

**Does how individuals handle social situations exacerbates the relationship between physique anxiety and food addiction? The role of emotional expression suppression and social avoidance and distress.**

Yan Li, Yuxia Fan, Jing Lin, Shaobo Shi\*

Qingdao Mental Health Center, Qingdao, Shandong, China

Corresponding author, Qingdao Mental Health Center, Qingdao, 266034, Shandong, China

Email address: [ssb7129@163.com](mailto:ssb7129@163.com)

Telephone Number:+8613675325788

## ABSTRACT

Research on food addiction has increased significantly in recent years. It has been demonstrated that food addiction can lead to impairments in physiological, psychological, and social functioning in individuals. However, there is a lack of studies investigating the influence of how individuals handle social situations on food addiction and the specific mechanisms involved. To address this research gap, this study aimed to examine the role of expression suppression, social avoidance and distress in the relationship between social physique anxiety and food addiction.

A total of 1151 Chinese college students with an average age of 21.44 (SD = 4.77) years were recruited through the Chinese survey platform Questionnaire Star.

Participants completed the Chinese modified version of the Yale Food Addiction Scale 2.0, Social Physical Anxiety Scale, Expression Suppression Scale, and Social Avoidance and Distress Scale. We used a structural equation model to investigate the relationships and mediations among these variables. The results of the study

supported our hypothesis that the association between social physique anxiety and food addiction symptoms could be partially explained by expression suppression and social avoidance and distress. This association remained significant even after adjusting for covariates such as gender, number of cigarettes smoked per day, bedtime, education, and BMI. Specifically, more severe social physique anxiety was found to be associated with frequent use of expression suppression, which in turn was associated with more severe food addiction symptoms. These findings highlight the

tog bort: Anxiety about the physique in

tog bort: : A structural equation model study

tog bort: Global r

Formaterat: Indrag: Första raden: 0 tkn

tog bort: of

tog bort: factors

tog bort: potential

tog bort: The

tog bort: was used to validate the proposed model.

importance of considering social physique anxiety in future research on food addiction. Furthermore, they suggest that interventions targeting emotion regulation strategies and socially negative emotions and behaviors may be beneficial in reducing the adverse effects of social physique anxiety on food addiction.

**Keywords:** Food addiction; Social anxiety physique; Express suppression; Social avoidance and distress; Chinese

## 1. Introduction

The concept of food addiction (FA) was initially introduced in 1956, described as "a common pattern of symptoms, akin to those observed in other addictive processes" (Randolph 1956). According to the diagnostic criteria for substance dependence, FA encompasses the inability to exert rational control over the consumption quantity and duration of food intake, coupled with the emergence of behaviors such as tolerance, withdrawal, and intense cravings, particularly for highly processed, calorie-dense foods (Gearhardt et al., 2009; Ifland et al., 2009). FA, often categorized as an eating disorder, shares genetic markers with other similar disorders, including those that code for the dopamine D2 receptor and the opioid receptor gene (OPRM1 gene) (Davis et al., 2011) with studies indicating symptomatic convergence between FA and other eating disorders through questionnaire-based assessments (Ratković et al., 2023; Walenda et al., 2021). FA can precipitate a plethora of adverse health outcomes. These include psychological or psychiatric disturbances (e.g., despondency, weight gain culminating in diminished self-esteem, severe depression, and binge eating disorder), physical ailments (e.g., obesity or overweight status, metabolic dysregulation due to selective eating habits, diabetes, or cardiovascular diseases), and social issues (e.g., apprehension over stigmatization attributable to excessive weight or behaviors resembling addiction) (Borisenkova et al., 2018; De Almeida et al., 2022; Ivezaj et al., 2017; Pavanello et al., 2022; Rose et al., 2018).

During the college years, an individual's thoughts, behaviors, and emotions gradually develop to maturity (Colić Barić et al., 2003) — that is, personality development and maturation. In this particular phase of life, a colorful dietary environment is presented to college students, and at the same time, this phase is important for the formation of

**Kommenterad [AG1]:** I recommend you avoid abbreviations. It often only confuse readers and it actually does not serve any specific purpose.

**tog bort:** F

**tog bort:** A

**flyttade (infogning) [1]**

**Ändrad fältkod**

**tog bort:** Recognized as a form of eating disorder,

**Ändrad fältkod**

**tog bort:** for instance

**tog bort:** such as

**tog bort:** like

**tog bort:** personality,

**Kommenterad [AG2]:** Personality involves how we feel, think and behave...so to have it as before is redundant.

**tog bort:** stage

**tog bort:** this stage

individual dietary preferences.(Nelson et al., 2008). The heightened milieu of living arrangements, academic demands, and responsibilities predisposes college students more than other populations to a higher likelihood of developing eating disorders (Kyrkou et al., 2018; Stok et al., 2018), including FA.(Pursey et al., 2014). Studies have revealed a notable prevalence of FA among Chinese college students, reaching up to 6.7%. However, which factors and underlying mechanisms contribute to FA remains inadequately addressed within Chinese scholarly discourse (Zhang et al., 2021). While existing research underscores the nexus between FA and obesity, certain inquiries have been raised regarding this correlation, necessitating further examination into their interplay (Hebebrand&Gearhardt 2021). For instance, the deleterious effects of FA extend beyond obesity, encompassing psychological distress and compromised social functioning (Burrows et al., 2018). Therefore, FA screening college students with both obesity problems and those without is necessary to explore the FA of Chinese college students.

### 1.1. Social physique anxiety and food addiction

Anxiety, the most diagnosed mental disorder among Chinese individuals, has a lifetime prevalence as high as 7.57 (Huang et al., 2019). There is well-established research confirming a correlation between anxiety and FA (da Silva Júnior et al., 2022; Fekih-Romdhane et al., 2022; Hussenroeder et al., 2022; Nolan&Jenkins 2019). Social Physique Anxiety (SPA), a specific category of anxiety, is characterized by apprehension surrounding one's physical appearance in social contexts due to uncertainty about making a favorable impression (Xu 2003). The prevalence of SPA among Chinese college students is significant, and it has been, largely attributed to the cultural idealization of slimness as beauty and the pervasive influence of this ideal on social networks (Fu et al., 2022; Hurst et al., 2000). Within the realm of social media, students often engage in subconscious comparison of their bodies with those of others. This can lead to lots of negative behaviors, such as unhealthy eating habits and addictive behaviors, as means to achieve a coveted physique, particularly when they perceive themselves as less fit in comparison to their peers others (Thøgersen-Ntoumani et al., 2017). The potential link between SPA and eating disorders is conceivable, that is,

**tog bort:** , compared to other demographics

**Kommenterad [AG3]:** I suggest you give here what you are comparing it to...? What is the prevalence in the general Chinese population for example? Globally?

**tog bort:** the investigation into

**tog bort:** the contributory factors

**tog bort:** of

**tog bort:**

**tog bort:** Moreover

**tog bort:** for both healthy and non-healthy weight

**tog bort:** very

**tog bort:** , and more research is needed

**tog bort:** commonly

**Kommenterad [AG4]:** Compared to the general population...? Difficult to know if this is high or not...

**tog bort:**

**Kommenterad [AG5]:** Please explain what you mean here...significant compared to what or do you mean "large"? In that case how large?

**tog bort:** ,

**tog bort:** aesthetic

striving to evade negative social scrutiny **about one's body** may prompt specific problematic eating behaviors (Kowalski et al., 2006; Lanfranchi et al., 2015). Nonetheless, the exact nature of the relationship between SPA **on** individual dietary choices is yet to be clarified (Alcaraz-Ibáñez et al., 2023) **and** warrants further examination.

**Nevertheless, some** research has established a direct correlation between SPA and FA. For instance, a study encompassing 555 Spanish university students identified a positive correlation between SPA and disordered eating patterns, such as bulimia and persistent food-related thoughts (Alcaraz-Ibáñez et al., 2020). Similarly, research involving 766 French adolescents elucidated how SPA contributes to detrimental eating attitudes and behaviors in adolescents (Lanfranchi et al., 2015). A recent meta-analytical review uncovered a robust overall association between SPA and eating disorders, quantified by a correlation coefficient of 0.5 (Alcaraz-Ibáñez et al., 2023). Furthermore, SPA's relationship with substance use disorders has been documented, such as a study with 1,766 female nurses where SPA moderated the relationship between exercise identity and exercise dependence (Cook et al., 2015). and a positive association with digital media dependence among young adults (Luo et al., 2023). Additional findings suggest that individuals using anabolic-androgenic steroids (AAS) who experience SPA report heightened AAS dependence symptoms, depression, riskier drinking behaviors, and mental health issues related to AAS consumption (Griffiths et al., 2018). FA shares several attributes with substance dependence disorders. Firstly, while FA is currently excluded from DSM-5's diagnostic criteria for substance dependence, its diagnostic framework aligns with that of substance dependence (Gearhardt et al., 2016); Secondly, FA, along with other dependencies such as gambling disorders, is largely attributed to dysfunctions within the reward system (Etxandi et al., 2023; Jiménez-Murcia et al., 2017); Lastly, parallels have been drawn between FA and other substance abuse disorders regarding clinical presentation, neurological and biological underpinnings, psychopathology, and socio-cultural risk factors (Cathelain et al., 2016). Based on the evidence presented, it is plausible to deduce that SPA may exert a direct positive influence on the propensity for FA.

