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Emotional and Sensory Drivers of Food Choices in Albania and Kosovo

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Abstract

In the context of rapid dietary transitions in the Western Balkans, marked by increased ultra-processed food consumption and erosion of traditional diets, this study applies the newly proposed MindSense framework to examine how emotions, mindful consumption (MC), sensorial stimuli (IS) and subjective well-being interact to influence sustainable food choices in Albania and Kosovo. Using structural equation modelling (SEM) on survey data from over 590 respondents, predominantly young women, the study examines food choices in positive and negative emotional contexts. Results show that negative emotions reduce SWB; externally oriented mindful consumption buffers hedonic choices in positive moods; and heightened sensitivity to sensory cues lowers healthy choices under negative moods. While we do not measure environmental footprints directly, categorising foods by established impact profiles allows cautious inference about sustainability implications: positive-mood indulgence tends to include ultra-processed, higher-impact items, whereas erosion of healthy staples under negative mood threatens plant-forward patterns. Policy implications include pairing “light-touch” self-regulation prompts in celebratory settings with reduced unhealthy sensory salience in stress-prone environments and integrating emotional and environmental considerations into dietary guidance to bolster resilience against unsupportive food environments.

Clinical Trial Registration

Not applicable.

1 Introduction

Food systems are both shaped by and shape what people eat, creating a complex and bidirectional relationship between diets and sustainability (Auestad & Fulgoni, 2015; Brouwer et al., 2021; Meybeck & Gitz, 2017, 2017; Woodside, 2023). Transitions toward sustainable diets are essential to address climate change, biodiversity loss, and public health challenges (Afshin et al., 2019; Auestad & Fulgoni, 2015; Willett et al., 2019). While socio-economic and environmental drivers are well-recognised, an emerging body of research highlights that food choices are also profoundly influenced by psychological and emotional factors, which can either reinforce or hinder sustainable eating practices (Adriaanse et al., 2011; Fuente González et al., 2022; Kemp et al., 2013; Ljubičić et al., 2023; Macht & Simons, 2011). Understanding these behavioural determinants is critical for achieving systemic food transformations.

Albania is currently undergoing a rapid dietary transition, marked by a 78% increase in imports of ultra-processed foods (UPFs), a 44% rise in packaged product consumption, and a 39% increase in meals eaten out-of-home (FAOSTAT; INSTAT, 2023). These changes threaten traditional dietary patterns and exacerbate both health and environmental risks. While equivalent statistical data are not yet available for Kosovo, market trends and consumer observations indicate a similar shift toward higher UPF consumption, greater reliance on packaged foods, and more frequent out-of-home eating (Cakoni et al., 2025; Sulejmani et al., 2021). Despite these developments, there is limited empirical understanding of how emotional states, subjective well-being, mindful consumption, and sensory stimuli interact to influence food choices in these contexts. Previous studies have linked negative emotions (e.g., stress, boredom) to increased consumption of high-calorie UPFs, and positive emotions or moral concerns to more sustainable dietary shifts (Barnhart et al., 2020; Fiorentini et al., 2020; Knaapila, 2022; Schubert & Bode, 2023). Similarly, mindful consumption has been associated with reduced emotional eating and greater alignment between food choices and personal values (Bahl et al., 2013; Garg et al.,

2024; Katterman et al., 2014; Stanszus et al., 2019). However, most evidence comes from high-income countries, with limited applicability to transitioning food systems. Moreover, few studies have integrated these variables into a single model that captures both the emotional and sensory dimensions of eating behaviour, while also allowing for an implicit understanding of their link to sustainability through the known environmental impacts of different food product categories. In this study, sustainable food choices refer to the selection of food categories generally associated with lower environmental impacts and positive health outcomes, based on established life-cycle assessment and nutrition evidence (Clark et al., 2022; Poore & Nemecek, 2018; Willett et al., 2019).

This study aims to examine how emotional states, subjective well-being, mindful consumption, and sensory stimuli jointly shape food choices among young consumers in Albania and Kosovo. The research addresses the question: *How do emotional states (via subjective well-being), reflective regulation (mindful consumption), and sensory/choice-architecture cues jointly influence food choices, and what are the inferred implications for dietary sustainability in rapidly changing food systems?* To guide this investigation, we draw on an exploratory conceptual framework that synthesises four interrelated psychosocial dimensions identified in prior literature as relevant to food choice but not often examined together, particularly in transitioning food systems. While proposed here as an initial integrative model, MindSense 's role in this study is to provide a structured basis for empirical testing through structural equation modelling (SEM). The term MindSense food choice model is used throughout the paper to denote this integrated framework, combining mindful consumption orientation and sensory responsiveness as dual moderators of the emotion–consumption link.

By empirically testing this model, the study contributes to understanding how emotional and sensory factors influence food choices. Although sustainability is not directly measured, the results may offer insights into potential dietary implications for sustainability, given the established environmental impacts of different food product categories. These insights will provide policy-relevant perspectives for Albania, Kosovo, and other Western Balkan food systems in transition, where behavioural levers could complement structural food policy measures. The remainder of the paper is organised as follows: Section 2 reviews literature on emotions, well-being, mindful consumption, and sensory stimuli in food choices. Section 3 presents the methodology, including the sample, measures, and SEM approach. Section 4 reports the results, followed by a discussion in Section 5. Section 6 concludes with implications for theory, policy, and practice.

2 Theoretical Foundation and Research Hypotheses

2.1 Emotions and Subjective Well-being

Emotions are core affective experiences that reflect an individual’s psychological response to internal and external stimuli, encompassing both positive and negative states (Diener & Chan, 2011; Fredrickson & Joiner, 2002). Positive emotions, such as joy or contentment, have been consistently linked to higher levels of life satisfaction and subjective well-being (SWB) by broadening cognitive selection and enhancing resilience (Cohn et al., 2009; Martínez-Líbano et al., 2025; Schutte et al., 2002). Conversely, negative emotions, such as stress or sadness, tend to narrow attentional focus, increase avoidance behaviours, and reduce SWB (Bastian et al., 2014; Diener & Chan, 2011; Fredrickson & Joiner, 2002; Tugade et al., 2004; Tugade & Fredrickson, 2004). Positive emotions, such as happiness and satisfaction, are closely linked to higher SWB, which in turn supports healthier dietary patterns, including increased fruit and vegetable consumption (Brookie et al., 2018; Mujcic & J.Oswald,

2016; Warner et al., 2017). Negative emotions may undermine SWB, leading to less nutritious and more convenience-oriented food choices (Moss et al., 2021). Meta-analytic evidence in healthy adults shows that higher stress is reliably associated with greater consumption of “unhealthy” foods and lower consumption of healthy foods overall (Hill et al., 2022; Lane et al., 2022). Such dietary shifts have dual implications: environmentally, they increase the footprint of food systems through higher demand for processed products, and from a public health perspective, they exacerbate the burden of non-communicable diseases (NCDs).

Recent studies suggest that these dynamics may not affect all consumers equally. Young, female, and urban populations often report stronger emotional responses in daily life and greater susceptibility to stress-induced eating, which may intensify the relationship between emotions and SWB (Ashurst et al., 2018; Evers et al., 2018; Kandiah et al., 2006; Martínez-Líbano et al., 2025; Moss et al., 2021; Peters et al., 2018). At the same time, these groups are key drivers of emerging sustainable consumption patterns, making their role central in linking emotions, dietary behaviour, and sustainability (Kokthi, Guri, et al., 2025).

Hypothesis 1

(H1): *Positive emotions will be positively associated with subjective well-being, particularly among young, female, and urban consumers, while negative emotions will be negatively associated with subjective well-being.*

2.2 Subjective Well-Being and Food Choices in Positive Emotional Contexts

SWB reflects an individual’s overall evaluation of their quality of life, encompassing both cognitive judgments (life satisfaction) and affective components (positive and negative affect) (Cohn et al., 2009; Diener & Chan, 2011; K.-T. Lee & Furukawa, 2023; Xiao, 2014). High levels of SWB are typically associated with more adaptive emotional regulation strategies, enabling individuals to engage in behaviours that reinforce or maintain their positive affective states (Bastian et al., 2014; Fredrickson & Joiner, 2002; Tugade et al., 2004; Tugade & Fredrickson, 2004). In the context of food choices, this implies that individuals experiencing higher SWB may be more inclined to select foods that complement or enhance their current positive mood. Existing literature highlights that positive emotions can lead to both indulgent and health-oriented eating behaviours, depending on the interplay between hedonic motivation and self-regulatory resources (Arexis et al., 2023; Coccurello & Maccarrone, 2018; Cohn et al., 2009; Fredrickson & Joiner, 2002; Martínez-Líbano et al., 2025; Teixeira et al., 2011). For instance, individuals in positive moods may choose indulgent items such as ice cream or processed snacks to amplify pleasure (Wansink et al., 2003), while others may opt for foods perceived as rewarding yet acceptable to their self-image, such as nuts (Macht & Dettmer, 2006). The outcome depends on the interactive influence of hedonic reward mechanisms and the availability and application of self-regulatory resources and autonomous motivation (Fredrickson & Joiner, 2002). When executive control and motivation to maintain health are strong, positive mood states foster food selections that amplify pleasure without compromising self-image or health (Arexis et al., 2023). When self-regulation falters, positive emotions may accentuate hedonic drives, resulting in indulgent consumption (Coccurello & Maccarrone, 2018). Building on theories of emotion regulation and empirical findings on mood-congruent consumption (Canetti et al., 2002; Gardner et al., 2014), we suggest that individuals with higher SWB are more likely to select food items that prolong or intensify pleasant affective states.

Hypothesis 2

(H2): *Individuals with higher levels of subjective well-being (SWB) are more likely to choose sustainable foods associated with positive emotional contexts (P.Em).*

2.3 Subjective Well-Being and Food Choices in Negative Emotional Contexts

While SWB is generally linked to positive effects and adaptive coping, emotional states are dynamic, and even individuals with high SWB experience periods of negative affect (Diener et al., 2010). The way these individuals respond to negative emotions through food choice reflects their emotional regulation strategies and their interplay with established eating habits (Macht & Dettmer, 2006; Wansink et al., 2003). Negative emotional states have been shown to influence both the quantity and type of food consumed, often leading to comfort eating as a means of mood regulation (Moss et al., 2021; Tugade & Fredrickson, 2004; Wansink et al., 2003). However, the literature presents a nuanced picture: while some studies suggest that negative emotions increase the likelihood of consuming high-calorie, indulgent foods (Macht & Simons, 2011) others report that individuals may turn to more “wholesome” or “safe” foods, such as fruits or cereals, particularly if their baseline well-being is high and they possess stronger self-regulatory capacities (Teixeira et al., 2011). This aligns with mood-incongruent regulation strategies, where people choose foods that counterbalance their emotional state (Barnhart et al., 2020; Moss et al., 2021). Building on evidence that individuals with higher SWB maintain more stable consumption patterns, even under adverse emotional states, we expect SWB to be positively associated with selecting items such as fruits, vegetables, cereals, or desserts when negative emotions are present. This relationship is likely to be weaker than in positive emotional contexts, reflecting a more moderated adjustment in consumption behaviour.

Hypothesis 3

(H3): *When experiencing negative emotions, individuals with higher levels of SWB are more likely to select foods that reflect both mood regulation and self-care tendencies, such as fruits, vegetables, cereals, or desserts.*

2.3 Mindful consumption and sustainable food choices

Mindful consumption (MC) generally refers to an individual’s conscious awareness of food-related decisions, encompassing present-moment attention, deliberate choice, and an understanding of the consequences of eating behaviours for health and well-being (Bahl et al., 2013; Fischer et al., 2017; Garg et al., 2024; Nelson, 2017). In much of the psychological and public health literature, mindful consumption in eating is framed as an *intrinsic* and non-judgmental awareness that can encourage more balanced dietary habits and reduce impulsive consumption driven by emotional states (Keyte et al., 2022; Mantzios & Wilson, 2015).

In this study, mindful consumption is operationalised as attentiveness to eating patterns concerning weight control, measured through behaviours such as refusing food or drink due to weight concerns, reducing intake after perceived overconsumption, and avoiding eating between meals or in the evening. This form of mindful consumption reflects dietary restraint rather than the broader construct of mindful eating, which emphasises non-judgmental awareness of the eating experience (Nelson, 2017). In line with our hypothesised positive-emotion pathway, mindful consumption is defined here as weight-focused dietary restraint rather than broader

mindful eating, reflecting the behavioural salience of body image–driven attentiveness among young urban women, a demographic particularly susceptible to indulgence in positive mood states (Kim & Jang, 2017). Weight-control-oriented attentiveness can have mixed implications. On the one hand, it may reduce intake of calorie-dense, ultra-processed foods, thereby indirectly supporting healthier and potentially more sustainable patterns (Marty et al., 2018; Šeinauskienė et al., 2016). On the other hand, if driven primarily by body image concerns or short-term dieting trends, it may encourage restrictive or fad diets that do not align with long-term sustainability goals (Cairns et al., 2020; Michaelidou et al., 2012). These dynamics are particularly relevant for young individuals, whose eating habits are often influenced by peer norms, social media, and body image pressures (Botelho et al., 2019; Davis & Carpenter, 2009; Dunn et al., 2011). As such, the relationship between weight-control mindful consumption and sustainable eating patterns, depending on the types of foods consumed, is expected to be positive on average, but its strength may vary depending on whether motivations are intrinsic (health-driven) or extrinsic (appearance-driven).

