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# How AI-Powered Recommendations Moderate the Effect of Consumer Value on Ultra-Processing Food Consumption?

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**Abstract**

**Purpose:** This study applies the Theory of Consumption Value (TCV) to explore the direct effects of functional, emotional, social, and conditional values on the continuance consumption of ultra-processed foods (UPFs) among university students. Additionally, Rational Choice Theory (RCT) serves as the underpinning framework to examine how the perceived value of AI recommendations moderates these relationships within the model

**Design/Methodology/Approach:** This study employed a cross-sectional quantitative approach, involving 286 full-time university students from northern Peninsular Malaysia. Data was gathered through online surveys using purposive sampling to target students who are familiar with and use AI recommenders, and who regularly consume UPFs as part of their daily diet. To test the hypotheses related to direct and moderation effects, Partial Least Squares Structural Equation Modeling was utilized.

**Findings:** The study confirms that functional, emotional, social, and conditional values have a significant direct effect on the continuance consumption of UPFs. However, the perceived value of AI recommendations was found to moderate only the effects of emotional and conditional values on UPF consumption. Specifically, AI recommendation perceived value did not moderate the impact of functional and social values on UPF continuance consumption in this study.

**Research Limitations:** The study's geographical focus on northern peninsular Malaysia and its concentration on digitally adept university students may limit generalizability. Future research should explore these dynamics across diverse populations and cultural contexts to enhance applicability.

**Practical Implications:** Regulatory measures are needed to guide AI recommender algorithms toward promoting healthier eating habits. Policies should prioritize nutritional value alongside convenience and cost-effectiveness in food recommendations, particularly among young consumers influenced by digital technologies.

**Originality/value:** This research is a nexus between research on consumer values, AI technology, and UPF consumption among digitally native demographics, specifically university students.

**Keywords**: Artificial Intelligence, AI Recommender, Theory of Consumption Value, Ultra-Processed Food

**Classification:** Research paper

## Introduction

The global consumption of ultra-processed food (UPF) continues to increase despite widespread awareness of associated health risks (Caro et al., 2017; Hess et al., 2023; Calvo-Porral et al., 2024). This trend persists due to the affordability and widespread availability of UPF, as well as its appealing taste and appearance to consumers. Moreover, UPF represents a highly profitable sector for the food industry, offering products at competitive prices. It is important to note that UPF undergoes significant alteration of base ingredients through the addition of industrial flavorings, enhancers, colorants, and texture modifiers. These characteristics have contributed to UPF's popularity among young consumers as well as among busy working-class individuals, college students, and others leading fast paced lives who seek novel and innovative food options.

Another significant factor contributing to the consumption of UPF is the absence of a universally accepted definition for this category of products (Fardet & Rock, 2019). Brazil took the lead in 2014 by pioneering the classification of UPF as food subjected to extensive industrial processing, introducing the NOVA classification system to address obesity and the prevalence of non-communicable diseases within their population (Monteiro et al., 2018). This new food categorization includes not only traditional junk foods like processed chips but also products marketed as healthy, such as vegan, organic, low-calorie, and gluten-free items that contain UPF ingredients (Rybak et al., 2024; Calvo-Porral et al., 2024). Common examples of UPF products are chocolates, cakes, candies, breads, pastries, cookies, biscuits, instant soups, noodles, burger patties, sausages, and fortified beverages. These items are characterized by highly processed ingredients and additives, offering minimal nutritional value but high levels of energy, trans fats, sodium, and saturated fatty acids (Fuente Gonzalez et al., 2022). UPF remains popular in today's fast-paced society, which demands convenient foods rich in energy, including modern fortified products like 'power bars' and ‘energy drinks’. Critics argue that foods classified as UPF under the NOVA system still lack sufficient scientific evidence, validity, and a precise conceptual definition, which hinders comprehensive understanding among consumers and minimal regulation of these products (Bernal-Orozco et al., 2020; Chavan et al., 2024).

University students, who typically possess some awareness of UPF, often find these products irresistible. Despite having knowledge about the health risks such as non-communicable diseases like type-2 diabetes, and coronary failure, associated with UPF consumption, greater health literacy does not always translate into healthier eating habits. Consumer value towards consumption of UPF is shaped by pervasive online and offline marketing efforts (Kim & Chang, 2024), now research on UPF is established and gained footing in developed countries. However, there is a lack of prospective data on the prevalence of UPF consumption in middle-income

countries, particularly Malaysia. As debates over developing countries as potential emerging markets for highly processed food products continues, this gap in literature is apparent.

This study focuses on university students because they are the significant segment of society that consume UPF. University students' food consumption might be attributed to online marketing and product's influencers from social media (Norfarah et al., 2022), as they are constantly connected to the internet. While there is existing research on the general public, adolescents, and school students (Lemke et al., 2024; Mainard et al., 2020), limited research has been conducted specifically on university students, apart from the study by Bernal-Orozco et al. (2020) which examined dietary patterns and food intake among this demographic, and Palmedo et al. (2022) who studied youth in Bronx, New York on counter-marketing messages to dissuade them from taking sugar sweeten beverages (SSBs). Hence, we understand that research on UPF among university students and youth is important. Moreover, university students are a demographic that is heavily intertwined with internet connectivity, thereby they are mostly influenced by advertisements, online marketing, e-WOM and technology-based recommendations. University students represent a significant segment of society that is consistently online and interconnected (Vorderer et al., 2017), making their values and attitudes towards UPFs particularly relevant to be studied further.

