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Article

Snacking behavior in undergraduate students: impulsive buying and gender as predictors

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ABSTRACT

Unhealthy snacking is a major behavioral contributor to overnutrition and obesity, yet the psychological and demographic determinants of real-time snack selection remain unclear because most studies rely on retrospective self-reported dietary measures. Drawing on compensatory consumption theory and dietary restraint models, this study examined the main and interactive effects of trait impulsive buying and gender on objectively measured snack calorie selection. A cross-sectional observational study was conducted among 100 undergraduate students (80% female; aged 18–23 years) in Central Java, Indonesia. Trait impulsive buying was assessed using the validated 9-item Buying Impulsiveness Scale (α = 0.87). Objective snack selection was measured through a simulated online supermarket in which participants freely selected from 40 commercial snack products without budget constraints. Total caloric content (kcal) of the selected snacks was analyzed using a General Linear Model (GLM). Significant main effects were observed for gender ($F = 9.323$, $p = .003$, $\eta p^2 = .089$) and trait impulsive buying ($F = 5.734$, $p = .019$, $\eta p^2 = .056$). Male participants selected substantially more snack calories than females. A significant interaction between gender and impulsive buying ($F = 4.625$, $p = .034$, $\eta p^2 = .046$) indicated that higher impulsive buying predicted greater calorie selection among males but lower calorie selection among females. These findings suggest that gender moderates the relationship between impulsive buying and snack selection, reflecting distinct psychological mechanisms underlying eating behavior. Public health interventions should adopt gender-sensitive strategies by emphasizing impulse-control approaches for males and addressing emotional coping and dietary restraint processes among females to promote healthier snack choices.

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Introduction

Overnutrition has emerged as a critical global public health concern, underscored by recent statistics indicating that over 2.5 billion adults worldwide are classified as overweight, including those living with obesity (NCD-RisC, 2024). In Indonesia, the prevalence of overweight and obesity among adults has similarly reached an alarming 37.8% (SKI, 2023). While obesity is inherently multifactorial–driven by physical inactivity, metabolic factors, and overall dietary patterns–the uncontrolled consumption

of energy-dense foods represents a primary behavioral catalyst for noncommunicable diseases, such as cardiovascular disorders and type 2 diabetes (Knežević & Jandrić-Kočić, 2023; Mendis et al., 2025). Among dietary habits, snacking behavior has drawn heightened scrutiny; snacks are frequently nutritionally poor and exhibit higher caloric density than main meals (Hassen et al., 2018; Green et al., 2025), significantly accelerating daily excess caloric intake (Chanwikrai et al., 2022). Consequently, there is an urgent imperative to rigorously investigate the psychological and demographic determinants driving unhealthy snacking.

Impulsivity as a psychological trait–specifically trait impulsive buying–has been consistently linked to aberrant eating and purchasing patterns. Contemporary systematic reviews indicate that highly impulsive individuals demonstrate a heightened susceptibility to immediate reward cues, driving frequent snack purchases (Bénard et al., 2018; He, 2023). In the Indonesian context, self-regulatory deficits and trait impulsivity have similarly been identified as key psychological drivers of decision-making behavior among young adults (Anugrah & Helmi, 2021). Furthermore, acute situational states like hunger interact with trait impulsivity to attenuate cognitive control and exacerbate high-calorie food acquisitions (Bénard et al., 2018). Despite these documented associations, empirical discrepancies persist in the literature. Impulsivity does not uniformly translate into elevated body mass index across all populations (Scholten et al., 2014), and previous studies primarily rely on self-report dietary recalls or generalized food consumption scales (Honkanen et al., 2011; He, 2023), which are prone to social desirability and recall biases. Crucially, limited empirical research has directly quantified the relationship between trait impulsive buying and objective calorie intake under controlled purchasing conditions, leaving potential moderating variables unexplored.

Gender differences are also hypothesized to modulate unhealthy snacking patterns, yet current findings remain highly contradictory (Branscum & Sharma, 2014; Pitriyanti et al., 2023). Recent investigations show that young adult females exhibit higher tendencies toward emotional snacking and stress-induced food cravings (Juul et al., 2021; Suga et al., 2023). Conversely, other empirical evidence suggests males engage in higher overall daily snacking frequency or consume larger portion sizes (Savige et al., 2007). Adding to this ambiguity, several studies report no significant gender effects on snacking frequency or food choices (Adriaanse et al., 2015; Oh et al., 2023). These inconsistent findings highlight a clear empirical ambiguity regarding whether biological sex or cognitive-behavioral dynamics inherent to gender differentially dictate caloric intake from snacks.

