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*Original Research Article*

# Factors Influencing Consumers' Behaviour Towards Fraudulent Dietary Supplements

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**Abstract:** Dietary supplement fraud cases have become a major concern among consumers due to proven damage and effects on the health and lives of consumers. An increase in the risk of food safety might result from the high consumption of fraudulent dietary supplements. However, fraudulent activities are difficult to verify due to the lack of awareness of consumers on the safety and authenticity of active ingredients used in the dietary supplements' production. Thus, this study was carried out to achieve the following objectives: i) to determine consumers' behaviour towards fraudulent dietary supplements; ii) to determine factors that influence consumers' behaviour towards fraudulent dietary supplements. A purposive sampling method was used to select 400 respondents and a structured questionnaire was established to collect the data. Descriptive, Pearson correlation, Chi-square, factors and multiple regression analyses were employed to analyse the data. The results revealed that most of the respondents were aware of fraudulent dietary supplements. Socio-demographic profiles such as age, race, religion and education level had significant associations with consumers' behaviour towards fraudulent dietary supplements. There was a moderate positive relationship between knowledge and attitude of consumers towards fraudulent dietary supplements. Subjective norms, awareness, attitude and perceived behavioural control were the factors that influenced consumers' behaviour towards fraudulent dietary supplements. The study recommended that government and relevant agencies should continuously organize awareness campaigns and activities on the crime, existence and danger of food fraud especially for dietary supplements in Malaysia.

**Keywords:** dietary supplement; behavior; consumers; fraudulent; food fraud

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## 1. Introduction

Dietary supplements are proven to be able to meet the daily nutritional needs of consumers to stay fit, healthy and improve their quality of life (Chincholkar, 2016; Ghazali *et al*., 2006). Based on the National Institute of Health (1994), a dietary supplement is referred to as a product (other than tobacco) intended to supplement a diet that bears or contains one or more of the following dietary ingredients: (i) a vitamin; (ii) a mineral; (iii) an herbal or other botanical ingredient; (iv) an amino acid; (v) a dietary supplement used by individuals to supplement the diet by increasing total dietary intake; (vi) a concentrate, metabolite, constituent, extract or combination of any of the ingredients referred in to (i–vi). A dietary supplement is an item that is classified as a dietary supplement and is not intended for use as a conventional food or as a single meal or diet. A dietary supplement must be ingested orally by pill, capsule, tablet, and liquid form. The dietary supplement can be found in capsule, powder, gel cap, liquid and tablet. Examples of the dietary supplement brand available in the Malaysian market are Nutrilite, Elken, Cosway, Blackmores, and Herbalife (Bee & Wan, 2016).

Nowadays, consumers are becoming more concerned about their health and regularly consume dietary supplements to maintain their health. Various types of dietary supplements have been produced due to the growing interest in maintaining health and preventing disease among consumers (Bailey *et al*., 2013). In 2017, as reported by the Institute for Public Health, approximately 44.7% and 30.6% of Malaysian adolescents consumed vitamins, minerals, and food supplements, respectively (Institute for Public Health, 2017). These supplements are one of the ways used for disease prevention, correction of poor lifestyle behaviours and enhancement of physical performance (del Balzo *et al*., 2014). In Malaysia, the consumption of dietary supplements is growing among consumers because it was believed to increase the level of body's immunity (Sharma *et al*., 2014; Yusoff *et al*., 2016). Zheng and Navarro (2015) revealed that weight loss is the most important reason for taking these dietary supplements. Besides, aggressive advertisements in the mass media on dietary supplements have further gained interest in the use of dietary supplements among consumers (Goston & Correia, 2010). Due to the wide variety of supplements and the presence of established international brands such as Nutrilite, Live-well, Blackmores, and VitaHealth in the local market, Malaysian consumers are offered various choices of health dietary supplements. Besides, highly convincing marketing strategies of dietary supplements on social media platforms have triggered consumers to have regular purchasing and consumption of dietary supplements. According to Ahmad (2002), Malaysian consumers were reported to have spent an average of RM70 a month on health supplements such as traditional medicines and other health foods, such as herbs, foods and supplemented beverages. Further, the author indicated that consumers spending on these supplements are expected to increase for many years to come.

Health or dietary supplements are referred to as a diverse group of products commonly used to supplement the diet and improve health (Zahirudin & Zolkefli, 2019).

