



Understanding Behavioral Drivers Behind Students Intentions to Limit Ultra-Processed Food Intake

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Abstract: Indonesia faces increasing public health challenges due to the rising consumption of ultra-processed foods (UPF) driven by industrialization and urbanization. This study aims to identify the behavioral determinants influencing students' intentions to reduce UPF consumption by extending the Theory of Planned Behavior (TPB) with health consciousness and environmental concern. A quantitative explanatory design was applied involving 936 students in Malang City selected through purposive sampling. Data were collected using a structured online questionnaire and analyzed using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with WarpPLS 7.0. The results show that attitude, perceived behavioral control, and environmental concern significantly and positively affect students' intentions to reduce UPF consumption ($p < 0.01$). Both health consciousness and environmental concern act as significant mediators linking attitude, subjective norms, and perceived behavioral control with behavioral intention. The model explains 48.5% of the variance in students' behavioral intentions ($R^2 = 0.485$), indicating moderate predictive power. These findings emphasize the role of health and environmental awareness in shaping healthy and sustainable dietary intentions among university students. The study suggests that health and science education programs integrating behavioral and sustainability perspectives can effectively encourage reduced UPF consumption.

Keywords: Behavioral Intention; Health education; Science education ultra-processed foods; Theory of planned behavior

Introduction

The global nutrition transition driven by rapid industrialization, urbanization, and technological development has profoundly altered dietary patterns worldwide. Increasing dependence on ultra processed foods (UPF) foods high in sugar, fat, and synthetic additives has become a universal concern in health and environmental sciences (Baker et al., 2020). Beyond nutritional impacts, excessive UPF consumption is linked to rising global rates of obesity, diabetes, cardiovascular diseases, and even mental health issues (Atkinson et al., 2023; Pagliai et al., 2021). From an environmental perspective, the UPF industry

contributes to carbon emissions, water overuse, and non-biodegradable packaging waste, posing serious sustainability challenges (Atkinson et al., 2023).

Global consumption patterns, including in Indonesia, have undergone significant changes in line with the development of modern lifestyles, urbanization, and the growth of the food industry (Cyr-Scully et al., 2022; Kong et al., 2024). Consumption of foods that were once based on natural ingredients and minimally processed is now shifting toward ultra-processed foods (UPF), which are characterized by high levels of added sugar, saturated fat, sodium, and various synthetic additives such as colorings, emulsifiers, and preservatives (Calvo-Porrall et al., 2024; C. Monteiro et

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al., 2019). Ultra-processed foods are defined as industrial food products formulated with little or no whole foods, and generally contain synthetic additives such as colorings, artificial sweeteners, emulsifiers, and other additives that aim to extend shelf life and enhance flavor (C. A. Monteiro et al., 2018). This type of food has become a dominant part of people's daily consumption patterns, including in Indonesia, where products such as instant noodles, packaged snacks, sweetened drinks, and processed sausages are increasingly popular among young people, including college students (Setyowati et al., 2018; Wisnuwardani et al., 2022). This trend has raised serious concerns among public health experts because excessive consumption of UPF has been shown to contribute to the increasing prevalence of obesity, type 2 diabetes, cardiovascular disease, and other noncommunicable diseases (Nardocci et al., 2021; Srouf et al., 2019).

In Indonesia, a similar trend can be seen with the increase in consumption of ultra-processed products such as instant noodles, packaged snacks, and sweetened beverages, which contribute a significant portion of the total daily energy intake of the population (Diba, 2025; Setyowati et al., 2018). National data shows that in 2023, more than a third of the adult population will be overweight or obese, largely influenced by diets high in UPF (Kementerian Kesehatan RI, 2023). The NOVA classification as an analytical tool has been widely used to map the impact of processing levels on nutritional quality and consumer health, with ultra-processed foods being the main focus (Marino et al., 2021; C. Monteiro et al., 2019). In addition to its impact on health, UPF consumption also raises issues related to the environment and food system sustainability. The production process for ultra-processed foods generally has a higher carbon footprint, requires significant energy, and generates plastic packaging waste that is not environmentally friendly (Castellini & Graffigna, 2024). Thus, the issue of UPF consumption is not only relevant in the context of public health, but also important to discuss in the framework of sustainable agribusiness development, especially in relation to local food security and natural resource conservation.

Especially on campus, students are a productive age group that is prone to the trend of instant food consumption due to various factors, ranging from time constraints and costs to the influence of social media and advertising. In fact, students are also agents of change who have the potential to become pioneers of healthy lifestyles and sustainable food consumption. Therefore, it is important to understand the psychological and social factors that influence UPF consumption decisions in this group.

Understanding food-related behavior requires a theoretical foundation that captures cognitive, social,

and environmental determinants of decision-making. The Theory of Planned Behavior (TPB) proposed by Ajzen (1991) has been widely used to explain how attitudes, subjective norms, and perceived behavioral control influence behavioral intention and subsequent action (Sniehotta et al., 2014). Within food behavior research, TPB effectively predicts intentions toward healthy eating, sustainable food choices, and reduced meat or sugar consumption (Yadav & Pathak, 2017). In addition to these core constructs, variables such as health consciousness and environmental concern have been identified as important mediators or extensions of TPB, reflecting the growing complexity of behavioral motivations in modern consumer contexts (Dean et al., 2012).

