# Validation of the Czech Modified Yale Food Addiction Scale in a Representative Sample of Adolescents: Connections with Body Mass Index and Impulsivity

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**INTRODUCTION:** The Czech Republic records one of the highest prevalence levels of obesity in comparison to other European and world countries. The present study aims to fill a gap in the use of tools in research of food addiction (FA), which is believed to be one factor in the high prevalence of obesity. **METHODS:** A pen-and-paper study was conducted using a nationally representative non-clinical sample of 3950 adolescents aged 11–19. **RESULTS:** The FA prevalence rate was 4.1%. Exploratory and confirmatory factor analyses verified a one-factor structure. The reliability corresponded to KR = 0.80, CI95% = (0.79, 0.81), McDonald's ω = 0.79 (0.86 for continuous scale). The connection between FA and impulsivity was confirmed using Poisson regression and logistic regression, and the prevalence of FA decreases with lower impulsivity. **CONCLUSIONS:** The study findings suggest that the Czech version of mYFAS 2.0 is a reliable tool for research purposes with regard to the Czech environment. Further research should incorporate additional personality traits to obtain a more comprehensive understanding of the emerging topic of food addiction.

**Keywords | Food Addiction – Obesity – Yale Food Addiction Scale – Czech Population – Adolescence - Impulsivity**

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## 1 INTRODUCTION

Adolescence is a sensitive life period during which a person establishes his/her relationship to food. During adolescence, unhealthy eating behaviour and addictive tendencies are developed and established (Mies et al., 2017). With the dramatic change in the food environment and food practices, the fact that food is processed in ways which increase its potential reward can contribute to the severity of obesity (Pedram et al., 2013), a topic in the sphere of food addiction that has been widely researched in recent years. Especially since 2006, the number of academic publications regarding this topic has been growing rapidly (Gearhardt et al., 2011). Food addiction is widely researched in the Western world, and yet extensive research on adolescent obesity in the Czech environment is lacking. The majority of studies have been carried out in the US (n = 21 studies), followed by Germany (n = 7), Italy (n = 6), Spain (n = 4), and France (n = 3; Burrows et al., 2018). The prevalence of overweight and obesity in 11-, 13-, and 15-year-old adolescents in the Czech Republic rose from 1998 to 2014, as described in studies by the Health Behaviour in School-aged Children Study (HBSC). A study involving a total sample consisting of 19,103 adolescents (51.2% of them girls) revealed a significant increase in the prevalence of overweight (including obesity) (Hamřík et al., 2017).

A systematic review and meta-analysis that looked at body mass index (BMI) as a predictor of obesity in adolescence and adulthood (Simmonds et al., 2016) revealed that obese children/adolescents were around five times more likely to be obese in adulthood in comparison with those who were not obese. With the rising prevalence of obesity and its connection to food addiction (Davis et al., 2011; Pedram et al., 2013), it is also important to study these issues in this age span. A systematic review was conducted of 25 studies using the Yale Food Addiction Scale (YFAS; Pursey et al., 2014) and found that most of the research was conducted with an adult sample. The authors state that further research is needed to cover a wider age spectrum. More recently, Burrows et al. (2018) confirmed in a meta-analysis of studies on food addiction that the majority of studies were carried out with adults ( > 18 years, n = 47 studies, mean age 33.1 years and range 18.7–62.9), two studies were carried out with children/adolescents, and two studies included both children and adults.

Overweight/obesity has crucial effects on people's life quality, especially during the vulnerable period of adolescence. A higher weight status can result in the following: potential health problems are also associated with childhood obesity such as cardiovascular diseases, elevated blood pressure or raised blood cholesterol, diabetes type 2, joint problems, breathing difficulties, and metabolic syndrome (Yanovski, 2015; WHO, 2014). Obesity can also have psychological consequences such as poor self-image, body image disturbance, low self-confidence, and even depression and anxiety disorders. These are all problems that can continue from childhood into adolescence and adult life (Hesketh et al., 2004; Reeves et al., 2008; WHO, 2014). Apart from depression and lower self-esteem, overweight/obese Australian children and adolescents were also found to experience lower scores for their health-related quality of life (Sanders et al., 2015), a finding later confirmed by Fallon et al. (2005) in an American sample. Weight stigma is part of the lived experience of people with obesity and has a negative influence on their health (Puhl et al., 2020). Last, but definitely not least, the serious psychological consequences experienced by obese children and adolescents included teasing (Neumark-Sztainer et al., 2002) and bullying (Griffiths et al., 2006). Additional mental health symptoms and their relationships with food addiction emphasize the importance of studying the topic (Burrows et al., 2018).