However, the Ministry of Health, Malaysia (MoH) considered food supplements to be a part of health supplement products described as "products intended to complement the diet taken by mouth in forms such as pills, capsules, tablets, liquids or powders. Not represented as a conventional food/single food item or a diet" (para 9.1 Guidance Notes for Health Supplement Products, Drug Registration Guidance Document, August 2010, issued by the National Pharmaceutical Control Bureau, Ministry of Health, Malaysia). In Malaysia, the dietary supplements are regulated according to the Control of Drugs and Cosmetics Regulations 1984 (CDCR), supported by the Sale of Drugs Act 1952, Medicines (Advertisement & Sale) Act 1956, and Drug Registration Guidance Document (DRGD). The DRGD is regulated by the Drug Control Authority (DCA) of National Pharmaceutical Control Bureau (NPCB). The DRGD acts as a reference guide for product classification, product registration, application process, quality control, Good Manufacturing Practice (GMP) licensing, labeling criteria, post-market surveillance, and pharmacovigilance activities (National Pharmaceutical Regulatory Agency, 2020).

With increasing consumption of dietary supplements, there are also increasing food safety related incidents due to the high availability of fraudulent dietary supplements in the market by producers whose purpose is to gain extra profit but neglecting the consumers' safety issue. According to Wheatley and Spink (2013), dietary supplement fraud is a form of product fraud or food fraud and is known as economically motivated adulteration (EMA). Dietary supplement fraud has the potential to be harmful to consumers. A very risky type of fraud for health supplements and weight loss products, in general, is the introduction of undeclared or unregulated prescription active substances (drugs that are not meant to be present) for efficacy-enhancing purposes. Dietary supplements are at a very high fraud risk as consumers nowadays are too obsessed to consume supplements that are claimed to have a quick effect or result. As indicated by Medsafe (2019), the dietary supplements are not subject to any specific regulatory pre-approval criteria or pre-market health tests. Thus, this has encouraged dishonest manufacturers and distributors to intentionally adulterate dietary supplements by adding pharmaceutical drugs or substance analogy to increase product effectiveness within a short time. Besides, the availability and accessibility to social network have greatly opened the path for dietary supplement advertising, which could attract a consumer to buy the products without getting relevant health consultation from a doctor or pharmacist on possible adverse effects or medication reactions. Hence, the consumer is unable to recognize the truth from fraud (Wheatley & Spink, 2013).

Food fraud is a criminal activity involving deception and misrepresentation, leading to negative effects on consumers' health (Molins, 2017). Through the years, many fraudulent dietary supplement cases in Malaysia have been reported and the cases are listed in Table 1.

**Table 1.** Fraudulent dietary supplement cases in Malaysia.

| Year | Issue | Source |
|---|---|---|
| **2019** | The Penang Health Department has seized 16 tons of unregistered traditional Chinese medicines, unlabelled pills, and capsule products containing a scheduled poison that worth RM2.6 million. The case is being investigated under the Sale of Drugs Act 1952. | Othman (2019) |
| **2019** | The Ministry of Health Malaysia (MoH) confiscated eight (8) unregistered health products worth RM1.7 million containing hazardous substances such as Tadafil, Ibuprofen, Tetracycline HCL, Chloramphenicol, Dexamethasone, Cholorphenirame, Clarithromycin, and Lovastin. All the products are seized under the Poisons Act 1952 and the Sale of Drugs Act 1952. | Kannan (2019) |
| **2019** | The Kelantan Health Department has confiscated 1,353 bottles of unregistered products that worth RM67,650. | Zaimatuljuwita (2019) |
| **2018** | A beauty supplement company has been fined RM4,000 for having found guilty of selling five (5) unauthorized products. | Geraldine (2018) |
| **2017** | The Melaka Health Department has confiscated 562 unregistered health supplements, cosmetics, and traditional preparations worth approximately RM1.44 million. | Murali (2017) |
| **2017** | The Ministry of Health Malaysia (MoH) confirmed the withdrawal of two traditional Chinese products, Wan Ling Ren Sem Chin Kuo Pill and Chong Cao Dan, as they were found to contain Dexamethasone. | Noor (2017) |
| **2017** | The Kelantan Health Department seized 6,864 bottles of health products that are allegedly able to cure a diabetic disease. | Subaryati (2017) |

Meanwhile, according to Jauze (2017), many cases of adulterated dietary supplements fraud have been reported and recorded in Malaysia. The descriptions of the cases are listed in Table 2.