One relevant theoretical approach is the Theory of Planned Behavior (TPB), which emphasizes the role of attitudes, subjective norms, and perceived self-control in shaping individuals' intentions and actual behavior (Ajzen, 1991; Montano et al., 2008). In this context, aspects of health consciousness and environmental concern should also be considered as external variables that can mediate the relationship between intention and consumption behavior (Ayuningtyas, 2021; Liu et al., 2022). In Indonesia, the rise of UPF consumption mirrors global trends and has become particularly prominent among university students who tend to prefer convenience foods due to time pressure, affordability, and social influence (Dyah Setyowati et al., 2018; Wisnuwardani et al., 2022). Despite its growing public health relevance, limited empirical studies have examined the psychological and social mechanisms influencing young adults' intention to reduce UPF consumption using a behavioral framework such as TPB. Most existing research in Indonesia focuses on dietary intake or nutritional status rather than the underlying behavioral intentions and mediating psychological constructs that drive consumption choices (Lubis, 2024).

Many people are still unaware of the dangers of consuming UPF. This is due to the limited information available and the lack of knowledge about UPF consumption in Indonesia. As a result, many people consume UPF excessively, which can be harmful to the body. This research is very important considering that the increasing consumption of UPF can be harmful to the body. This study aims to thoroughly examine the consumption behavior of ultra-processed foods among students using an approach that considers attitudes, subjective norms, and self-control perceptions toward the intention to reduce UPF consumption. Additionally, it investigates whether health awareness and environmental concern can mediate attitudes, subjective norms, and self-control perceptions in reducing the consumption of ultra-processed foods.

This study extends the traditional Theory of Planned Behavior by incorporating health consciousness and environmental concern as mediating variables, aiming to provide a more comprehensive understanding of students' behavioral intentions toward reducing UPF consumption. This integration of health and sustainability perspectives represents a novel contribution to behavioral nutrition studies in Indonesia. The urgency of this research lies in the need to develop evidence based strategies within higher education to foster healthy and environmentally responsible consumption habits among students an essential step toward achieving long-term national health and sustainability goals.

Method

Time and Location of Research

This study was conducted from October to December 2024 in Malang City, East Java Province, Indonesia. Malang was purposively selected because it represents an urban academic environment with a large student population and a high prevalence of modern food consumption patterns, including ultra-processed foods (UPF). The city's demographic characteristics make it a relevant setting for studying students' behavioral intentions toward reducing UPF consumption.

Population and Sample

The research population consisted of undergraduate students in Malang City who had experience consuming ultra-processed foods. The sample size was 936 respondents, obtained through purposive sampling from a total of 1,016 submissions.

Inclusion criteria included: (1) being an active undergraduate student aged 18–25 years, (2) having consumed UPF at least once in the past month, and (3) voluntarily completing the questionnaire. The minimum sample size was determined using Cohen's (1985) table with three arrows of power and a 5% significance level, indicating a minimum of 124 respondents. Therefore, the final sample exceeded the statistical requirement, ensuring adequate analytical power for SEM-PLS analysis.

Type of Research

This research employed a quantitative explanatory design, aiming to examine causal relationships among behavioral variables related to students' intentions to reduce UPF consumption (Prasetya et al., 2025). The study was grounded in an extended version of the Theory of Planned Behavior (TPB), incorporating health consciousness and environmental concern as additional mediating variables to enhance the explanatory power

of the original TPB constructs (attitude, subjective norms, and perceived behavioral control).

Research Method

This study uses two types of data, namely primary data and secondary data. Primary data was obtained through the distribution of closed questionnaires, while secondary data was obtained from literature studies that served to support and strengthen the analysis of primary data. The researcher set the criteria for respondents, namely undergraduate students who had consumed UPF. These criteria were chosen because young people are more adaptable to new things and represent potential future consumers. Data collection was conducted online using a closed-ended questionnaire based on Google Forms, which was distributed online. The questionnaire used a 5-point Likert scale for measurement. The sample selection in this study employed purposive sampling. Purposive sampling is a data collection technique based on specific considerations (Sugiyono, 2018). The sample size was determined using Cohen's formula or table (1985) based on the following criteria (Hair et al., 2022), with a power of 3 arrows and an alpha significance of 5%, the desired number of respondents is at least 124 people.

Data Analysis Methods

Descriptive statistical analysis is a statistical method used to describe collected data as it is, without making comparisons or drawing general conclusions (Sugiyono, 2018). Descriptive statistics include the presentation of the minimum, maximum, and average values of each variable analyzed in the study. To analyze complex relationships between variables, this study uses the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method with the help of WarpPLS 7.0 software. Structural Equation Modeling (SEM) is a powerful and flexible statistical technique used to analyze complex relationships between various variables, both directly measurable variables and latent variables (constructs) (Kline, 2023).