Impulsivity is one of the important correlates/predictors of obesity (Schag et al., 2013). Impulsivity is closely related to, and a predictor of, tobacco and alcohol use and delinquency (Dolejš, 2016), behaviours that can be observed in adolescents and also adopted by adolescents with obesity and weight issues (Fields et al., 2013). Another study focused especially on the connection between food addiction and impulsivity and found that high impulsivity predicts FA (Meule et al., 2017). Impulsivity is an important trait targeted in the present study in relation to addictions and drug use (Čerešník et al., 2018; Dinçyurek et al., 2018; Dolejš & Orel, 2017; Trifilieff & Martinez, 2014) and is also an important psychological factor affecting addictions in general (Chamorro et al., 2012; Trifilieff & Martinez, 2014).

Impulsivity, as a multidimensional construct, predisposes rapid, unplanned stimulus responses with a reduced ability to consider the negative consequences of one's behaviour and a reduced ability to reflect on the long-term consequences of behaviour (Brewer & Potenza, 2008; Moeller et al., 2001). Similarly, other authors agree that impulsivity is a multidimensional construct (Patton et al., 1995; Whiteside & Lynam, 2001), but there is little consensus on what underlying dimensions impulsivity involves, and its theoretical concept is closely related to its measurement methods. Linhartova and Kasparek (2017) summarize that impulsivity can be conceived as a personality dimension of which a heightened level leads to pathological consequences. This concept of impulsivity is measured by self-evaluation questionnaires and analysed by factor analysis. A complementary approach views impulsive behaviour as a disruption of the neurobiological area measured with behavioural tests that examine the degree of disruption of the function. In our work, we approach impulsiveness as a personality trait.

Gearhardt et al. (2009) created the first version of the Yale Food Addiction Scale to provide a validated self-report measurement of addictive-like eating behaviour based on the diagnostic criteria for substance dependence. When the new fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) was released, it included changes in the substance-related and addictive disorders (SRAD) section and led to the development of YFAS 2.0. Both versions of the YFAS were similarly associated with elevated body mass index (Gearhardt et al., 2016). Gearhardt's work continued with the newest briefer version, mYFAS 2.0. which Schulte and Gearhardt created in 2017. They created a tool of good internal consistency with convergent, discriminant, and incremental validity (Schulte & Gearhardt, 2017).

## 2 METHODS

This study aims to evaluate the tool for measuring food addiction and find the relationships with connected psychological concepts using a qualitative approach in a representative sample.

### 2.1 Participants

The participants were adolescents who were attending basic schools, eight-year, six-year, and four-year grammar schools, secondary schools with a leaving examination, or secondary professional training colleges[1] in 2018. The study sample consisted of students aged 11–19 attending the selected schools. A total of 3139 test batteries were filled in. The average age of the respondents in the research sample was 15.73 years (SD ± 1.99). The average age of the boys was 15.74 years and that of the girls 15.72 years. In the analyses that follow, the number of respondents might differ because some information was missing.

### 2.2 Data collection

This research study covered all 14 regions of the Czech Republic. The respondents were selected by means of stratified random sampling of basic schools and secondary schools. As a result, the composition of the students in the study sample corresponds to the composition of students in the Czech Republic with respect to the region and the type of school. Any school from the Czech Republic might have been selected and thus also any student. In total, 79 school institutions were contacted to participate in the project. Cooperation was established with 48 schools (61%); a total of 31 schools declined to participate in the research (39%).

The test battery was presented by experienced and well-trained administrators. Group administration was conducted in school institutions during lessons. The participants filled in a paper test battery, making this a pen-and-paper method.