To address these methodological and empirical gaps, this study utilizes a simulated online supermarket environment to capture actual, real-time food selection rather than relying on retrospective self-reports. Trait impulsive buying will be operationalized using the validated Buying Impulsiveness Scale (BIS; Rook & Fisher, 1995; adapted with demonstrated internal consistency, Cronbach's $\alpha > 0.80$), while unhealthy snacking behavior is operationalized objectively as total snack calorie intake (measured in kilocalories, kcal) selected during the simulated shopping task. Specifically, this study aims to examine the main and interactive effects of trait impulsive buying and gender on objective snack calorie intake. Grounded in compensatory consumption theory and gender-specific cognitive restraint models, we test three hypotheses: (H1) Trait impulsive buying positively predicts snack calorie intake; (H2) Gender significantly predicts snack calorie intake, with males consuming higher snack calories than females; and (H3) Gender moderates the relationship between trait impulsive buying and snack calorie intake, such that the positive association is stronger in males, whereas highly impulsive females exhibit attenuated caloric intake due to heightened dietary restraint.

Methods

Study Design and Participants

To investigate the concurrent role of trait buying impulsiveness behavior and gender differences on snacking habits within an online retail environment, this study employed a cross-sectional

observational design coupled with direct behavioral measurements. The target population comprised active undergraduate students enrolled in the Faculty of Education and Psychology at the university. Using a non-probability purposive sampling method, the inclusion criteria required participants to be actively registered students aged 17 years or older. Importantly, to eliminate confounding variables related to intentional dietary restrictions, individuals currently undergoing any structured weight-loss or medical dietary program were excluded.

Prior to data collection, an a priori power analysis was executed using G*Power 3.1 software to ensure statistical validity. Based on an anticipated medium effect size ($f^2 = 0.15$), a statistical power of 0.90, and a standard alpha level of 0.05, the calculation indicated that a minimum threshold of 99 participants would be required to reliably detect the interaction effects. A total of 120 undergraduate students initially completed the session. However, after data cleaning, the data from 20 participants were excluded due to incomplete questionnaire submissions, invalid self-reported anthropometric data (BMI), or missing behavioral log data from the online platform. Consequently, the final analysis was limited to a sample size of 100 participants (aged 18–23 years).

All procedures performed in this study were strictly conducted in accordance with institutional ethical standards, having received official ethical clearance from the Konsorsium Psikologi Ilmiah Nusantara (KPIN) under reference number 243/2025 Etik/KPIN.

Procedure

Potential respondents were recruited via digital flyers distributed across multiple social media platforms and institutional WhatsApp communication groups. The invitation links directed interested individuals to a dedicated portal outlining the study's scope, consent terms, and technical requirements. The entire experimental sequence was executed in a fully digital, unmoderated environment, integrating a web-based survey platform with a simulated online supermarket interface.

The sequential workflow of the data collection timeline was strictly standardized for all participants. Upon accessing the main portal, participants first completed an electronic informed consent form confirming their voluntary participation. This was immediately followed by a demographic section to capture baseline personal characteristics, with a primary focus on gender. In the second phase, participants filled out the 9-item Buying Impulsiveness Scale (BIS) to evaluate their inherent buying impulsiveness behavior.

In the final core stage, participants were fully immersed in the simulated online supermarket environment. They were instructed to browse and freely select snacks for 'checkout' by interacting with high-resolution product images. Notably, while each item prominently displayed clear calorie information per pack, all pricing details were completely omitted. This experimental control was specifically implemented to eliminate budgetary constraints, thereby ensuring that snack selections were driven purely by trait impulsivity, internalized norms, and caloric awareness. The session automatically concluded once the participant confirmed their final cart checkout, and the total caloric value was recorded.

Materials and Operationalization of Variables

Trait Impulsive Buying Behavior. Buying Impulsiveness –defined as a consumer's predisposition to purchase spontaneously, unreflectively, and immediately–were evaluated using the 9-item Buying Impulsiveness Scale developed by Rook and Fisher (1995). Responses were captured using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with one item reverse-scored. The instrument covers critical cognitive and affective aspects of impulsivity, including irresistible urges to buy, spontaneous purchasing decisions, and a disregard for consequences. The scale was adapted for the target demographic through a formal forward-translation into Indonesian by a certified sworn translator, followed by a rigorous expert judgment process involving three panels in psychological measurement to ensure cultural and conceptual equivalence. While the original scale reported a Cronbach's α of 0.88, the translated scale in the current study demonstrated a robust internal consistency with a calculated Cronbach's α coefficient of 0.87.