The SEM-PLS method consists of two main components, namely the outer model and the inner model. The outer model is used to test the relationship between latent constructs and the indicators that represent them, as well as to assess convergent validity, discriminant validity, and composite reliability (Budiarsi, 2020). Meanwhile, the inner model is used to evaluate the relationship between latent constructs based on a predetermined theoretical framework (Solimun et al., 2017). Dalam inner model, pengujian dilakukan melalui analisis nilai R-square, estimasi koefisien jalur, dan goodness-of-fit model (Semuel & Putra, 2018).

In this research model, shown in (Error! Reference source not found.), the factors influencing the intention to reduce UPF consumption are explained through the variables of the Theory of Planned Behavior (TPB). In this study, there are three independent variables:

Attitude (X1), Subjective Norms (X2), and Perceived Behavioral Control (X3). The dependent variable in this study is Behavioral Intention (Y). Additionally, this study includes two mediating variables: Health Consciousness (Z1) and Environmental Concern (Z2).

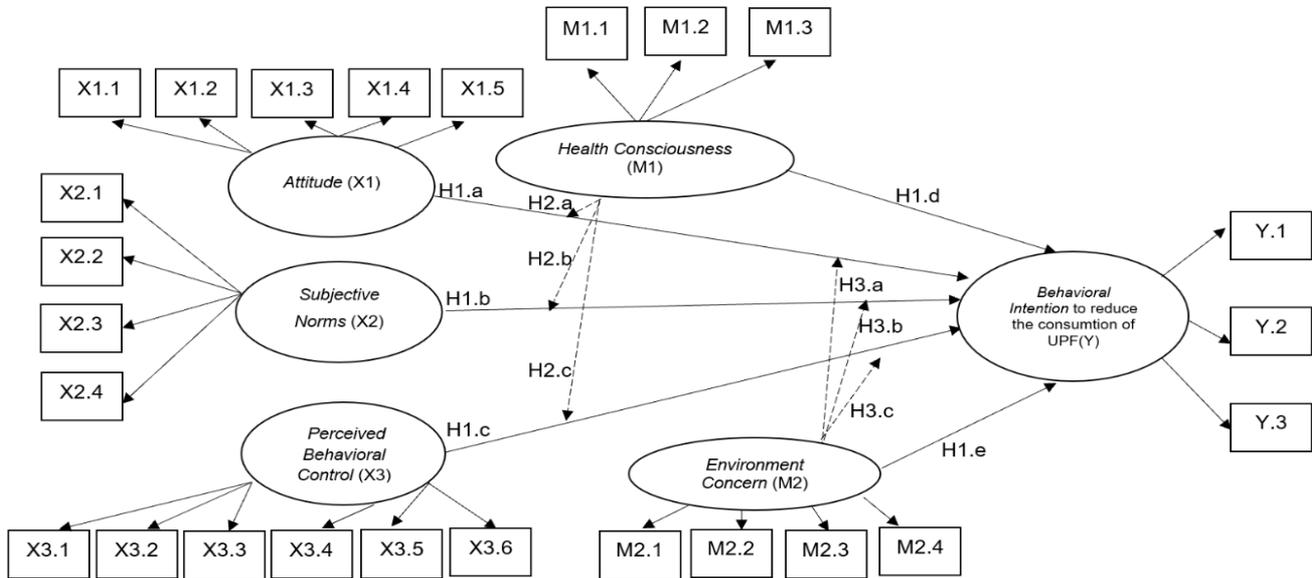


Figure 1. Research model

Result and Discussion

Result in Characteristic of Respondents and Descriptive Statistical Analysis

The criteria for samples or respondents used were undergraduate students aged at least 15 years old who

had consumed ultra-processed foods. In addition, respondents had a desire to reduce their consumption of ultra-processed foods. A total of 1,016 respondents filled out the questionnaire, but only 936 respondents met the established criteria and were willing to participate.

Table 1. Characteristic of Respondent (Primary Data Processed, 2025)

Characteristic	Categories	Total (Person)
Gender	Man	307
	Woman	629
Age	18	102
	19	209
	20	170
	21	179
	22	141
	23	66
	24	69
Income	< 500.000	150
	500.000-999.999	201
	1.000.000-1.499.999	228
	1.500.000-1.999.999	130
	2.000.000-2.499.999	90
	> 2.500.000	137
Frequency of Consumption Processed Foods	Ultra	
	More than once a day	99
	Once a day	220
	2-3 times a week	458
	Once a week	115
Rarely or never	44	

Based on the results above, it can be seen that the number of female respondents in this study was 629, while the number of male respondents was fewer than female respondents, namely 307 respondents. This is in line with a survey conducted by Rico-Campà et al., (2019) where women often show a higher level of concern for healthy eating, even if it requires sacrifices in terms of convenience and accessibility of food, which is often represented by ultra-processed foods.

From the results in the table above, respondents consume the most with a range of 2-3 times a week. This shows that the frequency of consumption varies, but the consumption pattern is still quite high, similar to the previous study (Prihandini et al., 2024), Consumption of ultra-processed foods is quite high because people prefer to eat quickly and easily after activities.