Hypothesis 4

(H4): *Individuals with stronger externally driven mindful consumption tendencies (e.g., eating less, paying close attention to intake, focusing on weight control) are less likely to select foods typically associated with positive emotional contexts (chips, nuts, processed foods, ice cream) when in a positive emotional state.*

2.4 The Role of Sensorial Stimuli in Food Choices

Sensorial stimuli, including the visual appearance, aroma, and taste of food, are important triggers for eating behaviour, often bypassing deliberate decision-making processes (David et al., 2018; Krishna & Schwarz, 2014; Morrin & Tepper, 2021). Such cues can interact with emotional states in complex ways. Pleasant aromas and appealing visual presentation may amplify positive emotions, increasing enjoyment of both healthy and indulgent foods (Meiselman, 2016). Conversely, in negative emotional states, the same sensory triggers often intensify cravings for high-calorie comfort foods, undermining dietary restraint and potentially leading to less sustainable eating patterns (Macht & Simons, 2011; Maggioni, 2015). Given this duality and recognising that young individuals may be susceptible to both sensory appeal and social eating cues, we hypothesise that negative emotions will heighten responsiveness to sensorial stimuli, increasing the likelihood of non-sustainable food choices.

Hypothesis 5

(H5): *Higher responsiveness to sensorial stimuli is associated with a lower likelihood of selecting vegetables, fruits, cereals, or desserts in negative emotional contexts.*

In this study, sensorial responsiveness is operationalised through self-reported reactions to sensory and situational food cues, such as consuming more when food has a pleasant aroma or appearance, feeling the urge to eat when passing a bakery or café, eating in response to seeing others consume food, and tasting food during preparation. These behaviours capture not only sensory appeal but also environmental and social triggers that may stimulate consumption beyond physiological hunger.

In summary, the proposed framework, conceptualised as MindSense, integrates affective (emotions), cognitive (mindful consumption), and food environmental dimensions (sensorial stimuli) into a unified model for

understanding food choices; see Fig. 1. Emotions act as the primary driver of subjective well-being (H1), which subsequently shapes food choice under both positive (H2) and negative (H3) affective states mediated by SWB. These pathways are moderated by mindful consumption (H4) in emotion-positive (P.em) contexts and by sensorial stimuli (H5) in emotion-negative contexts. We position mindful consumption (MC) H4) on the positive-emotion pathway because the three indicators in this study, eating less, paying close attention, and focusing on weight, capture a control-oriented restraint that is most needed when positive affect loosens discipline and increases hedonic approach. Prior work shows that good mood broadens choice sets and favours treats; externally framed self-control cues are effective precisely in these “permission-to-indulge” states (Keyte et al., 2022; Minari et al., 2024; Morillo-Sarto et al., 2023; Tapper, 2017; Warren et al., 2017). By contrast, negative emotions tend to narrow attention and heighten cue-reactivity; in such states, sensorial stimuli (IS)—aroma, smell, taste, food environment—do more to sway choice than deliberation does; see Fig. 1. Placing IS, H5 on the negative-emotion pathway reflects evidence that, under low mood, salient sensory and environmental prompts can override health goals. Negative emotions, such as stress, depressive mood, and loneliness, tend to narrow attentional focus and amplify reactivity to salient cues in the environment, which override more deliberative, goal-directed processes in food choice (Elliston et al., 2017; S. Lee & Min, 2022; Leigh Gibson, 2006; Zhang & Song, 2022). This cognitive narrowing under negative effects heightens the influence of sensory and environmental food cues, often at the expense of health goals or long-term dietary intentions (Ljubičić et al., 2023).

MindSense framework pathways advance literature by linking the self-regulatory role of mindful consumption with environmental cue sensitivity, framing them as complementary yet sometimes competing influences on decision-making. In doing so, it offers a behavioural economics perspective on how individuals balance immediate hedonic rewards with longer-term health and sustainability goals.

Figure 1 illustrates the *MindSense Pathway Food Choice Model*, which integrates emotions, mindful consumption practices (eating less, closely monitoring intake, and prioritising weight control), and sensorial stimuli to explain how subjective well-being mediates the relationship between emotional states and food choice in both positive and negative contexts.

3 Method

3.1 Measurement

MindSense is administered via a structured questionnaire to investigate the relationships among emotions, subjective well-being, sensory stimuli, and mindful consumption in food choices. The instrument comprised several sections. The demographic section collected information on participants' country of origin (Albania or Kosovo), type of residence (rural, urban, or peri-urban), sex, age, height, weight (for BMI calculation), educational level, employment status, smoking status, and marital status. Emotions were assessed by examining participants' responses to various emotions (e.g., anger, discouragement, happiness, relaxation), with a 5-point Likert scale measuring the degree to which these emotions influenced their desire to eat (see Table 1). For this study, we selected a broad set of emotions to capture the diverse affective states shown in the literature to influence food choice (Arnow et al., 1995; Leigh Gibson, 2006; Moss et al., 2021). Negative high-arousal emotions such as *anger*, *irritation*, and *impatience* have been associated with impulsive and hedonic consumption (Evers et al., 2018; Macht & Simons, 2011), while low-arousal states like *discouragement*,

hopelessness, and *monotony* are linked to reduced self-regulation and comfort eating (Bongers & Jansen, 2016). Anxiety-related emotions (*nervousness*, *worry*, *restlessness*) can alter food valuation and decision-making processes (Canetti et al., 2002). Self-conscious emotions, including *guilt* and *shame*, play a role in both compensatory and avoidance-oriented consumption (Daly et al., 2024). Conversely, positive affective states such as *happiness*, *relaxation*, and *excitement* are linked to more exploratory and health-oriented choices (Gardner et al., 2014). By integrating both positive and negative emotions, our design allows for a comprehensive assessment of how emotional states interact with mindful consumption and subjective well-being in shaping sustainable food choices see Table 4. Subjective well-being was measured using statements assessing life satisfaction and personal fulfilment, rated on a 4-point agreement scale. The role of sensory stimuli, such as aroma, taste, and visual appeal, in influencing food consumption was evaluated, as presented in Table 1.

Table 1
Measurement Items and Reference Sources

Measurement items	**References and sources**
Emotional eating Some types of feelings stimulate individuals to experience a desire to eat. *Please indicate the degree to which the following emotions make you feel a desire to eat by selecting the appropriate box. 1* (No desire to eat) -5 (An overwhelming urge to eat) Angry, Discouraged, Shaky, Worn out, Insufficient (see Table 4 for the full list of emotions)	(Arnow et al., 1995)
Subjective well-being 1 (Not true about me) – 4 (Mostly true about me	
1. In many ways, my life is close to my ideal.	Hamby, S., Grych, J., & Banyard, V. L. (2015) (Krishna & Schwarz, 2014; S. Lee & Min, 2022, 2022; Maggioni, 2015; Zhang & Song, 2022)
2. The conditions of my life are excellent.	
3. I am satisfied with my life.	
4. So far, I have gotten the important things I have wanted in life.	
5. If I could live my life over, I would hardly change anything.	
6. I am happy with myself.	
7. I have something to be proud of.	
Mindful consumption (1 = very rarely, 2 = rarely, 3 = moderately often, 4 = often, very often = 5)	
1. How often do you refuse food or drink offered to you because you are concerned about your weight?	Arhire et al. (2021); Cebola et al.. (2014); Barrada et al (2016)
2. When you think you have consumed too much in one day, do you start reducing the amount of consumption in the following days?	
3. How often do you try not to eat between meals because you are watching your weight?	
4. How often in the evening do you try not to eat because you are watching your weight?	
Sensorial stimuli and other factors influencing consumption	
1. Do you consume more than usual if the food has a pleasant aroma and looks good?	(Boesveldt & de Graaf, 2017; Epstein et al., 2007; Forde & de Graaf, 2022; Hayashi et al., 2023; Kanoski & Boutelle, 2022; S. Lee & Min, 2022; Ljubičić et al., 2023; Maggioni, 2015; Papies, 2013)
2. If you see or smell something tasty, do you feel like consuming it?	
3. If you have something tasty to eat, do you consume it immediately?	

Measurement items	References and sources
4. If you pass a bakery, do you feel like buying something tasty?	
5.. If you pass by a snack bar or café, do you feel like buying something tasty?	
6. If you see others eating, do you also feel the desire to eat?	
7. Can you resist consuming tasty foods?	
8. When you prepare a meal, are you inclined to eat something when seeing others eating?	
9. Do you consume more than usual when you are cooking?	
10. Do you consume more than usual when you stay at home?	

3.2 Product selection

Participants provided insights into the types of foods they consumed when feeling positive (e.g., chocolate, fruits, ice cream) or negative (e.g., processed meats, comfort foods, yoghurt), with ratings on a scale as presented in Table 1. The list of food products used in this study was developed to capture items that are both culturally relevant and representative of diverse sustainability profiles. Selection followed a two-step process. First, we identified foods with high prevalence of consumption in Albania and Kosovo using national dietary data (INSTAT, 2023; FAOSTAT, 2023) and prior research on dietary transitions in the region (Cakoni et al., 2025; El Bilali et al., 2022; Haas et al., 2021). Second, we ensured that the items reflected a spectrum of environmental and health impacts by consulting meta-analyses and life-cycle assessment (LCA) reviews (Poore & Nemecek, 2018; Clark et al., 2019; Willett et al., 2019). The final list included chocolate, ice cream, creamy desserts, breakfast cereals (cornflakes, muesli), processed meat products, sugary non-alcoholic beverages, drinks with artificial Sweeteners, alcoholic beverages, nuts (hazelnuts, peanuts, almonds), chips, “junk food”/fast food, fruits, vegetables, and dairy products (yoghurt, cottage cheese). These items were subsequently classified into “more sustainable,” “less sustainable,” or “variable” categories based on their relative environmental footprint and health implications, as shown in Table 2.

Table 2
Tested Food Items and Their Sustainability Profiles Based on Environmental Criteria

Food Category	Sustainability Level	Rationale	References
Chocolate	Variable	Impact depends on ingredients; cocoa production has high GHGs, land use; fair trade options have a lower impact.	Poore & Nemecek, 2018; Clark et al., 2019
Ice Cream	Less sustainable	High dairy content; high GHGs and land/water use.	Poore & Nemecek, 2018; Willett et al., 2019
Creamy Desserts	Less sustainable	Often dairy-heavy; higher environmental footprint.	Poore & Nemecek, 2018; Willett et al., 2019
Breakfast Cereals (cornflakes, muesli, etc.)	Variable	Impact varies with ingredients and processing; sugar-heavy cereals are less sustainable.	Poore & Nemecek, 2018; Clark et al., 2019
Processed Meat Products	Less sustainable	High environmental impact and adverse health outcomes.	Clark et al., 2019; Willett et al., 2019
Sugary Non-alcoholic Beverages	Variable	Depends on production and packaging; high sugar content is negative for health.	Amienyo & Azapagic, 2016; Poore & Nemecek, 2018
Drinks with Artificial Sweeteners	Variable	Lower caloric impact but still packaging- and processing-intensive.	Amienyo & Azapagic, 2016
Alcoholic Beverages	Variable	Impact varies by type; glass packaging and refrigeration are significant.	Amienyo & Azapagic, 2016; Rugani et al., 2013
Nuts (hazelnuts, peanuts, almonds)	More sustainable	Generally low GHGs; high nutrient density; some nuts have high blue-water footprint.	Poore & Nemecek, 2018; Clark et al., 2019; Mekonnen & Hoekstra, 2011
Chips	Less sustainable	Processed, high oil use; packaging has a significant impact.	Poore & Nemecek, 2018
Junk Food/Fast Food	Less sustainable	High processing, packaging, and often red meat content.	Poore & Nemecek, 2018; Clark et al., 2019
Fruits	More sustainable	Low GHGs, land/water use; strong health benefits.	Poore & Nemecek, 2018; Clark et al., 2019; Willett et al., 2019
Vegetables	More sustainable	Low GHGs, land/water use; strong health benefits.	Poore & Nemecek, 2018; Clark et al., 2019; Willett et al., 2019
Dairy Products (yoghurt, cottage cheese)	Less sustainable	High land/water use and GHGs; mixed health implications.	Poore & Nemecek, 2018; Willett et al., 2019

Note: The listed food products were used in the emotional eating assessment, where participants rated their desire to eat each product on a 5-point Likert scale (1 = No desire to eat, 5 = An overwhelming urge to eat) in response to specific emotions (e.g., anger, discouragement, fatigue).

