restraint (β = 0.27; p < 0.05), emotional eating (β=-0.43; p ≤ 0.001), and uncontrolled eating (β=-0.37; p ≤ 0.001), while the role of experienced stigma was no longer significant.

Next, after adding food literacy into analyses, we identified its role only in uncontrolled eating (β =-0.28; p ≤ 0.01). The association between self-devaluation and uncontrolled eating (β=-0.37; p ≤ 0.001) attenuated (β=-0.31; p ≤ 0.01) when food literacy was added to the final model. The explained variance in the final regression models for cognitive restraint, emotional eating, and uncontrolled eating was 10%, 41%, and 33%, respectively (Table 3).

Table 3
Regression analyses of the associations between weight stigmatization, food literacy and eating behaviour controlled for sociodemographic and clinical variables

| Models | Cognitive restraint | | | Emotional eating | | | Uncontrolled eating | | |
|---|---|---|---|---|---|---|---|---|---|
| | Beta | F change | Adj. $R^2$ | Beta | F change | Adj. $R^2$ | Beta | F change | Adj. $R^2$ |
| **Age** | -0.10 | 0.79 | -0.00 | **-0.19*** | **4.81*** | 0.07 | -0.05 | 0.26 | -0.01 |
| **Sex** | -0.07 | | | **0.22*** | | | -0.05 | | |
| **Age** | -0.16 | 2.21 | 0.03 | -0.15 | 1.37 | 0.07 | -0.02 | 0.90 | -0.02 |
| **Sex** | -0.07 | | | **0.23*** | | | -0.04 | | |
| **Education** | -0.18 | | | 0.13 | | | 0.11 | | |
| **Residence** | -0.08 | | | -0.00 | | | 0.02 | | |
| **Income** | -0.09 | | | 0.11 | | | 0.09 | | |
| **Age** | -0.13 | 0.40 | 0.03 | **-0.27**** | **15.36***** | 0.19 | -0.16 | **20.76***** | 0.15 |
| **Sex** | -0.07 | | | **0.24*** | | | -0.04 | | |
| **Education** | -0.18 | | | 0.17 | | | 0.18 | | |
| **Residence** | -0.09 | | | 0.01 | | | 0.05 | | |
| **Income** | -0.10 | | | 0.16 | | | 0.13 | | |
| **WHtR** | -0.07 | | | **0.37***** | | | **0.45***** | | |
| **Age** | -0.22 | 2.87 | 0.04 | -0.13 | **11.59**** | 0.26 | -0.06 | **5.41*** | 0.18 |
| **Sex** | -0.06 | | | **0.22*** | | | -0.07 | | |
| **Education** | -0.16 | | | 0.12 | | | 0.15 | | |
| **Residence** | -0.08 | | | -0.02 | | | 0.03 | | |
| **Income** | -0.12 | | | 0.18 | | | 0.14 | | |
| **WHtR** | -0.01 | | | **0.27**** | | | **0.37***** | | |
| **EWS** | 0.19 | | | **-0.32**** | | | **-0.23*** | | |
| **Age** | -0.21 | 2.30 | 0.07 | -0.11 | **13.25***** | 0.40 | -0.04 | **6.99**** | 0.27 |
| **Sex** | -0.05 | | | **0.17*** | | | -0.11 | | |
| **Education** | -0.13 | | | 0.14 | | | 0.17 | | |
| **Residence** | -0.09 | | | -0.04 | | | 0.01 | | |
| **Income** | -0.09 | | | 0.12 | | | 0.09 | | |
| **WHtR** | 0.01 | | | 0.15 | | | **0.26*** | | |
| **EWS** | 0.19 | | | -0.19 | | | -0.11 | | |
| **Self dev.** | **0.27*** | | | **-0.43***** | | | **-0.37***** | | |
| **Fear stig.** | -0.20 | | | 0.01 | | | 0.02 | | |
| **Age** | -0.20 | **3.80*** | 0.10 | -0.10 | 1.89 | 0.41 | -0.01 | **9.70**** | 0.33 |
| **Sex** | 0.03 | | | **0.21*** | | | -0.00 | | |
| **Education** | -0.16 | | | 0.12 | | | 0.13 | | |
| **Residence** | -0.04 | | | -0.00 | | | 0.09 | | |
| **Income** | -0.08 | | | 0.12 | | | 0.09 | | |
| **WHtR** | -0.01 | | | 0.15 | | | **0.24*** | | |
| **EWS** | 0.20 | | | -0.18 | | | -0.10 | | |
| **Self dev.** | **0.31*** | | | **-0.41***** | | | **-0.31**** | | |
| **Fear stig.** | -0.20 | | | 0.01 | | | 0.01 | | |
| **Food lit.** | -0.21 | | | -0.12 | | | **-0.28**** | | |