Table 2. Descriptive Statistical Analysis (Primary Data Processed, 2025)

Variable/ Item	Min	Max	Mean	Std. Deviation
X1 Attitude				
X1.1	1	5	4.19	0.832
X1.2	1	5	4.46	0.712
X1.3	1	5	3.67	0.935
X1.4	1	5	4.41	0.844
X1.5	1	5	4.28	0.765
X2 Subjective Norms				
X2.1	1	5	4.23	0.716
X2.2	2	5	4.16	0.695
X2.3	1	5	3.24	0.894
X2.4	1	5	3.80	0.777
X3 Perceived Behavioral Control				
X3.1	1	5	4.09	0.709
X3.2	1	5	4.05	0.712
X3.3	1	5	3.88	0.805
X3.4	1	5	3.81	0.800
X3.5	2	5	4.21	0.641
X3.6	1	5	3.97	0.775
Y Behavioral Intention				
Y1	1	5	4.38	0.626
Y2	1	5	4.34	0.607
Y3	2	5	4.37	0.654
M1 Health Consciousness				
M1.1	1	5	4.10	0.745
M1.2	1	5	4.04	0.770
M1.3	1	5	4.22	0.718
M2 Environmental Concern				
M2.1	1	5	4.14	0.680
M2.2	1	5	4.14	0.661
M2.3	1	5	4.37	0.603
M2.4	1	5	4.42	0.611

Based on the data in the descriptive statistical analysis table (Table 2) shows that the highest mean value for the attitude variable is 4.46, which falls into the high category (Solimun et al., 2017). The variable with the lowest mean value was subjective norm, with a value of 3.24, which falls into the moderate category. In data analysis, a low standard deviation value compared to the mean indicates that the data is well distributed and does not experience significant variation (Dugravot et al., 2015). Based on data from (Table 2), All standard deviation values for each variable are below the mean value, which means that no outliers were found in the sample data.

SEM-PLS (Partial Least Squares Structural Equation Modeling)

Outer Model

Convergent Validity

The first step in evaluating the outer model is to conduct a convergent validity test. Convergent validity in outer model evaluation aims to measure the extent to which reflective indicators correlate with latent variables. The validity of an indicator can be assessed through factor loading values, where values above 0.70 indicate that the indicator is valid in measuring the latent construct. Conversely, if the factor loading value is below 0.40, the indicator should be eliminated because

its contribution to the measured construct is considered weak (Hair et al., 2022). The following are the results of the convergent validity test in this study, presented in (Table 3).

The test results show that indicator M2.2 has very strong convergent validity with the highest loading

factor value of 0.844, while indicator X1.3 has the lowest value of 0.488. Although below the ideal limit, some studies still allow its use if the indicator is theoretically relevant and supports the understanding of the construct (Hair et al., 2022). That way, all variables used are valid.

Table 3. Convergent Validity Test Result (Primary Data Processed, 2025)

Variabel / Item	Nilai Loading	P-value
Standard Values	≥0.50	<0.05
X1 Attitude		
X1.1	0.799	<0.05
X1.2	0.821	<0.05
X1.3	0.488	<0.05
X1.4	0.788	<0.05
X1.5	0.793	<0.05
X2 Subjective Norms		
X2.1	0.615	<0.05
X2.2	0.721	<0.05
X2.3	0.745	<0.05
X2.4	0.713	<0.05
X3 Perceived Behavioral Control		
X3.1	0.823	<0.05
X3.2	0.848	<0.05
X3.3	0.715	<0.05
X3.4	0.716	<0.05
X3.5	0.733	<0.05
X3.6	0.791	<0.05
Y Behavioral Intention		
Y1	0.805	<0.05
Y2	0.854	<0.05
Y3	0.833	<0.05
M1 Health Consciousness		
M1.1	0.862	<0.05
M1.2	0.884	<0.05
M1.3	0.810	<0.05
M2 Environmental Concern		
M2.1	0.772	<0.05
M2.2	0.791	<0.05
M2.3	0.826	<0.05
M2.4	0.811	<0.05

In addition to using the loading factor, convergent validity is also evaluated through the Average Variance Extracted (AVE) value. If the AVE value reaches or exceeds 0.50, the latent construct is considered capable of adequately explaining most of the variance of its indicators. Conversely, if the AVE value is below 0.50, this indicates that the construct does not adequately represent the indicators used, suggesting that there may be another construct more suitable for explaining the variance (Hair et al., 2022). Based on the test results, the following AVE values were obtained: Attitude (0.560), Subjective norms (0.490), Perceived Behavioral Control (0.597), Behavioral Intention (0.690), Health Consciousness (0.727), Environmental Concern (0.640). The analysis results indicate that most constructs meet

the standards, although the subjective norms variable is slightly below the threshold (0.49). However, this is still acceptable if the composite reliability remains high (≥ 0.70), indicating that the construct can still adequately represent its indicators (Fornell & Larcker, 1981). This result aligns with findings by (Ismagilova et al., 2020), who reported that individuals with higher environmental concern exhibit stronger pro-environmental purchase intentions. Likewise, (Gleim et al., 2013) emphasized that environmental awareness is a key psychological driver of green consumer behavior. Overall, convergent validity has been fulfilled, indicating adequate reliability of the measurement model.