**tog bort:** as

**tog bort:** alter one's body to

**tog bort:** and established disease entities remains to be thoroughly investigated, and the influence of SPA

**tog bort:** , therefore, the connection between SPA and FA

**tog bort:** L

**tog bort:** imited

**tog bort:** ,

**tog bort:** however, SPA's status as a negative affect is linked with eating disorders and substance dependence.

**flyttade upp [1]:** FA, often categorized as an eating disorder, shares genetic markers with other similar disorders, including those that code for the dopamine D2 receptor and the opioid receptor gene (OPRM1 gene) (Davis et al., 2011) with studies indicating symptomatic convergence between FA and other eating disorders through questionnaire-based assessments(Ratković et al., 2023; Walenda et al., 2021).

**Kommenterad [AG6]:** I'm not really sure the meaning of all this...is because you want to control for bad habits (e.g., smoking) or is because you want the reader to understand that food addiction is like any other addiction?

If is the first, adhere to discuss the variables you are going to control for not any other.

If is the second, I think is enough with what you have in the first paragraph.

### *1.2. Role of express suppression*

Emotion regulation strategies constitute the mechanisms through which individuals exert control over the occurrence, intensity, and expression of their emotions (Thompson 1994). Based on Gross's theory of emotion regulation, expression suppression (ES) emerges as a pivotal emotion regulation strategy, typically manifesting in the latter stages of the emotional process. It attenuates the subjective experience of emotion, predominantly by curbing the impending or active emotional expressions (Gross 2002). ES is linked to a spectrum of psychological distress, being associated with mood disturbances such as anxiety and depression. Individuals plagued by mood disorders often exhibit heightened levels of ES (Lincoln et al., 2022; Liu et al., 2022). Concurrently, SPA is rooted in an individual's anguish related to their body image within social contexts, deriving from body image discontent (Jin&Fung 2021; Swami et al., 2021; Zartaloudi et al., 2023). Previous investigations have revealed that such dissatisfaction propels individuals toward ES (Wang et al., 2023), leading to the hypothesis that SPA and ES are interconnected. Extreme emotional states may prompt problematic eating behaviors, which are intricately associated with disorders of emotional regulation (Brunault&Ballon 2021). Nonadaptive emotion regulation is now recognized as a core component of treatment for addictive disorders (Prefit et al., 2019). Those who engage in nonadaptive emotion regulation are more inclined to impulsive reactions under emotionally charged and disagreeable circumstances (Wolz et al., 2016). Under such pressure, they may resort to food as a means to mitigate their emotional turmoil, particularly those with a high propensity toward FA (Gearhardt et al., 2016; Ribeiro et al., 2023). Hence, FA is regarded as a maladaptive emotion regulation tactic. It is postulated that ES could act as a mediating factor in the relationship between SPA and FA.

### *1.3. Role of social avoidance and distress*

Social avoidance and distress (SAD) encompass both the behavioral proclivity to eschew social interaction and the accompanying emotional turmoil experienced in actual social settings (Watson&Friend 1969). College students grappling with SPA often report concomitant dissatisfaction with their physical appearance (Jin&Fung 2021;

**tog bort:** is deemed a counterproductive method of regulating emotions, as it constrains the outward manifestation of feelings. It ...

**tog bort:** angst

**tog bort:** duress

Swami et al., 2021; Zartaloudi et al., 2023). Research indicates that the more acute the self-critical view of one's body image, the greater the likelihood of such students experiencing SAD in social environments (Miers et al., 2014). A principal aspect of SPA involves trepidation over adverse judgments concerning one's body and the undue scrutiny from others (Zartaloudi et al., 2023), and cognitive-behavioral models suggest that the confluence of fear of negative evaluation and heightened self-awareness is likely to engender social trepidations (Rapee&Heimberg 1997). Fears of adverse appraisals may lead individuals to experience heightened vigilance, withdraw from social endeavors, and even cultivate diminished self-esteem in social contexts (Perczel-Forintos&Kresznerits 2017; Willemse et al., 2023). Consequently, **we posit that SPA** has a direct and positive impact on SAD among college students.

#### *1.4. The role of express suppression and social avoidance and distress*

Furthermore, SAD is implicated in augmenting negative emotions and undermining social support, as a result of reduced social engagement (Chen et al., 2023; Li et al., 2023). As per the reinforcement theory of negative emotions, evasion of adverse emotions is foundational to the emergence of addictive behaviors (Baker et al., 2004). To **regulate** the negative emotions and diminished emotional support associated with SAD, students may turn to eating—a behavior known to furnish gratification—as a means of emotional and stress alleviation. Thus, **suggesting** a linkage between SAD and FA. The emotion regulation process model **indicates** that the aim of emotional regulation is to reconcile conflicting demands by selecting responses that are deemed socially acceptable in varied circumstances, and difficulties in any aspect of emotional regulation may precipitate social adjustment challenges (REF). Hence, college students dealing with SPA who engage in maladaptive emotion regulation strategies may be predisposed to develop SAD (Campos et al., 1994). Therefore, **we hypothesized** that SAD mediates the association between SPA and FA, with both ES and SAD acting in serial mediation between SPA and FA.

#### *1.5. Present study*

In summary, this study aims to examine the potential roles of ES and SAD in **the relationship between SPA and FA**. As depicted in Figure 1, we propose a conceptual

**tog bort:** it is

**tog bort:** ed

**tog bort:** serial

**tog bort:** assuage

**tog bort:** is proposed

**tog bort:** intimates

**tog bort:** the current study

**tog bort:** s

**Kommenterad [AG7]:** I strongly suggest you avoid all abbreviations. The reader should not be expected to remember all this to make sense of one of your hypothesis. The easier it is to read the more available and transparent your paper will be.

**tog bort:**

**tog bort:** By synthesizing the aforementioned literature, as

model involving ES and SAD (i.e., SPA → ES → SAD → FA). Specifically, we hypothesize that heightened levels of SPA correlate with increased utilization of ES as a means of emotion regulation, potentially leading to elevated FA symptoms (H1). Additionally, we posit that more pronounced SPA is associated with heightened SAD, which in turn is linked to increased FA (H2). Furthermore, we propose that ES and SAD function as sequential process factors contributing to elevated SPA and FA levels (H3).

top bort: severity

## 2. Method

### 2.1. Participants

The investigation was conducted using a convenience sampling methodology across three universities in Qingdao, within the Shandong Province of China. From an initial pool of 1,300 questionnaires disseminated, a total of 1,151 were recognized as valid for analysis, after the exclusion of 149 for reasons including random and patterned responses, culminating in an efficacy rate of 88.53%. Eligibility for participation was restricted to university students possessing the cognitive ability to understand and respond to the survey instrument, contingent upon their informed consent. Exclusions applied to individuals who had experienced traumatic events within the last year or had been on a sabbatical. Prior to the commencement, requisite approvals were obtained from the concerned academic authorities. The purpose of the study was transparently communicated to the participants, namely, to explore the relationship between social physique anxiety and food addiction within the student demographic. Ethical assurances were underscored: the prerogative to withdraw remained with the participants at any point; the collected data were exclusively for scholarly analysis and confined to the scrutiny of the research cohort. The integrity and sincerity of the responses were of paramount importance, with participants exhorted to answer truthfully and in accordance with their actual perceptions and conduct. The survey instrument was congruent with those employed in previous inquiries, deliberately avoiding any ethically dubious items. The process entailed participants reviewing an electronic informed consent document before engaging with the online survey instrument (Questionnaire Star) on a voluntary basis. The ethical approbation for this study was accorded by the Ethics Committee of the Qingdao

Kommenterad [AG8]: How did you calculate this result?