Residence – Place of residence (either rural area or city); Income – Household Income; WHtR – Waist to Height Ratio; EWS – Experienced Weight Stigma; Self dev. – Self Devaluation subscale of Weight Self Stigma Scale; Fear stig. – Fear of Enacted Stigma subscale of Weight Self Stigma Scale; Food lit. – Food literacy; residence in a rural area and male sex were sent as reference; *p < 0.05; **p ≤ 0.01; ***p ≤ 0.001.

## Analyses of the role of food literacy subscales in eating behaviour

Correlation analyses showed that higher cognitive restraint was associated with higher scores in the examining food labels subscale of food literacy (r=-0.29; p ≤ 0.001), healthy budgeting (r=-0.21; p < 0.05), and daily food planning (r=-0.29; p ≤ 0.001). Lower emotional eating was associated with better resilience-resistance (r=-0.52; p ≤ 0.001) and higher consumption of healthy snacks (r=-0.20; p < 0.05). Control in eating was found to be associated with better food preparation skills (r=-0.16; p < 0.05), resilience-resistance (r=-0.55; p ≤ 0.001), consumption of healthy snacks (r=-0.25; p ≤ 0.01), and social and conscious eating (r=-0.17; p < 0.05). Unhealthy food stockpiling was not associated with any of the dysfunctional eating behaviours.

Using regression analyses to control for sociodemographic variables, body size, and weight stigmatization, we found that higher cognitive restraint was associated with examining food labels (β=-0.34; p ≤ 0.01) and better daily food planning (β=-0.30; p ≤ 0.01). Lower emotional eating was associated with resilience-resistance (β=-0.41; p ≤ 0.001). Higher control in eating was found to be associated with food preparation skills (β=-0.24; p ≤ 0.01), resilience-resistance (β=-0.47; p ≤ 0.001), and consumption of healthy snacks (β=-0.22; p ≤ 0.01).

## Discussion

We aimed to assess the role of weight stigma and food literacy in eating behaviour, controlling for sociodemographic and clinical variables. Correlation analyses showed that higher education may play a role in higher cognitive restraint and higher emotional eating. The association between restraint and education is not surprising, since maintaining a healthy diet was found to be more prevalent in educated people [59]. A study by Rosenqvist et al. [31] also showed that women with a college education had higher odds of emotional eating compared to women with vocational or lower education. An explanation may be that emotional eating seems to be associated with work-related stress, but also with boredom, which are assumed to be more common in white-collar workers with higher educational attainment when compared to blue-collar workers [60]. We identified no association between income and maladaptive eating patterns. An explanation may involve sex differences, as previous research showed that restrained eating was higher in women with higher household income, and in men with higher occupational position, while emotional eating was associated with higher financial strain among women [31].

These findings indicate that higher status, represented by higher education, may play a role in restrained and emotional eating. On the other hand, we may assume that financial strain, rather than the traditional income categories, may be more directly linked to emotional eating. Future studies are needed to shed more light on the role of financial strain in eating patterns, especially since the Slovak population is more endangered by macroeconomic factors such as inflation or wage growth disparities relative to the cost of living when compared to other EU countries [49, 61–62]. The link between educational attainment and emotional and restrained eating, together with the absent role of income in maladaptive eating behaviour, may also reflect structural economic factors. For example, according to Eurostat data [61], Slovakia is among the top ten European countries with the lowest median annual net income of people with tertiary education. Thus, it seems that education level in our sample does not represent a reliable proxy for material resources, while still being able to reflect some occupational and psychosocial factors that may be relevant to eating behaviour.

Using multiple linear regression analyses, our study also indicated that younger females may be more prone to emotional eating. Some previous studies also concluded that younger [63] women may experience more stigma [9, 63] and self-devaluation [64]. Women in the Eastern European region may be at relatively high risk for developing negative body image [65]. We may also assume that in these sociocultural contexts, characterized by strong thin-ideal endorsement, weight stigma may be experienced more often and internalized more easily. With around 40% of individuals in our study reporting experiencing weight stigma, the prevalence fell within the range reported by previous studies in the Western population [9–11]. However, we found that the prevalence of experienced stigma was significantly higher in females (48.6%) than in males (30.2%).