Discriminant Validity and Reliability

The next step in evaluating the outer model is to conduct a discriminant validity test. Discriminant validity aims to measure the extent to which a construct in the model has clear differences from other constructs, so that each latent variable can be uniquely identified (Henseler et al., 2015). Discriminant validity testing can

be done by comparing the square root of the Average Variance Extracted (AVE) with the correlation between constructs in the model (table 4) present this comparison for each latent variable analyzed. According to Solimun et al. (2017), discriminant validity can be considered good if the square root AVE value for a latent variable is greater than its correlation with other latent variables.

Table 4. Discriminant Validity Test Result (Primary Data Processed, 2025)

	X1	X2	X3	Y	M1	M2
X1	(0.749)	0.319	0.514	0.507	0.395	0.430
X2	0.319	(0.700)	0.471	0.380	0.352	0.337
X3	0.514	0.471	(0.773)	0.562	0.536	0.511
Y	0.507	0.380	0.562	(0.831)	0.450	0.573
M1	0.395	0.352	0.536	0.450	(0.852)	0.539
M2	0.430	0.337	0.511	0.573	0.539	(0.800)

Table 5. Reliability Test Result (Primary Data Processed, 2025)

	Value standards	Composite reliability	Cronbach's alpha
X1 Attitude	>0.07	0.861	0.795
X2 Subjective Norms	>0.07	0.793	0.651
X3 Perceived Behavioral Control	>0.07	0.898	0.864
Y Behavioral Intention	>0.07	0.870	0.776
M1 Health Consciousness	>0.07	0.888	0.811
M2 Environmental Concern	>0.07	0.877	0.813

Based on the results of the analysis presented in (Table 4), It can be seen that the square root value of Average Variance Extracted (AVE), shown in parentheses, has a higher value than the correlations between other constructs. This confirms that each latent variable in the model has good discriminant validity, because the square root value of AVE is greater than the correlations between other constructs constructs (Fornell & Larcker, 1981). For example, for variable M1, the AVE square root value obtained is 0.852, which is higher than the correlations with other latent variables, namely X1 (0.749), X2 (0.700), X3 (0.773), Y (0.831), and M2 (0.800). Next, reliability testing was conducted by assessing the composite reliability and Cronbach's alpha values. According to Solimun et al. (2017), a construct is considered reliable if it has a composite reliability value ≥ 0.70 and Cronbach's alpha > 0.60 . Based on the reliability test results (Table 5), all variables in this study met both criteria, indicating that each construct had good internal consistency and was suitable for further analysis.

Inner Model

After testing the outer model, the next step is to test the inner model to evaluate the relationship between latent variables and the extent to which independent variables explain dependent variables (Hair et al., 2022). The evaluation was conducted through path coefficient analysis, R-square, VIF, Q-square, effect size (f^2), and

Goodness of Fit (GoF) to assess the predictive power and overall model fit.

Path coefficients indicate the direction and strength of the relationship between latent variables. The closer the value is to +1 or -1, the stronger and more significant the relationship between constructs. Conversely, values close to 0 indicate a weak and insignificant relationship. The path coefficient results in this study are presented in a structural model in figure 2. Based on figure 2, the path coefficients in the structural model show that some variables have positive path coefficients (+), while some variables have negative path coefficients (-). The relationship between X1 and Y, X2 and Y, X3 and Y, M1 and Y, M2 and Y, the mediating effect of M1 on X1 and Y, the mediating effect of M1 on X2 and Y, the mediating effect of M1 on X3 and Y, the mediating effect of M2 on X1 and Y, the mediating effect of M2 on X2 and Y, and the mediating effect of M2 on X3 and Y all show positive paths. This result aligns with previous findings by (Yadav & Pathak, 2017), who reported that attitude had a strong positive influence on consumers' intentions to purchase green products based on the Theory of Planned Behavior. Similarly, (Dean et al., 2012) found that attitude was the most significant determinant of pro-environmental behavioral intentions among young consumers. In the context of dietary behavior, research by (Kothe & Mullan, 2014) also confirmed that a favorable attitude toward healthy eating increases the likelihood of implementing such behavior. For example, the relationship between X1 (attitude) and Y (behavioral

intention) has a good path coefficient, indicating that a person's attitude positively influences their intention to reduce UPF consumption. The path coefficients for attitude, subjective norms, Perceived Behavioral Control, and Environmental Concern toward behavioral intention are 0.22, 0.08, 0.22, and 0.30, respectively, with p-values <0.01. These values indicate that attitude, subjective norms, Perceived Behavioral Control, and

Environmental Concern each have a positive and significant effect on behavioral intention by 22%, 8%, 22%, and 30%, respectively. The path coefficient of health consciousness on behavioral intention is 0.08 with a p-value of 0.01, indicating a small positive effect as the value is close to 0. However, the p-value = 0.01 (less than 0.05), so the relationship remains statistically significant.