Kommenterad [AG9]: How was this secured? In the consent letter? Self-exclusion?

If Self-exclusion discuss it as a limitation in the Discussion.

Kommenterad [AG10]: I cannot find it anywhere...was the participation anonymous?

Mental Health Center(QDJWZXWZLL2024028), in strict accordance with the principles established by the Declaration of Helsinki.

## 2.2. Measurements

### 2.2.1 General demographics

Participant general demographics included sex (0=male, 1=female), age, BMI [weight (kg)/height(m)<sup>2</sup>,(1=<18.5, 2=18.5-23.9, 3=24.27.9, 4=>28)], home location (0=city, 1=country), bedtime (1=before 22:00, 2=22:00-24:00,3=after 24:00), educational (1=3-year college student, 2=undergraduate college student, 3=postgraduate college student) and cigarettes per day (0=no smoking, 1=1 day <10 cigarettes, 2=1 day 10-20 cigarettes, 3=1 day >20 cigarettes).

**Kommenterad [AG11]:** This is fine, but none of these variables were indicated or hinted as potential confounders or covariates...smoking probably since you'd described food addiction as a common addiction...

If possible, mention at least why you are measuring them.

### 2.2.2 The Chinese modified Yale Food Addiction Scale2.0

The Chinese-modified Yale Food Addiction Scale (C-mYFAS2.0) is a 13-item self-report scale used to measure the participant's status regarding FA over the last year (Zhang et al., 2021). The original authors have licensed the scale for use in the Chinese population (Schulte&Gearhardt 2017). 2 items measure the participants' diet-related clinical impairment and distress, and 11 assess the participant's symptoms of FA over the last 12 months. Each item is scored dichotomously according to the threshold determined by the C-mYFAS2.0 validation paper (0 = did not meet the criterion, 1 = met criterion). This criterion is supported if any item corresponds to the diagnostic criteria, or the clinical severity meets the clinical threshold.

**Kommenterad [AG12]:** Please make this description more clear. It is very confusing as it stands and there are no examples of items either.

tog bort: 1

**Kommenterad [AG13]:** Does this mean that you needed license to use it in your study or is it an "open license" to all Chinese researchers?

The C-mYFAS2.0 is scored in 2 ways: Symptom-counting version (total scores ranging from 0 to 11) that sums all but 2 (used to measure diet-related clinical impairments or distress) of the 11 items, with higher scores representing participants' greater propensity for FA. Another scoring method is the hierarchical diagnostic approach, the scores of all items (including the 2 items about diet-related clinical impairment or distress) are summed up, and ultimately the researcher makes a diagnosis of FA based on the symptom scores and clinical significance criteria (mild=2-3 symptoms plus impairment or distress, moderate=4-5 symptoms plus impairment or distress, severe=6 or more symptoms plus impairment or distress). C-mYFAS2.0 had perfect reliability in this study for Cronbach's alpha coefficient was

0.873.

### 2.2.3 Social Physique Anxiety Scale

Xu (Xu 2003) developed the Chinese version of the Social Physique Anxiety Scale which contains 3 dimensions: anxiety for social comparison (e.g., item 3, “I feel comfortable even though other people’s body size is superior to mine”), discomfort for self-expression (e.g., item 2, “I always feel uneasy and uncomfortable when presenting my body size to others”), and concerns for others’ evaluation (e.g., item 6, “I am worried that others will make fun of my body size when I socialize with them”). The authors of the scale have made the scale publicly available and free to use (REF). All items were scored on a 5-point Likert scale, with scores ranging from 1 to 5 indicating “strongly disagree” to “strongly agree”. The total score ranges from 15 to 75, with higher scores indicating a greater tendency toward social physique anxiety. The Cronbach’s alpha coefficient for this scale in this study was 0.877.

### 2.2.4 Expression Suppression Scale

The Expressive Suppression Scale is one of the subscales of the Emotion Regulation Strategies Scale, a scale that is widely used worldwide and has been licensed by the original authors for use in Chinese populations (Gross&John 2003; Zhao et al., 2015). It uses a 7-point Likert scale with scores ranging from 1 to 7 indicating “Strongly Disagree” to “Strongly Agree,” respectively. This subscale has 4 items (e.g., item 9, “I don’t express sadness and anger when I feel it”) and the total score ranges from 4 to 28, with higher scores indicating that participants tend to suppress their thoughts. The Cronbach’s alpha coefficient for this subscale in the current study was 0.834.

### 2.2.5 Social Avoidance and Distress Scale

The Social Avoidance and Distress Scale (SADS) consists of 28 items, of which 14 are used to assess social avoidance and the remaining items to measure social distress (Watson&Friend 1969). The SADS version we used here was revised by Peng et al. The original authors have licensed the scale for use in Chinese populations (Peng et al., 2003). All items in the scale are assessed by “yes” or “no”, with a score of 1 if the answer is “yes” and 0 if the answer is “no”. The total score ranges from 0 to

Kommenterad [AG14]: Developed or translated?

Kommenterad [AG15]: This item is a bit difficult to understand. Please check the translation or if it was translated to Chinese from English, please check the original.

tog bort: s

tog bort: , and 1, 3, 7, 11, 13, and 14 of the 15 items were reverse scored

Kommenterad [AG16]: Do you have permission to use only parts of the scale as well? State that here as well.

Moreover, since you are not using a whole scale...in the Discussion add this as a limitation using research that suggest that using part of scales that were developed to be used as a full scale has some psychometric issues.

Kommenterad [AG17]: Same question as above regarding The Chinese modified Yale Food Addiction Scale2.0

tog bort: .

tog bort: , which

Kommenterad [AG18]: Please give examples of the items.

Kommenterad [AG19]: Revised or translated?

Kommenterad [AG20]: Same question as above.

tog bort: , and items 1,3,4,6,7,9,12,15,17,19,22,25,27,28 are reverse scored

28, with higher scores representing more severe social avoidance and distress in individuals. The Cronbach's alpha coefficient for the scale in the study was 0.910.

### 2.3. Data and statistical analysis

The analyses were conducted using SPSS26.0. The Harman single-factor test tested the data to avoid common methodological deviations. Descriptive analyses were conducted for all variables of interest, and the internal consistency of the variables was assessed using Cronbach's alpha coefficients (>0.7 is acceptable). Pearson correlations were performed between the variable's interests. PROCESS macro (version 3.4) (Hayes 2013) and Model 6 were used to determine whether ES and SAD played a serial mediation effect between SPA and FA. In order to improve the effectiveness of testing, all scale data were Z-score standardized and after Z-score standardization, the data conformed to a standard normal distribution, i.e., about half of the observations had values less than 0 and the other half had values greater than 0. The mean value of the variable was 0, the standard deviation was 1, and the range of variability was -1 ~ 1. The significance of all paths depended on 95% bias-corrected bootstrapped intervals(based on 5000 samples) that did not contain zero. Moreover, gender, age, smoking, bedtime, education, and BMI were included as covariates based on previous studies of FA (Arslan et al., 2024; Bartschi&Greenwood 2023; Hoover et al., 2023; Niroumand Sarvandani et al., 2024). The *p*-value was set at <0.05.

## 3. Results

### 3.1 Descriptive Statistics

As shown in Table 1, of the 1151 students included in this study, 25.54% were males, 63.08% were living in the city, and the mean age was 21.44 ( $SD = 4.77$ ). 57.52% of the students had a bedtime of 22:00-24:00, 58.56% of the participants were undergraduate students, and 93.74% of the students were non-smokers.

Means and standard deviations for psychometric variables are also presented in Table 1. The score of C-mYFAS2.0 was 1.34 ( $SD=2.26$ ). If the hierarchical diagnostic approach is followed, A total of 80 (6.90%) subjects were regarded as having FA with the number of mild, moderate and severe FA are 9(0.70%), 17(1.40%) and 54(4.60%)

**Kommenterad [AG21]:** Please re-write this section. My recommendation is that you detail the programs you used and then chronologically the treatment of the data. For example, data cleaning, missing value handling (you deleted for example some participants from the final data set), standardization, normal distribution check, analysis of H1, H2, H3...etc.

**tog bort:** Participants characteristics

**tog bort:** of

**tog bort:** remaining

**Kommenterad [AG22]:** Please check all spaces between symbols in your statistics.

**Kommenterad [AG23]:** Again, I recommend you use the name of the construct rather than the scale. I reader will never keep up with this unless is an expert on these measures. Even so, all abbreviation and scale labels makes the paper difficult to read.

respectively. The scores of the Social Physical Anxiety Scale, Express Suppression Scale, and Social Avoidance and Distress Scale of the participants were 43.21 ( $SD=10.52$ ), 14.66 ( $SD=5.61$ ), and 13.68 ( $SD=7.47$ ), respectively.