In line with current research [28], our findings further indicate that abdominal obesity may predict emotional and uncontrolled eating, but not cognitive restraint. The absent association between body size and restrained eating may be explained by physical inactivity, which in Slovakia is significantly higher than the EU average, as it was identified in 70% of Slovak adults [45]. As this inactive lifestyle may diminish weight control efforts, future studies on the role of restrained eating in body size should consider controlling for the level of physical activity and the amount of sedentary behaviour.

Our findings indicate that cognitive restraint in people with larger body sizes represents a harmful strategy, as it may increase uncontrolled and emotional eating and is associated with higher self-devaluation. Thus, another explanation for the lack of association between body size and restraint may be that cognitive restraint could represent a potential trigger for emotional and uncontrolled eating. In line with the significant role of weight stigma in emotional and uncontrolled eating identified in our study, we may also assume that pervasive stress related to weight stigma may contribute to the adoption of unhealthy eating patterns and coping mechanisms, consequently diminishing the intended benefits of restrained eating [28]. Restrained eaters, especially those with psychological symptomatology, may have trouble sustaining control over eating behaviours, leading to compensatory patterns such as binge or emotional eating [66]. Dieters may more often overeat to manage dysphoria, and although they may eat less or the same amount as non-dieters, they may experience episodes of overeating [67]. Individuals with high cognitive restraint are also assumed to exhibit more vulnerability to visual food cues [68]. Thus, our findings of the association between self-devaluation and higher cognitive restraint may indicate the dual aspect of restraint eating, which may involve intentional efforts to control food intake, especially when self-stigma is present, while it can also reflect a rigid and fragile regulatory mode prone to fail in emotionally challenging contexts.

On the other hand, higher restraint was associated with better food knowledge in subscales related to dietary awareness via examining food labelling, financial management, and meal planning skills. This discrepancy may stem from the fact that restrained eaters may possess higher levels of food literacy,

especially in areas associated with self-regulation and the ability to plan, yet may distort this knowledge in maladaptive ways, represented by rigid, selective, or biased application of food knowledge, that may be emotionally driven, and less responsive to the bodily signals of hunger and satiety, while these mechanisms may also be potentiated by experienced and internalized stigmatization [69–70]. Similarly, current research by Trompeter et al. [71] shows that people with disordered eating, particularly those with restrictive eating disorders, notice food labels more frequently and are also more prone to experience negative impacts of food labelling. Thus, future studies are needed to examine the role of rigid restraint and its association with eating disorders such as anorexia nervosa. Adaptive food knowledge should involve flexibility, awareness of context, and responsiveness to internal cues. It is therefore necessary to identify mechanisms that may help to shift focus away from strict restraint toward adaptive food literacy that will include intuitive eating and healthier food choices [68–69]. Future studies are also needed to identify a link between efforts to reduce food intake and actual reduction in food intake, as current findings show only a small-to-moderate association between cognitive restraint and consequent dietary restrictions [72].

Our study further showed that the role of central adiposity in emotional eating and uncontrolled eating was no longer significant or attenuated when stigmatization was added to regression models. The final models of regression analyses showed that self-devaluation was more significantly associated with higher restraint, higher emotional, and uncontrolled eating than experienced stigmatization and fear of enacted stigma. Thus, internalized stigma manifested as self-devaluation seems to be a more significant predictor of dysfunctional eating than body size per se or social determinants represented by experienced and anticipated weight stigma. Findings of the predominant role of self-devaluation in dysfunctional eating patterns suggest that individual-level psychological interventions, such as targeting self-esteem, may be particularly effective in people with larger body sizes. The more significant role of self-devaluation in maladaptive eating may be explained by the fact that, although related, experienced weight stigma and self-stigmatization are conceptually distinct. Experienced stigma refers to past external events of mistreatment, and fear of enacted stigma refers to anticipation of future events of mistreatment [73], whereas self-devaluation reflects an internalized and probably more contemporary psychological process. Future studies should therefore address the role of temporal dynamics in weight stigmatization.

We identified the association between lower food literacy, emotional eating, and uncontrolled eating using correlation analyses. Regression analysis showed that food literacy played a role only in better eating control. In line with our findings, previous research found a link between food literacy and higher self-control, or lower impulsiveness [39]. Our results further suggest that the link between self-devaluation and uncontrolled eating may be attenuated by food literacy.

Food literacy was also found to be lower in those who experienced weight-related self-devaluation. A possible explanation is that people with internalized stigma may have a lower level of food-related knowledge due to limited opportunities to acquire food literacy, as they may engage in weight-related experiential avoidance or avoid healthcare because of self-stigma, shame, or self-criticism [74–75]. We may also assume that psychological distress caused by self-devaluation may reduce motivation to acquire, build, and apply food knowledge, and undermine engagement in health behaviors [76].