Previous research on UPF has predominantly emanated from health sciences and ecological studies conducted in developed countries such as Europe and America (Switkowski et al., 2024; Monteiro et al., 2017). Ecological studies, for instance, have explored household availability of UPF and its correlation with obesity among adults (Fardet & Rock, 2019). According to the Pan American Health Organization (2015), retail sales data indicate that UPF and beverages are most prominently sold in the following ten countries: USA, Canada, Germany, Mexico, Belgium, Australia, Norway, UK, Japan, Switzerland, and the Netherlands. Bernal-Orozco et al. (2020) investigated dietary patterns among university students, while Lemke et al. (2024) developed the Meal and Snack Assessment (MESA) quality scale for children in southern Brazil, revealing that UPF consumption peaks during morning snack times. However, these studies primarily focus on nutritional aspects and scientific dietary intake, rather than exploring consumer choices, behavior, psychology, or consumption values.

Conversely, research within the realm of consumer choice and consumption values related to UPF remains sparse. Existing studies have predominantly focused on consumer personal values (Granzin & Bahn, 1982), perceived value of healthier eating (Anderson & Mirosa, 2014; De Kervenoael et al., 2021), consumption values of organic food (Cao et al., 2022), and the relationship between values and food-related lifestyles (Brunso et al., 2004). Most of these studies emphasize healthy eating or organic product purchasing behaviors. In contrast, studies specifically addressing the drivers of UPF consumption have been notably scarce. One noteworthy study by Calvo-Porral et al. (2024) developed measurement scales for UPF acceptance, but it did not employ a specific theoretical framework to establish the dimensions of UPF acceptance, instead drawing from a blend of Theory of Planned Behavior, and rational choice theory. This research gap has left both researchers and companies uncertain about the factors influencing consumer choice for UPF.

The closest in context of bad consumption behavior study is a study dated back three decades ago by Sheth et al. (1991). They examined consumer choice value related to cigarette smoking. Their study identified consumption value as a choice, and it can be explained by the theory of consumption value (TCV). In TCV, Sheth et al. (1991) came up with five factors explaining the choice for cigarette smoking and argued that "while it is desirable to maximize all five consumption values, it is often not practical" (Sheth et al., 1991, pp. 163). Therefore, this study examines four consumption values— functional, emotional, conditional, and social values — to address this research gap on consumption values of UPF. Another gap in research identified is, in last three decades, marketing of cigarette does not involve either e-WOM, or AI recommendations.

These days, debates on AI recommendations regarding consumer choices and food consumption are gaining traction. Reviews indicate artificial intelligence technology such as voice assistant, AI recommendation altered consumer behaviour (Padhiar et al., 2021; Tandon et al., 2021; Min et al., 2023; Thakur & Sharma, 2024; Yaiprasert & Hidayanto, 2024). Therefore, this paper incorporates the moderation effect of AI recommendation perceived value by the consumer to provide new insights into contemporary consumer value literature and make an important implication for policy makers.

This study aimed to address the gaps described above focusing on consumer values of UPF using quantitative research methodology. Accordingly, this paper uses survey questionnaire design to answer the following research questions. First, does functional, emotional, conditional, and social value influence the consumption of UPF among university students? Second, do AI recommendations perceived value moderate the effect of the four consumption values (functional, emotional, conditional and social) towards UPF purchase intention among university students?

To address our research questions, the subsequent section in this paper is organized as follows. Section 2 reviews the literature on consumer value and shed light on the recent debate on AI in consumer decision making and cognitive processes. Section 3 describes the methodology and research design. Section 4 discusses our findings regarding the descriptive statistics of respondents, measurement and structural model analysis. Section 5 presents suggestions for further research.

## Literature Review

### *Determinants of Consumption Value*

The field of consumer psychology emerged as a discipline to investigate consumer behavior and consumption choice in the marketplace. Consumer consumption usually focuses on the study of how emotional and cognitive aspects influence decision making (Chae et al., 2024; Ljubicic et al., 2023). Consumption value is subjective and can vary greatly among consumers (Sheth et al., 1991). Based on theory of consumption value (TCV), consumption values are explained by five dimensions: functional, emotional, conditional, epistemic and social values. Consumption value theory provides a holistic approach to understanding consumer behavior by recognizing that value is multifaceted and encompasses not only functional benefits but also experiential and symbolic aspects. The theory provides a useful framework, measuring and quantifying the different types of

consumption value which marketers can better meet consumer needs and preferences, ultimately influencing repurchasing decisions.

Prior research into TCV has been limited mostly to general food product consumption value, or organic product purchase intention studies (Chakraborty & Dash, 2023). To the best of our knowledge no study has been found on UPF consumption or repurchase intention of UPF using TCV, except for Mason et al. (2023), but they employed meta-analysis of past research related to consumer behavior using TCV as the underpinning theory. Therefore, this paper aims to examine the determining factors for UPF using TCV to close this literature gap.

***AI recommendation influences on consumers***

In contemporary digital society, artificial intelligence (AI) combined with influencer marketing became fundamental not only to consumer marketing, but also user experience (UX) in technology research. In the modern marketplace, a variety of technology has been developed to support user interactions either online or offline (Kim & Chang, 2024), hence digital savvy consumers and companies often found to optimize the usage of intelligence speech technology, and intelligent recommender system in their daily life for decision making (Flavian et al., 2022; Siti-Nabiha et al., 2021). With such intense interest in technology assisted marketing, many companies used AI recommender for marketing. For example, Mariani et al. (2022) in their systemic literature review paper on AI marketing topic found that this topic has an increasing popularity since 1972 to June 2021. Based on these, we understand that there is still significant progress needed in this research on AI for decision making in the consumer research area. In recent years, Akdim & Casalo (2023) from Spain and Kim & Chang (2024) from Korea also recognize the importance of AI and technology assistance for decision making to repurchase food products.