3.3 Participants

The study sample comprised 590 individuals recruited from Albania and Kosovo. This study was conducted using a fully anonymous, voluntary survey instrument with no collection of personally identifiable or sensitive data. Participants were informed about the purpose of the research and provided informed consent prior to participation. Ethical approval for the study was granted by the Ethics Committee of the Agricultural University of Tirana (Approval No. 3, 24 January 2025), and informed consent was obtained from all participants prior to data collection.

Eligible participants were adults aged 18 years or older residing in Albania or Kosovo at the time of data collection. **Data were collected between 31 January and 30 June 2025.** Recruitment was carried out through a structured questionnaire distributed both online, via university mailing lists, social media platforms, and community groups, and in person at university campuses and public spaces in urban centres. This approach ensured access to a diverse pool of young consumers while maintaining feasibility in data collection.

To enhance the representativeness of the transitional food environment, recruitment emphasised the inclusion of both students and working-age adults from urban and peri-urban contexts, while still capturing individuals from rural areas, as seen in Table 3. The resulting sample reflects populations most exposed to modern food environments and emotional eating dynamics—predominantly young, female, urban respondents—who are of particular interest for understanding emerging dietary transitions in the Western Balkans.

Table 3
Demographic Information of Participants (N = 590)

Characteristic	%	Frequency
Country of Origin		
Kosovo	34.40%	203
Albania	65.60%	387
Place of Residence		
Urban	66.20%	389
Rural	22.10%	130
Peri-urban	11.70%	69
Sex		
Female	80.50%	475
Male	19.50%	115
Age		
18–29	90.70%	535
30–39	6.30%	37
40–59	2.50%	15
> 60	0.50%	3
Education Level		
Basic education	4.20%	25
High school	33.20%	196
University	52.70%	311
Postgraduate	9.80%	58
Employment Status		
Student	50.80%	300
Unemployed	10.30%	61
Employed	38.30%	226
Retired	0.50%	3
Marital Status		
Married or living with partner/family	60.50%	355
Living alone	39.50%	232

3.4 Statistical analysis

Descriptive statistics were calculated for the MindSense constructs and paired-samples *t*-tests were conducted to compare within-participant differences in reported food preferences between positive and negative emotional states, allowing control for inter-individual variability. We used a two-step SEM approach, using AMOS and SPSS v24. First, confirmatory factor analyses (CFA) established the reliability and validity of latent constructs of MindSense (emotions, subjective well-being, mindful consumption, sensory/choice-architecture cues, and food-choice outcomes). Indicators were treated as categorically ordered and estimated with Weighted Least Squares Means and Variance adjusted (WLSMV); standardised loadings, composite reliability (ω), and average variance extracted (AVE) were examined. We evaluated measurement invariance across countries (configural, metric, scalar) before comparing structural paths.

Second, we estimated the structural model mapping hypotheses H1–H5. Latent interaction terms captured context-moderation and regulatory moderation by mindful consumption. We report standardised coefficients with robust standard errors and, where applicable, bias-corrected bootstrap confidence intervals (CIs) for indirect or conditional effects. Model fit was evaluated using the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR), with conventional thresholds indicating good fit as CFI and TLI ≥ 0.95, RMSEA ≤ 0.06, and SRMR ≤ 0.08 (Hu & Bentler, 1999). Sensitivity analyses were conducted to compare results with alternative specifications, including models without interaction terms and observed-score regressions, to ensure the robustness of findings.

3.4.1 Data Processing Methodology

To avoid potential substantial standard-method bias that could lead to spurious predictions of independent variables on dependent variables, this study employed two methods (procedural and statistical controls) in the data analysis. As foreseen in the literature, the data distribution was analysed; all the observed indicators are normal, and the Skewness and Kurtosis values are calculated within the band (-1.5 to + 1.5) following Mishra et al., (2019).

3.4. 2 Reliability and Validity Analysis

Three criteria ensure convergent validity. First, the standardised factor loading of each observed variable belonging to latent variables should be greater than 0.50 and statistically significant (Fornell & Larcker, 1981). Second, the values of Composite Reliability (CR) and Cronbach's Alpha (CA) for each construct should be greater than 0.70 (Black & Babin, 2019). Third, each construct's Average Variance Extracted (AVE) value should be greater than 0.50 (Fornell & Larcker, 1981) See Model 1 and 2 output in the Appendix.

4 Results

1. **4.1. Sample Characteristics**The study included 590 participants, predominantly from Albania (65.6%) and Kosovo (34.4%). Most respondents resided in urban areas (66.2%), followed by rural (22.1%) and peri-urban (11.7%) locations. The sample was skewed toward females (80.5%) compared to males (19.5%). The age distribution showed that 90.7% were aged 18–29 years, 6.3% were aged 30–39 years, and only 2.5% and 0.5% were aged 40–59 and 60 + years, respectively. Educational attainment was high, with 52.7% holding university degrees, 33.2% completing high school, 9.8% possessing postgraduate qualifications, and 4.2% having only basic education. In terms of employment status, 50.8% were students, 38.3% were employed,

10.3% were unemployed, and 0.5% were retired. Regarding marital status, 60.5% were married or cohabiting, while 39.5% lived alone. Before participants answered the questionnaire, an introductory statement informed them of the survey's purpose and emphasised the confidentiality, anonymity, and voluntary nature of their participation.

2. **4.2 Descriptive Statistics for Emotional Eating, Well-being, Mindful Consumption, and Sensory Cues**

The analysis examined how different emotional states influence the self-reported desire to eat, measured on a 5-point scale from 1 = no desire to eat to 5 = extraordinary desire to eat (Table 4). Overall, results suggest that emotional states exert heterogeneous effects on eating behaviour, with both positive and negative emotions shaping food cravings in distinct ways.

Positive emotions such as *happiness* (M = 2.93, SD = 1.363) and *relaxation* (M = 2.89, SD = 1.311) were associated with the highest average desire to eat. However, the relatively high standard deviation for happiness suggests substantial inter-individual variability in how this emotion triggers eating behaviour.

Conversely, negative emotions such as *guilt* (M = 1.76, SD = 1.152), *anger* (M = 1.84, SD = 1.138), *discouragement* (M = 1.85, SD = 1.040), and *disappointment* (M = 1.86, SD = 1.167) were associated with the lowest desire-to-eat scores, indicating that for many respondents, these emotions may suppress rather than stimulate food intake. Table 4 presents the descriptive statistics for all assessed emotions.

Table 4
Descriptive statistics on emotions and the desire to eat (N = 590)

Emotions	Mean	Std. Deviation
1. Angry	1.84	1.138
2. Discouraged	1.85	1.040
3. Shaky	1.96	1.066
4. Worn out	2.04	1.192
5. Insufficient	1.99	1.141
6. Excited	2.32	1.253
7. Rebellious	2.00	1.144
8. Bored	2.14	1.296
9. Anxious	1.99	1.282
10. Angry	1.94	1.198
11. Irritated	1.88	1.150
12. Worried	1.88	1.156
13. Jealous	2.08	1.208
14. Furious	1.85	1.179
15. Impatients	2.10	1.269
16. Confused	2.05	1.095
17. Nervous	2.15	1.248
18. Guilty	1.76	1.152
19. Monotonous	2.33	1.306
20. Hopeless	1.89	1.186
21. Disappointed	1.86	1.167
22. In distress	1.91	1.302
23. Restless	2.13	1.222
24. Happy	2.93	1.363
25. Relaxed	2.89	1.311
26. Shamed	1.81	1.115
Source: Author's elaboration		

Table 5 reports descriptive statistics for the three other latent constructs within the MindSense framework. Subjective well-being scores were moderate to high, with the highest agreement for “I have something to be proud of” (M = 3.34, SD = 0.812) and “I have a positive attitude towards myself” (M = 3.32, SD = 0.829), and the lowest for “If I could live my life over, I would hardly change anything” (M = 2.84, SD = 1.007).

Mindful eating scores indicated relatively infrequent engagement in weight-conscious eating behaviours, with the highest mean for “reducing consumption the day after overeating” (M = 2.33, SD = 1.14) and the lowest for refusing food or drink due to weight concerns (M = 2.06, SD = 1.01).

Sensorial and environmental cues showed that participants were moderately susceptible to external triggers. The strongest influences included eating immediately when something tasty is available (M = 3.23, SD = 1.375), consuming more when food is tasty and visually appealing (M = 3.13, SD = 1.266), and feeling tempted when passing a bakery (M = 3.18, SD = 1.353). Lower influence was reported for increased consumption when staying at home (M = 2.35, SD = 1.172) or during meal preparation (M = 2.34, SD = 1.195). A subset of activating emotions—including *excitement* (M = 2.32, SD = 1.253), *boredom* (M = 2.14, SD = 1.296), *nervousness* (M = 2.15, SD = 1.248), and *monotony* (M = 2.33, SD = 1.306)—elicited moderate increases in food cravings. Overall, these results suggest that while respondents maintain generally positive self-perceptions and some mindful eating practices, their eating behaviours remain sensitive to emotional states and sensory cues. This underscores the need for interventions that address both emotional regulation and environmental exposure in promoting healthier eating habits.

Table 5
MindSense Constructs Statistics

Subjective wellbeing	**Mean**	**Std. Deviation**
In many ways, my life is close to my ideal.	2.99	0.865
The conditions of my life are excellent.	3.15	0.764
I am satisfied with my life.	3.18	0.838
So far, I have gotten the important things I have wanted in life.	3.06	0.852
If I could live my life over, I would hardly change anything.	2.84	1.007
I am happy with myself.	3.24	0.824
I have something to be proud of.	3.34	0.812
I have a positive attitude towards myself.	3.32	0.829
Mindful eating		
How often do you refuse food or drink because you are concerned about your weight?	2.06	1.01
When you think you have consumed too much in one day, do you start reducing your consumption in the following days?	2.33	1.14
How often do you try not to eat between meals because you are watching your weight?	2.19	1.10
How often do you try not to eat in the evening because you are watching your weight?	2.34	1.14
Sensorial stimuli and other factors influencing consumption		
1. Do you consume more than usual if the food has a pleasant aroma and looks good?	3.13	1.266
2. If you see or smell something tasty, do you feel like consuming it?	2.99	1.294
3. If you have something tasty to eat, do you consume it immediately?	3.23	1.375
4. If you pass by a bakery, do you feel like buying something tasty?	3.18	1.353
5. If you pass by a snack bar or café, do you feel like buying something tasty?	2.56	1.339
6. If you see others eating, do you also feel the desire to eat?	2.67	1.297
7. Can you resist consuming tasty foods?	2.45	1.217
8. When you prepare a meal, are you inclined to eat something when seeing others eating?	2.58	1.286
9. Do you consume more than usual when you are cooking?	2.34	1.195
Source: Author's elaboration		
Emotions and Food Preferences		

Subjective wellbeing	Mean	Std. Deviation
10. Do you consume more than usual when you stay at home?	2.35	1.172
Source: Author's elaboration		
Emotions and Food Preferences		

To assess whether emotional state systematically alters food preferences, a series of paired-samples t-tests compared the reported desire for various foods when respondents experienced positive emotions (APE) versus negative emotions (ANE). This approach was appropriate because the same individuals rated their preferences under both emotional conditions, allowing us to test within-person differences while directly controlling for inter-individual variability.

The analysis revealed significant differences for most food categories (Table 6). Positive emotional states were associated with markedly higher preferences for indulgent foods such as chocolate (M difference = 0.15, $p = 0.001$), ice cream (M = 0.29, $p < 0.001$), creamy desserts (M = 0.29, $p < 0.001$), and processed meat products (M = 0.29, $p < 0.001$). Healthier options also showed substantial increases during positive moods, including fruits (M = 0.44, $p < 0.001$), vegetables (M = 0.45, $p < 0.001$), nuts (M = 0.28, $p < 0.001$), and dairy products such as yoghurt or cottage cheese (M = 0.37, $p < 0.001$). Similarly, positive emotions heightened preferences for sugary beverages, chips, and fast food.

In contrast, alcoholic drink preferences did not significantly differ between positive and negative emotional states ($p = 0.826$), suggesting relative stability in alcohol consumption tendencies across moods. Overall, the results indicate that positive emotions tend to amplify both indulgent and health-conscious food choices, while negative emotions reduce preferences for most categories.