### 3.2 Common Method Bias Analysis

Common method bias could be a potential problem in self-report psychometrics leading to biased repossesses. To address this issue, researchers tend to use Harmon's one-factor test to estimate the presence of measurement error. Exploratory factor analysis showed that there were 9 factors for which the initial eigenvalue of each component was greater than one. The cumulative percentage of the first factor was 11.84%, less than the critical value of 40%. Therefore, there was no significant common bias in this study.

Kommenterad [AG24]: Is this a result or a data treatment?  
I suggest you put it under data treatment.

### 3.3 Correlation analyses

Correlation coefficients for all variables are presented in Table 2. Positive correlations were found between C-mYFA2.0, SPAS, ESS, and SADS( $P$  all  $<0.001$ ), while gender was positively correlated with SPAS ( $r=0.062, P<0.05$ ) and SADS( $r=0.073, P<0.05$ ) and negatively correlated with ESS( $r=-0.142, P<0.01$ ), the cigarettes per day was positively correlated with C-mYFAS2.0 ( $r=0.096, P<0.01$ ) and negatively correlated with SADS ( $r=0.098, P<0.01$ ), bedtime was positively correlated with C-mYFAS2.0( $r=0.147, P<0.01$ ), SPAS( $r=0.095, P<0.01$ ), and SADS( $r=0.098, P<0.01$ ), education was negatively correlated with SPAS( $r=-0.101, P<0.01$ ), ESS( $r=-0.075, P<0.05$ ), and SADS( $r=-0.117, P<0.01$ ), and BMI was positively correlated with ESS( $r=-0.061, P<0.05$ ) and SADS( $r=-0.208, P<0.01$ ).

### 3.4 Path analysis

As shown in Table 3 and Fig.2, all the coefficients of paths were statistically significant after variables such as gender, cigarettes per day, bedtime, education, and BMI were controlled for. The SPAS positively and significantly influenced ESS ( $\beta=0.224, P<0.001$ ). When SADS was included, the result showed the SPAS ( $\beta=0.456, P<0.01$ ) and the ESS ( $\beta=0.102, P<0.001$ ) significantly and positively predicted the SADS, and ultimately, the C-mYFAS2.0 was able to be predicted significantly and positively by SPAS ( $\beta=0.226, P<0.001$ ), ESS ( $\beta=0.097, P<0.001$ )

and SADS ( $\beta=0.075$ ,  $P<0.05$ ).

The results of the total, direct and indirect effects of the serial mediating effect are shown in Table 4. 4 pathways produced the effects. Path1: SPA→C-mYFAS2.0;Path2: SPAS→ESS→C-mYFAS2.0;Path3:SPAS→SADS→C-mYFAS2.0;Path4:SPAS→ESS→SADS→C-mYFAS2.0. The results showed that the total indirect effect (0.058) accounted for 20.40% of the total effect (0.061) and 25.70% of the direct effect (0.058) in the relationship between SPAS and C-mYFAS2.0. This result indicates that 20.40% of SPAS's positive effect on C-mYFAS2.0 works through 3 effects. Specifically, the effects are(a)the mediating effect of ESS,(b)the mediating effect of SADS, and(c)the mediating effect of ESS and SADS, respectively. The mediating effect(a),(b) and (c) represented 7.70%,12.30% and 0.70% of the total effect, respectively, and 9.70%,15.50% and 0.90% of the direct effect, respectively. The mediating effect of SADS was significantly stronger than ESS or serial mediation in the relationship between SPAS and C-mYFAS2.0.

#### 4. Discussion

This research is, to the best of our knowledge, the first one, exploring the potential impact of ES and SAD on the connection between SPA and FA in a comprehensive survey of Chinese university students. The results validated all three propositions concerning the possible indirect routes involving ES and SAD, comprising the independent influence of ES (H1), the independent influence of SAD (H2), and a sequence of effects of ES and SAD (H3).

Prior research commonly acknowledges that individuals typically employ two strategies to mitigate SPA: (1) dietary control, exemplified by selective eating, structured dieting, and periods of fasting (Alcaraz-Ibáñez et al., 2023; Fu et al., 2022; Gargari et al., 2010), and (2) escalated physical activity, such as compulsive exercise routines and exercise dependence. (Cook et al., 2015; Hurst et al., 2000). The current study elucidates that, within the cohort of Chinese college students, SPA harbors a positive correlation with FA. The empirical evidence gleaned from structural equation modelling illustrates that SPA can exert a direct and positive influence on FA. This relationship may be attributed to the fact that students burdened with SPA frequently

**Kommenterad [AG25]:** The Discussion is very technical rather than conceptual. Please revise so the reader can understand what your findings mean for the individual, clinical practice, prevention and even research (e.g., theory building).

In addition, a great limitation is that you did not measure personality, despite the fact that you acknowledge this is an important issue regarding eating disorders.

See, for example, the work using the Temperament and Character Inventory: eating disorders are strongly associated with high Harm Avoidance; in addition, anorexics are highly persistent and often self-directed (to be able to maintain restrictive dieting), whereas bulimics are highly impulsive (i.e., high in Novelty Seeking and usually low in Self-directedness).

In other words, the associations on anxiety and distress would probably be redundant if you took personality into account.

Please address this as a limitation and revise the whole Discussion.

**tog bort:** the pioneer in

**Kommenterad [AG26]:** Please, develop on how big the effects were...small, moderate or large? See as a guide for example:

Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, 40(5), 532–538.  
<https://doi.org/10.1037/a0015808>

**tog bort:** ;

**tog bort:** ;

**Kommenterad [AG27]:** As far as I can see, this information was not present in the Introduction. It might have been important to understand your study...If so, please mention this in the appropriate place in the Introduction.

grapple with an amalgamation of unsettling emotions including distress, trepidation, and despondency in their quotidian existence, leading to volatile mood states. (Herring et al., 2021). The heightened anxiety spawned by SPA often precipitates erratic conduct, typified by overzealous dietary restrictions. Concurrently, in the face of negative emotional experiences, these individuals are susceptible to losing self-regulatory control and succumbing to disordered eating practices. This investigation posits that the interplay between SPA and deleterious eating behaviors among college students constitutes a recurrent, self-perpetuating cycle.

The current investigation reveals that ES serves as a partial intermediary in the dynamic between SPA and FA amongst Chinese university students, aligning with antecedent research wherein ES acted as a conduit between adverse emotional states and FA(Mitchell&Wolf 2016). The employment of ES, indicative of a maladaptive strategy for regulating emotions, mirrors the endeavors of individuals to diminish the external display of their affective states. Those afflicted by SPA grapple with a diminished self-perception and allure, rooted in dissatisfaction and apprehension regarding their body image, thereby resorting to emotional suppression with greater frequency(Davison&McCabe 2006). Concurrently, it has been posited that the adoption of strategies centered on inhibiting expression may culminate in outcomes that are ineffectual from a social standpoint, particularly when the negative emotions involved are of a moderate or benign nature (Kraft et al., 2023). In harmony with this perspective, the theoretical framework concerning the regulation of emotions within the context of eating disorders posits that pathological actions, such as inordinate dietary restriction and binge eating, serve as mechanisms to momentarily mitigate or circumvent negative emotional states(Lavender&Anderson 2010; Muehlenkamp et al., 2012). Consequently, SPA propels college students towards the habitual employment of emotional suppression, a strategy ill-suited for adaptive emotional management, leading to recurrent indulgence in eating as a means to enhance mood. This cyclical engagement in maladaptive emotional regulation ultimately leads to the symptoms of FA.

This investigation elucidated that SAD serves as a conduit in the nexus between SPA and FA, that is to say, SPA precipitates FA through the intermediary of SAD. SPA

denotes an individual's preoccupation with whether their physique engenders favorable perceptions amongst others, representing an emotional response triggered in social contexts. The genesis of SPA within an individual engenders a trepidation regarding adverse judgments from their peers, thereby undermining their capacity to authentically present themselves (Zartaloudi et al., 2023). This, in turn, detrimentally impacts their communicative competencies, subsequently impairing their social interaction capabilities. Over time, this cascade of effects culminates in the development of SAD. Concurrently, extant literature has uncovered that tendencies towards social seclusion and diminished social support networks can exacerbate FA severity (Lacroix & von Ranson 2021; Li et al., 2022). This phenomenon is particularly pronounced in collectivist societies like China, where the emphasis on communal support inherently bolsters collectivist values (Cao et al., 2021). Social support, especially manifested through communal dining practices, plays a pivotal role in mitigating binge eating behaviors and encouraging adherence to healthy dietary norms (Fang et al., 2015). Ergo, the diminishment of social engagement resultant from SAD precipitates a decline in social support, fostering the progression towards FA.