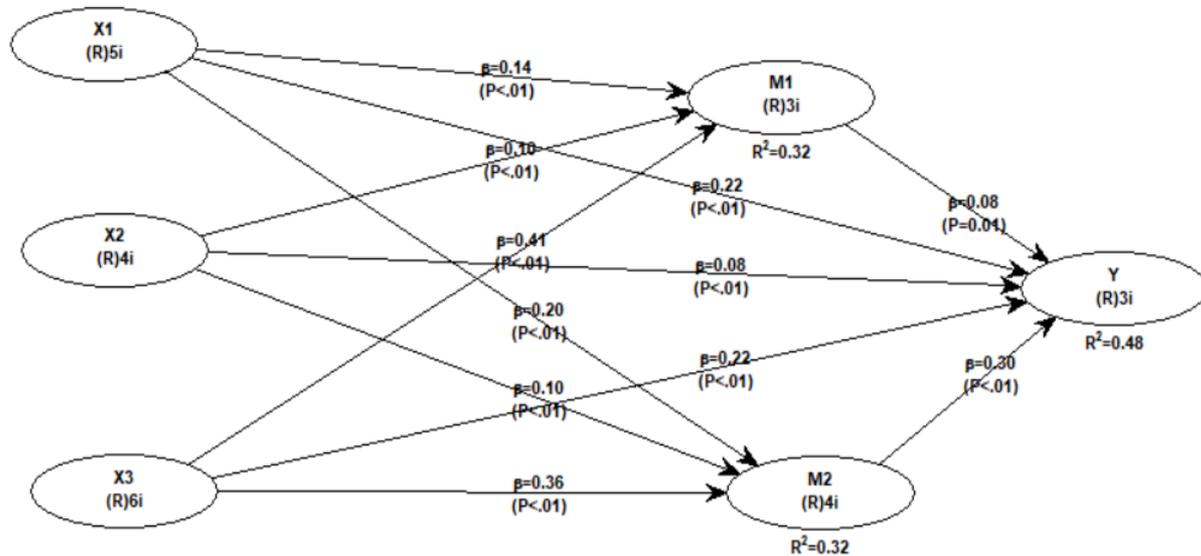


Figure 2. Path coefficients values in structural models

Meanwhile, the path coefficients for the mediating variable Health Consciousness from attitude, subjective norms, and Perceived Behavioral Control toward behavioral intention are 0.14, 0.10, and 0.41, respectively, with a p-value of 0.01. The path coefficients for the mediating variable Environmental Concern from attitude, subjective norms, and Perceived Behavioral Control toward behavioral intention are 0.20, 0.10, and 0.36, respectively, with a p-value of 0.01.

The R-square test shows the extent to which independent variables explain dependent variables. The inner model test is then conducted by analyzing the coefficient of determination (R-square), which is used to assess the extent to which independent variables are able to explain the variability of dependent variables in the research model. The R-square value ranges from 0 to 1, with the following interpretations: 0.75 (substantial), 0.50 (moderate), and 0.25 (weak) for endogenous latent variables (Hair et al., 2022). An R-square value of 0.485 falls into the moderate category, meaning that X1, X2, X3, M1, and M2 explain 48.5% of the variation in behavioral intention (Y), with the remaining 51.5% influenced by other factors (Hair et al., 2022). The R-square value for health consciousness (M1) is 0.322 and for environmental concern (M2) is 0.319, both of which are also in the moderate category. This indicates that although the relationship between variables is quite

strong, there are still external factors that influence M1, M2, and Y.

Based on the results of the path coefficient analysis, it can be seen that the first objective, attitude, has a positive and significant influence on behavioral intention, especially if reducing ultra-processed foods is considered useful for students. Perceived Behavioral Control also has a positive and significant influence, because students feel capable of reducing their consumption of ultra-processed foods. Environmental Concern has a positive and significant influence on students' behavioral intention to reduce consumption of ultra-processed foods, as students feel that significant social change is necessary to protect the environment.

Subjective Norms have a positive but weak and significant influence, as attitude and Perceived Behavioral Control play a larger role in influencing behavioral intention. Additionally, Health Consciousness also has a positive but weak and significant influence, especially if students perceive themselves as health-conscious consumers.

In the second objective, the variable Health Consciousness, as a mediating variable, has a positive and significant influence on the relationship between attitude and behavioral intention. This is because the high health consciousness that students have toward the intention to reduce consumption of ultra-processed

foods can enhance their attitude toward the high intention to behave in reducing consumption of ultra-processed foods. The variable subjective norms toward behavioral intention, mediated by Health Consciousness, has a positive and significant effect, as students with high levels of health consciousness are more influenced by positive opinions from their social environment regarding the benefits of reducing consumption of ultra-processed foods. The Health Consciousness variable, as a mediating variable, also has a positive and significant influence on the relationship between Perceived Behavioral Control and behavioral intention, especially if students feel they can access healthy foods or have control over their food choices to intend to reduce consumption of ultra-processed foods.