Table 6
Pair comparison of food preferences associated with positive and negative emotions

Pair comparisons (associated with positive emotions) APE– (associated with negative emotions) ANE	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Chocolate APE- Chocolate ANE	0.151	1.102	3.324	589	0.001
Ice Cream APE- Ice cream ANE	0.293	1.115	6.388	589	0.000
Creamy Desserts APE-Creamy Desserts ANE	0.286	1.033	6.735	589	0.000
Breakfast Cereals (cornflakes, muesli, etc.) APE-Breakfast Cereals ANE	0.297	1.11	6.493	589	0.000
Processed Meat Products APE- Processed Meat Products ANE	0.286	1.049	6.63	589	0.000
Sugary Non-alcoholic Beverages, Carbonated or Non-carbonated APE-Sugary Non-alcoholic Beverages, Carbonated or Non-carbonated ANE	0.224	1.174	4.627	589	0.000
Drinks with Artificial Sweeteners (0 calorie) APE-Drinks with Artificial Sweeteners ANE	0.125	1.043	2.921	589	0.004
Alcoholic Drinks APE- Alcoholic Drinks ANE	0.008	0.937	0.22	589	0.826
Nuts, Hazelnuts, Peanuts, Almonds, etc APE. -Nuts, Hazelnuts, Peanuts, Almonds, etc ANE	0.275	1.107	6.026	589	0.000
Chips APE-Chips ANE	0.193	1.068	4.394	589	0.000
Junk Food" Fast Food APE-Junk Food" Fast Food ANE	0.156	1.042	3.635	589	0.000
Fruits APE-Fruits ANE	0.442	1.11	9.681	589	0.000
Vegetables APE- Vegetables ANE	0.451	1.054	10.392	589	0.000
Dairy Products (yoghurt/cottage cheese) APE- Dairy Products (yoghurt/cottage cheese) ANE	0.368	1.072	8.332	589	0.000

Notes: APE = food choices associated with positive emotions, ANE= food choices associated with negative emotions

Building on these descriptive and comparative analyses, we employed Structural Equation Modelling (SEM) to examine the hypothesised relationships between emotional states, MindSense constructs, and food consumption patterns, providing an integrated view of both direct and indirect effects.

4.3 Structural Equation Modelling Results

4.3.1 Measurement Model Evaluation

The measurement model was assessed for reliability, convergent validity, and discriminant validity prior to hypothesis testing. Table 7 presents the standardised factor loadings, composite reliability (CR), average variance extracted (AVE), maximum shared variance (MSV), and maximum reliability (MaxR(H)) values. All constructs exceeded the recommended threshold of 0.70 for CR (Hair et al., 2013) While AVE values met or approached the 0.50 criterion (Fornell & Larcker, 1981) supporting convergent validity.

Table 7
Research Construct Factor Loadings

Item	Path	Factor	β0	β1	S.E.	C.R. (t value)	P value
IS5	<--	I.S.	0.583	1			
IS3	<--	I.S.	0.811	1.451	0.103	14.091	***
IS2	<--	I.S.	0.842	1.531	0.109	14.041	***
IS1	<--	I.S.	0.739	1.265	0.097	13.064	***
SWB8	<--	SWB	0.828	1			
SWB7	<--	SWB	0.706	0.835	0.044	18.885	***
SWB6	<--	SWB	0.822	0.987	0.054	18.276	***
SWB3	<--	SWB	0.688	0.84	0.053	15.91	***
MC2_4	<--	MC	0.813	1			
MC2_3	<--	MC	0.718	0.854	0.062	13.853	***
MC2_2	<--	MC	0.676	0.837	0.062	13.456	***
EM18_1	<--	EM	0.71	1			
EM17_1	<--	EM	0.725	1.106	0.065	16.908	***
EM15_1	<--	EM	0.675	1.047	0.067	15.649	***
EM14_1	<--	EM	0.776	1.119	0.063	17.862	***
EM13_1	<--	EM	0.672	0.994	0.064	15.538	***
EM12_1	<--	EM	0.738	1.044	0.061	17.113	***
EM11_1	<--	EM	0.821	1.155	0.061	18.862	***
EM10_1	<--	EM	0.797	1.168	0.064	18.279	***
EM9_1	<--	EM	0.73	1.145	0.068	16.889	***
EM8_1	<--	EM	0.678	1.075	0.069	15.646	***
EM7_1	<--	EM	0.63	0.882	0.06	14.648	***
EM2_1	<--	EM	0.66	0.84	0.055	15.399	***
PE11	<--	P.Em	0.794	1			
PE10	<--	P.Em	0.715	0.865	0.057	15.084	***
PE6	<--	P.Em	0.599	0.754	0.059	12.674	***
PE3	<--	P.Em	0.553	0.742	0.063	11.777	***
NE14	<--	N.Em	0.679	1			
NE13	<--	N.Em	0.613	0.883	0.054	16.283	***

Item	Path	Factor	β0	β1	S.E.	C.R. (t value)	P value
NE5	<--	N.Em	0.748	1.084	0.077	14.022	***
NE4	<--	N.Em	0.774	1.132	0.079	14.276	***

β0 *= Standardized regression coefficient*, **β1** *= Unstandardized regression coefficient, ***<0.0001.*

Note

SW = Subjective Well-being (SW8 = I have a positive attitude towards myself, SW7 = I have something to be proud of, SW6 = I am happy with myself, SW3 = I am satisfied with my life); EM = Emotions (EM2 = Discouraged, EM7 = Rebellious, EM8 = Bored, EM9 = Anxious, EM10 = Angry, EM11 = Irritated, EM12 = Worried, EM13 = Jealous, EM14 = Furious, EM15 = Impatient, EM17 = Nervous, EM18 = Guilty); IS = Interoceptive Sensitivity/Sensorial Stimuli (IS1 = Aroma, IS2 = Smell, IS3 = Taste, IS5 = Food environment/passing by); MC = Mindful Consumption (MC2 = Try to eat less, MC3 = Pay close attention, MC4 = Intentionally eat less for weight loss); PE = Positive-emotion Food Choices (PE11 = Chips, PE10 = Nuts, PE6 = Processed meat, PE3 = Ice cream); NE = Negative-emotion Food Choices (NE14 = Vegetables, NE13 = Fruits, NE5 = Cereals, NE4 = Desserts). See Table 5 *for the items*

Correlations among constructs were significant in expected directions, with the square root of AVE consistently exceeding inter-construct correlations, further indicating discriminant validity.

Negative Emotional Eating (N.Em) (r = 0.396, p < 0.001), while most inter-construct correlations were moderate or low, further supporting discriminant validity. Overall, these results confirm that the measurement model demonstrates acceptable reliability, convergent validity see Table 8, and discriminant validity, providing a robust basis for subsequent structural model testing.

Table 8
Convergent validity

IS.	CR	AVE	MSV	MaxR(H)	I.S.	S.W.	M.C.	E.M.	P.Em.	N.Em.
	0.84	**0.56**	**0.13**	**0.859**	**0.751**					
SWB.	0.85	0.58	0.04	0.86	0.033	**0.764**				
MC.	0.78	0.54	0.03	0.794	0.174***	-0.074	**0.738**			
EM.	0.93	0.52	0.03	0.932	0.058	-0.183***	0.088†	**0.72**		
P.Em.	0.76	0.45	0.16	0.79	0.086†	0.210***	-0.169**	0.01	**0.672**	
N.Em.	0.8	0.5	0.16	0.809	-0.355***	0.077	-0.157**	0.04	0.396***	**0.707**
Significance of Correlations: *† p < 0.100, * p < 0.050, ** p < 0.010, *** p < 0.001*										

4.3.2 Discriminant Validity (HTMT)

To confirm discriminant validity, the heterotrait-monotrait ratio of correlations (HTMT) was computed (see Table 9). All HTMT values were below the conservative threshold of 0.85 (Henseler et al., 2015)indicating that each construct measured a distinct concept. The results reinforce the adequacy of the measurement model for

subsequent structural analysis (Black & Babin, 2019; Hair et al., 2013; Henseler et al., 2015; Hu & Bentler, 1999; Malhotra, 2020).

Table 9
Heterotrait-monotrait ratio (HTMT)

I.S.	I.S.	S.W.	M.C.	E.M.	P.Em.	N.Em.
S.W.	0.022					
M.C.	0.172	0.075				
E.M.	0.081	0.183	0.088			
P.Em.	0.091	0.252	0.179	0.003		
N.Em.	0.334	0.105	0.161	0.025	0.401	

4.3.3 Model Fit Assessment

Model fit was evaluated using multiple Goodness-of-Fit indices. The initial structural model (Model 1) achieved acceptable fit with CMIN/DF = 2.555, RMSEA = 0.051, GFI = 0.891, AGFI = 0.871, CFI = 0.922, and TLI = 0.914. Guided by modification indices, adjustments were made, resulting in Model 2, which demonstrated improved fit: CMIN/DF = 2.010, RMSEA = 0.041, GFI = 0.917, AGFI = 0.901, CFI = 0.950, and TLI = 0.944. All values met or exceeded established cut-off criteria (Hu & Bentler, 1999), indicating excellent model fit (Table 10).

Table 10
Goodness-of-Fit Indices

Goodness-of-Fit Index	Value (Model 1)	Value (Model 2)	Evaluation Criteria	Reference
CMIN	1070.39	832.038	-	-
DF	419	414	-	-
CMIN/DF	2.555	2.01	< 5	Kline, 2016
P	0	0	-	-
RMSEA	0.051	0.041	< 0.08	(Cudeck, 2000; Hu & Bentler, 1999)
GFI	0.891	0.917	> 0.90	(Baumgartner, 2013; Bentler & Bonett, 1980)
AGFI	0.871	0.901	> 0.80	(Goretzko et al., 2024)
CFI	0.922	0.95	> 0.90	(Baumgartner, 2013; Bentler & Bonett, 1980)
TLI	0.914	0.944	> 0.90	(Baumgartner, 2013; Bentler & Bonett, 1980)
NFI	0.879	0.906	> 0.90	(Baumgartner, 2013; Bentler & Bonett, 1980)
RMR	0.056	0.052	< 0.05	-
SRMR	0.0414	0.0389	< 0.08	(Cudeck, 2000; Hu & Bentler, 1999)

Source: Authors' elaboration

4.3.4 Explained Variance

The model accounted for substantial variance in the endogenous constructs, with R^2 values of 0.33 for subjective well-being, 0.66 for positive emotion-related food choice, and 0.14 for negative emotion-related food choice. These values are considered satisfactory in behavioural research, given the constructs' latent nature (Bagozzi, 1977; Bollen, 1989).

4.3.5 Hypothesis Testing

Following the validation of the measurement model, the hypothesised structural relationships were tested. Standardised path coefficients, robust standard errors, critical ratios (t-values), and p-values were calculated, with results summarised in Table 11 and illustrated coefficient pathways in Fig. 2. All hypothesised paths (H1–H5) were significant at $p < 0.05$, supporting the proposed model. Specifically, emotional states negatively influenced subjective well-being (H1), while subjective well-being positively predicted both positive and negative emotion-related food choices (H2 and H3). Mindful consumption was negatively associated with positive emotion-related food choices (H4), and sensorial stimuli predicted negative emotion-related food choices (H5).

Table 11
Results of Hypothesis Testing

Label	Pathway			Path coefficient (β0)	S.E.	C.R. (t value)	P value	Decision
H1	EM.	◊	SWB	-0.18	0.04	-3.809	***	Supported
H2	SWB	◊	P.Em	0.205	0.076	4.088	***	Supported
H3	SWB	◊	N.Em	0.099	0.075	2.061	0.039	Supported
H4	MC	◊	P.Em	-0.155	0.058	-3.002	0.003	Supported
H5	IS	◊	N.Em.	-0.361	0.066	-6.546	***	Supported
*Notes: *** p < 0.001.*								

Emotions (EM) had a negative effect on Subjective Well-being (SWB) (β = −0.18, S.E. = 0.04, t = − 3.809, p < 0.001). In other words, higher intensity/frequency of the emotions measured (discouraged, anxious, angry, irritated, worried, jealous, impatient, nervous, guilty; loadings ≈ 0.63–0.82) were associated with lower SWB. Notably, the higher loadings of negative emotions within this construct suggest that these negative emotional states exert the greatest predictive power in explaining reductions in SWB.