**Table 2.** Adulterated dietary supplements fraud in Malaysia.

| Product | Type of Supplement | Reason |
|---|---|---|
| **Creative Herbs** | Traditional supplements for health and strengthening body. | Not registered and contains undeclared dexamethasone and chlorpheniramine. |
| **ABC Acai Berry Dietary Supplement** | Weight loss supplement. | Undeclared sildenafil. |
| **Bio Belut Putih** | Traditional supplement for asthma, gout, and knee pain. | Undeclared dexamethasone. |
| **D`Herbs Premium Diet** | Weight loss supplement. | Undeclared caffeine. |
| **Jamu Ajaib** | Traditional supplement for nerve pain, waist pain, and knee pain. | Undeclared dexamethasone. |

Source: Jauze (2017)

In 2019, the Ministry of Health, Malaysia (MoH) through the Pharmaceutical Enforcement Division has carried out 4,169 operations over the past three years on the registered pharmacy premises, private clinics, and other premises that have breached the laws and regulations regarding the dietary supplement fraud that worth RM 142 million. With strict enforcement actions by the MoH, 3,737 sanctions have been imposed on the websites and social media for undue health claims that advertise and sell prohibited health products online. Furthermore, many key factors contributed to the growth of dietary supplements in the market such as the increasing aging of the population, increasing lifestyle and increasing health care costs. These factors have provided a chance for irresponsible producers to gain more profit in a short time by involving in fraudulent dietary supplement activities. The MoH also discovered many products in the market that contain a wide variety of undeclared active pharmaceutical ingredients, most of which are labelled as a dietary supplement (Zulkifli, 2013). Since unscrupulous manufacturers and distributors intentionally leave active ingredients out of the labels to avoid regulatory complications, consumers remain unaware of what the products contain (Wheatley & Spink, 2013).

Consumers also lack knowledge regarding dietary supplements issues. This has led to high consumption of unsuitable dietary supplements, which provide many risks to their health. Consumers have a high tendency to consume dietary supplements without further consultation with their healthcare experts. This will indeed lead the consumers to get the wrong nutrients for their health. Dietary supplement fraud has been proven to have deteriorating effects on the health and lives of consumers. Thus, this study was carried out to achieve the following objectives: i) to determine consumers' behaviour towards fraudulent dietary supplements; and ii) to determine factors that influence consumers' behaviour towards fraudulent dietary supplements. Through this study, the government and other agencies will be able to utilise the data to know the level of awareness of consumers and their behaviour towards fraudulent dietary supplements. It is further increased the frequency and the medium to reach the consumers to spread more awareness on the past and recent cases and products proven to be fraudulent and how to identify fraudulent dietary supplements sold in the market.

## 2. Literature Review

In the study of human behaviour, the Theory of Planned Behaviour (TPB) is one of the most popular and influential ideas that have been developed, often commonly used for a variety of topics (Ajzen, 2002). The main factor in the Theory of Planned Behaviour (TPB) is the individual's intention to perform a given behaviour, which measures the motivational factor that influences behaviour as the intention characteristics (Ajzen, 1991). The author indicated how hard people are willing to try, of how much effort they planning to exert, just to perform a behaviour. The TPB measures how human action is guided and predicted the occurrence of behaviour, if behaviour is intentional. Human behaviour is influenced by three variables such as belief in the effects of behaviour (behavioural beliefs), belief in normative

expectations of other people (normative beliefs) and belief in the existence of factors that impede behavioural success (control beliefs). In the context of TPB, attitude towards behaviour is an antecedent of behavioural beliefs, which is measured and categorised based on favourable or unfavourable parameters (Ajzen, 1991). Normative beliefs create perceived social pressure, also called subjective norms. Control beliefs, in other words, are known as perceived behavioural control that can be referred to as ease or difficulty in performing the behaviour. Attitude towards behaviour was the first variable in TPB and it is referred to as the degree of favourable or unfavourable evaluation of the behaviour. Pelsmacker *et al*. (2006) described that people with a positive attitude towards a product tend to buy the product. The second variable, subjective norms is referred to as a perceived social pressure either to perform or not perform a behaviour. The third variable is perceived behavioural control (PCB), which is referred to as the ease or difficulty in performing behaviour reflects past experiences (Ajzen, 2002).