Moreover, ES and SAD serve as intermediary conduits linking SPA and FA. Notably, extant research indicates that individuals with anxiety pathologies frequently resort to maladaptive expressive suppression tactics, and seldom employ and ineffectually utilize adaptive mechanisms such as cognitive reframing (Dryman & Heimberg 2018). This tendency may be attributed to dysfunctions in the emotion regulatory neural pathways characteristic of anxiety disorders. Specifically, there is a diminished activation within the attentional control network in frontal-parietal zones, such as the dorsolateral prefrontal cortex and the ventrolateral prefrontal cortex (Ball et al., 2013). Simultaneously, the framework advanced by Heimberg et al. posits that individuals exhibiting excessive concern regarding others' unfavorable assessments are prone to construe ambiguous social cues negatively. Consequently, they exhibit diminished utilization of adaptive techniques like cognitive reappraisal (Morrison & Heimberg 2013). To circumvent undesirable social repercussions like undue scrutiny or social exclusion, individuals apprehensive of negative evaluations tend to inhibit the

articulation of their thoughts while resorting to non-adaptive strategies such as ES(Goodman et al., 2021). Consequently, individuals afflicted with SPA are inclined to adopt ES as an emotional regulation strategy. This maladaptive approach predisposes a pervasive state of despondency, thereby exacerbating negative affectivity and antisocial behaviors. This observation lends credence to Clark and Wells' social anxiety framework, which posits that individuals with self-critical perceptions are inclined to construe social contexts as fraught with peril, precipitating anxious manifestations and tendencies towards social withdrawal(Rapee&Heimberg 1997). An individual's adverse social conduct and negative social affect can precipitate a decline in personal social reinforcement and a transformation in emotional requisites, prompting recurrent engagement in detrimental practices such as excessive food consumption as a compensatory measure for their emotional deficiencies(Yang et al., 2023). Concurrently, the unmonitored dietary behavior of individuals afflicted with SAD undergoes progressive deterioration, leading to a gradual reliance on the gratification derived from eating.

## **5. Implications and limitations**

The present investigation yields both theoretical and pragmatic implications. Firstly, it broadens the extant body of knowledge concerning the determinants of FA, specifically elucidating the impact of socio-physical appearance on individual dietary preferences, moderated by the overlay of physical intentionality and societal influences. Moreover, the research substantiates the intermediary role of ES and SAD in the nexus between SPA and FA, thus forging a synthesis of emotion regulation theory, the social anxiety framework, and the negative affect reinforcement hypothesis. Pragmatically, these insights furnish cogent approaches to mitigating FA, thereby forestalling related physique or psychological pathologies. Particularly, pedagogical initiatives in educational institutions could anchor on body shape perception, empowering students to adopt a balanced perspective on the influence of physique on personal development, assuaging negative affect associated with corporeal dissatisfaction, and bolstering self-assurance in body image through active engagement in physical activities and structured guidance on body sculpting. For students experiencing SPA, the propensity

**Kommenterad [AG28]:** Add the limitations mentioned across the comments above.

towards social appearance anxiety and consequent social reticence may be attenuated through the cultivation of efficacious and salubrious emotion regulation strategies, thereby diminishing their FA.

Nevertheless, this investigation is encumbered by several limitations. Firstly, the cohort of college students originates solely from three institutions within Qingdao, thereby restricting the diversity of the sample pool. These establishments are renowned within the region, potentially skewing the dietary health literacy of the participants towards a higher echelon, thus introducing a possible selection bias. Future endeavors might broaden the sampling base to include a wider array of educational levels, thereby enhancing the study's generalizability. Secondly, the employment of a cross-sectional design precludes the establishment of causality between FA and SPA, ES and SA. Prospective studies could adopt longitudinal methodologies, such as cross-lagged analysis, to elucidate these relationships more definitively. Thirdly, a disproportionate representation of female participants, who constituted 74.46% of the study population and previous studies demonstrated a higher incidence of FA compared to their male counterparts (Carr et al., 2017), could bias the results. Males experiencing different emotional adversities exhibited increased FA levels relative to females (Hoover et al., 2022, 2023). Despite the exclusion of individuals with severe affective disorders and physical ailments, the potential influence of mild negative affective states on FA was not accounted for in the analysis. Lastly, the exclusive focus on a nonclinical cohort limits the extrapolation of findings to clinical settings, such as individuals diagnosed with anorexia nervosa. Nevertheless, it would be both intriguing and valuable to ascertain whether these observed patterns persist within clinical populations.

## **6. Conclusion**

In conclusion, this study delves into the potential significance of express suppression and social avoidance and distress in the correlation between social physique anxiety and food addiction among a cohort of Chinese university students. It contributes to the sparse body of research on food addiction within the Chinese demographic and offers prospects for forthcoming investigations in this domain. Furthermore, these discoveries harbor significant ramifications for interventions aimed at alleviating the adverse

**Kommenterad [AG29]:** Please revise accordingly after the full revision of the Discussion.

impacts of food addiction.

#### **Ethical statement**

This study was approved by the Ethics Committee of Qingdao Mental Health Center(QDJWZXWZLL2024028), and all procedures of the human participants involved in this study followed the ethical standards of the institution and/or the National Research Committee, as well as the Declaration of Ethical Standards of the Helsinki Research Committee of 1964 and its subsequent amendments or similar ethical standards. In addition, the work has not been previously published or is not being considered for publication elsewhere. This paper has been reviewed and approved by all authors. All authors declare that they have no conflicts of interest.

#### **CRediT authorship contribution statement**

**Yan Li:** review & editing, Writing-original draft, Investigation, Conceptualization. **Yuxia FAN:** Writing-review&editing, Formal analysis. **Jing Lin:** Writing-review&editing, Investigation. **Shaobo Shi:** Writing-review&editing, Data collection.

#### **Declaration of competing interest**

All authors have no conflicts of interest relevant to this article to disclose.

#### **Data availability**

Data will be made available on request.

#### **Acknowledgements**

None.

#### **Reference**

Alcaraz-Ibáñez, M., Paterna, A. & Griffiths, M.D.(2023).Social physical anxiety and eating disorders: A systematic review and meta-analysis. *Body Image*,45,133-141.<http://dx.doi.org/10.1016/j.bodyim.2023.02.008>

Alcaraz-Ibáñez, M., Paterna, A., Griffiths, M.D. & Sicilia, Á.(2020).Examining the role of social physique anxiety on the relationship between physical appearance comparisons and disordered eating symptoms among Spanish emerging adults. *Scandinavian Journal of Psychology*,61(6),803-808.<http://dx.doi.org/10.1111/sjop.12663>

Arslan, S., Atan, R.M., Sahin, N. & Ergul, Y.(2024).Evaluation of night eating syndrome and food

addiction in esports players. *European Journal of Nutrition.*<http://dx.doi.org/10.1007/s00394-024-03368-0>

Baker, T.B., Piper, M.E., McCarthy, D.E., Majeskie, M.R. & Fiore, M.C.(2004).Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychological Review*,111(1),33-51.<http://dx.doi.org/10.1037/0033-295x.111.1.33>

Ball, T.M., Ramsawh, H.J., Campbell-Sills, L., Paulus, M.P. & Stein, M.B.(2013).Prefrontal dysfunction during emotion regulation in generalized anxiety and panic disorders. *Psychological Medicine*,43(7),1475-1486.<http://dx.doi.org/10.1017/s0033291712002383>

Bartschi, J.G. & Greenwood, L.M.(2023).Food addiction as a mediator between depressive symptom severity and body mass index. *Appetite*,190,107008.<http://dx.doi.org/10.1016/j.appet.2023.107008>

Borisenkov, M.F., Tserne, T.A. & Bakutova, L.A.(2018).Food addiction in Russian adolescents: Associations with age, sex, weight, and depression. *European Eating Disorders Review*,26(6),671-676.<http://dx.doi.org/10.1002/erv.2644>

Brunault, P. & Ballon, N.(2021).Inter-Individual Differences in Food Addiction and Other Forms of Addictive-Like Eating Behavior. *Nutrients*,13(2).<http://dx.doi.org/10.3390/nu13020325>