SWB positively predicted food choices when feeling positive H2 – SWB → Pem (PEm) (β = 0.205, S.E. = 0.076, t = 4.088, p < 0.001). The P.Em latent factor is indicated by choices such as chips (loading ≈ 0.90), nuts (≈ 0.73), processed foods (≈ 0.69), and ice cream (≈ 0.53). Thus, higher SWB was linked to a greater likelihood of selecting these items in positive-emotion contexts. While in negative-emotion contexts **H3 – SWB → Nem**, SWB also showed a smaller, positive association with food choices when having negative emotions (N.Em) (β = 0.10, S.E. = 0.075, t = 2.061, p = 0.039). The N.Em latent factor is indicated by *vegetables (≈ 0.69), fruits (≈ 0.62), cereals (≈ 0.73), and desserts* (≈ 0.79) **. Hence, even in the presence of negative emotions, higher SWB modestly increased the likelihood of making these selections. Mindful consumption (MC), **H4 – MC → PEm**—measured with try to eat less (≈ 0.68), pay close attention (≈ 0.72), and weight focus (≈ 0.81)—was negatively related to PEm (β = −0.155, S.E. = 0.058, t = − 3.002, p = 0.003). Participants reporting stronger *externally driven* mindful consumption tendencies were less likely to choose chips, nuts, processed foods, or ice cream when feeling positive. Finally, **H5 – IS → Nem**, sensorial stimuli (IS)—indicated by aroma (≈ 0.74), smell (≈ 0.84), taste (≈ 0.82), and food environment (≈ 0.58)—had a negative effect on NEm (β = −0.361, S.E. = 0.066, t = − 6.546, p < 0.001). Greater sensitivity to these sensorial choice-architecture cues was associated with a lower tendency to select vegetables, fruits, cereals, or desserts when experiencing negative emotions, as shown in Fig. 2 of the MindSense constructs.

Source: Author's elaboration

Emotions are colour-coded based on widely accepted associations in colour psychology: warm hues (e.g., red, orange, yellow) denote high-arousal negative states; cool hues (e.g., blue, green) denote calmer or reflective states; and muted tones (e.g., grey, beige) denote low-arousal states (Elliot & Maier, 2014; Valdez & Mehrabian, 1994)

5. Discussion

Conducted in a young, female, urban sample, the study shows that emotions, subjective well-being (SWB), mindful consumption (MC), and sensorial/choice-architecture cues (IS) jointly shape food choices in ways that matter for both health and sustainability.

Descriptive statistics show that positive emotions (e.g., happiness, relaxation) were associated with the greatest desire to eat, broadening preferences toward both indulgent items (ice cream, creamy desserts, chips, sugary beverages) and health-oriented items (fruits, vegetables, nuts). This aligns with evidence that positive emotions can widen choice sets and increase openness to treats as well as healthier options (Gardner et al., 2014; Macht & Simons, 2011). By contrast, several negative emotions (e.g., guilt, anger, discouragement, disappointment) were linked to a lower desire to eat, suggesting appetite-diminishing rather than comfort-seeking, diverging from common patterns reported in high-income settings (Macht & Simons, 2011). Paired t-tests confirmed this asymmetry: positive emotions increased preferences across most categories; negative emotions reduced them, with alcohol notably stable across moods. In Albania and Kosovo, where traditional markets and fresh produce remain salient amidst a rapidly industrialising food environment, cultural norms and ready availability of minimally processed foods may buffer the typical “comfort food” pattern; increased emotional awareness may also slow impulsive decisions and support more deliberate choices (Baumeister et al., 2006; Tugade et al., 2004).

The SEM results confirm these patterns. Emotions → SWB was negative ($\beta = -0.18$, $p < 0.001$): higher intensity/frequency of (primarily negative) emotions predicted lower SWB, consistent with evidence linking negative emotional states to reduced life satisfaction and self-regulation (Diener et al., 2009). SWB → PEm was positive ($\beta = 0.205$, $p < 0.001$); higher SWB increased the likelihood of selecting chips, nuts, processed foods, and ice cream when feeling positive, consistent with mood-congruent choice. SWB → NEm was smaller but positive ($\beta = 0.10$, $p = 0.039$): even under negative emotions, higher SWB modestly increased the likelihood of choosing vegetables, fruits, cereals, and desserts, suggesting resilience in downbeat states (Nguyen-Rodriguez et al., 2009). Two MindSense pathways were central, 1. MC → PEm was negative ($\beta = -0.155$, $p = 0.003$), indicating that externally oriented restraint (“eat less,” “pay attention,” “weight focus”) buffered hedonic selection in positive moods; IS → NEm was negative and larger ($\beta = -0.361$, $p < 0.001$), indicating that, when feeling negative, stronger responsiveness to aroma/appearance/taste/environment pulled choices away from the typically healthier NEm set (vegetables, fruits, cereals).

The overrepresentation of young women in urban areas is consistent with groups who report stronger emotional reactivity and more frequent emotional eating (Adriaanse et al., 2011; Evers et al., 2018; Kozubal et al., 2023). Exposure to dense retail, social dining, and time scarcity in cities heightens cue-responsiveness and convenience seeking, even among educated consumers who know health and sustainability messages (Story et al., 2008; Swinburn et al., 2019).

The broadening under positive emotions echoes prior work showing greater openness to both hedonic and healthful foods (Gardner et al., 2014). The suppression under many negative emotions contrasts with some stress-eating evidence from high-income settings (Macht & Simons, 2011), plausibly reflecting (i) Albania/Kosovo’s mixed food landscape, where fresh produce is salient, and (ii) greater recognition of negative emotions that can support short-run restraint (Baumeister et al., 2006). Boredom/monotony/nervousness still nudged cravings upward, in line with eating for stimulation (Moss et al., 2021).

The MindSense pathways show that the buffering role of MC in positive contexts fits work showing that light-touch restraint and attention cues can temper treat-seeking when discipline loosens in good moods (Jordan et al., 2014; Tapper, 2017). Importantly, MC in this study was externally oriented (weight-focused restraint) rather than classic, internally driven mindfulness, yet it still delivered self-regulatory benefits, extending prior findings (Keyte et al., 2022; Mantzios & Wilson, 2015; Shriver et al., 2020). By contrast, the more substantial IS effect in negative contexts aligns with evidence that salient sensory cues (aroma, display, proximity) override deliberation when emotions are low (Cohen et al., 2008; Forde & de Graaf, 2022; Watson & Spence, 2007).

Regarding Sustainability implications on the environment and health, items loading on PEm mix high-impact ultra-processed choices (chips, processed foods, ice-cream) with nuts (generally health-promoting and lower-emission than animal products, but sometimes water-intensive), while NEm items (vegetables, fruits, cereals, desserts) lean toward lower environmental footprint and better cardiometabolic profiles (Poore & Nemecek, 2018; Clark et al., 2019; Willett et al., 2019). Two takeaways follow: 1. Positive emotions open the door to both sustainable (plant-based) and less sustainable (UPF) choices, so steering is needed to channel good-mood eating toward minimally processed, plant-rich options. 2. Under negative emotions, heightened sensorial salience can pull choices away from sustainable staples, so environmental design should temper unhealthy cues where negative emotions are likely (e.g., late-night retail, transit hubs). From the behavioural economics perspective, the coefficient asymmetry ($|IS \rightarrow NEm| > |MC \rightarrow PEm|$) suggests policy leverage in two ways: first, to reduce unhealthy sensory salience (placement, portion display, aroma dispersal, promotional signage) in settings where negative emotions are prevalent. Second, embed light-touch MC prompts (pause points, portion cues, salient defaults, “think-twice” prompts) in social/celebratory venues where positive emotions elevate indulgence. These nudges respect autonomy while shifting salience and defaults toward healthier, lower-impact choices (Sunstein, 2024).

In Albania and Kosovo’s transitional food systems, with rapid urbanisation, proliferation of industrialised outlets, and encroaching Westernised diets alongside enduring fresh markets (Kokthi, Miftari, et al., 2025) MindSense helps target where and when to intervene, protect the sensory appeal of fresh produce markets, limit aggressive UPF cues in urban retail, and equip campuses and cafés with restraint prompts and plant-forward defaults.

Limitations and future research

Findings reflect a young, female, urban sample; results may differ for older adults and men. The cross-sectional design limits causal inference; longitudinal/experimental studies should test whether shifting MC/IS cues change choices across different emotions. Measures were self-reported, so social desirability and recall bias are possible; combining the survey with objective purchase/consumption or physiological markers would strengthen inference. “Sustainability” was inferred via product categories rather than directly measuring footprints; future work should link choices to measured environmental and health outcomes. Finally, MC captured externally oriented restraint rather than full dispositional mindfulness; comparing externally versus internally motivated self-regulation is a valuable next step.

Conclusions

This study examined how emotions, subjective well-being (SWB), mindful consumption (MC), and sensorial/choice-architecture cues (IS) shape food choices among predominantly young, female, urban respondents in Albania and Kosovo, contexts undergoing rapid dietary transition. Positive emotions broadened

preferences, increasing desire for both indulgent items (e.g., ice cream, creamy desserts, chips, sugary drinks) and healthier options (fruits, vegetables, nuts). Many negative emotions, by contrast, were associated with lower desire to eat, with alcohol relatively stable across moods. Structural equation modelling refined these patterns: (i) emotions negatively predicted SWB; (ii) SWB increased the likelihood of selecting foods in positive emotional contexts and, to a smaller extent, healthier selections in negative contexts; (iii) externally oriented MC (eat less, pay attention, weight focus) buffered hedonic choices under positive emotions; and (iv) sensorial stimuli exerted a stronger (and adverse) pull under negative emotions, reducing the likelihood of choosing typically healthier categories (vegetables, fruits, cereals, desserts). Taken together, the MindSense model reveals asymmetric pathways: environmental cues associated with negative emotions are more influential than restraint cues associated with positive emotions.

Contributions to knowledge. First, we propose and operationalise the MindSense framework, integrating emotional states, SWB, externally oriented mindful consumption, and sensorial cues to explain food choices in transitional food environments. Second, we show that externally driven mindful consumption, often overlooked compared with intrinsic mindfulness, can still yield self-regulatory benefits in positive emotional contexts. Third, we demonstrate that sensorial stimuli have a larger influence under negative emotions, highlighting a context–mechanism asymmetry that helps reconcile mixed findings in emotional eating research. Finally, by mapping product sets to indicative sustainability profiles, we connect emotion-linked choices to implications for both environmental impact and the risk of non-communicable diseases (NCDs).

Practical applications. The coefficient asymmetry suggests two complementary, behaviourally informed strategies. In settings where negative emotions are likely, especially in (e.g., late-night retail, transit hubs, queues), dampen unhealthy sensory salience: limit prominent placement and aroma dispersion of ultra-processed items; reduce impulse triggers at checkouts; use smaller displays and neutral lighting for energy-dense snacks. In social and celebratory venues (campuses, cafés), embed light-touch MC prompts: pause-points (“take a moment before choosing”), salient portion cues, plant-forward defaults, and prompts to add fruits/vegetables. Regionally, protecting and enhancing the sensory appeal of fresh produce markets (visibility, aroma, sampling) can counterbalance the growing presence of industrialised outlets. For health systems and universities, brief, externally framed self-regulation prompts can be integrated into canteens and vending interfaces without restricting choice. Policy packages that combine choice-architecture tweaks with marketing guide rails near schools and transport nodes are likely to yield co-benefits for sustainability and NCD prevention.

We suggest four pathway extensions for future research: (1) Causality and dynamics through the use of longitudinal, ecological momentary assessment, and field experiments to test how shifts in emotions, MC prompts, and sensory cues change choices in real time. (2) Replicate across more gender-balanced and older samples, and across rural settings and other Western Balkans countries to test cultural moderators. (3) Pair surveys with objective purchase/consumption data and incorporate direct environmental indicators (e.g., product-level footprints) to validate sustainability inferences. Compare externally oriented restraint with intrinsic mindfulness facets (present-moment attention, non-judgment) to isolate which forms of MC are most protective, (4) test bundles of nudges, default switches, display redesign, pricing/portion cues, while tracking both environmental and health outcomes.

Overall, MindSense offers a tractable lens for aligning emotionally influenced food choices with healthier, lower-impact patterns in rapidly changing food systems.

Declarations

Ethics approval and consent to participate

Ethical Approval The study protocol was reviewed and approved by the **Ethics Committee of the Agricultural University of Tirana** (Approval No. 3, dated 24 January 2025). The research was conducted in accordance with **Law No. 80/2015 on Higher Education and Scientific Research in Higher Education Institutions in the Republic of Albania**, the **Labour Code of the Republic of Albania**, the **Statute of the Agricultural University of Tirana**, and the ethical guidelines, scientific integrity principles, and scientific standards of the institution.

Consent to Participate

Informed consent was obtained from all participants before their involvement in the study. Participation was voluntary, and students were informed they could withdraw at any point without consequence. The study involved completing an anonymous questionnaire, and participants were assured that their responses would be kept confidential and used solely for research purposes.