For repurchasing certain products, AI recommendations generate personalized suggestions by machine-learning algorithm, provides intelligence recommendation systems based on users' historical searches data and internet searches behavior (Yaiprasert & Hidayanto, 2024). These recommendations aim to enhance user experience by predicting preferences, interests, or needs, thereby assisting individuals in discovering relevant content, products, or services (Bojic, 2024). Therefore, there is an increasing relevance of AI recommendations in retail and consumer marketing has been witnessed by emergence of several literature on the topic. For example, Pappalardo et al. (2024) conducted a survey on the impact of AI recommenders on human behavior, Yaiprasert & Hidayanto (2024) studied on AI recommendation on Thai food service. Min et al. (2023) also studied AI in modern consumer-driven food systems. There are studies about the threat in the increased use of AI recommendations such as voice assistant recommendation effects on consumer behaviour (Flavian et al., 2022).

However, there are limited studies on whether AI recommendations would affect consumption value alteration on food and dietary choice. AI recommendations might alter what consumers perceive as valuable or desirable. With frequent use of AI recommendations, there might be concerns about dependency or addictive behaviors. Consumers might find it difficult to ignore AI recommendations and rely on AI recommendations for decisions. Trusting AI recommendations might influence decisions that consumers might later regret, in consuming stuff that is not healthy, and highly processed. To close this literature gap, this paper utilizes theory of rational choice

(RCT) as the underpinning theory to support the moderation effect of AI recommendation on the relationship between consumption values (functional, emotional, conditional and social value) towards UPF consumption.

Based on RCT this study examines the role of AI recommendation perceived value in moderating the influence of TCV's consumption value factors on UPF continuance consumption. We argue that consumers who perceive AI recommendations as valuable, may have strengthened the effect of consumption values towards UPF. In other words, consumers who subscribed to AI recommendations about UPF updates, promotions, and advertisements are more engaged with UPF products recommendations and advertisements.

Our study is distinctively different compared to past literature and makes the following contributions. First, our article focuses on the modern consumer consumption values which are increasingly conditioned by their interaction with AI-powered recommendations, and this provides an integrative view of two streams of literature. Second, our research is contextualized on university students and their temptation for ultra processed food. University students which are a large group of consumers that exposed to AI recommenders, hence based on past research, their affinity towards modern food, that is highly processed are worrying (Lemke et al., 2024). Therefore, in addition to consumers' exposure to AI technology, UPF consumption represents another prevalent research area that holds significant appeal for research in young consumers' segment, and this research look at multidisciplinary linkages between these three fields (user experience with AI technology, young consumer behavior and UPF food consumption).

As a corollary of previous point, this research adopted theory of consumption value, and rational choice lenses to facilitate better understanding AI recommendations affecting young consumers decision making about ultra processed food consumption. In this research consumers' choice to purchase UPF is hypothesized to be influenced by functional, emotional, social and conditional values, as suggested by Sheth et al. (1991) who studied on choice involving cigarettes smoking. Chakraborty & Dash (2022) in India and Jebarajakirthy et al. (2021) in United States applied TCV in food consumption buying situations.

## Hypotheses Development

### The influence of functional value on UPF continuance consumption

Functional value considered the primary determinant of consumer consumption choices resonates strongly with rational choice theory's premise that consumers behave as logical economic actors (Rahnama, 2017). This theory suggests that individuals prioritize maximizing utility when making decisions, a principle that heavily influences purchasing behaviors (Kushwah et al., 2019; Moubarac et al., 2014). Moreover, the concept of functional value extends beyond theoretical frameworks to practical considerations grounded in product attributes. Elements such as products' reliability, price, affordability, and convenience play pivotal roles in shaping consumer preferences and ultimately driving purchasing decisions (Lin et al., 2020). For example, when selecting food items, consumers often weigh factors like nutritional content and taste to satisfy both physiological needs and personal preferences. Therefore, it is reasonable to anticipate that:

Hypothesis 1. Functional value has a positive direct effect on UPF continuance consumption among university students.

**The influence of emotional value on UPF continuance consumption**

Emotional value refers to the perceived utility derived from the ability to evoke feelings or affective states (Rahnama, 2017). A food product gains emotional value when it is linked to specific emotions or when it triggers or sustains those feelings (Lin et al., 2020). This value is often assessed through the range of emotions associated with the consumed product. For instance, food often elicits emotional responses, such as happiness when enjoying cakes or cookies, or comfort from eating ice cream after a stressful day. Even more utilitarian products can possess emotional value; for example, candies and sugary foods often evoke feelings of comfort tied to childhood memories. Research in advertising indicates that marketing and promotional strategies can elicit emotional responses that extend to the products being marketed (Sangadji & Handriana, 2023; Swasty & Mustafa, 2023) and hence lead to continuance consumption of the food. We therefore postulate the following:
Hypothesis 2. Emotional value has a positive direct effect on UPF continuance consumption among university students.

**The influence of social value on UPF continuance consumption**

Social value in food consumption refers to the perceived benefits derived from associating with specific social groups, often shaped by demographic, socioeconomic, and cultural factors (Rahnama, 2017). This study focuses on university students to control for these demographic and socioeconomic variables. In the context of ultra-processed foods (UPFs) consumption, social value is often evaluated based on the packaging colors (Swasty & Mustafa, 2023), imagery and social symbolism associated with consumer choices. Products that are highly visible and intended for sharing, such as those used in entertainment or celebrations, are frequently driven by social value. For instance, a particular cake shop might be selected more for the social prestige it offers than for its functional benefit of satisfying hunger.

Previous research has significantly contributed to our understanding of social values. Notably, Sheth et al. (1991) explored the social class implications of consumption behaviors, while Rogers (1962) highlighted the role of social values in consumer decisions through interpersonal communication and information sharing. More recent studies, such as those by Kaiser & Schultz (2024) and Swasty & Mustafa (2023), continue to explore the impact of social value on consumer choices. Building on this foundation, it is hypothesized that:
Hypothesis 3. Social value has a positive direct effect on UPF continuance consumption among university students.