The method used for the selection and administration and the extent of the study sample make it possible to state that this is a representative sample of Czech students aged 11–19. This enables the results and findings to be generalized to the entire population of Czech 11–19-year-olds.

The participants filled in a sociodemographic questionnaire, the Czech version of mYFAS 2.0, and an impulsivity scale, the Scale of Impulsivity (Dolejš & Skopal, 2016).

1 | Basic school is a type of school attended by children aged 6-15" (grades 1-9"), in our sample upper grades of basic school were included (age 11 to 15). Upper grades of basic schools mean middle or lower secondary school in other education systems. Students in "lower grammar schools" are at the age 11 to 15. Students of higher grammar schools and secondary schools are at the age of 15 to 19.

### 2.3 Measures

#### Modified Yale Food Addiction Scale 2.0

We used the latest short version of the Yale Food Addiction scale – the modified Yale Food Addiction Scale, which consists of 13 items evaluated on an eight-point Likert-type scale ranging from never to every day, such as: "I ate to the point where I felt physically ill". Each of the items is related to individual addiction criteria as stated by DSM-5 or to a clinical significance (two items). The mYFAS 2.0 scale was developed as a single-factor scale with CFA parameters of fit CFI = 0.96, TLI = 0.95, RMSEA = 0.08. The mYFAS 2.0 scale showed good internal reliability, as measured by Kuder–Richardson alpha (mYFAS 2.0 = 0.86; Schulte & Gearhardt, 2017). In a validation study, the scale showed high convergent validity, discriminant validity, and incremental validity (Schulte & Gearhardt, 2017).

With the permission of the author of the scale, Ashley Gearhardt, we conducted a translation procedure to obtain a Czech version of mYFAS 2.0. First, the original English version was translated into Czech by four independent translators and these versions were compared on the basis of Czech translation research. A linguist also conducted content analysis and definition of the Czech versions of the items and subsequent pilot testing was carried out to find out if all the items were intelligible for the respondents. The pilot testing results were used for the completion of every item into the Czech language by the researchers.

When choosing the tool, we also considered the children's version, YFAS-C. The validation study of YFAS-C included participants with a mean age of 8.32 years (SD = 2.78, Range 4–16; Gearhardt et al., 2013); we decided to choose the same version, mYFAS 2.0, for the entire age span.

#### The Scale for Impulsivity of Dolejš & Skopal (SIDS)

First published in the Czech language in 2016, this scale was created with the purpose of estimating the connection between risky behaviour and impulsivity amongst Czech adolescents (Dolejš & Skopal, 2016).

The scale assesses impulsivity in adolescence and the scale items were created on the basis of a literature study and theory. The longer version was used for the validation study and 24 items were statistically established. The Likert scale ranges from "strongly agree" to "strongly disagree". The items are correlated with an overall score range between $r$ = .22 and $r$ = .63, and thus the majority is in a medium-strong relation, at a significance level $p$ = .001. Factor load values range from 0.19 to 0.65.

The scale was already used in a number of representative studies of adolescents in the Czech Republic (Kulišek & Dolejš, 2019) and Slovakia (Čerešník et al., 2018). These research studies confirmed the extremely positive internal consistency of the items, with a Cronbach's alpha from 0.83 to 0.87. The norms are for the Czech population aged from 11 to 19.

## 2.4 Analytic plan

The data set was first cleaned and the respondents who did not fill in one or more answers or whose questionnaires seemed to be filled in sloppily were removed from the data set. All the calculations were performed in the R environment (version 3.6.1, Team R. Core., 2019). Exploratory factor analysis (EFA) was first performed on the responses on 13 test items. The polychoric correlation coefficient matrix was used to respect the ordinal form of the responses. Oblimin rotated maximum likelihood estimations of factor weights were computed. The calculations were performed using the *psych* package (Revelle, 2018), while parallel analysis was performed with the nFactors library (Raiche, 2012). The *lavaan* library (Rosseel, 2012) was used to perform a confirmatory factor analysis (CFA). The Weighted Least Squares with Mean and Variance Adjustment (WLSMV) method was used. We used RMSEA (the recommended value is < .05), CFI (recommended > 0.95), and SRMR (recommended < .08) as indicators of soundness of fit (for further details on the thresholds, see Hooper, Coughlan, & Mullen, 2008). We compared the factor structure of the groups using the *semTools* package (Jorgensen et al., 2019). The reliability of the scale was assessed using Cronbach's α and McDonald's ω coefficients.