According to Conner (2001), attitude is the final behavioural assessment that is positive or negative for a person. Attitude is based on a belief in the likely outcome of behaviour (behavioural beliefs). Fishbein and Ajzen (1975) claimed that concepts such as desire, interest, feeling, valance, and utility all tend to indicate bipolar assessment and may, therefore, be subsumed under the attitude group. Conner (2001) further revealed that intentions are mostly predicted by attitude and consumers tend to show a high positive attitude towards consumption. Based on the TPB, the more resources and opportunities individuals believe they have, and the fewer barriers they anticipate, the greater their perceived control over behaviour should be (Ajzen, 1991). Perceived behavioural control (PBC) also has a direct influence on behaviour when perceptions of control precisely match the actual control (Armitage & Conner, 2001). However, PBC was not a major indicator of the use of products (Conner, 2001) but it is an indicator of a range of health behaviour (Godin & Kok, 1996).

Chireh (2011) explained that knowledge is the key to prevent human error, while education is the key to develop and gain knowledge. Consumers must have good knowledge of dietary and herbal supplements so that they can use it safely and effectively. Individuals of higher education and a high level of dietary supplement knowledge are expected to be more cautious in their use of dietary or herbal supplements than the general population (Axon *et al*., 2017). Zhu and Xie (2015) explained that knowledge significantly contributes to attitude formation towards products. Furthermore, Kemper (2003) described that health care professionals had insufficient knowledge of the adverse effects of dietary and herbal supplements and did not regularly consult with patients about dietary and herbal supplements. Kobayashi (2017) stated that knowledge on the dietary supplements is inadequate particularly on their effectiveness, product quality, and adverse effects. However, the author claimed that knowledge can affect consumers' attitudes. Frewer (2002) stated that negative attitudes may be caused by a lack of knowledge, which results in confusion as to the risks and benefits of

products and ultimately contributes to unfavourable perceptions of the technology and its implementations.

The awareness of consumers (either consciously or unconsciously) precedes control, modification, elimination, and change in human behaviour and decision making (Chartrand, 2005). According to Ishak and Zabil (2012), there is an important relationship between the awareness and effective behaviour of consumers. Nevertheless, the awareness of consumers differs considerably between locations where urban dwellers showed less awareness compared to those dwelling in sub-urban areas. While urban consumers were more aware than rural consumers of their rights to consumer protection (Gowd *et al.*, 2014). Arora *et al*. (2014) mentioned that consumer awareness plays an important role in decision-making, in which adolescents are not fully aware of quality assurance marks for different products. The authors further indicated that male adolescents are more aware of consumer rights than female adolescents. According to Chincholkar (2016), consumers are aware of health and nutritional supplements and believed that these products will benefit them in maintaining good health. Kulkarni and Mehta (2013) revealed that most consumers are aware of consumer rights, but never lodge claims against traffickers. Most consumers are unaware of adulteration (Ishwar *et al*., 2018) and its harmful effects on the body (Gautam & Singh, 2016). Consumers' awareness of rights and responsibilities is high, but low concerning food adulteration (Gupta & Panchal, 2009).

## 3. Methodology

Figure 1 shows the conceptual framework that was established for this study. The framework was adapted from the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The TPB is one of the most established and most implemented theories of human behavioural research (Paul & Lin, 2002). The variables such as attitude, subjective norms, and perceived behavioural control were adapted from the TPB, while the other two variables namely awareness and knowledge were adapted from studies by Axon *et al*. (2017) and Chartrand (2005). The dependent variable of this study was consumers' behaviour towards fraudulent dietary supplements and the independent variables namely attitude, subjective norms, perceived behavioural control, and awareness were used to determine factors that influence consumers' behaviour towards fraudulent dietary supplements. Meanwhile, the independent variable, knowledge was described to have a relationship with consumers' attitude. Socio-demographic profiles were included and used to measure the association between consumers' behaviour towards fraudulent dietary supplements.