Our findings further indicate that food literacy was higher in females, despite their reported higher self-devaluation. This is not surprising, as meal planning and preparation are still predominantly done by females [77]. Another finding that stems from our study is that female sex itself and self-devaluation may play a more important role in emotional eating, and the negative effect of self-devaluation may not be mitigated by adequate food literacy, although food knowledge was found to be higher in females. This significant role of self-devaluation may be caused by stronger social pressure on women to be thin when compared to men [78], as well as a more common experience of stigmatization or weight-related discrimination among females [9], which was also confirmed in our study. Thus, female-focused interventions should prioritize coping strategies aimed at reducing self-stigma before emphasizing dietary education. We also found that males and people living in rural areas or small towns reported a lower level of food literacy than people living in urban areas, which may be linked to limited access to healthy foods in rural settings [79]. Thus, food literacy represents not just an individual responsibility but seems to be influenced by social and structural factors. Overall, it can be assumed that some individuals may possess knowledge of healthy food choices yet be unable to effectively apply this knowledge due to socioeconomic or health-related factors. Therefore, future qualitative research may shed more light on barriers and facilitators that may affect eating patterns in people with larger body sizes. Our findings suggest that weight stigma represents not only a psychosocial burden but also a public health concern associated with maladaptive eating patterns. Food literacy may represent a potentially protective factor against maladaptive eating, highlighting its relevance as a modifiable target for public health interventions.

## Strengths and limitations

This is one of the first studies that addresses the role of food literacy in eating behaviour. As research on eating patterns, weight stigma, and food literacy in non-Western contexts is scarce [47–48], data derived from the Slovak population represent one of the key strengths of this study. Eastern/Central Europe (CEE) may differ due to decades of socialist dictatorship, which may still pose sociocultural impact [48]. Another strength of this study is that we followed EASO criteria, and participants in our study were included based not only on BMI but also on WHtR level [51]. Finally, distinguishing between fear of enacted stigma and self-devaluation may help to build more nuanced interventions.

Despite the strengths of this study, its cross-sectional design limits the ability to establish causal relationships. The self-perceived food literacy scale measures only the individual dimension of food literacy, thus overlooking the environmental implications and critical reflection on the effect of food choice on society [80]. Moreover, some items of this tool lack the measurement of respondents' behaviour, yet it is critical for implementing knowledge and assessment of everyday food-related practices [81].

## Implications for practice and future research

Our findings provide evidence that internalized weight-related self-devaluation is a more significant predictor of maladaptive eating patterns than obesity per se or social determinants, represented by experienced and anticipated weight stigmatization. It thus seems imperative to intervene to address weight stigma

at all levels, from the structural through interpersonal, but mostly to the intrapersonal level. Using different scales on stigmatization with a focus on weight microaggressions could provide more information on subtle stigmatizing experiences.

Our findings further indicate that food literacy may diminish emotional eating, enhance eating control, and alleviate the negative effects of stigma. As a potentially modifiable determinant, food knowledge represents a promising target for public health strategies to diminish maladaptive eating. Future interventions should focus on developing comprehensive programs that encompass dietary education, with a specific focus on the more vulnerable population, which in our study was represented by males and people living in rural areas. Our findings also showed that public health interventions aimed at strengthening food preparation skills and supporting healthier snack choices at school, work, and home environments, as well as community or supermarket settings, may increase eating control and mitigate emotional eating. Next, our findings indicate that supporting resilience-resistance by utilizing adaptive coping strategies may mitigate uncontrolled and emotional eating in people with larger body sizes. We also found that social and conscious eating played a role in better eating control. Thus, enhancing mindfulness-based eating awareness, supporting family meals, and social eating behaviour may have the potential to address problematic eating behaviours and the challenges in controlling food intake [82–83].

Public health nutrition campaigns to promote food knowledge may often elicit resistance through weight-stigmatizing messages that healthy eating behaviour and weight loss are simple. Effective campaigns to build food knowledge should therefore emphasize health rather than weight, and should stem from consultation with researchers and people with lived experience of weight stigmatization and maladaptive eating patterns [1]. In line with recent meta-synthesis [71], we found that people with cognitive restraint may be more prone to examining food labels, which may also contribute to disordered eating [71]. Thus, public health policies aimed at nutrition labelling should be very sensitive to potential unintended consequences, as those may elicit policy resistance, whereby the intervention could mitigate its intended outcome by instead prompting individuals with restrictive eating disorders to experience greater psychological distress [1].