**The influence of conditional value on UPF continuance consumption**

The conditional value of food pertains to the perceived benefits derived from specific situations or circumstances faced by the consumer (Sangadji & Handriana, 2023). This value increases when physical or social conditions enhance the food's functional or social appeal (Kushwah et al., 2019). For example, promotions such as free delivery offered by food delivery platforms can significantly

boost the conditional value of food by creating favorable circumstances that encourage purchase (Lin et al., 2020). Nowadays, consumers often receive free delivery as part of promotional offers, which can make ordering ultra-processed foods (UPFs) more attractive (Sangadji & Handriana, 2023). Based on these insights, we hypothesize that a higher perceived conditional value will positively impact consumers' intentions to continue purchasing UPFs through food delivery services. This hypothesis highlights the role of situational factors, such as promotional offers, in shaping consumer behavior towards UPFs in the context of modern food delivery platforms. Thus, it is hypothesized that:

Hypothesis 4. Conditional value has a positive direct effect on UPF continuance consumption among university students.

**AI Recommendation Perceived Value as a moderator**

We propose that consumers who perceive advertisements such as AI recommendations as valuable resources are likely to develop more favorable attitudes toward UPFs recommended to them, resulting in greater engagement with these products. This argument is consistent with past research in personalized advertisement by Boerman et al., (2021) and Zhu & Chang, 2016). This proposition aligns with rational choice theory, which suggests that individuals who find their experience with AI recommendation services enjoyable are more likely to engage with their self-determined choices (Chen et al., 2019; Chen et al., 2023). Furthermore, this aligns with the Theory of Consumption Value, which posits that addressing consumers' functional, emotional, social, and conditional values in relation to UPFs can be enhanced by their perception of AI recommendation value, potentially leading to increased UPF consumption. Therefore, we hypothesize:

Hypothesis 5a. Perceived Value of AI recommendations for UPF have a significant moderation effect on the relationship between functional value and UPF continuance consumption.

Hypothesis 5b. Perceived Value of AI recommendations for UPF have a significant moderation effect on the relationship between emotional value and UPF continuance consumption.

Hypothesis 5c. Perceived Value of AI recommendations for UPF have a significant moderation effect on the relationship between conditional value and UPF continuance consumption.

Hypothesis 5d. Perceived Value of AI recommendations for UPF have a significant moderation effect on the relationship between social value and UPF continuance consumption.

The proposed research framework and relationships are shown in Figure 1.

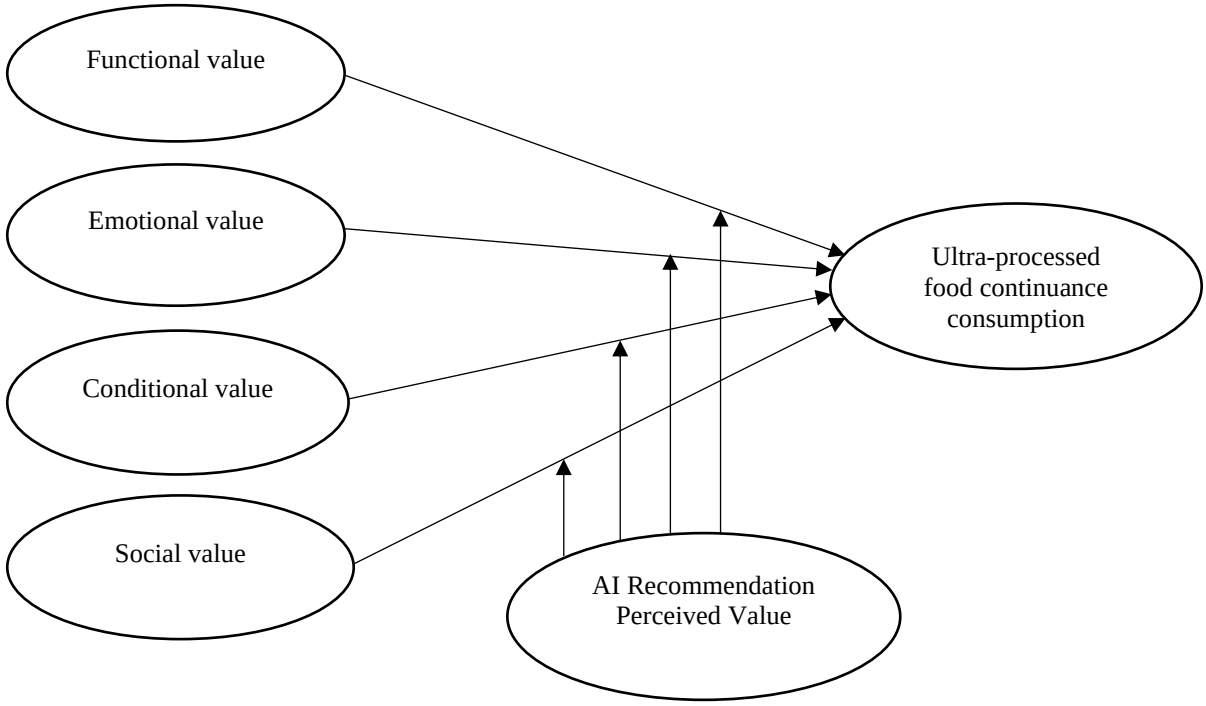


Figure 1. Conceptual framework of UPF continuance consumption

## Methodology

### *Sample*

Responses were gathered through an online survey from a sample of 286 university students who are consumers of UPF food and beverages. The study was conducted at universities located in northern peninsular Malaysia. Participants were university students who use AI recommendations for making decisions about their UPF consumption. Prospective respondents were required to have used AI recommendation services for dietary decisions. The samples are university students aged between 20 and 40 years old. Screening questions were developed to ensure eligibility based on these criteria. Detailed explanations and examples of AI recommendation services and UPF were provided to enhance respondents' understanding of these concepts. Google Survey Form was used for online data collection, it was chosen for its flexibility, convenience, and cost-effectiveness. Purposive sampling was employed, allowing for targeted recruitment of individuals with experience using AI recommenders and consumers of UPF. Data collection took place from March to May 2024. The survey explicitly informed participants that their involvement was voluntary and anonymous to reduced bias.