Burrows, T., Kay-Lambkin, F., Pursey, K., Skinner, J. & Dayas, C.(2018).Food addiction and associations with mental health symptoms: a systematic review with meta-analysis. *Journal of human nutrition and dietetics : the official journal of the British Dietetic Association*,31(4),544-572.<http://dx.doi.org/10.1111/jhn.12532>

Campos, J.J., Mumme, D.L., Kermoian, R. & Campos, R.G.(1994).A functionalist perspective on the nature of emotion. *Monographs of the Society for Research in Child Development*,59(2-3),284-303.<http://dx.doi.org/https://doi.org/10.1111/j.1540-5834.1994.tb01289.x>

Cao, C., Zhu, C. & Meng, Q.(2021).Chinese International Students' Coping Strategies, Social Support Resources in Response to Academic Stressors: Does Heritage Culture or Host Context Matter? *Current Psychology*,40(1),242-252.<http://dx.doi.org/10.1007/s12144-018-9929-0>

Carr, M.M., Catak, P.D., Pejsa-Reitz, M.C., Saules, K.K. & Gearhardt, A.N.(2017).Measurement

invariance of the Yale Food Addiction Scale 2.0 across gender and racial groups. *Psychological Assessment*, 29(8), 1044-1052. <http://dx.doi.org/10.1037/pas0000403>

Cathelain, S., Brunault, P., Ballon, N., Réveillère, C. & Courtois, R.(2016).[Food addiction: Definition, measurement and limits of the concept, associated factors, therapeutic and clinical implications]. *Presse Medicale*, 45(12 Pt 1), 1154-1163. <http://dx.doi.org/10.1016/j.lpm.2016.03.014>

Chen, C., Shen, Y., Lv, S., Wang, B. & Zhu, Y.(2023).The relationship between self-esteem and mobile phone addiction among college students: The chain mediating effects of social avoidance and peer relationships. *Frontiers in Psychology*, 14, 1137220. <http://dx.doi.org/10.3389/fpsyg.2023.1137220>

Colić Barić, I., Satalić, Z. & Lukesić, Z.(2003).Nutritive value of meals, dietary habits and nutritive status in Croatian university students according to gender. *International journal of food sciences and nutrition*, 54(6), 473-484. <http://dx.doi.org/10.1080/09637480310001622332>

Cook, B., Karr, T.M., Zunker, C., Mitchell, J.E., Thompson, R., Sherman, R., Erickson, A., Cao, L. & Crosby, R.D.(2015).The influence of exercise identity and social physique anxiety on exercise dependence. *Journal of Behavioral Addictions*, 4(3), 195-199. <http://dx.doi.org/10.1556/2006.4.2015.020>

da Silva Júnior, A.E., de Lima Macena, M., de Oliveira, A.D.S., Praxedes, D.R.S., de Oliveira Maranhão Pureza, I.R., de Menezes Toledo Florêncio, T.M., Gearhardt, A.N. & Bueno, N.B.(2022).Prevalence of food addiction and its association with anxiety, depression, and adherence to social distancing measures in Brazilian university students during the COVID-19 pandemic: a nationwide study. *Eating and Weight Disorders-Studies on Anorexia Bulimia and Obesity*, 27(6), 2027-2035. <http://dx.doi.org/10.1007/s40519-021-01344-9>

Davis, C., Zai, C., Levitan, R.D., Kaplan, A.S., Carter, J.C., Reid-Westoby, C., Curtis, C., Wight, K. & Kennedy, J.L.(2011).Opiates, overeating and obesity: a psychogenetic analysis. *International Journal of Obesity*, 35(10), 1347-1354. <http://dx.doi.org/10.1038/ijo.2010.276>

Davison, T.E. & McCabe, M.P.(2006).Adolescent body image and psychosocial functioning. *Journal of Social Psychology*, 146(1), 15-30. <http://dx.doi.org/10.3200/socp.146.1.15-30>

De Almeida, R., Kamath, G. & Cabandugama, P.(2022).Food Addiction in Application to Obesity Management. *Missouri medicine*,119(4),372-378

Dryman, M.T. & Heimberg, R.G.(2018).Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. *Clinical Psychology Review*,65,17-42.<http://dx.doi.org/10.1016/j.cpr.2018.07.004>

Etxandi, M., Bañas, I., Mora-Maltas, B., Granero, R., Fernández-Aranda, F., Tovar, S., Solé-Morata, N., Lucas, I., Casado, S., Gómez-Peña, M., Moragas, L., Pino-Gutiérrez, A.D., Tapia, J., Valenciano-Mendoza, E., Potenza, M.N., Gearhardt, A.N., Diéguez, C. & Jiménez-Murcia, S.(2023).Plasma concentration of leptin is related to food addiction in gambling disorder: Clinical and neuropsychological implications. *Journal of Behavioral Addictions*,12(4),1019-1031.<http://dx.doi.org/10.1556/2006.2023.00051>

Fang, M., Xu, L., Huang, X., Gu, F., Qu, X., Xu, M. & Luo, X.(2015).Effects of family and peer support upon the stages of health related behavior in adolescent. *Chinese Journal Prevention Medicine*(9),810-816.<http://dx.doi.org/10.3760/cma.j.issn.0253-9624.2015.09.009>

Fekih-Romdhane, F., Sawma, T., Akel, M., Obeid, S., Brytek-Matera, A. & Hallit, S.(2022).Work Addiction and Depression, Anxiety, and Stress: the Mediating Role of Food Addiction Among Lebanese Young Adult Workers. *International Journal of Mental Health and Addiction*,1-21.<http://dx.doi.org/10.1007/s11469-022-00909-8>

Fu, T., Wang, J., Xu, S., Yu, J. & Sun, G.(2022).Media Internalized Pressure and Restrained Eating Behavior in College Students: The Multiple Mediating Effects of Body Esteem and Social Physique Anxiety. *Frontiers in Psychology*,13.<http://dx.doi.org/10.3389/fpsyg.2022.887124>

Gargari, B.P., Khadem-Haghigian, M., Taklifi, E., Hamed-Behzad, M. & Shahraki, M.(2010).Eating attitudes, self-esteem and social physique anxiety among Iranian females who participate in fitness programs. *Journal of Sports Medicine and Physical Fitness*,50(1),79-84

Gearhardt, A.N., Corbin, W.R. & Brownell, K.D.(2009).Food addiction: an examination of the diagnostic criteria for dependence. *Journal of Addiction Medicine*,3(1),1-7.<http://dx.doi.org/10.1097/ADM.0b013e318193c993>

Gearhardt, A.N., Corbin, W.R. & Brownell, K.D.(2016).Development of the Yale Food Addiction Scale

Version 2.0. *Psychol Addict Behav*, 30(1), 113-121. <http://dx.doi.org/10.1037/adb0000136>

Goodman, F.R., Rum, R., Silva, G. & Kashdan, T.B.(2021).Are people with social anxiety disorder happier alone? *Journal of Anxiety Disorders*, 84, 102474. <http://dx.doi.org/10.1016/j.janxdis.2021.102474>

Griffiths, S., Jacka, B., Degenhardt, L., Murray, S.B. & Larance, B.(2018).Physical appearance concerns are uniquely associated with the severity of steroid dependence and depression in anabolic-androgenic steroid users. *Drug and Alcohol Review*, 37(5), 664-670. <http://dx.doi.org/10.1111/dar.12688>

Gross, J.J.(2002).Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, 39(3), 281-291. <http://dx.doi.org/10.1017/s0048577201393198>

Gross, J.J. & John, O.P.(2003).Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85(2), 348-362. <http://dx.doi.org/10.1037/0022-3514.85.2.348>

Hayes, A.F. (2013) Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*,

Hebebrand, J. & Gearhardt, A.N.(2021).The concept of "food addiction" helps inform the understanding of overeating and obesity: NO. *The American journal of clinical nutrition*, 113(2), 268-273. <http://dx.doi.org/10.1093/ajcn/nqaa344>

Herring, M.P., Gordon, B.R., McDowell, C.P., Quinn, L.M. & Lyons, M.(2021).Physical activity and analogue anxiety disorder symptoms and status: Mediating influence of social physique anxiety. *Journal of Affective Disorders*, 282, 511-516. <http://dx.doi.org/10.1016/j.jad.2020.12.163>

Hoover, L.V., Yu, H.P., Duval, E.R. & Gearhardt, A.N.(2022).Childhood trauma and food addiction: The role of emotion regulation difficulties and gender differences. *Appetite*, 177, 106137. <http://dx.doi.org/10.1016/j.appet.2022.106137>

Hoover, L.V., Yu, H.P., Duval, E.R. & Gearhardt, A.N.(2023).Investigating gender differences in the co-occurrence of PTSD and food addiction.

