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# The Influence of Food Motives on Attitude: A Study of Genetically Modified Organism Food in Malaysia

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***Abstract:***

*The influence of food motives on Malaysian consumers' attitudes towards genetically modified (GMO) foods is explored in this study, specifically to investigate whether motivations can be explained by four dimensions: knowledge, risk perception, technology orientation and labelling. A structured questionnaire was used to collect 337 usable responses. Structural Equation Modelling (SEM) was employed to test the hypothesised relationship. The findings reveal that food motive has a significantly positive influence on consumer attitude toward GMO food. The results of the study emphasise the necessity to improve consumers' knowledge, risk perceptions, and to increase labelling transparency to increase the consumers' support for GMO food products in Malaysia. The findings offer policy implications for policymakers, advertisers, and stakeholders involved in GMO food promotion and regulation.*

***Keywords: Genetically Modified Organism (GMO) Food, Food Motives, Consumer Attitude, Malaysia***

***ARTICLE INFORMATION***

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## INTRODUCTION

The developments achieved in the field of biotechnology have resulted in a considerable increase in the production and commercialisation of genetically modified organisms (GMOs) derived food in many countries. This development is accompanied by a controversial, so far positive, discussion on consumer acceptance in various regions (Fröder et al., 2020; Kwak et al., 2020). Western countries, including the US, have largely incorporated GMO foods into the food supply without much opposition. However, consumers in the European Union and some parts of Asia indicate the opposite viewpoint, where they had increased levels of concern regarding health safety from potential risks, environmental effects, and ethical dimensions of genetically modifying foods (Russo et al., 2020). The differing attitudes observed reflect the influence of cultural perspectives on the perception and magnitude of risks, as well as the availability of information, all of which collectively shape public perceptions of GMO food products.

Recent studies provide the main concerns about genetically modified foods, many of which have recently been empirically reviewed. Systematic studies have demonstrated that when GMOs conduct thorough regulatory testing, health-related concerns, including potential allergenicity and inadvertent gene transfer, are reduced (Rodríguez-Oramas et al., 2022; Wen, Wang, & Sun, 2024). While they are frequently mentioned, environmental issues such as cross-pollination and biodiversity loss have been largely addressed by precision breeding technology and biosafety frameworks (Vega Rodríguez et al., 2022). Furthermore, long-term feeding studies and meta-analyses have objectively debunked beliefs about GMO foods being hazardous or linked to cancer by demonstrating their nutritional and safety

equivalence to conventional crops (Goodman et al., 2024). However, due to a lack of trust and misinformation, public mistrust persists, underscoring the importance of open communication and evidence-based education.

Some consumers in Malaysia remain unconvinced of GMO food, regardless of global developments and regulations. According to studies, it stems from inadequate public awareness, misconceptions about the health risks associated with biotechnology, low level of confidence in the safety of novel technologies, and a lack of clear labelling standards that could let consumers know about their high level of transparency (Kwak et al., 2020; Muringai, 2020). The technology orientation, which indicates trust and acceptance in scientific innovation, is also important, since another element of trust in consumer responses towards GMOs affects consumers' trust in biotechnology (Russo et al., 2020). Moreover, clear and consistent labeling has been pointed out as an important element for consumer empowerment and well-informed choice, to overcome the irregularities in information that sustain negative perceptions (Fröder et al., 2020).

Although studies have been conducted on the individual influences of GMO acceptance, it is still uncertain how multiple food motives, namely knowledge, risk perception, technology orientation, and labelling awareness, together influence Malaysian consumer attitude, especially in the socio-cultural Malaysian situation (Chen et al., 2011; Wallnoefer et al., 2021). That this gap is addressed is important since consumer attitudes are a strong predictor of behavioural intentions in this and especially in cases of new food technology contexts.

Given this background, this study was designed to gather more empirical evidence on examining whether/which these four dimensions of food motives influence Malaysian consumers' attitudes toward GMO foods. Considering all these influences within a comprehensive framework, the current study aims to provide policymakers, industry players, and marketers with information to inform the formulation of customised strategies that improve consumer understanding, trust, and transparency in labelling for biotechnology. Ultimately, the formation of well-informed and favourable attitudes is vital to sustain the use of GMO food products in Malaysia.

## LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Although the regulatory-approved genetically modified foods are typically considered safe when proper risk evaluations are conducted, consumer concerns over the long-term effects, environmental impact, and possible allergenicity remain significant (Wen, Wang, & Sun, 2024; Warda et al., 2024). Comparative studies and meta-analyses also indicate that public acceptance of newer technologies, such as gene editing, is generally higher than that of older GMO techniques, particularly when institutions are trusted and labels are transparent (Paleologo et al., 2024). Perceptions of danger are considerably moderated in ASEAN nations by regulatory clarity, labelling regulations, and perceived benefits, such as nutritional enhancement (Rahman & Hoque, 2023). The inclusion of such research assists in presenting the Malaysian situation within a more expansive and dynamic empirical framework.

Investigating consumers' perception of genetically modified organism (GMO) food can be convenient in order to understand their food consumption decisions. The concept of food motives includes several cognitive and perceptual factors, including knowledge, risk perception, technology orientation, and labelling awareness, which significantly affect consumer utilisation concerning food choices (Wallnoefer et al., 2021; Konttinen et al., 2021). Previous researches have emphasized that consumers' willingness to accept or not GMO foods is rarely influenced by a unique factor but that is the combination of a set of factors interacting in a multifaceted manner, such as information knowledge, perception of risk, trust on the scientific progress and the transparency of the product labelling (Russo et al., 2020; Fröder et al., 2020). Drawing on consumer behaviour theories, especially the Theory of Planned Behaviour (TPB) by Ajzen (1991), this research combines four major dimensions of food motives to understand their combined effect on attitudes toward GMO food products. The following subsections discuss each dimension of the attitude toward GMO food and then consolidate a theoretical basis underlying the contention that food motives lead to a positive effect on consumer attitudes toward GMO food.