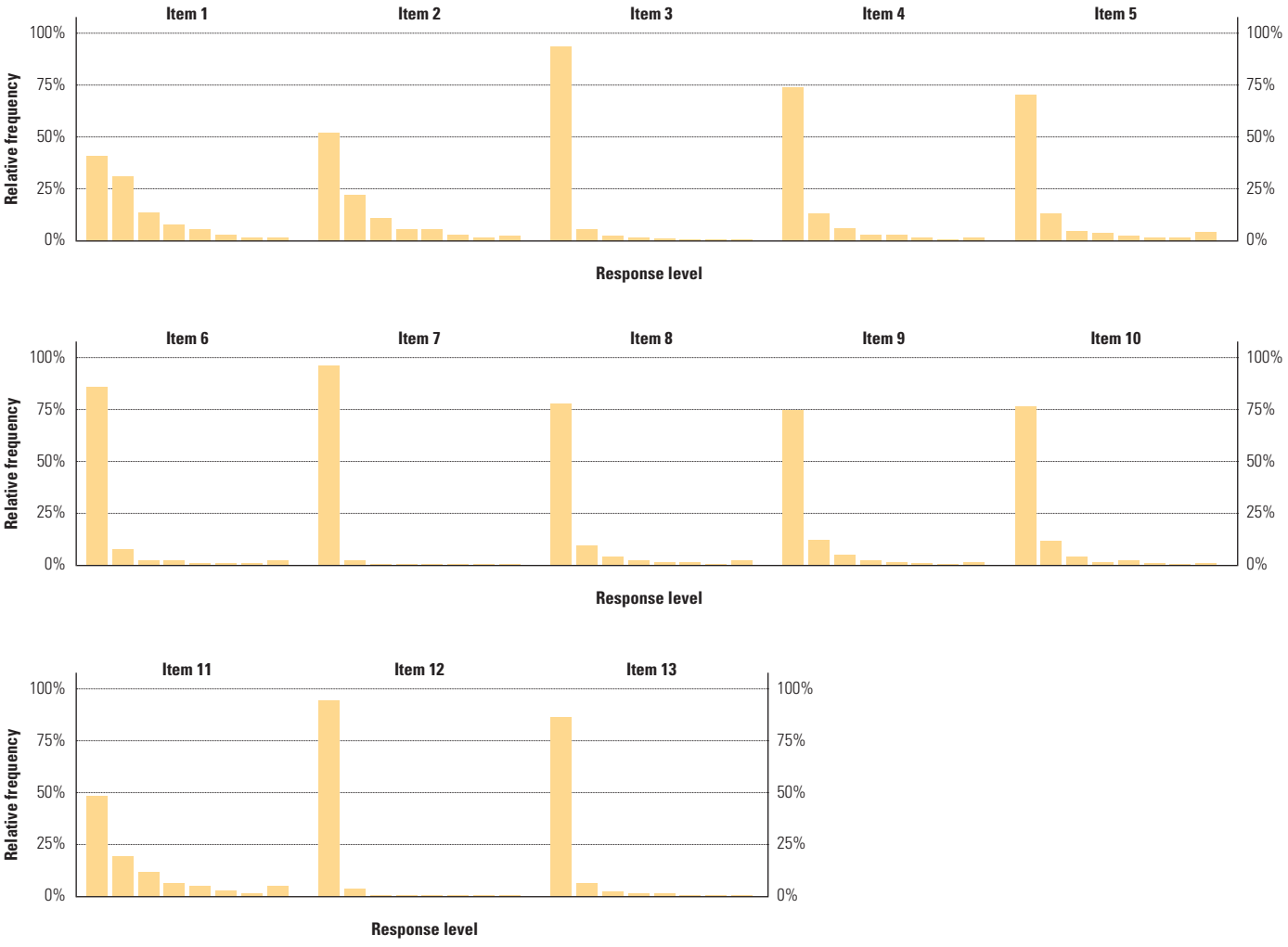
The relationships between the number of symptoms, sex, age, BMI, school type, and impulsivity were modelled using Poisson regression. The relationship between the presence of food dependence and the above-mentioned regressors was investigated using logistic regression. We used McFadden's Pseudo $R^2$ from the *DescTools* package (Signorell, 2019) to quantify the quality of the models.