### Measurement

The measurement scales used in this study were adapted from existing literature. Each scale item was assessed using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The variables related to consumption value—functional, emotional, social, and conditional—were adapted from Akdim & Casalo (2023), Sheth et al. (1991), and Chakraborty & Dash (2022). Each

factor comprises three to four items that assess aspects such as functional, emotional, conditional, and social values associated with UPF consumption and perceived value of AI recommendation. The items demonstrated adequate scale reliability and consistency. All items are continuous measurement items, and they are modeled based on reflective measurement.

**Respondents' Profile**

The final collection of survey responses concluded after 12 weeks, yielding 286 valid responses. Measures were implemented in the survey design to minimize missing responses. Detailed demographic profiles are presented in Table 1.

Table 1: Respondents Profile

| Criteria | Category | Number | Percentage (%) |
|---|---|---|---|
| Gender | Male | 130 | 45 |
| | Female | 156 | 55 |
| Age Group | 20-25 | 120 | 42 |
| | 26-30 | 77 | 27 |
| | 31-35 | 48 | 17 |
| | 36-40 | 18 | 6 |
| Education Level | Undergraduate | 109 | 38 |
| | Master | 103 | 36 |
| | PhD | 74 | 26 |

**Analysis and Findings**

Details regarding the measurement model assessment are presented in Table 2. Prior to conducting data analysis, the study rigorously checked for the presence of common method bias (CMB). To assess this, the research employed Harman's one-factor test. This test involves combining all items in the model into a single factor to examine the variance explained by this factor. In this study, Harman's one-factor test yielded a value of 21.7%. According to the rule of thumb, values less than 50% suggest that common method bias is unlikely to significantly affect the results (Podsakoff, 2003). Therefore, the results indicate that there is no significant common method bias present in this research.

**Measurement model assessment**

The assessment of the measurement models validated the measurement scales at both the indicator and construct levels utilizing PLS algorithm calculation. In the first PLS algorithm calculation, all indicators exhibited loadings above 0.70, except for AIR2, which fell below this threshold. Consequently, indicator AIR2 was removed.

Then, measurement model assessment was re-run producing results as per Table 2. Table 2 displays the outer loadings, construct validity, and reliability, demonstrating the convergent validity of the measurement scales. Average Variance Extracted (AVE) values exceeded 0.50. Additionally, all constructs achieved high levels of composite reliability and Cronbach's alpha at 0.70 or above. Thus, the results of the specific measurement model met the established criteria.

Furthermore, we examined the variance inflation factor (VIF) to assess the problem of multicollinearity in the data. As suggested by past literature, the values of VIF must be less than 5, and this study found VIF values below the suggested range, depicting no issue of multicollinearity in the data (Hair et al., 2019).

Table 2: Results of the measurement model assessment

| Constructs & Source | Code | Items | FL | CR | AVE |
|---|---|---|---|---|---|
| Perceived Value of AI Recommendation (Akdim & Casalo, 2023) | AIR1 | I believe that using AI recommendations services to obtain recommendation is valuable | 0.812 | 0.845 | 0.646 |
| | AIR2 | I follow recommendations from AI systems | Deleted* | | |
| | AIR3 | I trust the recommendations made by AI systems | 0.843 | | |
| | AIR4 | AI recommendations are useful in improving my decision-making | 0.753 | | |
| Functional Value (Sheth et al., 1991) | FV1 | Consuming fortified beverages/energy drinks/coffee/soft drinks offer benefits for my focus and cognitive function | 0.838 | 0.895 | 0.682 |
| | FV2 | I consider purchasing ultra-processed foods (UPF) because of convenient compared to preparing fresh meals | 0.822 | | |
| | FV3 | I consider UPF offer the best quality for the best price | 0.806 | | |
| | FV4 | the longer shelf life of ultra-processed foods (UPF) is important in my food purchasing decisions | 0.836 | | |
| Emotional Value (Sheth et al., 1991) | EV1 | Eating UPF products make me feel satisfied | 0.801 | 0.910 | 0.717 |
| | EV2 | Eating UPF makes me feel like in a higher class | 0.904 | | |
| | EV3 | Consuming UPF brings good mood | 0.892 | | |
| | EV4 | Eating cakes/biscuits arouse feelings of happy | 0.783 | | |
| Conditional Value (Chakraborty & Dash, 2022) | CV1 | Under time pressure condition, I would like to purchase UPF | 0.931 | 0.947 | 0.857 |

| | | | | | |
|---|---|---|---|---|---|
| | CV2 | If UPF are available at reduced price, I would purchase them | 0.941 | | |
| | CV3 | If UPF are available at a discount or with a promotional offer, I would choose to purchase them | 0.904 | | |
| Social Value (Chakraborty & Dash, 2022) | SV1 | After purchasing UPF, I would feel acceptable. | 0.741 | 0.782 | 0.545 |
| | SV2 | After purchasing UPF, I would feel receiving social approval | 0.770 | | |
| | SV3 | Purchasing UPF would assist me improve my public image | 0.741 | | |
| UPF Continuance Consumption (Chakraborty & Dash, 2022) | UCC1 | In the near future, I intent to continue purchasing UPF | 0.713 | | |
| | UCC2 | I am thinking of ordering some UPF | 0.706 | | |
| | UCC3 | I will buy more UPF in the future | 0.750 | | |

To further ensure the discriminant validity of the constructs, the Heterotrait-Monotrait (HTMT) ratio was examined. Discriminant validity is affirmed when HTMT values are below the recommended threshold values of 0.85. As depicted in Table 3, all HTMT values fell below 0.85, firmly establishing the discriminant validity of the constructs.