**Food Motives and Attitudes**

Food motives represent the deeper psychological, cultural, and social reasons for which consumers make food decisions. These reasons assortment from health, convenience, taste, morality, and information about the source of food (Renner et al., 2012). Attitude was defined in the present context as a consumer's overall positive or negative evaluation of each of the food choices based upon these motives (Ajzen, 1991). The relationship between food motives and consumer attitudes is particularly important in generating nutritional consumption and preferences. Studies have shown that the perception of various factors, such as risk, benefits, technological advances, and labelling transparency, affects consumers' attitudes towards food (Kushwah et al., 2019). For example, health-oriented consumers have a tendency to form positive attitudes toward organic or natural foods, whereas convenience-oriented consumers might prefer processed ones. Therefore, food motives serve as precursors to consumer attitudes; they inform not only what people eat but also how they will appraise different food categories. It has important implications for policymakers and marketers interested in encouraging healthier or more sustainable choices of food. When food motivation is in line with favourable attitudes, it is suggested that a consumer is more likely to perform desired behaviours such as the choice of environmentally or nutritionally healthy products (Verain et al., 2021).

**Knowledge**

Consumer awareness is a key determinant in attitudes towards Genetically Modified Organisms (GMO) foods. It is also well established that people who have a higher level of awareness and knowledge regarding GMO technologies are likely to be more positive, or at least they might make more informed decisions (Nawaz et al., 2019). Knowledge would expand indistinctness, correct misconceptions, and support consumers to be better informed about the benefits and possible risks of GMO products (Hirschi, 2020). Information appeared as an independent dimension of the general field of food motives in this study (see factor analyses). The survey responses showed differences in knowledge of GMO content, differentiation from conventional foods, and maturity with the regulatory rules of Malaysia. These results are consistent with other studies, which have demonstrated that a lack of knowledge can result in uncertainty or rejection to accept such products, especially out of fear of the unknown (Weir et al., 2020). Accordingly, improving consumer understanding of GMO processes and regulations for safety is expected to have a favourable influence on the attitudes of the public, as indicated by the relatively high loading of knowledge items in both EFA and CFA.

**Risk**

The level of perceived risk is one of the main factors in consumers' reticence to consume GMO foods. Some common concerns are health impact, environmental effect and moral issues (Zhang et al., 2021). This research reiterated the prominence of perceived risk in Malaysian consumers' food motives, as risk emerged as a healthy and different dimension in the factor pattern. Strong loadings on risk-related items reflect considerable trepidation on the part of respondents about the safety and long-term effects of GMO foods. This finding is consistent with the previous result that scientifically based (or otherwise) perceived risk can lead to overperceived benefit in consumer decisions (Oladipo et al., 2020). The structural model also showed that risk interacts with other motives and affects the overall attitude toward GMO products. Communicating about these perceived risks and providing regulatory assurance is necessary to support more equitable consumer attitudes.

**Technology**

Perception towards technology, especially when applied to food production, is fundamental in the acceptance of GMOs. Consumers' general science orientation is related to the knowledge of and acceptance of GMO foods (Russo et al., 2020). In this study, technology was confirmed to be an important dimension of food motives and the participants acknowledged the contribution of science and innovation towards food security and better nutritional results. But if the technological confidence was there, it was also concerned over by fears and doubts

about the deeper ethical and ecological implications. This contrast resonates with previous studies, suggesting that consumers value the progress of technology on one hand, while they also pursue guarantees about safety, sustainability, and societal well-being on the other (Sedigheh et al., 2019). The positive relationship between technology acceptance and favourable attitudes toward GMO food products indicates that the dissemination of scientific and social benefits of GE technology may improve consumers' acceptance.

**Labelling**

Transparency, informed decision-making, and labelling are important interfaces between GMO food producers and consumers (Fröder et al., 2020). The current study has substantiated labelling as a unique motivation with respondents strongly stating their preference that GMO food labelling on food is clear and compulsory. The high factor loadings on labelling items suggest that Malaysian consumers pay attention to product information and regard labelling as an important factor in trust formation. Previous research has highlighted that a well-functioning labelling system reduces information asymmetry and may alleviate the negative attitude towards GMO food products (Palmieri et al., 2020). In an environment where consumers are highly suspicious, clear labelling can be a tool to increase confidence and self-sufficiency in choice. Thus, regulatory interventions that target uniform labelling practices may ultimately be essential to determining consumer acceptance of GMO foods in Malaysia.

## GMO FOOD MOTIVES AND ATTITUDE

Furthermore, regarding genetically modified organism (GMO) foods, food motives are even more important due to the difficulty consumers have in understanding them. Four major factors can influence food motivation: knowledge, perceived risk, technological orientation and labelling awareness of GMO food. The combined effects of these factors on consumers' attitudes toward GMO food products would be taken into consideration (Zhang et al., 2021). In general, the role of knowledge is that the more educated the consumer is regarding GMO technology, the more positive they are towards it, based on understanding the potential benefits, such as increased crop production or improved nutrition (Li & Bautista, 2020). On the other hand, ignorance frequently leads to either uncertainty or opposition. Risk perception continues to be a leading dominant with concerns over health implications, environmental effects and ethical issues influencing negative attitudes toward consuming GMOs (Muringai et al., 2020). Technology orientation represents the openness of consumers to scientific progress in food manufacturing. Positive attitudes toward biotechnology and scientific institutions are associated with acceptance of GMO foods (Russo et al., 2020). In the meantime, awareness of labels influences consumers to choose and decide. Clear and obligatory labelling is associated with an increase in consumer trust and acceptance of GMO products (Fröder et al., 2020). In view of these dynamics, several studies stress that food motives are an important influence on attitudes towards GMO food. A favourable attitude is exhibited once customers believe in the advantages more than risks and have sufficient knowledge and trust in technology (Xu & Wu, 2020). It is thus important to know the motivations behind GMO food to predict acceptance by consumers and facilitate successful communication. From the literature, this study suggests the following hypothesis:

H1: Food motives have a positive influence on consumers' attitudes towards GMO products.