## 2.5 Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants and their parents were informed about the study and the purpose of the study and parents/legal representatives signed the consent to participate in the study.

Informed consent was obtained from the parents of the participants. Participation in the study was anonymous and voluntary.

**Figure 1 |** Relative frequencies of response levels in each mYFAS 2.0 item




*Note:* The percentage corresponds to the relative frequency of responses that indicate the presence of a symptom.

**Table 1 |** Confirmatory factor analysis of the Yale Food Addiction Scale 2.0 (mYFAS 2.0), Czech version

| Model | $\chi^2$ | df | $\chi^2$/df | CFI | RMSEA (90%CI) | SRMR |
|---|---|---|---|---|---|---|
| mYFAS 2.0 continuous | | | | | | |
| 1-factor | 269.56 | 65 | 4.15 | .968 | .032 (.028-.036) | .075 |
| 2-factor | 251.12 | 64 | 3.92 | .971 | .031 (.027-.035) | .066 |
| 3-factor | 179.83 | 62 | 2.90 | .982 | .025 (.020-.029) | .058 |
| mYFAS 2.0 categorical | | | | | | |
| 1-factor | 203.48 | 65 | 3.13 | .953 | .026 (.022-.030) | .070 |
| 2-factor | 164.37 | 64 | 2.57 | .966 | .022 (.018-.027) | .060 |
| 3-factor | 107.42 | 62 | 1.73 | .985 | .015 (.010-.020) | .045 |

*Note:* 90%CI = 90% confidence interval; CFI = confirmatory fit index; df = degrees of freedom; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

## 3 RESULTS

### 3.1 Sample description

The sample (n = 3139) consisted of 1429 (46%) boys and 1710 (54%) girls. A five-number summary (minimum, quartiles, and maximum) of the ages is 11.50, 15.29, 16.70, 17.94, and 19.96. The observed difference in the distribution of age between the boys and girls is negligible (Kolmogorov-Smirnov $D$ = 0.04, $p$ = .24). The five-number summary of the BMI was equal to 11.00, 19.00, 20.80, 23.10, and 38.20 (three nonsense values were removed); 71 (2.3%) of the respondents reported a BMI greater than or equal to 30. The frequency of responses to the mYFAS 2.0 items is shown in *Figure 1*. A total of 96% was not identified as food-addicted. The addiction was mild in 1.7% of the respondents, the addiction was moderate in 1.1%, and a severe food addiction was found in 1.3%.

### 3.2 Factor structure and reliability

The EFA of continuously scored items suggests the presence of one dominant factor. In order to further test the robustness of the scale, we used parallel analysis. The results from the parallel analysis suggest a three-factor solution. The first four eigenvalues are 7.65, 1.25, 1.08, and 0.59. The use of dichotomous scoring leads to similar results (eigenvalues of 7.04, 1.08, 0.93, and 0.66); however, parallel analysis finds two factors. The models offered from the EFA were compared with the confirmatory factor analysis. We compared one-, two-, and three-factor solutions using both continuous and dichotomous scoring. Items were assigned to factors according to the maximum loading obtained with EFA using oblimin rotation. The factors were modelled as correlated. See *Table 1* for the results.

All the solutions demonstrated a sufficient fit. Although the multi-factor solutions show a better match than the one-factor solutions, we will treat the scale as one-dimensional. This is because this solution is frequent in mYFAS 2.0 and because there is no clear psychological interpretation for multi-factor solutions.

The method demonstrated satisfactory reliability, KR = 0.80, CI 95% = (0.79, 0.81), McDonald's $\omega$ = 0.79 (0.86 for continuous scale). In the original version, however, the internal consistency was slightly higher, KR = 0.86 (Schulte & Gearhardt, 2017). All the loadings in the Czech version exceed the value of 0.35 (median 0.48).