Gender. Gender was documented as a nominal categorical variable via a single-choice self-report question, where participants identified as either male or female.
Snacking Behavior. Snacking behavior was operationally defined as the cumulative caloric value of the products selected during the virtual shopping task. The simulated online supermarket featured a diverse array of 40 widely available commercial snacks. Participants were permitted to browse and add items to their cart without numerical restrictions to mimic an authentic e-commerce grocery experience. The backend system automatically calculated the overall snack consumption pattern by multiplying the frequency of the selected products by their respective caloric values (e.g., selecting two packages of a 130-calorie snack resulted in an aggregated score of 260 calories).

Table 1. Summary of Variable Operationalization and Experimental Controls.

Variable	Operational Definition	Scale/Measurement Tool
Impulsive Buying Behavior.	Spontaneous, unreflective buying predisposition.	9-item Buying Impulsiveness Scale (Rook & Fisher, 1995); 5-point Likert scale (α= 0.87).
Gender	Biological sex assigned at birth.	Self-report single-choice question (Male / Female).
Snacking Behavior	Total caloric volume of selected snacks in a single virtual trip.	Automated backend calculation

Data Analysis
The statistical analysis was executed in two primary phases using IBM SPSS Statistics software. First, descriptive statistics–including means, standard deviations, and frequency distributions–were computed to summarize the baseline demographic profiles, trait scores, and total caloric distributions. Second, to test the primary research hypotheses regarding the main and interaction effects, inferential statistical modeling was conducted within the General Linear Model (GLM) Univariate framework. Prior to hypothesis testing, standard statistical assumptions–including normality of residuals using the Shapiro-Wilk test and homogeneity of variances using Levene's test–were strictly verified.

Results and Discussion

Results
Primary data collection was carried out at Universitas Negeri Semarang, utilizing a dual-method approach that combined psychometric questionnaires with an experimental behavioral simulation. While structured questionnaires were employed to evaluate buying impulsiveness behavior (measured using the Buying Impulsiveness Scale, BIS; Rook & Fisher, 1995; Cronbach′ s α = 0.87), a simulated online supermarket environment was developed to capture direct behavioral metrics. To test the primary research hypotheses, inferential statistical modeling was conducted within the General Linear Model (GLM) framework. This statistical approach allowed for a rigorous examination of the main effects of gender and impulsive buying, as well as their potential interactive effects, on the primary outcome variable: overall snack calorie intake.

Table 2. Participants characteristics (n = 100)

Characteristics	Total	%
Age (years)		
18-23	100	100
Gender		
Male	20	20

Characteristics	Total	%
Female	80	80
Body Mass Index		
Underweight	24	24
Ideal	64	64
Overweight	14	14
Obese	9	9

The baseline demographic characteristics of the sample, as detailed in Table 2, indicate that within the targeted 18–23 age bracket (n = 100), the sample was predominantly female, accounting for 80% of the participants, while males comprised the remaining 20%. Regarding the anthropometric profile, the distribution of the participants' body mass index (BMI) was classified as follows: 24% were categorized as underweight, 64% maintained an ideal or normal weight, 14% were classified as overweight, and 9% met the criteria for obesity.

Table 3. Descriptive statistics data

Variable	n	Mean	Std. Deviation
Gender			
Male	20	2659.15	3638.48
Female	80	1131.36	974.13
Total	100	1436.92	1917.08

The descriptive data presented in Table 3 reveals a notable difference in snack calorie consumption between genders. Specifically, male participants exhibited a substantially higher caloric intake from snacks (M = 2659.15, SD = 3638.48) compared to their female counterparts (M = 1131.36, SD = 974.13). Furthermore, the considerably larger standard deviation observed within the male group indicates a wider variance and greater heterogeneity in their snack consumption patterns. Across the entire sample, the aggregate mean for participant snack calorie consumption was 1436.92 with a standard deviation of 1917.08. This high overall standard deviation underscores a substantial degree of variation in snack calorie consumption throughout the studied research population.

Table 4. Test of between-subjects effects

Sources	**F**	**p-value**	**Partial Eta Squared**
Gender	9.323	.003	.089
Impulsiveness	5.734	.019	.056
Gender X Impulsiveness	4.625	.034	.046

The inferential analysis results presented in Table 4 reveal a significant main effect of gender on snack calorie intake, $F(1, 96) = 9.323$, $p = .003$, $\eta p^2 = .089$, confirming pronounced differences in caloric consumption between male and female participants. Furthermore, trait impulsive buying was found to contribute significantly to snack calorie intake, $F(1, 96) = 5.734$, $p = .019$, $\eta p^2 = .056$, indicating that individual levels of impulsivity directly influence subsequent caloric choices. Most notably, the analysis yielded a significant two-way interaction effect between gender and impulsive buying on snack calorie consumption, $F(1, 96) = 4.625$, $p = .034$, partial $\eta p^2 = .046$. This critical interaction suggests that the impact of impulsive buying on snacking behavior is distinctively moderated by the participant's gender.