Then, in the third objective, the Environmental Concern variable as a mediating variable had a positive and significant effect on the relationship between attitude and behavioral intention, because students who had a positive attitude toward environmentally friendly consumption also tended to have a high concern for the environmental impact of their consumption behavior. In the relationship between subjective norms and behavioral intention, Environmental Concern acts as a mediator with a positive and significant effect, as

support from peers, family, and the community encourages students to adjust their eating behavior to align with social expectations and environmental concerns. The Environmental Concern variable, also acting as a mediating variable, has a positive and significant influence on the relationship between Perceived Behavioral Control and behavioral intention, as environmental concern strengthens the belief that individual actions, such as reducing consumption of ultra-processed foods, have positive ecological impacts, thereby increasing their intention to act in accordance with their control and values.

The final evaluation of the inner model was conducted by assessing the Goodness of Fit (GoF) value, which indicates how well the model can accurately explain the relationships between constructs (Hair et al., 2022). Based on table 4, the model is considered valid because the APC, ARS, and AARS values are significant ($p < 0.05$), and $AVIF \leq 5$ and $AFVIF \leq 3.3$, indicating no multicollinearity. A GoF value ≥ 0.36 indicates that the model has a high fit with the data (Tenenhaus et al., 2005). Additionally, SPR and RSCR values of 1.000, along with SSR and NLBCDR ≥ 0.7 , confirm that this model is valid and reliable for further analysis.

Table 6. Goodness of Fit indices results (Primary Data Processed, 2025)

Model fit and quality indices	Criteria Fit	Results	Information
Average path coefficient (APC)	$p < 0.05$	0.201 (P<0.001)	Fulfilled
Average R-squared (ARS)	$p < 0.05$	0.375 (P<0.001)	Fulfilled
Average adjusted R- squared (AARS)	$p < 0.05$	0.373 (P<0.001)	Fulfilled
Average block VIF (AVIF)	Acceptable if ≤ 5 , ideally ≤ 3.3	1.618	Fulfilled
Average full collinearity VIF (AFVIF)	acceptable if ≤ 5 , ideally ≤ 3.3	1.701	Fulfilled
Tenenhaus GoF (GoF)	small ≥ 0.1 , medium ≥ 0.25 , large ≥ 0.36	0.481	Large
Sympson's paradox ratio (SPR)	acceptable if ≥ 0.7 , ideally = 1	1.000	Fulfilled
R-squared contribution ratio (RSCR)	acceptable if ≥ 0.9 , ideally = 1	1.000	Fulfilled
Statistical suppression ratio (SSR)	acceptable if ≥ 0.7	1.000	Fulfilled
Nonlinear bivariate causality direction ratio (NLBCDR)	acceptable if ≥ 0.7	1.000	Fulfilled

Next, hypothesis testing was conducted to examine the relationship between variables in the model. The testing was performed using WarpPLS analysis with t-test criteria. The hypothesis was accepted if the p-value was ≤ 0.05 with a significance level of 5%. Based on the test results, the explanations for each operational hypothesis are presented as follows:

$H_0 = \lambda_i = 0$: attitude has a negative impact on behavioral intention.

$H_{1.a} = \lambda_i \neq 0$: attitude has a positive impact on behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.22, and the p-value for hypothesis 1.a is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the result is significant, and the coefficient obtained is positive. Therefore, it can be

concluded that H_0 is rejected and $H_{1.a}$ is accepted, meaning that there is a positive influence of attitude on behavioral intention. Thus, an increase in attitude can increase behavioral intention.

$H_0 = \lambda_i = 0$: subjective norms have a negative impact on behavioral intention.

$H_{1.b} = \lambda_i \neq 0$: subjective norms have a positive impact on behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.08 and the p-value for hypothesis 1.b is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the results obtained are significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{1.b}$ is accepted, meaning that there is a positive influence of subjective

norms on behavioral intention. Thus, an increase in subjective norms will also increase behavioral intention.

$H_0 = \lambda_i = 0$: perceived behavioral control has a negative effect on behavioral intention.

$H_{1.c} = \lambda_i \neq 0$: perceived behavioral control has a positive effect on behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.22 and the p-value for hypothesis 1.c is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the result obtained is significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{1.c}$ is accepted, meaning that there is a positive effect of perceived behavioral control on behavioral intention. Thus, an increase in perceived behavioral control will also increase behavioral intention.

$H_0 = \lambda_i = 0$: health consciousness has a negative effect on behavioral intention.

$H_{1.d} = \lambda_i \neq 0$: health consciousness has a positive effect on behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.08 and the p-value for hypothesis 1.d is 0.01. This result indicates that the p-value is ≤ 0.05 , so the results obtained are significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{1.d}$ is accepted, meaning that there is a positive effect of health consciousness on behavioral intention. Thus, an increase in health consciousness will also increase behavioral intention.