We verified the invariance of the model with respect to the sex of the respondents and with respect to the age group. Regarding age, we divided the respondents into two groups: younger than 15 years and 15 years and older. We verified the invariance in four steps: a configurational invariance assuming the same factor structure, a scalar invariance with the same charge restriction and polychoric correlation coefficient thresholds in both groups, a strict residual invariance, and finally, a mean invariance assuming the same intercept values in the groups that were compared.

We only found statistically significant differences in the models between the boys and girls. Each added restriction significantly reduces the fit (see *Table 2*). Despite these significant differences, all the models meet the criteria of CFI > .95 and RMSEA < .05. Although the SRMR of all the models is around 0.12, which slightly exceeds the recommended level, we can describe the fit of all the models as satisfactory.

### 3.3 The relationship of mYFAS 2.0 to impulsivity

A positive relationship between food addiction and impulsivity has already been demonstrated (Pivarunas & Conner, 2015). The relationship between the selected variables and mYFAS 2.0 was examined using regression models. The variables of age in years, gender (reference level female), type of school, BMI, and impulsivity measured by the SIDS inventory (both in the form of a z-score) were used as regressors. We distinguished between four types of schools, basic schools (reference level), lower grammar school, secondary schools without a leaving exam, secondary schools with a leaving exam, and higher grammar schools. The dependent variable of the first model

**Table 2 |** Invariance of the model between boys and girls and between age groups

| Model | $\chi^2$ | df | CFI | RMSEA | SRMR | Model difference |
|---|---|---|---|---|---|---|
| Gender | | | | | | |
| configural | 524.82 | 130 | .974 | .044 | .114 | |
| loadings | 682.81 | 142 | .965 | .049 | .123 | $\chi^2(12) = 85.19$, $p < .001$ |
| residuals | 718.06 | 154 | .963 | .048 | .124 | $\chi^2(12) = 22.20$, $p = .035$ |
| means | 887.04 | 155 | .952 | .055 | .126 | $\chi^2(1) = 30.70$, $p < .001$ |
| Age group | | | | | | |
| configural | 563.60 | 130 | .972 | .046 | .116 | |
| loadings | 601.64 | 142 | .970 | .045 | .121 | $\chi^2(12) = 16.39$, $p = .174$ |
| residuals | 623.49 | 154 | .969 | .044 | .123 | $\chi^2(12) = 16.41$, $p = .173$ |
| means | 629.64 | 155 | .969 | .044 | .124 | $\chi^2(1) = 1.40$, $p = .237$ |

*Note:* CFI = confirmatory fit index; df = degrees of freedom; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual. The model difference compares the current model with the previous one using the method proposed by Satorra (2000).

was the number of symptoms (between 0 and 13). Since this variable has a highly skewed distribution, we modelled it using the Poisson distribution. The second logistic model predicted a dichotomous variable, with zero being the coded individuals for whom no food dependency was present. The remaining degrees were coded as one without distinction and mild, moderate, or severe food addictions. The observed effects and their statistical significance are shown in *Table 3*.

Both regression models found that there was a highly significant effect of gender, BMI, and impulsivity. The results indicate that girls and people with a higher BMI and higher impulsivity have a higher tendency to suffer from food addiction. The observed effect of the school type did not reach statistical significance (in the Poisson model $p = .078$) and there was only a marginally significant trend of a higher number of symptoms associated with lower education. Although the influence of several regressors is significant, the overall effect is relatively weak. McFadden's Pseudo $R^2$ is around 15% for both models, with a considerable proportion of the effect provided by the variable of impulsivity (after impulsivity has been removed, $R^2$ drops to .074 and 0.113, respectively, in the logistics model).

## 4 DISCUSSION

The aim was to psychometrically evaluate mYFAS 2.0 and identify the relationship between FA and impulsivity and BMI. Our results showed an expected one-factor structure, which was reported by the authors of the tool (Gearhardt et al., 2016) and also researched in similar studies, for example in an American sample (Carr et al., 2016). The one-factor structure (e.g. CFI = 0.93, RMSEA = 0.07) and the good psychometric properties (e.g. Cronbach's $\alpha = 0.89$) of mYFAS 2.0 have also been replicated recently in a large sample of Brazilian adults (Nunes-Neto et al., 2018). Our results also show that the structure remains the same for younger and older participants and that the tool also worked perfectly for the adolescents.