This hypothesis reflects the idea that when consumers have congruent motives, they tend to have a positive attitude toward consuming GMOs (i.e., knowledge, reduced risk perception, favourable attitudes towards technology, and trust in labelling).

## PROPOSED MODEL

The conceptual model of this study aims to examine the impact of Food Motives on Malaysian consumers' attitudes towards genetically modified organisms (GMOs). Based on the Theory of Planned Behaviour (TPB) and literature concerning food choice behaviour, this model conceptualises Food Motives as a second-order factor with four key dimensions, including Knowledge, Risk, Technology, and Labelling (Ajzen, 1991; Chen et al., 2011). These four

attributes represent the multi-dimensional nature of the influences on consumer attitudes and purchasing decisions regarding GMO foods. Awareness is associated in this model with consumers' information about and understanding of GMO foods (Lobb et al., 2007) that, in turn, shapes attitudes as it reduces uncertainty and misinformation (Nawaz et al., 2019). In contrast, Risk perception consists of the health and environmental risks of western foods and could serve as a problem to positive attitudes towards consuming GMOs, particularly since they were mentioned to be unsafe (Muringai, 2020). In terms of technology. This dimension reflects dependability and takes into account trust in scientific advances in food production, influencing willingness to accept GMO innovations (Russo et al., 2020). Finally, Labelling contracts with the information needs of consumers in discharging functions of transparent knowledge as a requirement for making purchasing decisions, which can serve as a means of risk reduction and build trust (Fröder et al., 2020).

The model hypothesises a direct and positive relationship between Food Motives and Attitude (H1) equivalent to when these motives are favourably disposed of, supported by sufficient knowledge, perceived low level of risk, trust in technology, and transparency of clear labelling, consumers are more likely to develop a positive attitude towards GMO food products. This relationship is shown in Figure 1, where Food Motives is a second-order latent variable that is obstructed by the four dimensions and, in turn, predicts Attitude. This model offers an underpinning to empirically examine how underlying food-related motivations are predictive of consumer characteristics and is of importance to policy-makers, marketers, and stakeholders working to improve market acceptance of GM foods.

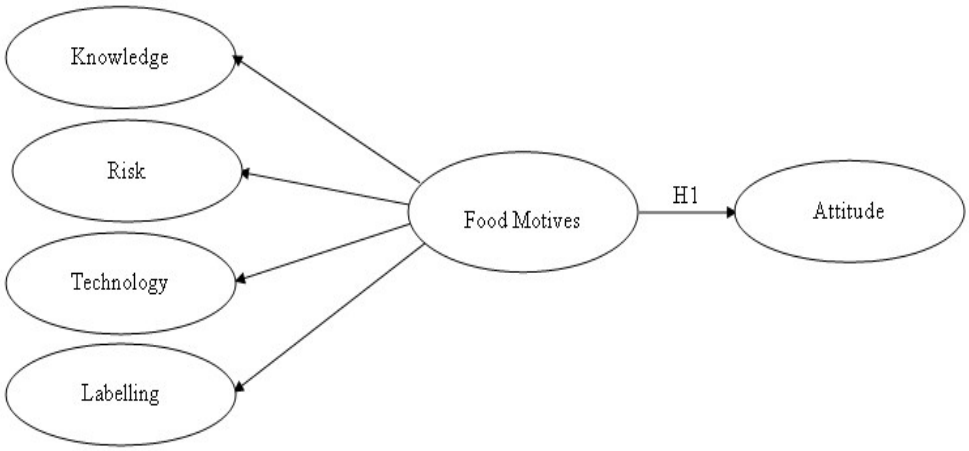


Figure 1. Conceptual Model of the Study
Source: Author's Computation (2025)

## RESEARCH METHODOLOGY

The research design used was quantitative to investigate the food motives on Malaysian attitudes towards GMO food. Information was gained through a structured questionnaire developed from validated scales so that the content was relevant and clear (Sekaran & Bougie, 2019). A sample of 377 respondents was purposively sampled based on their exposure to food consumption patterns and GMO awareness. The survey instrument consisted of items reflecting four food motive dimensions (Knowledge, Risk, Technology, Labelling) together with consumer Attitude. Responses for all items were coded on a Likert scale to measure participants' relative strength of feelings (Bryman, 2016). An online survey conducted using Google Forms was used to gather data between March and May 2025. The results of the survey were then shared throughout Malaysia via university networks and social media. Before submission, informed consent was acquired, and participation was confidential and voluntary.

Descriptive statistics, reliability testing, and Exploratory Factor Analysis (EFA) to detect factorial structure of the Scale were applied by SPSS 29 for data analysis. Next, CFA and SEM were conducted in AMOS 29 to evaluate the measurement model and the hypothesised relationship of food motives and attitude, and all model estimations and path coefficients were based on standardised estimates as per structural equation modelling best practices (Hair et al., 2019). These procedures helped ensure the soundness and accuracy of the study results. The full questionnaire, which includes

questions about knowledge, risk perception, technology orientation, labelling awareness, and attitude towards GMO foods, is included in the Appendix, guaranteeing methodological transparency and data dependability.