Table 3. HTMT (0.85)

| **Constructs** | AIR | CV | UCC | EV | FV | SV |
|---|---|---|---|---|---|---|
| AIR | | | | | | |
| CV | 0.064 | | | | | |
| UCC | 0.691 | 0.456 | | | | |
| EV | 0.247 | 0.374 | 0.607 | | | |
| FV | 0.329 | 0.238 | 0.735 | 0.478 | | |
| SV | 0.506 | 0.373 | 0.811 | 0.410 | 0.603 | |

Note: AIR=AI Recommendation Perceived Value, CV=Conditional Value, UCC=UPF Continuance Consumption, EV=Emotional Value, FV=Functional Value, SV=Social Value

**Assessment of the structural model**

The structural equation model was assessed using 10,000 subsamples in the Bootstrapping calculation. The structural paths findings show all four values direct effects have significant effects on UPF continuance consumption. Thus, we accepted the direct relationships of H1, H2, H3 and H4. Moreover, the moderation effects results show that AI recommendations perceived value

significantly moderate the effect from Conditional and Emotional values but did not moderate the effect from Social and Functional values (see Table 4). Effect size, $f^2$ value for conditional, emotional, functional and social values are 0.055, 0.067, 0.056 and 0.027 suggested that the effect size shows small and significant effect. As for moderation effect of AIR*CON, effect size is 0.031, and AIR*EMO effect size is 0.055, also within significant small effect threshold.

Table 4. Summary of hypothesized relationships

| **Hypothesized Relationships** | **Beta** | ***f*²** | **Mean** | **STDEV** | **t-Value** | **Decision** |
|---|---|---|---|---|---|---|
| Direct Effects | | | | | | |
| CON → UCC | 0.184* | 0.055 | 0.180 | 0.058 | 3.156 | Supported |
| EMO → UCC | 0.235* | 0.067 | 0.232 | 0.070 | 3.386 | Supported |
| FUN →UCC | 0.215* | 0.056 | 0.217 | 0.057 | 3.776 | Supported |
| SOC → UCC | 0.146* | 0.027 | 0.152 | 0.058 | 2.519 | Supported |
| Moderation Effects | | | | | | |
| AIR*CON→UCC | 0.127* | 0.031 | 0.123 | 0.056 | 2.275 | Supported |
| AIR*EMO→UCC | 0.190* | 0.055 | 0.178 | 0.056 | 3.380 | Supported |
| AIR*SOC→UCC | $0.009^{ns}$ | 0.001 | 0.005 | 0.059 | 0.150 | Not supported |
| AIR*FUNC→UCC | $-0.045^{ns}$ | 0.003 | -0.045 | 0.055 | 0.821 | Not supported |

Note: * indicates significance at $p<0.05$, $^{ns}$ indicates not significant at $p<0.05$

Table 5. Model's predictive power results

| Construct | $R^2$ | $Q^2$ |
|---|---|---|
| UPF Continuance Consumption | 0.503 | 0.450 |

Note: Predictive relevance ($Q^2$); determination of coefficient ($R^2$)