Food addiction and its close connection to BMI, which was also confirmed by our results, specifically by each BMI standard deviation with a score for FA, increase by 21%, while the chance of having an addiction increases 1.49 times. The increase in FA along with an increase in BMI was also confirmed by additional research (Pedram et al., 2013). The prevalence of food addiction was higher in persons who were underweight or obese, relative to normal weight or overweight (Schulte & Gearhardt, 2018). The results obtained by Mies et al. (2017) show that food addiction seemed more prevalent in overweight adolescents (5.9%) and adolescents with normal weight (2.0%) and underweight (1.9%). Those results were not fully confirmed in the validation study of the German version of YFAS in the normal weight sample, where only a small positive correlation ($r = .17$) between YFAS symptoms and BMI was found (Meule et al., 2012). The authors summarize these results with the statement that correlations between BMI and food addiction symptoms do not have a clear positive relationship (Meule, 2012).

The effect of the type of school is hardly noticeable, though pupils from less demanding types of secondary schools tend to report more symptoms. Overall, however, the effect of these variables is relatively weak (although statistically significant). The opposite tendency, found in a sample of Dutch adolescents, was amongst highly educated adolescents showing a slightly higher prevalence of FA (Mies et al., 2017). These results are hard to compare within international research because of the differences in school systems.

Our results also demonstrated that girls are more prone to this type of addiction (boys with 39% fewer symptoms and only a one-to-five chance of developing the addiction). Our results showed a higher prevalence of FA in the girls than in the boys. The results showed a non-significant change in fit, which supported a partial strict invariance for mYFAS 2.0 when comparing men and women (Carr et al., 2016). A higher rate of FA was also found in the adult Canadian population of women as compared to men (Pedram et al., 2013). There

**Table 3** | Relationship between mYFAS 2.0 and selected variables

| | Poisson model | | | Logistic model | | |
|---|---|---|---|---|---|---|
| **Regressor** | **Effect** | **Wald z** | **p** | **Odds ratio** | **Wald z** | **p** |
| (Intercept) | 1.16 | | | 0.06 | | |
| Age | -4% | -1.61 | .107 | 1.00 | -0.04 | .965 |
| Gender (male = 1) | -39% | -10.03 | <.001 | 0.20 | -6.38 | <.001 |
| BMI (z-score) | +21% | 8.78 | <.001 | 1.49 | 4.44 | <.001 |
| Impulsivity (z-score) | +72% | 23.68 | <.001 | 1.92 | 6.64 | <.001 |
| **School type (reference basic school)** | | | | | | |
| Lower grammar school | -0% | -0.02 | .985 | 1.24 | 0.60 | .550 |
| Higher grammar school | -4% | -0.38 | .706 | 1.05 | 0.10 | .918 |
| Secondary school with a leaving exam | +7% | 0.67 | .506 | 0.92 | -0.19 | .853 |
| Secondary school without a leaving exam | +19% | 1.57 | .116 | 0.92 | -0.18 | .859 |
| McFadden's Pseudo R2 | | .145 | | | .157 | |

*Note:* The effect column contains an exponentially transformed regression weight minus one. We can interpret it, for example, as boys reporting an average of 39% fewer symptoms than girls, or that for each BMI standard deviation, the number of symptoms increases by an average of 21%.

**Table 4** | Relationship between food addiction and body mass index

| **Girls** | **No Food Addiction** | **Mild Food Addiction** | **Moderate Food Addiction** | **Severe Food Addiction** |
|---|---|---|---|---|
| Underweight | 95.61 | 2.34 | 0.88 | 1.17 |
| Normal weight | 93.29 | 2.95 | 1.97 | 1.79 |
| Overweight | 94.87 | 0.85 | 2.56 | 1.71 |
| Obese | 79.17 | 8.33 | 4.17 | 8.33 |

| **Boys** | **No Food Addiction** | **Mild Food Addiction** | **Moderate Food Addiction** | **Severe Food Addiction** |
|---|---|---|---|---|
| Underweight | 98.52 | 0.49 | 0.00 | 0.99 |
| Normal weight | 99.27 | 0.31 | 0.21 | 0.21 |
| Overweight | 98.26 | 0.58 | 0.00 | 1.16 |
| Obese | 85.11 | 6.38 | 2.13 | 6.38 |

were no significant differences in the percentage of women (16.0%) and men (14.3%) who met the criteria for FA (Schulte & Gearhardt, 2017).