## DATA ANALYSES AND RESULTS

The present study employed a systematic data analysis process to develop valid and reliable measurement and structural models. Descriptive statistics were initially used to describe the demographic information of the respondents. The Cronbach Alpha was calculated to estimate the reliability of the constructs to prove internal consistency (Pallant, 2020). Methodology: EFA was performed to reveal the latent factor structure, and then CFA was executed to verify the model measurement. Lastly, the study examined the proposed relationship between food motives and consumers' attitudes toward GMO foods using Structural Equation Modelling (Hair et al., 2019). This thorough analysis at least secures sturdy results, in accordance with the usual procedure in social science research.

### Respondents Profile

A total of 337 responses were received to the questionnaire. A large proportion of respondents were males (75.7%), single (64.4%), and aged between 23-30 years (42.4%). The majority was non-Malaysian (68.5%) and 43.0% earned < RM 1000 per month. When it comes to education, 39.5% held a bachelor's degree and 24.3% held a master's degree. Overall, the sample characterises a young, educated population of relatively low income; we would argue that this is ideal for evaluating attitudes toward GMO foods.

Table 1: Demographic Profile of the Respondents (n = 377)

| Demographic | Characteristics | Frequency | Percentage (%) |
|---|---|---|---|
| Gender | Male | 255 | 75.7% |
| | Female | 82 | 24.3% |
| Marital Status | Single | 217 | 64.4% |
| | Married | 120 | 35.6% |
| Age | 18-22 | 82 | 24.3% |
| | 23-30 | 143 | 42.4% |
| | 31-40 | 79 | 23.4% |
| | 41-50 | 27 | 8.0% |
| | Over 50 | 6 | 1.8% |
| Nationality | Malaysia | 106 | 31.5% |
| | Others | 231 | 68.5% |
| Monthly Income (RM) | Below 1000 | 145 | 43.0% |
| | 1001-2000 | 75 | 22.3% |
| | 2001-3000 | 45 | 13.4% |
| | 3001-4000 | 23 | 6.8% |
| | 4001-5000 | 12 | 3.6% |
| | Above 5000 | 37 | 11.0% |
| Education Level | Secondary School/High School | 48 | 14.2% |
| | Diploma | 17 | 5.0% |
| | College Graduate/ Bachelor's Degree | 133 | 39.5% |
| | Master's Degree | 82 | 24.3% |
| | PhD/Doctorate Degree | 57 | 16.9% |

Source: Author's Computation (2025)

### Attributes of The Questionnaire

The scale included five constructs: Knowledge, Risk, Technology, Labelling, and Attitude towards genetically modified organism (GMO) foods with 27 items. A five-point Likert scale was used, and it is one of the commonly used scales for gaining attitudes and perceptions in social science studies (Joshi et al., 2015). The instrument also showed satisfactory reliability (Cronbach's Alpha = 0.857), above the cut-off value of 0.70 for internal

consistency (Hair et al., 2019). The items were adopted from existing literature to ensure content validity with respect to the context of GMO food consumption in Malaysia (Boateng et al., 2018). These findings provide evidence that the questionnaire represents a strong and valid tool to measure food motivation in relation to consumer attitudes.

Table 2. Reliability Statistics of the Questionnaire

| Cronbach's Alpha | Cronbach's Alpha Based on Standardised Items | N of Items |
|---|---|---|
| 0.857 | 0.857 | 27 |

Source: Author's Computation (2025)

## Exploratory Factor Analysis (EFA)

To extract the underlying structure of the food motives construct and confirm the dimensionality of the measurement items, the study performed the EFA. Before the EFA, data suitability was checked using the KMO measure and Bartlett's Test of Sphericity. The KMO value was 0.824, which is higher than the recommended threshold of 0.70, indicating that the sample size was well-suited for factor analysis (Hair et al., 2019). Moreover, Bartlett's Test of Sphericity was significant ($\chi^2 = 2044.428$, $df = 91$, $p < 0.001$), which indicates the existence of sufficient correlations between items for an EFA to be appropriate (Field, 2018). The study employed principal component analysis (PCA) with Varimax rotation, resulting in four factors that aligned with the theoretical framework. These four dimensions correspond to the Knowledge, Risks, Technology, and Labelling food motive dimensions. Factor loadings for all items were high, with all values exceeding the acceptable cut-off of 0.50 (Hair et al., 2019), indicating strong construct validity. In particular, an item of knowledge (DIMK2, DIMK3, DIMK4) explained from 0.564 to 0.731 in the Knowledge dimension. The Risks dimension comprised a total of five items (DIMR1 to DIMR5) and had a coefficient ranging from 0.680 to 0.874. The Technology dimension was composed of four items (DIMT1-DIMT4) with loadings ranging from 0.572 to 0.730. Finally, the Labelling dimension was composed of two items (DIML3 and DIML4) with very high loadings of 0.738 and 0.880, respectively. These findings provide strong evidence that the items employed in the present study reliably represent the constructs of interest, thus lending support to the multidimensional nature of food motives with regard to the need for food consumption of genetically modified organism (GMO) food.