The mean individual income reported in our study (1273.12 ± 801) was slightly above the corresponding net wage in 2023 in Slovakia of 1.062€, which represents approximately only 45% of the average net wage in the EU. Thus, it seems that the population in Slovakia may be more prone to experiencing food insecurity compared to other EU countries [49], which may contribute to the development or exacerbation of cognitive restraint or dietary restrictions [84]. Future studies should thus assess the role of food insecurity in maladaptive eating and body size.

Since the TFEQ provides a limited range of emotional triggers, and cut-offs to state prevalence of dysfunctional eating patterns are not available, other scales should also be employed. Longitudinal studies are needed as previous research implies that stigma might have relatively short-term effects, unless those experiences are repeated [25]. Assessment of eating patterns in the general population using the TFEQ-R-18 questionnaire may help deepen the clinical/diagnostic examination, while it may assist clinicians and researchers to support the development of targeted interventions addressing dysfunctional eating [85].

Collecting data on eating pathology, such as binge eating, purging, laxative use, or excessive exercise, as well as using food diaries and incorporating ecological momentary assessment methods that capture real-time stigmatizing experiences and emotional states, may provide more detailed and contextually rich insights into eating behaviour and stigma research [24, 70]. Cognitive restraint represents a potential to trigger emotional and uncontrolled eating, while it was found to be associated with self-stigmatization. As restrictive eating showed the lowest explained variance, further research is needed to identify the factors that may influence cognitive restraint in people with larger body sizes.

In line with previous research [1], similar to weight stigma, maladaptive eating was unequally distributed by sex and body size. Racial/ethnic identity, gender, or sexual orientation represent other variables that may play a role in stigmatization, maladaptive eating, or that may influence the effectiveness of campaigns to promote healthy eating [1, 25, 86–88]. However, the present study was limited by the underrepresentation of certain ethnic groups – particularly Roma participants – and the absence of participants identifying outside traditional sex/gender categories, highlighting an opportunity to strengthen inclusivity in future recruitment efforts by prioritizing the inclusion of more diverse and representative populations of the CEE region. According to the minority stress model, discrimination, stigma, and social marginalization contribute to psychological distress, causing a higher prevalence of maladaptive eating behaviors and disordered eating symptomatology [86–87]. As sexual and gender minorities in CEE seem to be disproportionately highly exposed to stressors [89–90], future research focusing on eating patterns in queer populations in this region is of importance.

## Conclusions

Experienced stigma was associated with emotional and uncontrolled eating. However, internalized weight-related self-devaluation seems to be a more significant predictor of dysfunctional eating behaviour than body size per se or social determinants, represented by experienced and anticipated weight stigmatization. Given the widespread nature and impact of weight stigma on maladaptive eating behaviour, it is imperative to intervene to address weight stigma at all levels, from the structural to the intrapersonal. Food literacy appears to increase eating control in adults with larger body sizes, although female-focused interventions should prioritize reducing stigma before emphasizing nutritional knowledge. Future interventions should focus on developing comprehensive programs that encompass dietary education, aimed especially at the more vulnerable population of males and people living in rural areas.

## Abbreviations

BMI: body-mass index

CEE: Central and Eastern Europe

CR: cognitive restraint

EE: emotional eating

EWS: experienced weight stigma

GP: general practitioner

SPFL: food literacy scale

UE: uncontrolled eating

WHtR: waist-to-height ratio

WSS: weight self-stigma

## Declarations

**Ethics approval and consent to participate**

This study was performed in line with the principles of the Helsinki Declaration. The Ethics Committee of Pavol Jozef Safarik University (EK 1 N/2023) approved the study. Informed consent was signed by all participants included in the study.

**Consent for publication**

Not applicable

**Availability of data and materials**

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

**Competing Interests**

The authors declare no competing interests.

**Clinical trial number**

Not applicable

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**Authors' contributions**

VT was involved in Conceptualization, Methodology, Investigation, Project administration, Funding acquisition, Resources, Data curation, Formal analysis, and Writing – original draft.

PMik was involved in Conceptualization, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review and editing.

AHT was involved in Conceptualization, Investigation, Formal analysis, Writing – review and editing.

DM was involved in Conceptualization, Data curation, and Writing – review and editing.

PMin was involved in Conceptualization, Data curation, and Writing – review and editing.

LO was involved in Conceptualization, Data curation, and Writing – review and editing.

IN was involved in Funding acquisition, Conceptualization, Methodology, Formal analysis, Writing – review and editing.

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