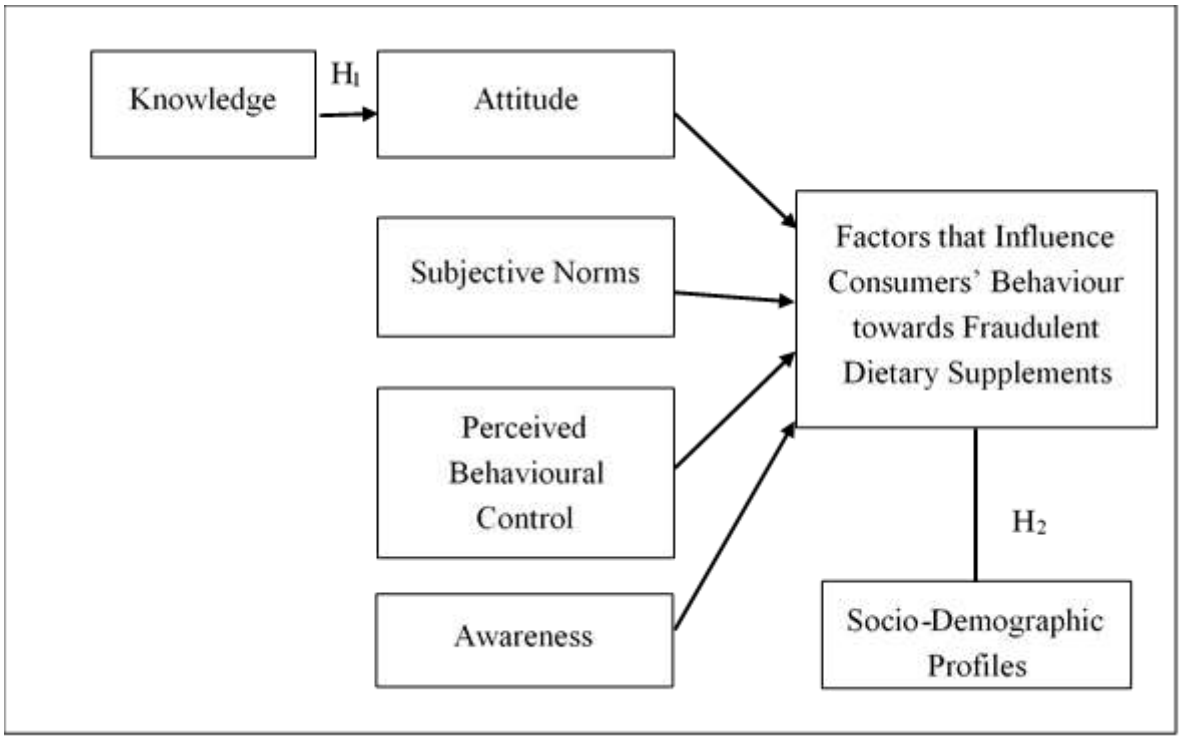


**Figure 1.** Conceptual framework of factor that influence consumers' behaviour towards fraudulent dietary supplements. Source: Adapted from Ajzen (1991); Chartrand (2005); Axon *et al*. (2017).

A total of 400 respondents resided in selected areas in Peninsular Malaysia such as Petaling Jaya, Ampang, Serdang, Shah Alam, Bangi and Putrajaya were selected using a purposive sampling method. Purposive sampling is a non-random approach that does not include underlying hypotheses or a fixed number of respondents (Etikan *et al*., 2016). Based on this sampling method, the researcher determines what needs to be known and decides people who can and are willing to give the information under knowledge or experience (Bernard, 2002). Thus, in this study, the target respondents were selected based on their experience in consuming dietary supplements. To collect the data from the target respondents, a structured questionnaire was developed, consisting of Part A — respondent's socio-demographic profiles; Part B — respondent's knowledge on fraudulent dietary supplements, and Part C — factors that influence consumers' behaviour towards fraudulent dietary supplements. All the statements in Part B and Part C were established based on a 5-point Likert scale. These statements were aimed to obtain responses on consumers' awareness and behaviour towards fraudulent dietary supplements.

The data collected were analysed using several statistical analyses such as descriptive, Chi-square, Pearson correlation, factor and multiple regression analyses. Descriptive analysis was used to explain the socio-demographic profiles of the respondents, and consumer awareness level. Chi-square analysis on the other hand was used to measure the associations between socio-demographic profiles and consumers' behaviour towards fraudulent dietary

supplements. Meanwhile, Pearson correlation analysis was used to identify the relationship between knowledge and consumers' attitude towards fraudulent dietary supplements. The following research hypotheses were developed for Chi-square analysis and Pearson correlation analysis (Table 3).