Table 3: KMO and Bartlett's Test

| | | |
|---|---|---|
| **Kaiser-Meyer-Olkin Measure of Sampling Adequacy** | | 0.824 |
| **Bartlett's Test of Sphericity** | Approx. Chi-Square | 2044.428 |
| | df | 91 |
| | Sig. | <.001 |

Source: Author's Computation (2025)

Table 4: Exploratory Factor Analysis.

| Rotated Component Matrix | | | | |
|---|---|---|---|---|
| **Items (Variables)** | **Factor 1 Knowledge** | **Factor 2 Risks** | **Factor 3 Technology** | **Factor 4 Labelling** |
| DIMK2 | 0.564 | | | |
| DIMK3 | 0.687 | | | |
| DIMK4 | 0.731 | | | |
| DIMR1 | | 0.700 | | |
| DIMR2 | | 0.680 | | |
| DIMR3 | | 0.874 | | |
| DIMR4 | | 0.778 | | |
| DIMR5 | | 0.827 | | |
| DIMT1 | | | 0.572 | |
| DIMT2 | | | 0.670 | |
| DIMT3 | | | 0.708 | |
| DIMT4 | | | 0.730 | |
| DIML3 | | | | 0.880 |
| DIML4 | | | | 0.738 |

Source: Author's Computation (2025)

## Confirmatory Factor Analysis (CFA)

CFA was performed to verify the measurement model and to examine the relationships between the observable indicators and the latent constructs. CFA is commonly thought to be a strong statistical method to assess how well the observed variables represent the number of constructs (see Hair et al., 2019). CFA was carried out in two steps in this investigation: first-order models and second-order models to validate the factor structure of the Food Motives construct and the dimensions Knowledge, Risk, Technology, and Labelling.

Validating the factor structure in the First Order CFA, the first-order model fit the data well, with acceptable model fit indices, suggesting that the four-factor structure of food motives was statistically appropriate. The Chi-square was 152.106 at df . 71, and the normed Chi-square (CMIN/DF) was 2.142, which is within an acceptable and good-fitting range below 3.0 (Bryman, 2016). The Comparative Fit Index (CFI) was also 0.959, which is higher than the commonly accepted value of 0.90, demonstrating a good fit between the model and actual data (Hu & Bentler, 1999). The Root Mean Square Error of Approximation (RMSEA) value was 0.058, which was smaller than the cut-off value of 0.08, which also suggested the model was adequate (MacCallum et al., 1996). The study conducted a follow-up second-order CFA to test whether these four factors could be reduced to a higher-order latent factor classified as Food Motives. The 2nd-order model also showed good fit values, with a Chi-square value ($\chi 2$ = 158.121; df = 73). The normed Chi-square value was 2.166, the CFI was 0.957 and the RMSEA was 0.059. These loadings indicate that the higher-order factor effectively represents the variance shared among the four dimensions, which is consistent with qualitative recommendations for construct validation (Kline, 2015).

For both models, the factor loadings were all statistically significant and greater than the criterion of 0.50, indicating a good relationship between the observed variables and latent constructs (Hair et al., 2019). The results support the reliability and validity of the measurement model, suggesting the dimensions of Knowledge, Risk, Technology, and Labelling sufficiently operationalise the construct of Food Motives among Malaysian consumers in relation to their perceptions of GMO foods.

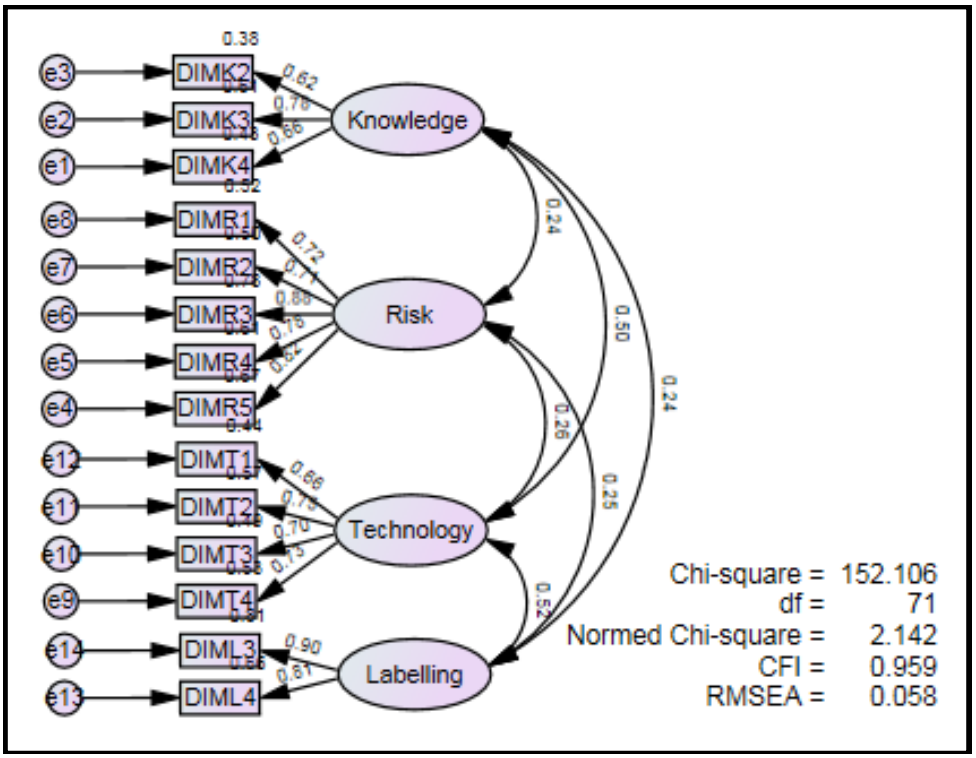


Figure 2: Measurement Model (1st Order)
Source: Author's Computation (2025)