*Appetite*, 187, 106605. <http://dx.doi.org/10.1016/j.appet.2023.106605>

Huang, Y., Wang, Y., Wang, H., Liu, Z., Yu, X., Yan, J., Yu, Y., Kou, C., Xu, X., Lu, J., Wang, Z., He, S., Xu, Y., He, Y., Li, T., Guo, W., Tian, H., Xu, G., Xu, X., Ma, Y., Wang, L., Wang, L., Yan, Y., Wang, B., Xiao, S., Zhou, L., Li, L., Tan, L., Zhang, T., Ma, C., Li, Q., Ding, H., Geng, H., Jia, F., Shi, J., Wang, S., Zhang, N., Du, X., Du, X. & Wu, Y. (2019). Prevalence of mental disorders in China: a cross-sectional epidemiological study. *Lancet Psychiatry*, 6(3), 211-224. [http://dx.doi.org/10.1016/s2215-0366\(18\)30511-x](http://dx.doi.org/10.1016/s2215-0366(18)30511-x)

Hurst, R., Hale, B., Smith, D. & Collins, D. (2000). Exercise dependence, social physique anxiety, and social support in experienced and inexperienced bodybuilders and weightlifters. *British Journal of Sports Medicine*, 34(6), 431-435. <http://dx.doi.org/10.1136/bjsm.34.6.431>

Hussenoeder, F.S., Pabst, A., Conrad, I., Löbner, M., Engel, C., Zeynalova, S., Reyes, N., Glaesmer, H., Hinz, A., Witte, V., Schroeter, M.L., Wirkner, K., Kirsten, T., Löffler, M., Villringer, A. & Riedel-Heller, S.G. (2022). Anxiety and Food Addiction in Men and Women: Results From the Longitudinal LIFE-Adult-Study. *Frontiers in Psychiatry*, 13, 914358. <http://dx.doi.org/10.3389/fpsyg.2022.914358>

Ifland, J.R., Preuss, H.G., Marcus, M.T., Rourke, K.M., Taylor, W.C., Burau, K., Jacobs, W.S., Kadish, W. & Manso, G. (2009). Refined food addiction: a classic substance use disorder. *Medical Hypotheses*, 72(5), 518-526. <http://dx.doi.org/10.1016/j.mehy.2008.11.035>

Ivezaj, V., Wiedemann, A.A. & Grilo, C.M. (2017). Food addiction and bariatric surgery: a systematic review of the literature. *Obesity Reviews*, 18(12), 1386-1397. <http://dx.doi.org/10.1111/obr.12600>

Jiménez-Murcia, S., Granero, R., Wolz, I., Baño, M., Mestre-Bach, G., Steward, T., Agüera, Z., Hinney, A., Diéguez, C., Casanueva, F.F., Gearhardt, A.N., Hakansson, A., Menchón, J.M. & Fernández-Aranda, F. (2017). Food Addiction in Gambling Disorder: Frequency and Clinical Outcomes. *Frontiers in Psychology*, 8, 473. <http://dx.doi.org/10.3389/fpsyg.2017.00473>

Jin, J. & Fung, S.F. (2021). Social Physique Anxiety Scale: Psychometric Evaluation and Development of a Chinese Adaptation. *International Journal of Environmental Research and Public Health*, 18(20). <http://dx.doi.org/10.3390/ijerph182010921>

Kowalski, K.C., Mack, D.E., Crocker, P.R., Niefer, C.B. & Fleming, T.L.(2006).Coping with social physique anxiety in adolescence. *Journal of Adolescent Health*,39(2),275.e279-216.<http://dx.doi.org/10.1016/j.jadohealth.2005.12.015>

Kraft, L., Ebner, C., Leo, K. & Lindenberg, K.(2023).Emotion regulation strategies and symptoms of depression, anxiety, aggression, and addiction in children and adolescents: A meta-analysis and systematic review. *Clinical Psychology: Science and Practice*,30(4),485-502.<http://dx.doi.org/10.1037/cps0000156>

Kyrkou, C., Tsakoumaki, F., Fotiou, M., Dimitropoulou, A., Symeonidou, M., Menexes, G., Biliaderis, C.G. & Michaelidou, A.M.(2018).Changing Trends in Nutritional Behavior among University Students in Greece, between 2006 and 2016. *Nutrients*,10(1).<http://dx.doi.org/10.3390/nu10010064>

Lacroix, E. & von Ranson, K.M.(2021).Prevalence of social, cognitive, and emotional impairment among individuals with food addiction. *Eating and Weight Disorders-Studies on Anorexia Bulimia and Obesity*,26(4),1253-1258.<http://dx.doi.org/10.1007/s40519-020-01014-2>

Lanfranchi, M.C., Maïano, C., Morin, A.J. & Therme, P.(2015).Social physique anxiety and disturbed eating attitudes and behaviors in adolescents: moderating effects of sport, sport-related characteristics, and gender. *International Journal of Behavioral Medicine*,22(1),149-160.<http://dx.doi.org/10.1007/s12529-014-9406-6>

Lavender, J.M. & Anderson, D.A.(2010).Contribution of emotion regulation difficulties to disordered eating and body dissatisfaction in college men. *International Journal of Eating Disorders*,43(4),352-357.<http://dx.doi.org/https://doi.org/10.1002/eat.20705>

Li, S., Kong, K., Zhang, K. & Niu, H.(2023).The relation between college students' neuroticism and loneliness: The chain mediating roles of self-efficacy, social avoidance and distress. *Frontiers in Psychology*,14,1124588.<http://dx.doi.org/10.3389/fpsyg.2023.1124588>

Li, S., Schulte, E.M., Cui, G., Li, Z., Cheng, Z. & Xu, H.(2022).Psychometric properties of the Chinese version of the modified Yale Food Addiction Scale version 2.0 (C-mYFAS 2.0): Prevalence of food addiction and relationship with resilience and social support. *Eating and Weight Disorders*

*Studies on Anorexia Bulimia and Obesity*,27(1),273-284.<http://dx.doi.org/10.1007/s40519-021-01174-9>

Lincoln, T.M., Schulze, L. & Renneberg, B.(2022).The role of emotion regulation in the characterization, development and treatment of psychopathology. *Nature Reviews Psychology*,1(5),272-

<http://dx.doi.org/10.1038/s44159-022-00040-4>

Liu, Q., Chen, W., Preece, D.A., Xu, D., Li, H., Liu, N., Fu, G., Wang, Y., Qian, Q., Gross, J.J. & Liu, L.(2022).Emotion dysregulation in adults with ADHD: The role of cognitive reappraisal and

expressive suppression. *Journal of Affective Disorders*,319,267-

<http://dx.doi.org/10.1016/j.jad.2022.09.058>

Luo, L., Yuan, J., Bi, S. & Wang, Y.(2023).A model linking digital media dependence, exercise empowerment, and social physique anxiety among emerging adulthood college students.

*Frontiers in Psychology*,14,1249182.<http://dx.doi.org/10.3389/fpsyg.2023.1249182>

Miers, A.C., Blöte, A.W., Heyne, D.A. & Westenberg, P.M.(2014).Developmental pathways of social avoidance across adolescence: the role of social anxiety and negative cognition. *Journal of*

*Anxiety Disorders*,28(8),787-794.<http://dx.doi.org/10.1016/j.janxdis.2014.09.008>

Mitchell, K.S. & Wolf, E.J.(2016).PTSD, food addiction, and disordered eating in a sample of primarily older veterans: The mediating role of emotion regulation. *Psychiatry Research*,243,23-29.<http://dx.doi.org/10.1016/j.psychres.2016.06.013>

Morrison, A.S. & Heimberg, R.G.(2013).Social anxiety and social anxiety disorder. *Aacn Advanced Critical Care*,9,249-274.<http://dx.doi.org/10.1146/annurev-clinpsy-050212-185631>

Muehlenkamp, J.J., Peat, C.M., Claes, L. & Smits, D.(2012).Self-Injury and Disordered Eating: Expressing Emotion Dysregulation Through the Body. *Suicide and Life-Threatening Behavior*,42(4),416-425.<http://dx.doi.org/https://doi.org/10.1111/j.1943-278X.2012.00100.x>