**Table 3.** Research hypotheses.

| Analysis | Null Hypothesis ($H_0$) | Alternative Hypothesis ($H_1$) |
|---|---|---|
| **Chi-Square** | There is no association between socio-demographic profiles and consumers' behaviour towards fraudulent dietary supplements. | There is an association between socio-demographic profiles and consumers' behaviour towards fraudulent dietary supplements. |
| **Pearson Correlation** | There is no relationship between knowledge and consumers' attitude towards fraudulent dietary supplements. | There is a relationship between knowledge and consumers' attitude towards fraudulent dietary supplements. |

Factor analysis was used to summarize the information contained in a large number of variables to a smaller number of variables by reducing the number of variables or group variables with similar characteristics. Before conducting the factor analysis, the reliability analysis was employed to measure the reliability of the variables or items that are used in the factor analysis. Based on the reliability analysis, Cronbach's alpha (α) was 0.899 which is above 0.7, indicating all the variables were valid and reliable for factor analysis. According to Nunnally and Bernstein (1978), Cronbach's alpha (α) of 0.7 and above was good reliability. Besides, Tenko and George (2008) indicated that Cronbach's alpha (α) equal to 0.5 level and less than 0.5 level were still acceptable in social science research and marketing research.

Multiple regression analysis was carried out to identify the factors that influenced consumers' behaviour towards fraudulent dietary supplements. The model that was established for this study as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon \quad (1)$$

Where,

Y = dependent variable (consumers behaviour towards fraudulent dietary supplements)
A = constant
$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficient of $X_1, X_2, X_3, X_4$
$X_1$ = subjective norms
$X_2$ = awareness
$X_3$ = attitude
$X_4$ = perceived behavioural control (PCB)
$\epsilon$ = error

## 4. Results and Discussions

### *4.1 Socio-Demographic Profiles of Respondents*

Table 4 shows the results of the socio-demographic profiles of the respondents in this study.

**Table 4:** Respondents' socio-demographic profiles.

| **Variable** | | **Frequency (*n*)** | **Percentage (%)** |
|---|---|---|---|
| **Gender** | Male | 107 | 27.0 |
| | Female | 293 | 73.0 |
| **Age (years old)** | 18–24 | 112 | 28.0 |
| | 25–34 | 194 | 48.5 |
| | 35–44 | 58 | 14.5 |
| | 45–54 | 29 | 7.25 |
| | 55–63 | 7 | 1.75 |
| **Race** | Malay | 346 | 86.0 |
| | Chinese | 19 | 5.0 |
| | Indian | 24 | 6.0 |
| | Others | 11 | 3.0 |
| **Religion** | Islam | 346 | 86.5 |
| | Christian | 30 | 7.5 |
| | Hinduism | 17 | 4.25 |
| | Buddhism | 7 | 1.75 |
| **Marital Status** | Married | 250 | 62.5 |
| | Single | 150 | 37.5 |
| **Monthly Income (RM)** | ≤ 1,000 | 191 | 47.8 |
| | 1,001–2,000 | 110 | 27.5 |
| | 2,001–3,000 | 73 | 18.2 |
| | 3,001–4,000 | 11 | 2.8 |
| | 4,001–5,000 | 6 | 1.5 |
| | > 5,000 | 9 | 2.2 |
| **Educational Level** | Primary School | 3 | 0.75 |
| | Secondary School | 236 | 59.0 |
| | Diploma | 96 | 24.0 |
| | Degree | 57 | 14.25 |
| | Master | 5 | 1.25 |
| | PhD | 2 | 0.5 |
| | Others | 1 | 0.25 |
| **Occupation** | Government Sector | 50 | 12.5 |

| Variable | | Frequency (*n*) | Percentage (%) |
|---|---|---|---|
| | Private Sector | 94 | 23.5 |
| | Self-employed | 102 | 25.5 |
| | Housewife | 64 | 16.0 |
| | Unemployed | 6 | 1.5 |
| | Students | 82 | 20.5 |
| | Retired | 2 | 0.5 |

Note: $n = 400$

Based on the results in Table 4, the highest number of respondents involved in this study were females (73%, 293) followed by males (27%, 107). The majority of the respondents were Malay, accounted for 86% (346), and aged between 25–34 years old (48.5%). Most of the respondents were Muslims, which accounted for 86.5% (346) and 62.5% (250) of the respondents were married. In terms of the monthly income, most of the respondents earned a monthly income of less than RM 1,000, accounted for 47.8% (191), and majority of them, 59% (236) were secondary school leavers. About 25.5% (102) of the respondents were self-employed.