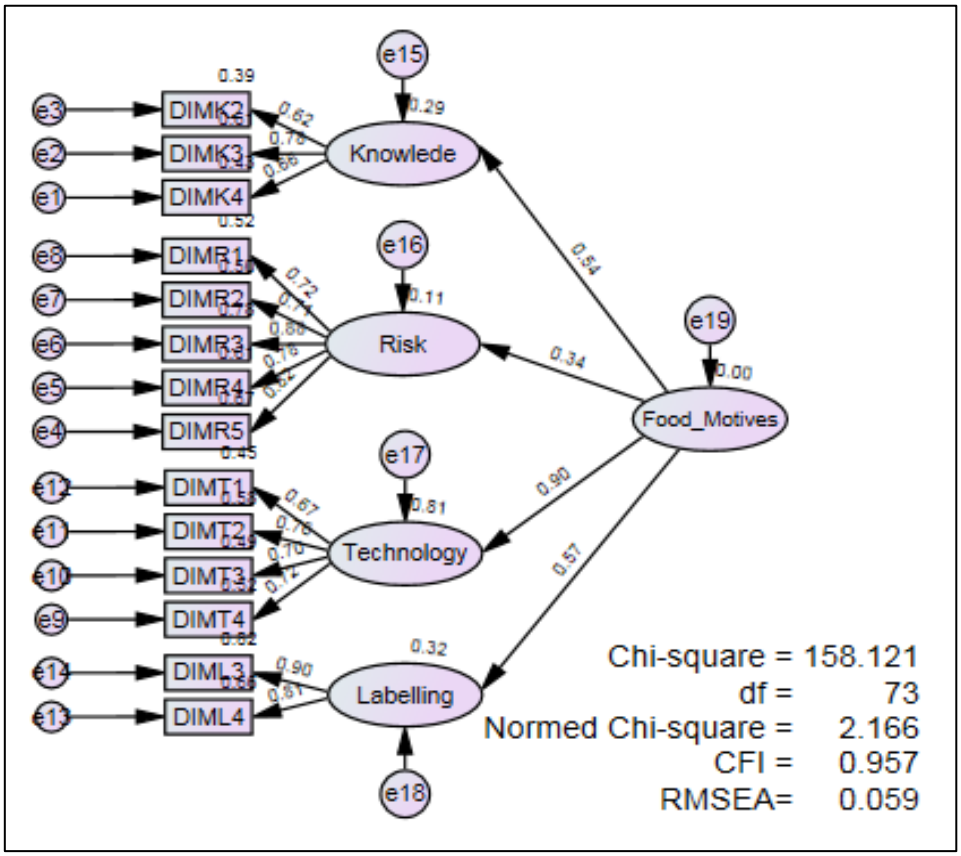


Figure 3: Measurement Model (2nd Order)
Source: Author's Computation (2025)

### Hypothesis Testing

The Structural Equation Model (SEM) was performed to test the relationship between food motives and consumer's attitudes towards consuming GMO foods. The model fit well ($\chi^2$ = 447.712, df = 165, CMIN/df = 2.713, CFI = 0.911, RMSEA = 0.071) (Hair et al., 2019). The indirect effect from Food Motives to Attitude to the intention to consume GMO products was also significant ($\beta = 0.573$, $p < 0.001$), which is consistent with the expectation that strong food motives could lead to a favourable attitude towards GMO products. This is consistent with the Theory of Planned Behaviour, which suggests that informed motivations predict positive consumer attitudes (Ajzen, 1991; Fishbein & Ajzen, 2010).

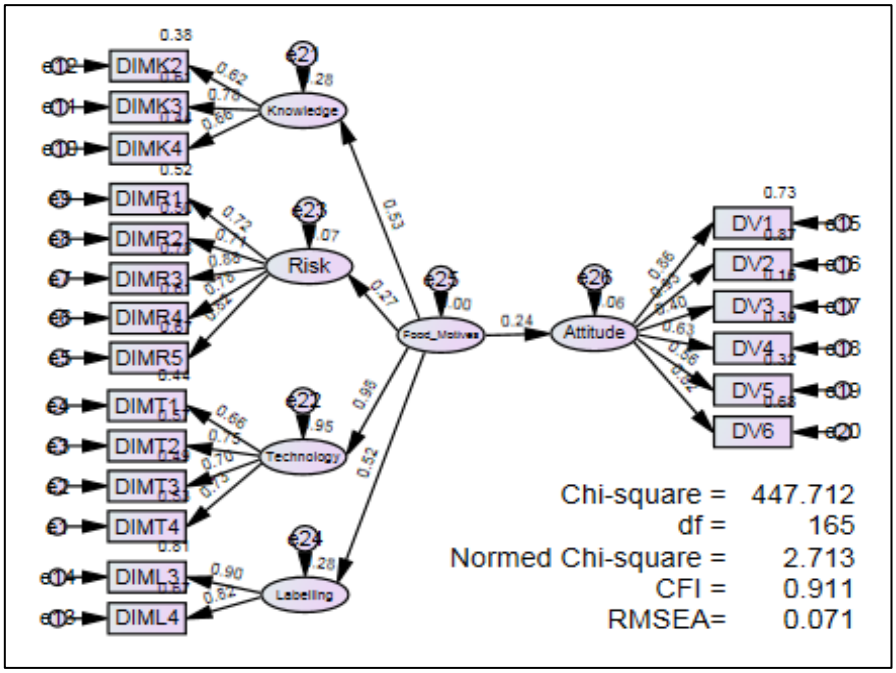


Figure 4: Final Structural Model
Source: Author's Computation (2025)