The average BMI for the girls in our sample was 20.82 (SD 3.11), while for the boys it was, on average, 21.87 (SD 3.54). Hamřík et al. (2017) also found that the prevalence of overweight in boys was significantly higher compared to girls. Food addiction was associated with a higher body mass index in women and persons who were older (Schulte & Gearhardt, 2018). Our sample of adolescents aged 11–19 showed the prevalence of FA to be 4.1%. Our findings reveal a lower prevalence and Burrows et al. (2018) conducted a meta-analysis of 51 studies and found the mean prevalence of a food addiction diagnosis to be at 16.2%, with an average of 3.3% food addiction symptoms being reported. In a small sample of 75 children aged four to 16 the prevalence was 7.2% (Gearhardt et al., 2013). Torres et al. (2017) found a prevalence of 2.5% of FA in a non-clinical Portuguese samples. The authors suggest that it could be because of YFAS, which they used, being sensitive to cultural food habits and preferences.

The results of the method are related to impulsivity, which can be understood as proof of the construct validity. A similar strong relationship between FA and impulsivity was also found in other research (Pivarunas & Conner, 2015; Meule et al., 2017). When it comes to gender, higher impulsivity was found in men than women, which was also confirmed by a study in the Turkish Cypriot population (Dinçyurek et al., 2018), while higher impulsivity in women than in men was also found in the research study by Pedram et al. (2013).

### 4.1 Strengths and limitations

The study provided a new concept and a new tool to Czech psychological research. This study has several significant strengths, such as a large and representative sample. Stratified random sampling and the size of the sample make the study representative. The data collection was organized as paper-based, which underlines the strength of the methodology that was used. The limitations can be found in the fact that the respondents were not controlled for eating disorders and their BMI was self-reported.

### 4.2 Implications

We translated the tool, proceeded with its validation, and established the prevalence of food addiction in the Czech adolescent population. Subsequent research steps include a choice of different sampling criteria resulting in gaining more detailed data (e.g. on a sample of clinical respondents).

This research opens up a new approach to research on the relationship to food in the Czech Republic and can help provide an understanding of the situation regarding a high prevalence of obesity. The scale can be used by researchers in future studies based not only on mYFAS 2.0 but also on other tools measuring the relationship to food and food behaviour, so as to be able to determine the discrimination validity of the tool and provide a better understanding of the complexity of the relationship to food.

The results showed a higher prevalence of food addiction in connection with higher impulsivity, which might lead to different approaches in intervention and prevention, which is not only focused on the resulting addiction and obesity, but also on the personality traits leading to establishing the addiction issue.

The connection between food addiction and higher BMI also provides pointers for the treatment approach; the treatment of food addiction requires a comprehensive psychological approach which is different from an approach that is only medically-oriented.

## 5 CONCLUSION

In this study, we translated mYFAS 2.0 into Czech, adapted its Czech version, and administered it face to face to a nationally representative non-clinical sample of 3,950 adolescents. We found a one-factor structure and adequate psychometric properties such as high reliability. With the lower prevalence of an FA diagnosis and its connection to impulsivity, the overall prevalence of FA was 4.1%.

**Authors' contributions:**
HP, MD and JS designed the study and proposed study design. DD performed the statistical analysis and participated in data interpretation, and manuscript preparation. All authors designed the initial form of the manuscript. HP, MD and JS conducted a literature review and summary of related work. KK supervised the statistical analysis and participated in the preparation of the manuscript. All authors contributed to the emergence article and approved the final version of the manuscript.

**Declaration of interest:**
The authors do not have any conflict of interest in connection with the current paper.

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