### *4.2 Consumers' Awareness of Fraudulent Dietary Supplements*

Table 5 shows that 395 (98.75%) of the consumers in this study were aware of fraudulent dietary supplements, while the remaining 5 (1.25%) consumers were not aware of it. Most of the consumers received fraudulent dietary supplements information from both mass media and social media.

**Table 5.** Consumers awareness.

| | Frequency (*n*) | Percentage (%) |
|---|---|---|
| **Aware** | 395 | 98.75 |
| **Not aware** | 5 | 1.25 |
| **Total** | **400** | **100.00** |

### *4.3 Associations between Socio-Demographic Profiles and Consumers' Behaviour towards Fraudulent Dietary Supplements*

The results based on Chi-square analysis showed that age, race, religion and education level were significantly associated with consumers' behaviour towards fraudulent dietary supplements. Race ($p = 0.000$) and educational level ($p = 0.000$) were significant at 1% level of significance ($p < 0.01$), while age ($p = 0.035$) and religion ($p = 0.034$) were significant at 10% level of significance ($p < 0.10$), respectively. Other variables namely gender, marital status, occupation, and monthly income were not significantly associated

with consumers' behaviour towards fraudulent dietary supplements. Table 5 shows the results of the associations between socio-demographic profiles and consumers' behaviour towards fraudulent dietary supplements.

**Table 6.** Associations between socio-demographic profiles and consumers' behaviour towards fraudulent dietary supplements.

| Variable | Chi-square | *dF* | Significant | Result |
|---|---|---|---|---|
| **Gender** | 0.316 | 1 | 0.574 | Fail to reject $H_0$ |
| **Age** | 10.329 | 4 | 0.035** | Reject $H_0$ |
| **Race** | 23.634 | 3 | 0.000*** | Reject $H_0$ |
| **Religion** | 8.675 | 3 | 0.034** | Reject $H_0$ |
| **Marital Status** | 0.406 | 1 | 0.524 | Fail to reject $H_0$ |
| **Monthly Income** | 6.665 | 5 | 0.247 | Fail to reject $H_0$ |
| **Educational Level** | 32.904 | 6 | 0.000*** | Reject $H_0$ |
| **Occupation** | 3.514 | 6 | 0.742 | Fail to reject $H_0$ |

Note: $n$ = 400, ***Significant at 1% level of significance, **Significant at 5% level of significance

### *4.4 Relationship Between Consumers' Knowledge and Attitude*

Pearson correlation analysis was employed to examine the relationship between knowledge and attitude variables. The results in Table 7 show that $r = 0.104$ and $p < 0.038$, indicating a moderate positive relationship between consumers' knowledge and attitude. The relationship was significant at 5% level of significance. Based on Dancey and Reidy (2007), the *r*-value, which is less than 0.5 implies a moderate positive relationship.

**Table 7.** Results of relationship between consumers' knowledge and attitude.

| | | **Knowledge** | **Attitude** |
|---|---|---|---|
| **Pearson Correlation (*r*)** | Knowledge | 1 | 0.104 |
| | Attitude | 0.104 | 1 |
| **Sig. (2-Tailed)** | Knowledge | | 0.038** |
| | Attitude | 0.038** | |

Note: $n$ = 400, **Significant at 5% level of significance

### *4.5 Factors that Influence Consumers' Behaviour towards Fraudulent Dietary Supplements*

#### *4.5.1 Factor analysis*

Based on the factor analysis of this study, the results of Kaiser-Mayer-Olkin Measure of Sampling Adequacy (KMO) was 0.728, indicating the variance among the variables were estimable (Kaiser, 1974). Bartlett's Test of Sphericity was 1670.185, which exhibited 1% level of significance, indicating the correlation matrix in the factor model and the factor analysis with a given variable was appropriate (Tenko & George, 2008). Table 8 shows the summary of factor analysis results with four (4) factors extracted, and the cumulative

variance explained was 74.565%. The factors were named subjective norms, awareness, attitude and perceived behavioural control (PCB).