Table 5. Estimates of the Hypothesised Model

| Structural Path | Hypothesized Relationship | Std. Reg. Weight | S. E. | C. R. | P |
|---|---|---|---|---|---|
| **Food Motives → Attitude** | **H1[s]** | **0.573** | **0.166** | **3.445** | *** |
| **Statistic** | | **Suggested** | | **Obtained** | |
| Chi-square significance | | ≥ 0.05 | | 0.000 | |
| Normed chi-square (CMIN/df) | | ≤ 5.00 | | 2.713 | |
| Comparative fit index (CFI) | | ≥ 0.90 | | 0.911 | |
| Root mean square error of approximation (RMSEA) | | ≤ 0.08 | | 0.071 | |
| **Note: s = Supported, *** = p < 0.001** | | | | | |

Source: Author's Computation (2025)

## DISCUSSION

The study contributes measurable evidence from the literature that illuminates how food motives characterised in terms of knowledge, risk perception, technology orientation, and labelling awareness have been substantial in determining Malaysian consumers' attitudes toward genetically modified organism (GMO) foods. The structural model demonstrated that these combined motives had a highly significant and positive effect on attitude ($\beta = 0.573$, $p < 0.001$), thereby verifying the empirical hypothesis and strengthening the Theory of Planned Behaviour (Ajzen, 1991), which posits that attitudinal factors strongly influence behavioural intentions.

These results support the previous research (Chen et al., 2011; Kim & Paek, 2009) and extend the knowledge by situating it within a Malaysian situation. Particularly, the study has typically focused on either knowledge or risk and combines both technology and labelling into a multi-dimensional model, unlike the others. Knowledge was also found to significantly predict attitude, as found in Nawaz et al. (2019), who argued that greater knowledge might break fear and myths surrounding GM food.

This research contrasts prior research in the sense that risk perception, while frequently associated with negative attitudes, can be conditioned with trust in regulatory systems and scientific innovation. Technology orientation was identified as a strong supportive factor, which corresponds with the findings of Russo et al. (2020), who found that belief in science increases one's acceptance of GMOs. However, this dimension has been infrequently investigated in developing countries, since consumers' trust in institutions is diverse. This is considered as an expression for labelling awareness a further innovation which has frequently been overlooked in the literature, despite Fröder et al. (2020) and Zhang et al. (2021) emphasized its significance in consumers' confidence. In this paper, the study confirms this by presenting empirical evidence that clearer labelling is indeed favourably related to attitudes, particularly when consumers have a sense of empowerment in the decision-making process. The distinctiveness of this study lies in its focus on a Malaysian context where public discourse on both food and biotechnology security is in a state of instability. Unlike previous studies that generalised the findings of the study across regions, this study provides context-based findings that are needed for policy and educational campaigns in Malaysia. The model's fit is also excellent, as evidenced by such strong model fit indices (e.g., CFI = 0.911, RMSEA = 0.071), which provides supporting evidence for the validity of combining these four dimensions under one higher-order construct.

The findings also show that contextual elements, such as institutional trust and label transparency, influence Malaysian consumers' opinions towards GMO foods. Perceived risk is dependent on trust in science and regulatory integrity and is not always bad, according to recent research (Costa-Font & Gil, 2022; Siegrist & Hartmann, 2020). Furthermore, when backed by clear information and reliable labelling, technology orientation becomes a prominent factor that indicates consumers' receptivity to innovation (Liu et al., 2023; Zhang et al., 2021). By highlighting the mediating function of attitude in culturally specific contexts, these findings extend beyond previous models of GMO adoption and suggest that science literacy and trust-based communication activities could enhance public receptivity to GMO technology in Malaysia.

In summary, this investigation not only supports the current literature but also extends it by offering a detailed, culturally sensitive framework. It highlights the need for comprehensive interventions, including consumer education, clear labelling, and the provision of GMO technologies, as a means to foster informed and positive attitudes towards GMO food products in Malaysia.

## CONCLUSIONS AND RECOMMENDATIONS

This paper further establishes that food motives, including knowledge, risk perception, technology orientation, and labelling comprehension, significantly influence Malaysian consumers' attitudes toward GMO foods. The findings validate previous studies that assert the impact of cognitive and informational processes on consumer beliefs (Ajzen, 1991; Chen et al., 2011). Increasing awareness, trust in technology, risk perception, and transparent labelling were the most important predictors for improving attitudes towards GMOs. To support GMO foods becoming more acceptable, policymakers should make efforts to conduct awareness campaigns, implement a clear labelling system, and communicate the regulatory defences appropriately. It is crucial to establish consumer trust by providing transparent information regarding the benefits and risks of biotechnology (Fröder et al., 2020; Russo et al., 2020). The study focuses on consumers in Malaysia, which may limit generalisation. Cross-cultural studies and multiple variables (e.g., ethical issues or media effects) need to be analysed in the future to extend our knowledge of consumers' attitudes toward GMO food.

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**Author Contributions**: Mohi Uddin carried out the research, including its conception, methodology, data collection, analysis, and manuscript drafting. Dr Muhammad Tahir Jan and Dr Suharni Bt. Maulan provided the text with a critical evaluation, offered insightful criticism, and contributed to the improvement of the research design and findings interpretation. The manuscript's final draft has been read and approved by all writers.

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# APPENDIX:

## Questionnaire

**The Influence of Food Motives on Attitude: A Study of GMO Food in Malaysia**

Definition of Genetically Modified Organisms (GMO) Foods:
*Genetically modified organisms (GMOs) can be defined as organisms (i.e., plants, animals, or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally through mating and/or natural recombination. The technology is often called "modern biotechnology" or "gene technology", sometimes also "recombinant DNA technology" or "genetic engineering". It allows selected individual genes to be transferred from one organism to another, also between nonrelated species. Foods produced from or using GM organisms are often referred to as GM foods (Source: WHO).*

Dear Participant,

My name is Mohi Uddin, and I am a PhD candidate at IIUM. I am conducting a study on genetically modified (GMO) foods, focusing on their importance and consumer purchasing behaviour in Malaysia. This survey aims to understand consumers' perceptions and intentions regarding GMO foods.