Parameter estimates further elucidate the specific nature of this interaction across genders. For male participants, the analysis reveals a statistically significant positive relationship between trait impulsive buying and snack calorie consumption, $B = 123.58$, $SE = 57.46$, $t = 2.15$, $p = .034$, 95% CI [9.52, 237.63], partial $\eta^2 = .046$. This indicates that higher levels of impulsive buying in males are directly associated with an increase in subsequent snack calorie intake. Conversely, the parameter estimates for female participants indicate a significant inverse relationship between impulsivity and

caloric selection, B = -130.59, SE = 50.57, t = -2.58, p = .011, 95% CI [-230.97, -30.20], partial η^2 = .065. This negative coefficient demonstrates that among females, heightened levels of impulsive buying are paradoxically accompanied by a decrease in overall snack calorie consumption.

Discussion

The findings of this study provide empirical support for all proposed hypotheses, demonstrating that trait impulsive buying, gender, and their interaction significantly dictate snacking behavior, specifically regarding total caloric intake. The analysis confirms that both the main effects of gender and impulsive buying behavior, along with their synchronous interaction, serve as critical determinants of individual dietary choices. Consequently, this study underscores the pivotal role of personological factors in driving consumption patterns, highlighting the necessity of accounting for these individual differences when designing targeted interventions aimed at promoting healthier snack choices in daily life.

The results of this study elucidate a critical interaction between gender and trait impulsive buying, demonstrating that the influence of impulsivity on snack calorie consumption is fundamentally divergent between males and females. Among male participants, snack choices directly mirror their inherent impulsivity. Consistent with the foundational work of Bénard et al. (2019) and Jasińska et al. (2012), highly impulsive individuals exhibit a heightened sensitivity to immediate rewards and pronounced difficulties with delayed gratification, a behavioral pattern that is particularly manifest in snack selection (Verplanken et al., 2005). Conversely, an inverse pattern emerges among female participants, where higher levels of impulsivity paradoxically correspond to lower snack calorie consumption. This phenomenon can be critically attributed to the confounding influences of dietary restraint and heightened health consciousness, which are systematically more prevalent in females (Wardle et al., 2004; Keller & Siegrist, 2015). As documented by Wardle et al. (2004), females consistently demonstrate a higher propensity than males to consciously avoid high-fat foods. Furthermore, Adriaanse et al. (2016) noted that women generally consume a higher proportion of healthy snacks and fewer unhealthy alternatives compared to men. Taken together, these gender-specific cognitive styles offer a robust explanation as to why highly impulsive females selectively purchase lower-calorie snacks, whereas their male counterparts gravitate toward high-calorie options.

The findings indicate that impulsive buying serves as a behavioral response to psychological distress, although the subsequent outcome regarding caloric intake diverges fundamentally by gender. This phenomenon is highly consistent with compensatory consumption theory, which posits that individuals utilize consumption as a mechanism to compensate for psychological distress, including stress, negative affect, and self-regulatory deficits (Cao et al., 2025). Among male participants, the lower presence of food-related psychological conflict allows their snack choices to directly mirror their trait impulsivity. This aligns with Greenwood et al. (2014), who demonstrated that impulsivity significantly moderates restrained eating and food intake in males, whereas this regulatory disruption is not observed in females. Conversely, for female participants, psychological compensation is successfully achieved through the act of impulsive buying itself as a consumption-based coping mechanism, which does not necessitate the selection of high-calorie snack products. Within this framework, while the behavioral act of impulsive buying functions as a primary coping mechanism to mitigate distress, the specific characteristics of the chosen products are governed by internal self-regulation and internalized norms; thus, the selected snack products carry a symbolic relevance tailored to the individual's specific distress (Cao et al., 2025). Given that females systematically experience more pronounced food-related psychological conflicts than males (Rolls et al., 1991), this theoretical paradigm elucidates the observed gender variations within compensatory consumption.