Consent to Publish

Not applicable. This study does not include any personal data (such as individual details, images, or videos) from any person.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Author Contribution

Author Contributions: Conceptualization, E.K. A.H and K.K; methodology, E.K, KK. and A.H; software, E.K.; validation, K.K., A.H. and M.B.; formal analysis, EK and K.K.; investigation, AM..; resources, A.M.; data curation, K.K.; writing—original draft preparation, , E.K. AH and KK,MB.; , E.K. MB, and KK writing—review and editing, KK. AH; visualisation, E.K; supervision, E.K.; project administration, E.K. AH and KK.; funding acquisition, no funding. All authors have read and agreed to the published version of the manuscript.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. Correspondence and requests for materials should be addressed to A.H and K.K

References

1. Arhire LI, et al. Validation of the Dutch Eating Behavior Questionnaire in a Romanian adult population. Experimental Therapeutic Med. 2021;22(5):1262. https://doi.org/10.3390/nu13113890.
2. Adriaanse MA, de Ridder DTD, Evers C. Emotional eating: Eating when emotional or emotional about eating? Psychol Health. 2011;26(1):23–39. https://doi.org/10.1080/08870440903207627.
3. Afshin A, Sur PJ, Fay KA, Cornaby L, Ferrara G, Salama JS, Mullany EC, Abate KH, Abbafati C, Abebe Z, Afarideh M, Aggarwal A, Agrawal S, Akinyemiju T, Alahdab F, Bacha U, Bachman VF, Badali H, Badawi A, Murray CJL. Health effects of dietary risks in 195 countries, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2019;393(10184):1958–72. https://doi.org/10.1016/S0140-6736(19)30041-8.
4. Arexis M, Feron G, Brindisi M-C, Billot P-É, Chambaron S. A scoping review of emotion regulation and inhibition in emotional eating and binge-eating disorder: What about a continuum? J Eat Disorders. 2023;11(1):197. https://doi.org/10.1186/s40337-023-00916-7.
5. Arnow B, Kenardy J, Agras WS. The emotional eating scale: The development of a measure to assess coping with negative affect by eating. Int J Eat Disord. 1995;18(1):79–90. https://doi.org/10.1002/1098-108X(199507)18:1%3C79::AID-EAT2260180109%3E3.0.CO;2-V.
6. Ashurst J, van Woerden I, Dunton G, Todd M, Ohri-Vachaspati P, Swan P, Bruening M. The Association among Emotions and Food Choices in First-Year College Students Using mobile-Ecological Momentary Assessments. BMC Public Health. 2018;18(1):573. https://doi.org/10.1186/s12889-018-5447-0.
7. Auestad N, Fulgoni VL. What Current Literature Tells Us About Sustainable Diets: Emerging Research Linking Dietary Patterns, Environmental Sustainability, and Economics. Adv Nutr. 2015;6(1):19–36. https://doi.org/10.3945/an.114.005694.
8. Bagozzi RP. Structural Equation Models in Experimental Research. J Mark Res. 1977;14(2):209. https://doi.org/10.2307/3150471.
9. Bahl S, Milne GR, Ross SM, Chan K. Mindfulness: A Long-Term Solution for Mindless Eating by College Students. J Public Policy Mark. 2013;32(2):173–84. https://doi.org/10.1509/jppm.11.008.
10. Barnhart WR, Braden AL, Jordan AK. Negative and positive emotional eating uniquely interact with ease of activation, intensity, and duration of emotional reactivity to predict increased binge eating. Appetite. 2020;151:104688. https://doi.org/10.1016/j.appet.2020.104688.
11. Bastian B, Kuppens P, De Roover K, Diener E. Is valuing positive emotion associated with life satisfaction? Emotion. 2014;14(4):639–45. https://doi.org/10.1037/a0036466.
12. Baumeister RF, Gailliot M, DeWall CN, Oaten M. Self-Regulation and Personality: How Interventions Increase Regulatory Success, and How Depletion Moderates the Effects of Traits on Behavior. J Pers. 2006;74(6):1773–802. https://doi.org/10.1111/j.1467-6494.2006.00428.x.
13. Baumgartner M. A Regularity Theoretic Approach to Actual Causation. Erkenntnis. 2013;78(1):85–109. https://doi.org/10.1007/s10670-013-9438-3.
14. Bentler PM, Bonett DG. Significance tests and goodness of fit in the analysis of covariance structures. Psychol Bull. 1980;88(3):588–606. https://doi.org/10.1037/0033-2909.88.3.588.
15. Black W, Babin BJ. (2019). Multivariate Data Analysis: Its Approach, Evolution, and Impact. In B. J. Babin & M. Sarstedt, editors, *The Great Facilitator: Reflections on the Contributions of Joseph F. Hair, Jr. To Marketing*

and Business Research (pp. 121–130). Springer International Publishing. https://doi.org/10.1007/978-3-030-06031-2_16

16. Boesveldt S, de Graaf K. The Differential Role of Smell and Taste For Eating Behavior. Perception. 2017;46(3–4):307–19. https://doi.org/10.1177/0301006616685576.
17. Bollen KA. (1989). *Structural Equations with Latent Variables* (1st ed.). Wiley. https://doi.org/10.1002/9781118619179
18. Bongers P, Jansen A. (2016). Emotional Eating Is Not What You Think It Is and Emotional Eating Scales Do Not Measure What You Think They Measure. *Frontiers in Psychology*, *7*. https://doi.org/10.3389/fpsyg.2016.01932
19. Botelho AM, de Camargo AM, Dean M, Fiates GMR. Effect of a health reminder on consumers' selection of ultra-processed foods in a supermarket. Food Qual Prefer. 2019;71:431–7. https://doi.org/10.1016/j.foodqual.2018.08.017.
20. Brookie KL, Best GI, Conner TS. Intake of Raw Fruits and Vegetables Is Associated With Better Mental Health Than Intake of Processed Fruits and Vegetables. Front Psychol. 2018;9:487. https://doi.org/10.3389/fpsyg.2018.00487.
21. Brouwer ID, van Liere MJ, de Brauw A, Dominguez-Salas P, Herforth A, Kennedy G, Lachat C, Omosa EB, Talsma EF, Vandevijvere S, Fanzo J, Ruel M. Reverse thinking: Taking a healthy diet perspective towards food systems transformations. Food Secur. 2021;13(6):1497–523. https://doi.org/10.1007/s12571-021-01204-5.
22. Cairns P, Ozakinci G, Perrett DI. Reactions to an Online Demonstration of the Effect of Increased Fruit and Vegetable Consumption on Appearance: Survey Study. J Med Internet Res. 2020;22(7):e15726. https://doi.org/10.2196/15726.
23. Cakoni R, Moramarco S, Kosiqi A, Andreoli A, Buonomo E. Dietary Habits and Nutritional Status of Youths Living in Rural and Semi-Urban Albania in the Ongoing Nutrition Transition: Preliminary Results. Children. 2025;12(1):98. https://doi.org/10.3390/children12010098.
24. Canetti L, Bachar E, Berry EM. Food and emotion. Behav Process. 2002;60(2):157–64. https://doi.org/10.1016/S0376-6357(02)00082-7.
25. Clark M, Springmann M, Rayner M, Scarborough P, Hill J, Tilman D, Macdiarmid JI, Fanzo J, Bandy L, Harrington RA. (2022). Estimating the environmental impacts of 57,000 food products. *Proceedings of the National Academy of Sciences*, *119*(33), e2120584119. https://doi.org/10.1073/pnas.2120584119
26. Coccurello R, Maccarrone M. (2018). Hedonic Eating and the Delicious Circle: From Lipid-Derived Mediators to Brain Dopamine and Back. *Frontiers in Neuroscience*, *12*. https://doi.org/10.3389/fnins.2018.00271
27. Cohen JB, Pham MT, Andrade EB. The Nature and Role of Affect in Consumer Behavior. Handbook of Consumer Psychology. Routledge; 2008.
28. Cohn MA, Fredrickson BL, Brown SL, Mikels JA, Conway AM. Happiness unpacked: Positive emotions increase life satisfaction by building resilience. Emotion. 2009;9(3):361–8. https://doi.org/10.1037/a0015952.
29. Cudeck R. (2000). 10—Exploratory Factor Analysis. In H. E. A. Tinsley & S. D. Brown, editors, *Handbook of Applied Multivariate Statistics and Mathematical Modeling* (pp. 265–296). Academic Press. https://doi.org/10.1016/B978-012691360-6/50011-2

30. Daly AN, Kearney JM, O'Sullivan EJ. The underlying role of food guilt in adolescent food choice: A potential conceptual model for adolescent food choice negotiations under circumstances of conscious internal conflict. Appetite. 2024;192:107094. https://doi.org/10.1016/j.appet.2023.107094.
31. David IA, Krutman L, Fernández-Santaella MC, Andrade JR, Andrade EB, Oliveira L, Pereira MG, Gomes FS, Gleiser S, Oliveira JM, Araújo RL, Volchan E, Braga F. Appetitive drives for ultra-processed food products and the ability of text warnings to counteract consumption predispositions. Public Health Nutr. 2018;21(03):543–57. https://doi.org/10.1017/S1368980017003263.
32. Davis B, Carpenter C. Proximity of Fast-Food Restaurants to Schools and Adolescent Obesity. Am J Public Health. 2009;99(3):505–10. https://doi.org/10.2105/AJPH.2008.137638.
33. Diener E, Chan MY. Happy People Live Longer: Subjective Well-Being Contributes to Health and Longevity: HEALTH BENEFITS OF HAPPINESS. Appl Psychology: Health Well-Being. 2011;3(1):1–43. https://doi.org/10.1111/j.1758-0854.2010.01045.x.
34. Diener E, Sandvik E, Pavot W. (2009). Happiness is the Frequency, Not the Intensity, of Positive Versus Negative Affect. In E. Diener, editor, *Assessing Well-Being* (Vol. 39, pp. 213–231). Springer Netherlands. https://doi.org/10.1007/978-90-481-2354-4_10
35. Diener E, Wirtz D, Tov W, Kim-Prieto C, Choi D, Oishi S, Biswas-Diener R. New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings. Soc Indic Res. 2010;97(2):143–56. https://doi.org/10.1007/s11205-009-9493-y.
36. Dunn KI, Mohr P, Wilson C, Wittert G. Determinants of Fast-Food Consumption. An Application of the Theory of Planned Behaviour. Appetite. 2011;57(2):349–57. https://doi.org/10.1016/j.appet.2011.06.004.
37. El Bilali H, Berjan S, Ben Hassen T, Memon JA, Vaško Ž, Allahyari MS. Research on food loss and waste in the Western Balkans: A systematic review. Front Nutr. 2022;9:983639. https://doi.org/10.3389/fnut.2022.983639.
38. Elliot AJ, Maier MA. Color Psychology: Effects of Perceiving Color on Psychological Functioning in Humans. Ann Rev Psychol. 2014;65(1):95–120. https://doi.org/10.1146/annurev-psych-010213-115035.
39. Elliston KG, Ferguson SG, Schüz N, Schüz B. Situational cues and momentary food environment predict everyday eating behavior in adults with overweight and obesity. Health Psychol. 2017;36(4):337–45. https://doi.org/10.1037/hea0000439.
40. Epstein LH, Leddy JJ, Temple JL, Faith MS. Food reinforcement and eating: A multilevel analysis. Psychol Bull. 2007;133(5):884–906. https://doi.org/10.1037/0033-2909.133.5.884.
41. Evers C, Dingemans A, Junghans AF, Boevé A. Feeling bad or feeling good, does emotion affect your consumption of food? A meta-analysis of the experimental evidence. Neurosci Biobehavioral Reviews. 2018;92:195–208. https://doi.org/10.1016/j.neubiorev.2018.05.028.
42. Fiorentini M, Kinchla AJ, Nolden AA. Role of Sensory Evaluation in Consumer Acceptance of Plant-Based Meat Analogs and Meat Extenders: A Scoping Review. Foods. 2020;9(9). https://doi.org/10.3390/foods9091334. Article 9.
43. Fischer D, Stanszus L, Geiger S, Grossman P, Schrader U. Mindfulness and sustainable consumption: A systematic literature review of research approaches and findings. J Clean Prod. 2017;162:544–58. https://doi.org/10.1016/j.jclepro.2017.06.007.
44. Forde CG, de Graaf K. Influence of Sensory Properties in Moderating Eating Behaviors and Food Intake. Front Nutr. 2022;9:841444. https://doi.org/10.3389/fnut.2022.841444.