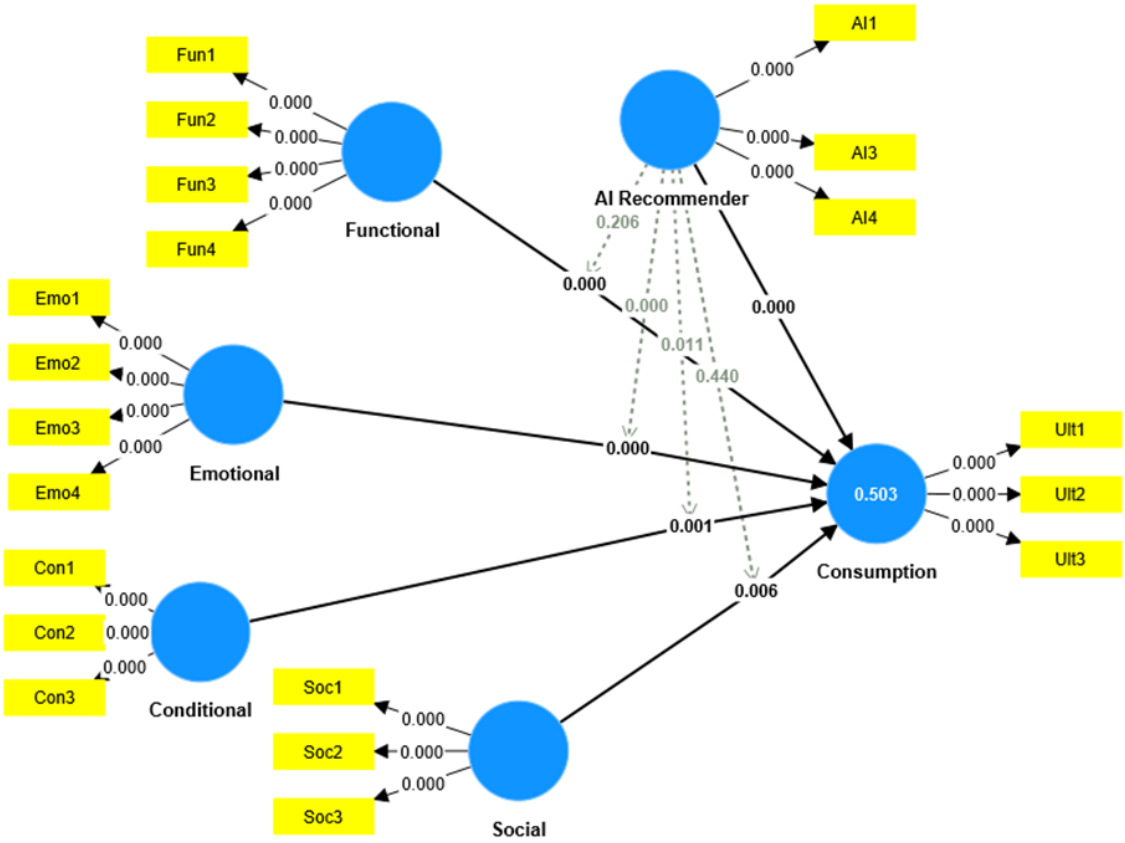


Figure 2. Structural model of UPF continuance consumption

Before scrutinizing the AI recommendation perceived value moderation effect, we assessed the model explanatory power. The values of determination of coefficient ($R^2$) are above threshold value 0.1. This study found that 50.3% variance occurred in UPF continuance consumption, explained by four consumption values can be considered moderate explanatory power. Moreover, the value of $Q^2$ should be larger than zero, at $Q^2$ equal to 0.450, model's predictive relevance was achieved. Hence, this study's results were both within the threshold level, and the study model's predictive relevance was achieved (see Table 5).

**Simple Slope Analysis for Significant Moderation Effects**

After observing significant moderation effects in the relationships (AIR*CON→UCC) and (AIR*EMO→UCC), a simple slope plot was generated to enhance understanding of these results from the moderator analysis. This plot visually illustrates the two-way interaction effect (see Figure 3 and Figure 4).

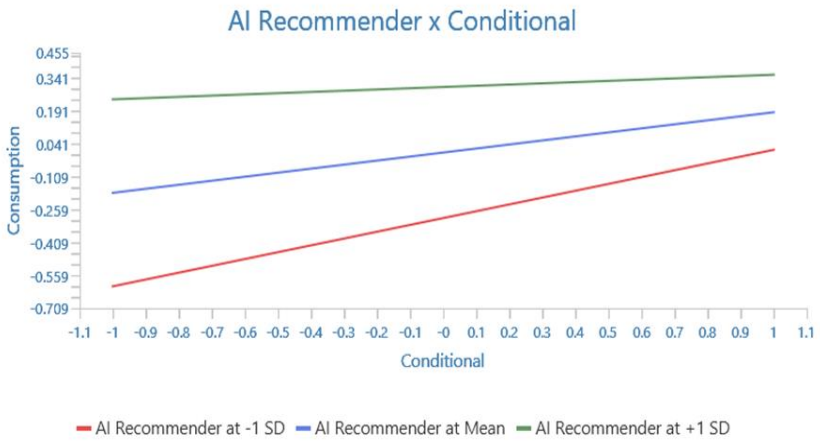


Figure 3. UPF Continuance Consumption by Conditional Value on Lower AI recommendation usage

The three lines shown in Figure 3 represent the relationship between Consumption (x-axis) and Conditional (y-axis). The middle line represents the relationship for an average level of the moderator variable, Perceived Value of AI Recommendation (AIR). The other two lines represents the relationship between Consumption of UPF and Conditional value for higher (i.e., mean value of AIR plus one standard deviation unit) and lower (i.e., mean value of AIR minus one standard deviation unit) levels of moderator variable AIR. The relationship between Consumption and Conditional is positive for all three lines as indicated by positive slope.

The steeper slope observed at -1 standard deviation unit indicates that the effect is more pronounced among samples with lower AI recommendation perceived values. In other words, when AI recommendation perceived values are lower, the impact on the outcome (UCC) is more significant.

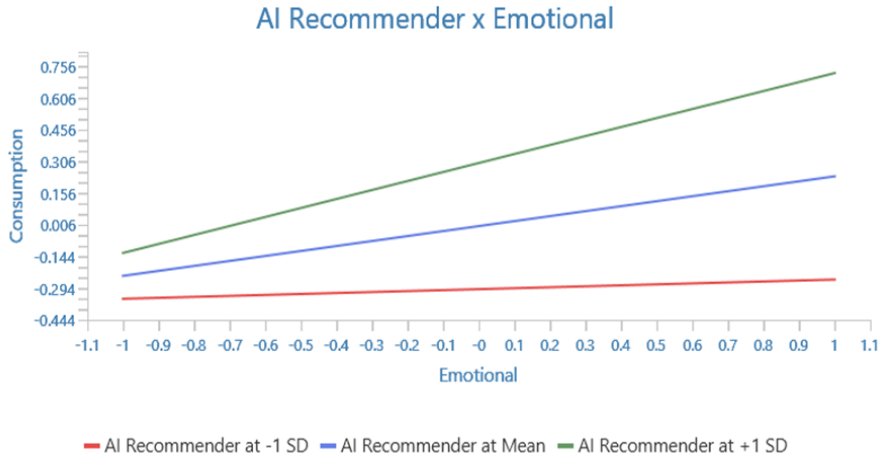


Figure 4. UPF Continuance Consumption by Emotional Value on Higher AI recommendation usage

In Figure 4, higher levels of Emotional values go hand in with higher levels of Consumption, meaning the emotional value commensurate with increase UPF consumption. The steeper slope is for +1 standard deviation unit, means at higher AI recommendation perceived value, UPF Continuance Consumption is more acute. Hence confirming that there is heterogeneity in samples who has high versus low AI recommendation perceived value.

**Discussion and Future Directions**

This study aimed to delve into the factors influencing the consumption of ultra-processed foods (UPFs) through the lens of four consumer values—functional, emotional, conditional, and social—based on the theory of consumption values. Additionally, it sought to investigate how the perceived value of AI recommendations moderates these values in relation to UPF consumption. The results revealed that all four consumer values positively impact UPF consumption among university students, aligning with previous research that emphasizes the critical role of consumer values in shaping dietary behaviors (Cao et al., 2022).