The results of this study further demonstrate that gender significantly contributes to snack calorie intake, with male participants exhibiting substantially higher caloric consumption compared to their female counterparts. These divergent findings between genders can be critically understood by accounting for variations in physiological requirements and levels of physical activity (Griadhi et al.,

2026), both of which are intrinsically linked to daily energy expenditure. Consistently, a robust body of literature indicates that men generally maintain a higher caloric intake than women (Rolls et al., 1991; Leblanc et al., 2014). For instance, an empirical study by González Galeano and Cuenca Jara (2022) quantified this disparity, revealing that men consumed approximately 30.5% more calories than women.

Furthermore, trait impulsive buying significantly contributes to snack calorie intake, illustrating how psychological predispositions dictate dietary decision-making. Individuals characterized by elevated impulsivity tend to make spontaneous food choices with little regard for their actual energy requirements. This behavioral pattern aligns with the findings of Churchill et al. (2008), who demonstrated that highly impulsive individuals are more prone to snacking on high-calorie items, as well as Bénard et al. (2018), who noted that impulsivity positively correlates with total energy intake. However, while this main effect is consistent with such prior literature, the novelty of the present study lies in a crucial nuance: this spontaneous, high-calorie consumption pattern is predominantly driven by male participants, whereas females exhibit a more restrained, compensatory behavior.

Nevertheless, rival hypotheses must be considered when evaluating these gender differences. The observed female restraint could be partially attributable to the Hawthorne effect or social desirability bias, where female participants, conscious of being evaluated in an experimental setting, intentionally altered their shopping behavior toward healthier items (Scholten et al., 2014; Green et al., 2025). Additionally, unmeasured acute situational variables, such as immediate pre-experimental hunger levels or recent meal intake, could represent confounding factors influencing caloric selection (Bénard et al., 2018).

The findings of this study should be interpreted in light of certain methodological limitations regarding its experimental setting. First, the sample was marked by a severe gender imbalance (80% female vs. 20% male). The small male sub-sample (n = 20) and its extreme variance (SD = 3638.48) restrict the statistical power of the male-specific parameter estimates and limit the generalizability of these findings to broader male populations. Second, the snack choices available within the simulated online supermarket environment may not fully capture the extensive variety typically found in real-world retail settings. Given that physical supermarkets offer a significantly broader assortment of products and multisensory environmental cues, future investigations should expand the range of snack options and recruit balanced gender samples to enhance the ecological validity of the findings and better simulate authentic consumer decision-making.

Theoretically, this study is anticipated to provide a deeper understanding of the concurrent roles of trait impulsive buying and gender, as well as their interaction, on unhealthy snacking behavior. Furthermore, the findings enrich the empirical literature regarding the dynamics of maladaptive dietary behaviors, particularly by elucidating how gender differences moderate the impact of impulsiveness on caloric intake during snack selection. From a practical perspective, the insights derived from this study offer an evidence-based foundation for practitioners to design targeted intervention programs aimed at mitigating unhealthy snacking, specifically tailored to an individual's level of impulsivity and gender.

Conclusions

This study demonstrates that trait impulsive buying and gender significantly interact to dictate objective snack caloric intake. While highly impulsive males gravitate toward elevated calorie consumption, highly impulsive females paradoxically select lower-calorie snacks. These divergent patterns are meaningfully illuminated through compensatory consumption theory and gender-specific cognitive restraint models, suggesting that snack choices reflect internal psychological conflict and distinct coping mechanisms. While alternative frameworks such as reward sensitivity or dual-system models account for the direct drive toward high-calorie foods in impulsive males, compensatory consumption offers a more comprehensive explanation for why impulsive females deliberately exercise dietary restraint as a symbolic form of self-regulation. Methodologically, this

study advances nutritional behavioral research by capturing direct purchasing metrics via a simulated online store–minimizing retrospective recall errors and removing price-related financial confounders. However, several methodological constraints qualify these findings. The use of a non-probability convenience sample of undergraduate students at Universitas Negeri Semarang limits generalizability to older or clinical populations. Furthermore, while the virtual supermarket provides a controlled environment, it lacks the multi-sensory cues, ambient promotions, and naturalistic monetary stakes of real-world retail purchasing. Theoretically, this work enriches the eating behavior literature by identifying gender as a critical boundary condition that moderates how impulsivity translates into caloric consumption. Practically, these insights highlight that public health interventions and nutritional counseling should move beyond a one-size-fits-all model. Interventions targeting unhealthy snacking must be tailored, addressing impulse-control strategies in males while supporting healthy emotional coping and reducing post-consumption cognitive distress in females. Future research should employ longitudinal designs, balance gender ratios, and expand product assortments within naturalistic shopping environments to evaluate the stability of these gender-specific compensatory mechanisms over time.

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