45. Fornell C, Larcker DF. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*. (Sage CA: Los Angeles, CA). https://doi.org/10.1177/002224378101800104
46. Fredrickson BL, Joiner T. Positive Emotions Trigger Upward Spirals Toward Emotional Well-Being. Psychol Sci. 2002;13(2):172–5. https://doi.org/10.1111/1467-9280.00431.
47. Fuente González CE, Chávez-Servín JL, de la Torre-Carbot K, Ronquillo González D, de los Barreiro A Á., Navarro O. L. R. (2022). Relationship between Emotional Eating, Consumption of Hyperpalatable Energy-Dense Foods, and Indicators of Nutritional Status: A Systematic Review. *Journal of Obesity*, *2022*, 4243868. https://doi.org/10.1155/2022/4243868
48. Gardner MP, Wansink B, Kim J, Park S-B. Better moods for better eating? How mood influences food choice. J Consumer Psychol. 2014;24(3):320–35. https://doi.org/10.1016/j.jcps.2014.01.002.
49. Garg R, Bansal S, Rathi R, Bhowmick S. Mindful consumption – A systematic review and research agenda. J Clean Prod. 2024;459:142373. https://doi.org/10.1016/j.jclepro.2024.142373.
50. Goretzko D, Siemund K, Sterner P. Evaluating Model Fit of Measurement Models in Confirmatory Factor Analysis. Educ Psychol Meas. 2024;84(1):123–44. https://doi.org/10.1177/00131644231163813.
51. Haas R, Imami D, Miftari I, Ymeri P, Grunert K, Meixner O. Consumer Perception of Food Quality and Safety in Western Balkan Countries: Evidence from Albania and Kosovo. Foods. 2021;10(1):160. https://doi.org/10.3390/foods10010160.
52. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate Data Analysis. Pearson Education Limited; 2013. https://books.google.al/books?id=VvXZnQEACAAJ.
53. Hayashi D, Edwards C, Emond JA, Gilbert-Diamond D, Butt M, Rigby A, Masterson TD. What Is Food Noise? A Conceptual Model of Food Cue Reactivity. Nutrients. 2023;15(22):4809. https://doi.org/10.3390/nu15224809.
54. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci. 2015;43(1):115–35. https://doi.org/10.1007/s11747-014-0403-8.
55. Hill D, Conner M, Clancy F, Moss R, Wilding S, Bristow M, O'Connor DB. Stress and eating behaviours in healthy adults: A systematic review and meta-analysis. Health Psychol Rev. 2022;16(2):280–304. https://doi.org/10.1080/17437199.2021.1923406.
56. Hu L, Bentler PM. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*. (world). https://doi.org/10.1080/10705519909540118
57. Jordan CH, Wang W, Donatoni L, Meier BP. Mindful eating: Trait and state mindfulness predict healthier eating behavior. Pers Indiv Differ. 2014;68:107–11. https://doi.org/10.1016/j.paid.2014.04.013.
58. Kandiah J, Yake M, Jones J, Meyer M. Stress influences appetite and comfort food preferences in college women. Nutr Res. 2006;26(3):118–23. https://doi.org/10.1016/j.nutres.2005.11.010.
59. Kanoski SE, Boutelle KN. Food cue reactivity: Neurobiological and behavioral underpinnings. Reviews Endocr Metabolic Disorders. 2022;23(4):683–96. https://doi.org/10.1007/s11154-022-09724-x.
60. Katterman SN, Kleinman BM, Hood MM, Nackers LM, Corsica JA. Mindfulness meditation as an intervention for binge eating, emotional eating, and weight loss: A systematic review. Eat Behav. 2014;15(2):197–204.

https://doi.org/10.1016/j.eatbeh.2014.01.005.

61. Kemp E, Bui M, Grier S. When food is more than nutrition: Understanding emotional eating and overconsumption. J Consumer Behav. 2013;12(3):204–13. https://doi.org/10.1002/cb.1413.
62. Keyte R, Harding-Jones G, Hussain M, Wood J, Egan H, Mantzios M. Body Esteem Explains the Relationship Between Mindful Eating and Self-Compassion: A Mediation Analysis. J Cogn Enhancement. 2022;6(4):478–84. https://doi.org/10.1007/s41465-022-00252-9.
63. Kim D, Jang S. (Shawn). (2017). Stress and food choices: Examining gender differences and the time horizon framing effect. *International Journal of Hospitality Management*, *67*, 134–142. https://doi.org/10.1016/j.ijhm.2017.08.012
64. Kline RB. Assessing statistical aspects of test fairness with structural equation modelling. Fairness Issues in Educational Assessment. Routledge; 2016.
65. Knaapila A. Sensory and Consumer Research Has a Role in Supporting Sustainability of the Food System. Foods. 2022;11(13). https://doi.org/10.3390/foods11131958. Article 13.
66. Kokthi E, Guri F, Dafku Z. Climate Change Awareness and Urban Food Choices: Exploring Motivations for Short Food Chain Engagement. Urban Sci. 2025;9(5):142. https://doi.org/10.3390/urbansci9050142.
67. Kokthi E, Miftari I, Hasani A, Tili I, Basha A. (2025). *The Role of Habit in Fast Food Consumption: Integrating Habit into the Theory of Planned Behaviour*. https://doi.org/10.21203/rs.3.rs-6221337/v1
68. Kozubal M, Szuster A, Wielgopolan A. Emotional regulation strategies in daily life: The intensity of emotions and regulation choice. Front Psychol. 2023;14:1218694. https://doi.org/10.3389/fpsyg.2023.1218694.
69. Krishna A, Schwarz N. Sensory marketing, embodiment, and grounded cognition: A review and introduction. J Consumer Psychol Sens Percept Embodiment Grounded Cognition: Implications Consumer Behav. 2014;24(2):159–68. https://doi.org/10.1016/j.jcps.2013.12.006.
70. Lane MM, Gamage E, Travica N, Dissanayaka T, Ashtree DN, Gauci S, Lotfaliany M, O'Neil A, Jacka FN, Marx W. Ultra-Processed Food Consumption and Mental Health: A Systematic Review and Meta-Analysis of Observational Studies. Nutrients. 2022;14(13):2568. https://doi.org/10.3390/nu14132568.
71. Lee K-T, Furukawa H. Exploring Subjective Happiness, Life Satisfaction, and Sustainable Luxury Consumption in China and Japan Amidst the COVID-19 Pandemic. Administrative Sci. 2023;13(7). Article 7. https://doi.org/10.3390/admsci13070169.
72. Lee S, Min D. Sensory Stimuli to Sustainable Social Wellbeing: A Multimodal Approach Based on Warm Scent. Behav Sci. 2022;12(5):146. https://doi.org/10.3390/bs12050146.
73. Leigh Gibson E. Emotional influences on food choice: Sensory, physiological and psychological pathways. Physiol Behav Mak Sense Food. 2006;89(1):53–61. https://doi.org/10.1016/j.physbeh.2006.01.024.
74. Ljubičić M, Matek Sarić M, Klarin I, Rumbak I, Colić Barić I, Ranilović J, Dželalija B, Sarić A, Nakić D, Djekic I, Korzeniowska M, Bartkiene E, Papageorgiou M, Tarcea M, Černelič-Bizjak M, Klava D, Szűcs V, Vittadini E, Bolhuis D, Guiné RPF. Emotions and Food Consumption: Emotional Eating Behavior in a European Population. Foods. 2023;12(4):872. https://doi.org/10.3390/foods12040872.
75. Macht M, Dettmer D. Everyday mood and emotions after eating a chocolate bar or an apple. Appetite. 2006;46(3):332–6. https://doi.org/10.1016/j.appet.2006.01.014.
76. Macht M, Simons G. (2011). Emotional Eating. In I. Nyklíček, A. Vingerhoets, & M. Zeelenberg, editors, *Emotion Regulation and Well-Being* (pp. 281–295). Springer. https://doi.org/10.1007/978-1-4419-6953-8_17

77. Maggioni E. (2015). *The Smell of Emotions: Olfactory Influences on Emotions and Consumer Behaviour*. https://boa.unimib.it/handle/10281/70695
78. Malhotra NK. (2020). *Marketing research: An applied prientation*. Pearson. https://thuvienso.hoasen.edu.vn/handle/123456789/12586
79. Mantzios M, Wilson JC. Exploring Mindfulness and Mindfulness with Self-Compassion-Centered Interventions to Assist Weight Loss: Theoretical Considerations and Preliminary Results of a Randomized Pilot Study. Mindfulness. 2015;6(4):824–35. https://doi.org/10.1007/s12671-014-0325-z.
80. Martínez-Líbano J. Axel Kosch Serey, & Guillermo Barahona-Fuentes. (2025). Emotional Regulation and Subjective Well-Being in Adolescents: A Systematic Review. Mental Health: Global Challenges J, *8*(1), 14–26. https://doi.org/10.56508/mhgcj.v8i1.240
81. Marty L, Nicklaus S, Miguet M, Chambaron S, Monnery-Patris S. When do healthiness and liking drive children's food choices? The influence of social context and weight status. Appetite. 2018;125:466–73. https://doi.org/10.1016/j.appet.2018.03.003.
82. Meiselman HL. Quality of life, well-being and wellness: Measuring subjective health for foods and other products. Food Qual Prefer. 2016;54:101–9. https://doi.org/10.1016/j.foodqual.2016.05.009.
83. Mekonnen MM, Hoekstra AY. The green, blue and grey water footprint of crops and derived crop products. Hydrol Earth Syst Sci. 2011;15(5):1577–600. https://doi.org/10.5194/hess-15-1577-2011.
84. Meybeck A, Gitz V. (2017). Sustainable diets within sustainable food systems. *Proceedings of the Nutrition Society*, *76*(1), 1–11. https://doi.org/10.1017/S0029665116000653
85. Michaelidou N, Christodoulides G, Torova K. Determinants of healthy eating: A cross-national study on motives and barriers. Int J Consumer Stud. 2012;36(1):17–22. https://doi.org/10.1111/j.1470-6431.2011.01031.x.
86. Minari TP, de Araújo-Filho GM, Tácito LHB, Yugar LBT, Rubio TdeA, Pires AC, Vilela-Martin JF, Cosenso-Martin LN, Fattori A, Yugar-Toledo JC, Moreno H. Effects of Mindful Eating in Patients with Obesity and Binge Eating Disorder. Nutrients. 2024;16(6). https://doi.org/10.3390/nu16060884. Article 6.
87. Mishra P, Pandey CM, Singh U, Gupta A, Sahu C, Keshri A. Descriptive Statistics and Normality Tests for Statistical Data. Ann Card Anaesth. 2019;22(1):67–72. https://doi.org/10.4103/aca.ACA_157_18.
88. Morillo-Sarto H, López-del-Hoyo Y, Pérez-Aranda A, Modrego-Alarcón M, Barceló-Soler A, Borao L, Puebla-Guedea M, Demarzo M, García-Campayo J, Montero-Marin J. Mindful eating' for reducing emotional eating in patients with overweight or obesity in primary care settings: A randomized controlled trial. Eur Eat Disorders Rev. 2023;31(2):303–19. https://doi.org/10.1002/erv.2958.
89. Morrin M, Tepper BJ. Multisensory marketing: Effects of environmental aroma cues on perception, appetite, and consumption of foods and drinks. Curr Opin Food Sci. 2021;40:204–10. https://doi.org/10.1016/j.cofs.2021.04.008.
90. Moss RH, Conner M, O'Connor DB. Exploring the effects of positive and negative emotions on eating behaviours in children and young adults. Psychol Health Med. 2021;26(4):457–66. https://doi.org/10.1080/13548506.2020.1761553.
91. Mujcic R,J.Oswald, A. Evolution of Well-Being and Happiness After Increases in Consumption of Fruit and Vegetables. Am J Public Health. 2016;106(8):1504–10. https://doi.org/10.2105/AJPH.2016.303260.