A particularly noteworthy finding is the significant moderation effect of AI recommendation perceived value on the emotional and conditional values related to UPF consumption. Specifically, AI recommendations enhance the emotional appeal of UPF consumption, suggesting that UPFs often serve as a stress-relief mechanism for students. Furthermore, conditional values, such as promotions and discounts facilitated by AI, are found to increase UPF purchases, indicating that AI-driven offers can effectively boost UPF consumption. These findings are consistent with clinical observations that highlight the emotional and conditional aspects of food consumption among youth.

Conversely, the perceived value of AI recommendations did not significantly moderate the functional and social values associated with UPF consumption. This suggests that university students' decisions regarding UPFs are less influenced by nutritional considerations and social influences when AI recommendations are involved. This unexpected outcome underscores the need for a more nuanced understanding of how AI impacts different facets of consumer behavior.

These mixed results underscore the importance of regulating marketing practices and AI algorithms that promote unhealthy dietary choices. While past research has suggested measures like taxing unhealthy foods (Caro et al., 2017), this study highlights the necessity of developing guidelines for AI recommendations. Such guidelines should ensure that AI systems prioritize nutritional value alongside convenience to promote healthier food choices. This study contributes to our understanding of the role AI plays in shaping consumption behaviors and offers insights into fostering healthier eating habits in a digital age.

The findings reflect a broader trend in the transformative influence of AI technologies on consumer behavior, particularly among younger populations (Pappalardo et al., 2024; Bojic, 2024). While university students are generally receptive to AI-driven prompts and view them as valuable aids, there are concerns about the potential negative impact on dietary choices, especially in the context of UPF consumption (Chari et al., 2023). These insights highlight a critical area for future research: understanding the nuanced role of AI in influencing consumer behavior, particularly among younger demographics, and addressing the risks associated with promoting UPFs.

It is important to note that this study's sample was limited to 286 full-time students from northern Peninsular Malaysia, which may affect the generalizability of the results. Future research should aim to replicate these findings with more diverse samples across different cultural contexts and demographic groups to enhance the applicability and validity of the results. Such studies could provide deeper insights into how AI recommendation systems interact with perceived values and influence dietary behaviors across varied populations.

**Theoretical and Practical Implications**

The Theory of Consumption Value (TCV) and Rational Choice Theory (RCT) utilized in this study have significantly advanced research in AI marketing and consumer behavior. These theoretical frameworks have provided coherence and structure to our research questions and design, effectively integrating AI recommendation technology with consumer values pertinent to the continuance consumption of Ultra-Processed Food (UPF) products.

The application of TCV highlights key factors—functional, emotional, conditional, and social values—that influence UPF repurchase intentions. It elucidates how these values interact with AI recommendations, shaping consumer decisions regarding unhealthy dietary products. Similarly, RCT offers insights into the rational decision-making processes influenced by AI recommendations in the context of UPF consumption.

Practically, the findings underscore the implications for Malaysia's retail sector, which has experienced substantial growth with the introduction of new retail concepts (Norfarah et al., 2018). Understanding how AI-driven recommendations affect consumer behavior towards UPF consumption provides valuable guidance for marketers and policymakers aiming to promote healthier dietary choices.

In conclusion, this study demonstrates that TCV and RCT are robust theories that delineate the conditions and boundaries of relationships involved in consumer decision-making. These theories offer a foundation for future research examining consumer values and choices related to UPF consumption across different economic strata, including middle-income and lower-income groups. Currently, there is insufficient data on the prevalence of UPF consumption in middle-income countries, warranting further investigation to comprehensively understand dietary habits in these specific contexts.

The practical application of TCV and RCT in this study addresses real-world challenges and provides actionable insights for policymakers and the Malaysian government on strategies to mitigate UPF consumption among university students and the broader population. By leveraging these theories, future research can contribute to evidence-based interventions that promote healthier eating behaviors and enhance public health outcomes.

**Conclusion**

This study set out to predict which factors influence UPF continuance consumption among universities students in northern peninsular Malaysia. The study has examined the role of AI recommendations perceived value as moderators in this model. This study has shown that all four

consumption values have a direct effect on UPF consumption. The second major findings were that AI recommendation moderates the effect of emotional and conditional values towards UPF consumption. The results of this research support the idea that university students' consumption of UPF can be predicted using theory of consumption value. The study has raised important questions about the need for regulation for AI recommendation as marketing tools. Although this study focuses on AI recommendations moderation effect, the findings may well have a bearing on consumer behavior.

The findings will be of interest to consumer marketing in the middle-income countries, as there is a significant lack of data on the prevalence of UPF consumption in middle-income countries. While some past studies had offer insights, comprehensive and forward-looking data are crucial to fully grasp UPF consumption in these economic contexts. This gap impedes researchers and policymakers from accessing current information necessary for assessing health implications, developing targeted interventions, and formulating policies to mitigate potential health risks associated with high UPF consumption in these regions.

The theoretical implications of these findings are significant. This study sheds light on the factors driving UPF consumption among university students, emphasizing the influence of functional, conditional, emotional, and social values. These results support the Theory of Consumption Value (TCV) by demonstrating that these values directly affect consumer behavior. Moreover, the study reveals how AI recommenders moderate emotional and conditional values, highlighting their significant role in shaping dietary choices. This underscores the need to incorporate AI considerations into theoretical frameworks to enhance our understanding of how emerging technologies influence consumer behavior, thereby supporting the Rational Choice Theory as well.

Although the findings should be interpreted with caution, this study possesses several methodological strengths that enhance its robustness and replicability. The use of a clear theoretical framework, systematic data collection, and rigorous analysis contributes to the reliability of the results. Furthermore, the study's design allows for replication in different contexts, which can help verify and extend these findings across diverse populations and settings.

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