$H_0 = \lambda_i = 0$: environmental concern has a negative effect on behavioral intention.

$H_{1.e} = \lambda_i \neq 0$: environmental concern has a positive effect on behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.30 and the p-value for hypothesis 1.e is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the results obtained are significant and the coefficients obtained are positive. Therefore, it can be concluded that H_0 is rejected and $H_{1.e}$ is accepted, meaning that there is a positive effect of environmental concern on behavioral intention. Thus, an increase in environmental concern will also increase behavioral intention.

$H_0 = \lambda_i = 0$: health consciousness does not mediate attitude with behavioral intention.

$H_{2.a} = \lambda_i \neq 0$: health consciousness mediates attitude with behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.14 and the p-value for hypothesis 2.a is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the results obtained are significant and the coefficients obtained are positive. Therefore, it can be concluded that H_0 is rejected and $H_{2.a}$ is accepted, meaning there is a positive mediating effect of health

consciousness between attitude and behavioral intention. Thus, increasing the mediating effect of health consciousness through attitude will enhance behavioral intention.

$H_0 = \lambda_i = 0$: Health consciousness does not mediate subjective norms and behavioral intention.

$H_{2.b} = \lambda_i \neq 0$: Health consciousness mediates subjective norms and behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.10 and the p-value for hypothesis 2.b is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the obtained result is significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{2.b}$ is accepted, meaning there is a positive mediating effect of health consciousness between subjective norms and behavioral intention. Thus, increasing the mediation of subjective norms through attitude will enhance behavioral intention.

$H_0 = \lambda_i = 0$: health consciousness does not mediate perceived behavioral control and behavioral intention.

$H_{2.c} = \lambda_i \neq 0$: health consciousness mediates perceived behavioral control and behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.41 and the p-value for hypothesis 2.c is < 0.001 . These results indicate that the p-value is ≤ 0.05 , so the results obtained are significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{2.c}$ is accepted, meaning that there is a positive mediating effect of health consciousness between perceived behavioral control and behavioral intention. Thus, an increase in health consciousness mediation through perceived behavioral control will increase behavioral intention.

$H_0 = \lambda_i = 0$, environmental concern does not mediate attitude with behavioral intention.

$H_{3.a} = \lambda_i \neq 0$: environmental concern mediates attitude with behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.20 and the p-value for hypothesis 3.a is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the obtained result is significant and the coefficient obtained is positive. Therefore, it can be concluded that H_0 is rejected and $H_{3.a}$ is accepted, meaning there is a positive mediating effect of environmental concern between attitude and behavioral intention. Thus, increasing the mediating effect of environmental concern through attitude will enhance behavioral intention.

$H_0 = \lambda_i = 0$: environmental concern does not mediate subjective norms and behavioral intention.

$H_{3.b} = \lambda_i \neq 0$: environmental concern mediates subjective norms and behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.10 and the p-value for

hypothesis 3.b is < 0.001 . This result indicates that the p-value ≤ 0.05 , so the obtained result is significant and the coefficient obtained is positive. Therefore, it can be concluded that H0 is rejected and H3.b is accepted, meaning there is a positive mediating effect of environmental concern between subjective norms and behavioral intention. Thus, increasing the mediating effect of environmental concern through subjective norms will enhance behavioral intention.

H0 = $\lambda_i = 0$: environmental concern does not mediate perceived behavioral control and behavioral intention.

H3.c = $\lambda_i \neq 0$: environmental concern mediates perceived behavioral control and behavioral intention.

Based on the results of the hypothesis testing analysis, the coefficient value is 0.36 and the p-value for hypothesis 3.c is < 0.001 . These results indicate that the p-value ≤ 0.05 , so the results obtained are significant and the coefficient obtained is positive. Therefore, it can be concluded that H0 is rejected and H3.c is accepted, meaning there is a positive mediating effect of environmental concern between perceived behavioral control and behavioral intention. Thus, increasing the mediating effect of environmental concern through perceived behavioral control will enhance behavioral intention.

Conclusion

This study demonstrates that attitude, perceived behavioral control, and environmental concern significantly influence students' intentions to reduce ultra-processed food (UPF) consumption, with health consciousness and environmental concern serving as key mediators that enhance the explanatory power of the extended Theory of Planned Behavior (TPB). These findings emphasize the importance of integrating health awareness and environmental responsibility into behavioral education programs to encourage sustainable and healthy eating habits among university students. Theoretically, this study contributes to expanding the TPB framework in the context of sustainable nutrition behavior. However, since the data were collected through self-reported online questionnaires within a cross-sectional design, potential response bias and limited causal interpretation remain as shortcomings. Therefore, future research should adopt longitudinal or experimental approaches and include more diverse populations to strengthen the generalizability and temporal validity of the findings.

Author Contributions

Conceptualization, F.A., T.W.N and A.W.M; methodology, F.A.; software, F.A.; validation, F.A.; formal analysis, F.A.; writing – original draft preparation, F.A.; writing – review and editing, F.A.

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Conflicts of Interest

The authors declare no conflict of interest.

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