You are invited to participate if you reside in Malaysia, regardless of nationality. Participation is entirely voluntary, and your responses will remain strictly confidential. There are no right or wrong answers, and the survey should take approximately 15 minutes to complete.

Your participation will greatly contribute to this research, and it is sincerely appreciated. If you have any questions, please feel free to contact me, Mohi Uddin, at mohiiium@gmail.com

Thank you for your time and support.

Best regards,
Mohi Uddin
PhD Candidate, IIUM

| **Please Circle. 1= Strongly Disagree, 2= Disagree, 3= I am Not Sure, 4= Agree, and 5= Strongly Agree** |
|---|

**SECTION A**

| | ***Attitude towards GMO foods*** | | | | | |
|---|---|---|---|---|---|---|
| 1 | I prefer to buying GMO foods. | 1 | 2 | 3 | 4 | 5 |
| 2 | Choosing GMO foods is a good idea. | 1 | 2 | 3 | 4 | 5 |
| 3 | I always check for GMO foods when I buy items. | 1 | 2 | 3 | 4 | 5 |
| 4 | The presence of GMO foods when I am purchasing foods is important. | 1 | 2 | 3 | 4 | 5 |
| 5 | Consuming GMO foods is my own choice. | 1 | 2 | 3 | 4 | 5 |
| 6 | Consuming GMO foods is beneficial. | 1 | 2 | 3 | 4 | 5 |

**SECTION B**

| | ***Food Motives (Knowledge)*** | | | | | |
|---|---|---|---|---|---|---|
| 1 | I know what GMO foods contained. | 1 | 2 | 3 | 4 | 5 |
| 2 | I know the difference between GMO food and conventional food. | 1 | 2 | 3 | 4 | 5 |
| 3 | I know that I am eating GMO food that exist in my country. | 1 | 2 | 3 | 4 | 5 |
| 4 | I know the type of GMO food is imported into Malaysia for consumers' consumption. | 1 | 2 | 3 | 4 | 5 |
| 5 | I know there are laws and regulations that regulate the consumption of GMO foods in Malaysia. | 1 | 2 | 3 | 4 | 5 |

| | ***Food Motives (Risks)*** | | | | | |
|---|---|---|---|---|---|---|
| 1 | The consumption of GMO food has a risk to consumers' health. | 1 | 2 | 3 | 4 | 5 |
| 2 | The farming of genetically modified crops will cause severe environmental damage. | 1 | 2 | 3 | 4 | 5 |
| 3 | The consumption of GMO foods will have negative effects on the consumer's health. | 1 | 2 | 3 | 4 | 5 |
| 4 | The production and consumption of GMO food have threatened human nature. | 1 | 2 | 3 | 4 | 5 |
| 5 | The consumption of GMO foods will cause diseases in human. | 1 | 2 | 3 | 4 | 5 |
| 6 | The consumption of GMO foods carries out the nutrition for human health. | 1 | 2 | 3 | 4 | 5 |

| | ***Food Motives (Technology)*** | | | | | |
|---|---|---|---|---|---|---|
| 1 | Science and Technology are the main concerns nowadays. | 1 | 2 | 3 | 4 | 5 |
| 2 | Science and technology are fundamental for developing Malaysian society. | 1 | 2 | 3 | 4 | 5 |
| 3 | Science and technology are necessary for generating healthy food products in Malaysia. | 1 | 2 | 3 | 4 | 5 |
| 4 | New technological equipment is effective for ecological equilibrium in Malaysia. | 1 | 2 | 3 | 4 | 5 |
| 5 | Science and technology can contribute to improving the Malaysian economy. | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Food Motives (Labelling)*** | | | | | | |
| 1 | I have seen a product labelled GMO food product. | 1 | 2 | 3 | 4 | 5 |
| 2 | I have the tendency to read labels of the foods that I intent to purchase and consume. | 1 | 2 | 3 | 4 | 5 |
| 3 | Any GMOs' ingredients must be indicated on the food and product labelling. | 1 | 2 | 3 | 4 | 5 |
| 4 | The ingredient of any products that have been genetically modified must be clearly advertised. | 1 | 2 | 3 | 4 | 5 |
| 5 | Government should have laws and regulations on the labelling of GMO foods. | 1 | 2 | 3 | 4 | 5 |

**SECTION C**

***Please Circle the Appropriate Box***

| **AGE** | **18-22** | **23-30** | **31-40** | **41-50** | **Over 50** |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** |

| **Marital Status** | **Single** | **Married** | **Other** |
|---|---|---|---|
| | **1** | **2** | **3** |

| **Monthly Income (RM)** | **Below1000** | **1001-2000** | **2001-3000** | **3001-4000** | **4001-5000** | **Above 5000** |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |

| **Educational Background** | **Secondary School/High School** | **Diploma** | **College Graduate/ Bachelor's Degree** | **Master's Degree** | **PhD/ Doctorate Degree** | **Other** |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |

***The education level that you HAVE COMPLETED, Not the one you are currently pursuing***

| **Gender** | **Male** | **Female** |
|---|---|---|
| | **1** | **2** |

| **Nationality** | **Malaysian (√)** | |
|---|---|---|
| | **Other** | ***Please specify your country of origin:*** _____ |

***** THANK YOU FOR YOUR SUPPORT *****