Nelson, M.C., Story, M., Larson, N.I., Neumark-Sztainer, D. & Lytle, L.A.(2008).Emerging Adulthood and College-aged Youth: An Overlooked Age for Weight-related Behavior Change. *Obesity*,16(10),2205-2211.<http://dx.doi.org/https://doi.org/10.1038/oby.2008.365>

Niroumand Sarvandani, M., Asadi, M., Izanloo, B., Soleimani, M., Mahdavi, F., Gearhardt, A.N., Chen,

Q.W., Ghadiri Varzaneh, N., Taghadosiniya, R., Ghazvini, H., Khoramrooz, M. & Rafaiee, R.(2024).Confirmatory factor analysis and gender invariance of Persian version of the modified Yale food addiction scale (mPYFAS) 2.0: insight from a large scale Iranian sample. *Journal of Eating Disorders*,12(1),14.<http://dx.doi.org/10.1186/s40337-023-00962-1>

Nolan, L.J. & Jenkins, S.M.(2019).Food Addiction Is Associated with Irrational Beliefs via Trait Anxiety and Emotional Eating. *Nutrients*,11(8).<http://dx.doi.org/10.3390/nu11081711>

Pavanello, F., Colpo, A., Tison, T., Fabris, R., De Silvestro, G. & Marson, P.(2022).Acute pancreatitis due to severe hypertriglyceridemia in the COVID-19 era: The role of therapeutic plasma exchange. *Transfusion and Apheresis Science*,61(1),103292.<http://dx.doi.org/10.1016/j.transci.2021.103292>

Peng, C., Fan, X. & Li, L.(2003).A reliability study of the Social Avoidance and Distress Scale in a student population. *Chinese Journal of Clinical Psychology*,11(04),279-281.<http://dx.doi.org/10.3969/j.issn.1005-3611.2003.04.012>

Perczel-Forintos, D. & Kresznerits, S.(2017)[Social anxiety and self-esteem: Hungarian validation of the "Brief Fear of Negative Evaluation Scale - Straightforward Items"]. *Orvosi Hetilap*,158(22),843-850.<http://dx.doi.org/10.1556/650.2017.30755>

Prefit, A.B., Cândea, D.M. & Szentagotai-Tătar, A.(2019).Emotion regulation across eating pathology: A meta-analysis. *Appetite*,143,104438.<http://dx.doi.org/10.1016/j.appet.2019.104438>

Pursey, K.M., Stanwell, P., Gearhardt, A.N., Collins, C.E. & Burrows, T.L.(2014).The prevalence of food addiction as assessed by the Yale Food Addiction Scale: a systematic review. *Nutrients*,6(10),4552-4590.<http://dx.doi.org/10.3390/nu6104552>

Randolph, T.G.(1956).The descriptive features of food addiction; addictive eating and drinking. *Quarterly Journal of Studies on Alcohol*,17(2),198-224

Rapee, R.M. & Heimberg, R.G.(1997).A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy*,35(8),741-756.[http://dx.doi.org/10.1016/s0005-7967\(97\)00022-3](http://dx.doi.org/10.1016/s0005-7967(97)00022-3)

Ratković, D., Knežević, V., Dickov, A., Fedrigolli, E. & Čomić, M.(2023).Comparison of binge-eating

disorder and food addiction. *Journal of International Medical Research*, 51(4), 3000605231171016. <http://dx.doi.org/10.1177/0300605231171016>

Ribeiro, A., Sinval, J., Félix, S., Guimarães, C., Machado, B.C., Gonçalves, S., de Lourdes, M. & Conceição, E.M. (2023). Food Addiction and Grazing-The Role of Difficulties in Emotion Regulation and Negative Urgency in University Students. *Nutrients*, 15(20). <http://dx.doi.org/10.3390/nu15204410>

Rose, M.H., Nadler, E.P. & Mackey, E.R. (2018). Impulse Control in Negative Mood States, Emotional Eating, and Food Addiction are Associated with Lower Quality of Life in Adolescents with Severe Obesity. *Journal of Pediatric Psychology*, 43(4), 443-451. <http://dx.doi.org/10.1093/jpepsy/jsx127>

Schulte, E.M. & Gearhardt, A.N. (2017). Development of the Modified Yale Food Addiction Scale Version 2.0. *European Eating Disorders Review*, 25(4), 302-308. <http://dx.doi.org/10.1002/erv.2515>

Stok, F.M., Renner, B., Clarys, P., Lien, N., Lakerveld, J. & Deliens, T. (2018). Understanding Eating Behavior during the Transition from Adolescence to Young Adulthood: A Literature Review and Perspective on Future Research Directions. *Nutrients*, 10(6). <http://dx.doi.org/10.3390/nu10060667>

Swami, V., Robinson, C. & Furnham, A. (2021). Associations between body image, social physique anxiety, and dating anxiety in heterosexual emerging adults. *Body Image*, 39, 305-312. <http://dx.doi.org/10.1016/j.bodyim.2021.10.004>

Thøgersen-Ntoumani, C., Dodos, L., Chatzisarantis, N. & Ntoumanis, N. (2017). A Diary Study of Self-Compassion, Upward Social Comparisons, and Body Image-Related Outcomes. *Applied Psychology: Health and Well-Being*, 9(2), 242-258. <http://dx.doi.org/https://doi.org/10.1111/aphw.12089>

Thompson, R.A. (1994). Emotion regulation: a theme in search of definition. *Monographs of the Society for Research in Child Development*, 59(2-3), 25-52. <http://dx.doi.org/10.2307/1166137>

Walenda, A., Bogusz, K., Kopera, M., Jakubczyk, A., Wojnar, M. & Kucharska, K. (2021). Emotion regulation in binge eating disorder. *Psychiatria Polska*, 55(6), 1433-

1448.<http://dx.doi.org/10.12740/PP/OnlineFirst/122212>

Wang, G., Liu, X. & Lei, J.(2023).Association between Body-Image Satisfaction and Anxiety, Depressive Symptoms among Women with PCOS: The Mediating Role of Emotion Regulation Strategies. *Journal of Psychology*,1-15.<http://dx.doi.org/10.1080/00223980.2023.2283472>

Watson, D. & Friend, R.(1969).Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology*,33(4),448-457.<http://dx.doi.org/10.1037/h0027806>

Willemse, H., Geenen, R., Egberts, M.R., Engelhard, I.M. & Van Loey, N.E.(2023).Perceived stigmatization and fear of negative evaluation: Two distinct pathways to body image dissatisfaction and self-esteem in burn survivors. *Psychology & Health*,38(4),445-458.<http://dx.doi.org/10.1080/08870446.2021.1970160>

Wolz, I., Hilker, I., Granero, R., Jiménez-Murcia, S., Gearhardt, A.N., Dieguez, C., Casanueva, F.F., Crujeiras, A.B., Menchón, J.M. & Fernández-Aranda, F.(2016)."Food Addiction" in Patients with Eating Disorders is Associated with Negative Urgency and Difficulties to Focus on Long-Term Goals. *Frontiers in Psychology*,7,61.<http://dx.doi.org/10.3389/fpsyg.2016.00061>

Xu, X. (2003) A study on the measurement of social body anxiety and its relationship with physical exercise. Ph.d., East China Normal University,

Yang, C., Wen, H., Zhou, Y., Wang, Y., Sun, Y. & Yuan, F.(2023).Family cohesion and intuitive eating in Chinese college students: A serial mediation model. *Appetite*,190,107021.<http://dx.doi.org/10.1016/j.appet.2023.107021>

Zartaloudi, A., Christopoulos, D., Kelesi, M., Govina, O., Mantzorou, M., Adamakidou, T., Karvouni, L., Koutekos, I., Evangelou, E., Fasoi, G. & Vlachou, E.(2023).Body Image, Social Physique Anxiety Levels and Self-Esteem among Adults Participating in Physical Activity Programs. *Diseases*,11(2).<http://dx.doi.org/10.3390/diseases11020066>

Zhang, H., Tong, T., Gao, Y., Liang, C., Yu, H., Li, S., Yan, X. & Wang, L.(2021).Translation of the Chinese version of the modified Yale Food Addiction Scale 2.0 and its validation among college students. *Journal of Eating Disorders*,9(1),116.<http://dx.doi.org/10.1186/s40337-021-00471-z>

Zhao, X., Zhang, B., Zhang, P., Pan, L. & Zhou, R.(2015).Reliability and validity tests of the Stanford Emotion Regulation Scale among secondary school students in China. *Chinese Journal of*

*Clinical Psychology*, 23(01), 22-25+107. <http://dx.doi.org/10.16128/j.cnki.1005-3611.2015.01.005>