92. Nelson JB. Mindful Eating: The Art of Presence While You Eat. Diabetes Spectrum: Publication Am Diabetes Association. 2017;30(3):171–4. https://doi.org/10.2337/ds17-0015.
93. Nguyen-Rodriguez ST, Unger JB, Spruijt-Metz D. Psychological Determinants of Emotional Eating in Adolescence. Eat Disord. 2009;17(3):211–24. https://doi.org/10.1080/10640260902848543.
94. Papies EK. Tempting food words activate eating simulations. Front Psychol. 2013. https://doi.org/10.3389/fpsyg.2013.00838. *4*.
95. Peters R, Elsey H, Newell J, Hill AJ. (2018). Understanding Nutrition Transition Among Internal Rural-to-Urban Migrant Women in Nairobi, Kenya. *Proceedings of the Nutrition Society*. https://doi.org/10.1017/s0029665118001957
96. Poore J, Nemecek T. Reducing food's environmental impacts through producers and consumers. Science. 2018;360(6392):987–92. https://doi.org/10.1126/science.aaq0216.
97. Schubert E, Bode S. Positive emotions and their upregulation increase willingness to consume healthy foods. Appetite. 2023;181:106420. https://doi.org/10.1016/j.appet.2022.106420.
98. Schutte NS, Malouff JM, Simunek M, McKenley J, Hollander S. Characteristic emotional intelligence and emotional well-being. Cogn Emot. 2002;16(6):769–85. https://doi.org/10.1080/02699930143000482.
99. Šeinauskienė B, Maščinskienė J, Petrikė I, Rūtelionė A. Materialism as the Mediator of the Association between Subjective Well-being and Impulsive Buying Tendency. Eng Econ. 2016;27(5):594–606. https://doi.org/10.5755/j01.ee.27.5.13830.
100. Shriver LH, Dollar JM, Calkins SD, Keane SP, Shanahan L, Wideman L. Emotional Eating in Adolescence: Effects of Emotion Regulation, Weight Status and Negative Body Image. Nutrients. 2020;13(1):79. https://doi.org/10.3390/nu13010079.
101. Stanszus LS, Frank P, Geiger SM. Healthy eating and sustainable nutrition through mindfulness? Mixed method results of a controlled intervention study. Appetite. 2019;141:104325. https://doi.org/10.1016/j.appet.2019.104325.
102. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating Healthy Food and Eating Environments: Policy and Environmental Approaches. Annu Rev Public Health. 2008;29(1):253–72. https://doi.org/10.1146/annurev.publhealth.29.020907.090926.
103. Sulejmani E, Hyseni A, Xhabiri G, Rodríguez-Pérez C. Relationship in dietary habits variations during COVID-19 lockdown in Kosovo: The COVIDiet study. Appetite. 2021;164:105244. https://doi.org/10.1016/j.appet.2021.105244.
104. Sunstein CR. Choice engines and paternalistic AI. Humanit Social Sci Commun. 2024;11(1):888. https://doi.org/10.1057/s41599-024-03428-0.
105. Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR, Brinsden H, Calvillo A, De Schutter O, Devarajan R. (2019). The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. *The Lancet*, *393*(10173), 791–846. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32822-8/fulltext
106. Tapper K. Can mindfulness influence weight management related eating behaviors? If so, how? Clin Psychol Rev. 2017;53:122–34. https://doi.org/10.1016/j.cpr.2017.03.003.
107. Teixeira PJ, Patrick H, Mata J. Why we eat what we eat: The role of autonomous motivation in eating behaviour regulation. Nutr Bull. 2011;36(1):102–7. https://doi.org/10.1111/j.1467-3010.2010.01876.x.

108. Tugade MM, Fredrickson BL. Resilient Individuals Use Positive Emotions to Bounce Back From Negative Emotional Experiences. J Personal Soc Psychol. 2004;86(2):320–33. https://doi.org/10.1037/0022-3514.86.2.320.
109. Tugade MM, Fredrickson BL, Feldman Barrett L. Psychological Resilience and Positive Emotional Granularity: Examining the Benefits of Positive Emotions on Coping and Health. J Pers. 2004;72(6):1161–90. https://doi.org/10.1111/j.1467-6494.2004.00294.x.
110. Valdez P, Mehrabian A. Effects of color on emotions. J Exp Psychol Gen. 1994;123(4):394–409. https://doi.org/10.1037/0096-3445.123.4.394.
111. Wansink B, Cheney MM, Chan N. Exploring comfort food preferences across age and gender. Physiol Behav. 2003;79(4):739–47. https://doi.org/10.1016/S0031-9384(03)00203-8.
112. Warner RM, Frye K, Morrell JS, Carey G. Fruit and Vegetable Intake Predicts Positive Affect. J Happiness Stud. 2017;18(3):809–26. https://doi.org/10.1007/s10902-016-9749-6.
113. Warren JM, Smith N, Ashwell M. A structured literature review on the role of mindfulness, mindful eating and intuitive eating in changing eating behaviours: Effectiveness and associated potential mechanisms. Nutr Res Rev. 2017;30(2):272–83. https://doi.org/10.1017/S0954422417000154.
114. Watson L, Spence MT. Causes and consequences of emotions on consumer behaviour: A review and integrative cognitive appraisal theory. Eur J Mark. 2007;41(5/6):487–511. https://doi.org/10.1108/03090560710737570.
115. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, Jonell M, Clark M, Gordon LJ, Fanzo J, Hawkes C, Zurayk R, Rivera JA, De Vries W, Sibanda M, Murray L, C. J. L. Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. Lancet. 2019;393(10170):447–92. https://doi.org/10.1016/S0140-6736(18)31788-4.
116. Woodside JV. (2023). Achieving a sustainable food supply, for good health and planetary health; a focus on the international context. *Proceedings of the Nutrition Society*, *82*(OCE2), E46. https://doi.org/10.1017/S0029665123000551
117. Xiao JJ. (2014). Life Satisfaction and Sustainable Consumption. In A. C. Michalos, editor, *Encyclopedia of Quality of Life and Well-Being Research* (pp. 3578–3581). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_3698
118. Zhang Y, Song Y. The Effects of Sensory Cues on Immersive Experiences for Fostering Technology-Assisted Sustainable Behavior: A Systematic Review. Behav Sci. 2022;12(10). Article 10. https://doi.org/10.3390/bs12100361.
119. Appendix.

Footnotes

1. More details in appendixes

Unsectioned Paragraphs

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Paper highlights

1. **External, restraint-based mindfulness reduces hedonic choices in positive moods.**
2. **Sensory/environmental cues in low mood had more than twice the effect size observed for mindfulness in positive mood.**
3. **Higher subjective well-being under negative emotions was linked to healthier choices with potential sustainability benefits.**

Note: The listed food products were used in the emotional eating assessment, where participants rated their desire to eat each product on a 5-point Likert scale (1 = No desire to eat, 5 = An overwhelming urge to eat) in response to specific emotions (e.g., anger, discouragement, fatigue).

Source: Author's elaboration

Source: Author's elaboration

Emotions and Food Preferences

Notes: APE = food choices associated with positive emotions, ANE= food choices associated with negative emotions

Significance of Correlations: *† p < 0.100, * p < 0.050, ** p < 0.010, *** p < 0.001*

Source: Authors' elaboration

*Notes: *** p < 0.001.*

Figures

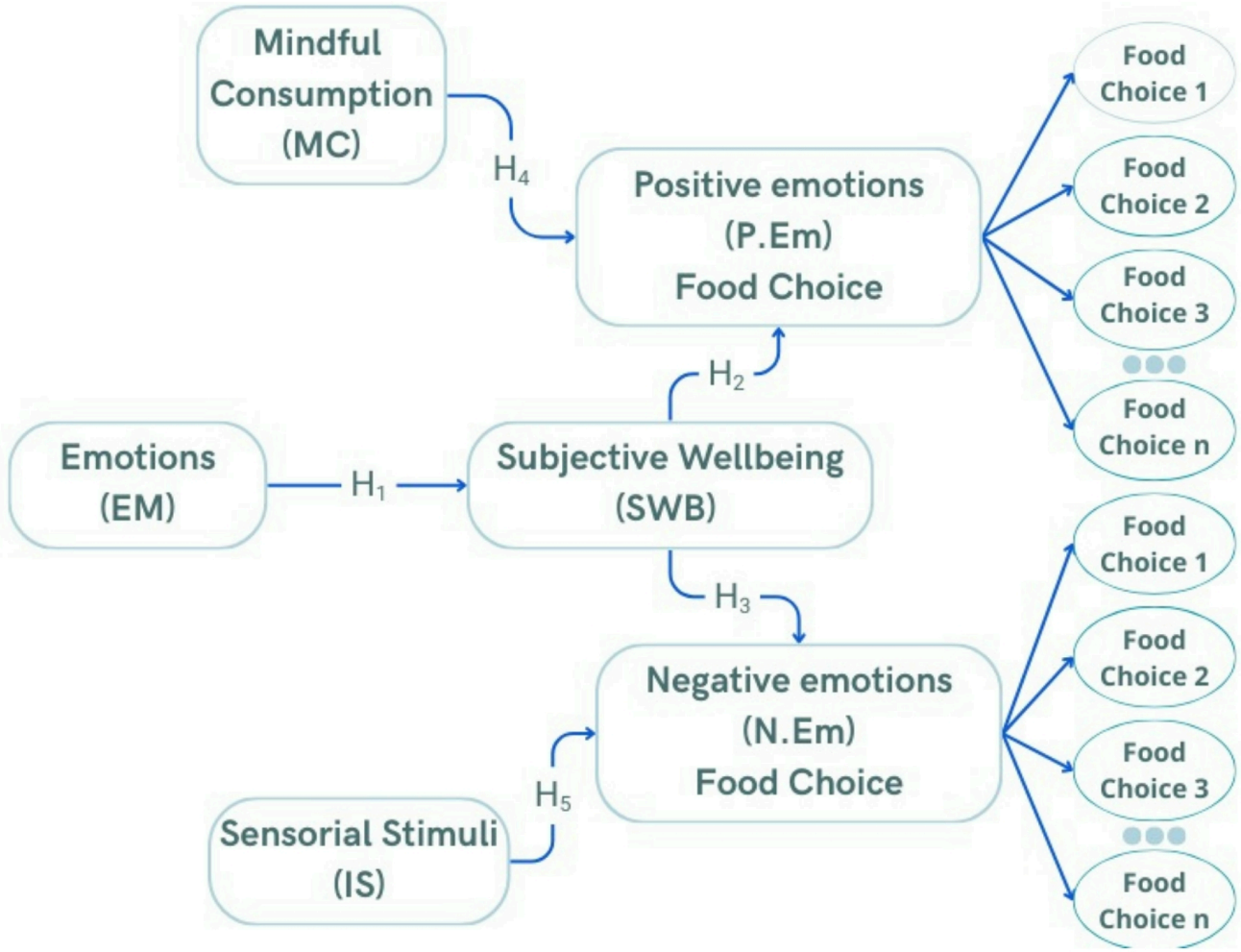


Figure 1

illustrates the *MindSense Pathway Food Choice Model*, which integrates emotions, mindful consumption practices (eating less, closely monitoring intake, and prioritising weight control), and sensorial stimuli to explain how subjective well-being mediates the relationship between emotional states and food choice in both positive and negative contexts.

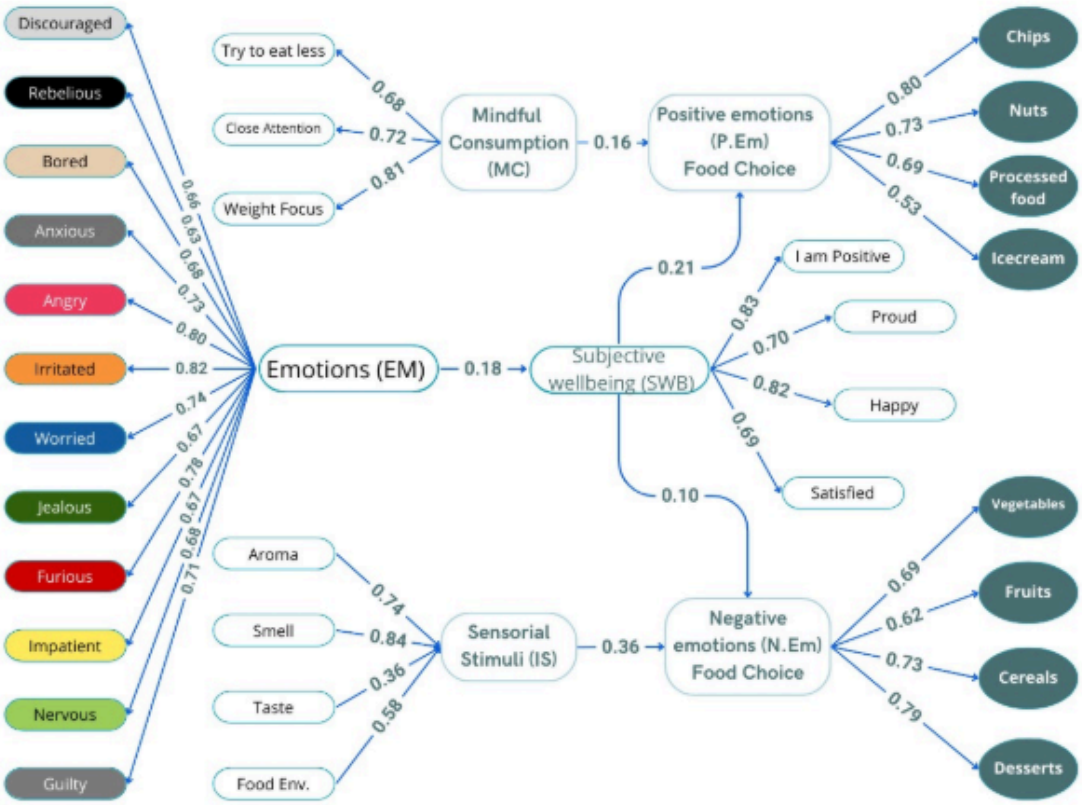


Figure 2

MindSense framework pathways linking emotions, mindful consumption, sensorial stimuli, and sustainable food choices in Albania and Kosovo