**Table 8.** Summary of factor analysis results.

| Items | Factor loading |
|---|---|
| Factor 1: Subjective Norms | |
| a) I am confident to consume dietary supplements that were introduced by my friends. | 0.854 |
| b) I consumed dietary supplements because I was influenced by a good review of the product. | 0.842 |
| c) I consumed dietary supplements because I was influenced by the product's ambassador who provides good reviews of the product. | 0.820 |
| d) My family's opinion has influenced me to purchase dietary supplements that are available in the market. | 0.768 |
| Eigenvalues | 2.940 |
| % of variance explained | 26.725 |
| Cumulative % of variance explained | 26.725 |
| Cronbach's alpha | 0.845 |
| Factor 2: Awareness | |
| a) I am aware of fraudulent dietary supplements. | 0.863 |
| b) I am aware of the effects of consuming dietary supplement fraud. | 0.859 |
| c) I am aware of the existence of dietary supplement fraud in the market. | 0.733 |
| Eigenvalues | 2.779 |
| % of variance explained | 25.268 |
| Cumulative % of variance explained | 51.993 |
| Cronbach's alpha | 0.784 |
| Factor 3: Attitude | |
| a) I always check the ingredients of dietary supplements before purchasing them. | 0.932 |
| b) I always check the information on the packaging of dietary supplements before purchasing them. | 0.914 |
| Eigenvalues | 1.433 |
| % of variance explained | 13.026 |
| Cumulative % of variance explained | 65.019 |
| Cronbach's alpha | 0.864 |

| Items | Factor loading |
|---|---|
| Factor 4: Perceived Behavioural Control (PCB) | |
| a) I can find about fraudulent dietary supplements in the news. | 0.856 |
| b) I always ready to search for dietary supplements that are legally sold in the market. | 0.801 |
| Eigenvalues | 1.050 |
| % of variance explained | 9.545 |
| Cumulative % of variance explained | 74.565 |
| Cronbach's alpha | 0.670 |

Note: $n$ = 400

Based on Table 8, the first factor extracted was subjective norms with an eigenvalue of 2.940. The factor explained a total variance of 26.725% and consisted of four (4) sub-variables with factor loadings between 0.768–0.854. The first sub-variable was *"I am confident to consume dietary supplements that were introduced by my friends"* (0.854), followed by the second sub-variable was *"I consumed dietary supplements because I was influenced by a good review of the product"* (0.842), the third sub-variable was *"I consumed dietary supplements because I was influenced by the product's ambassador who provides good reviews of the product"* (0.820) and the fourth sub-variable was *"My family's opinion has influenced me to purchase dietary supplements that are available in the market"* (0.768). The internal reliability analysis, indicating Cronbach's alpha of the four (4) sub-variables was 0.845.

The second factor extracted was awareness with an eigenvalue of 2.779. The factor explained a total variance of 25.268% and consisted of three (3) sub-variables with factor loadings between 0.733 - 0.863. The first sub-variable was *"I am aware of fraudulent dietary supplements"* (0.863), followed by *"I am aware of the effects of consuming dietary supplement fraud"* (0.859) as the second sub-variable and the third sub-variable was *"I am aware of the existence of dietary supplement fraud in the market"* (0.733). The internal reliability analysis, indicating Cronbach's alpha of the three (3) sub-variables was 0.784.

The third factor extracted was attitude with an eigenvalue of 1.433. This factor consisted of two (2) sub-variables, which explained a total variance of 13.026%. The first sub-variable was *"I always check the ingredients of dietary supplements before purchasing them*" (0.932) and the second sub-variable was "*I always check the information on the packaging of dietary supplements before purchasing them*" (0.914). The internal reliability analysis, indicating Cronbach's alpha of the two (2) sub-variables was 0.864.

The fourth factor extracted was perceived behavioural control (PCB) with an eigenvalue of 1.050. The factor explained a total variance of 9.545% and consisted of two

(2) sub-variables. The first sub-variable was *"I can find about fraudulent dietary supplements in the news"* (0.856) and the second sub-variable was *"I always ready to search for dietary supplements that are legally sold in the market"* (0.801). The internal reliability analysis, indicating Cronbach's alpha of the two (2) sub-variables was 0.670.

### *4.5.2 Multiple regression analysis*

Multiple regression analysis was used to identify the factors that most influence consumers' behaviour towards fraudulent dietary supplements. The independent variables included in the model were subjective norms, awareness, attitude, and perceived behavioural control (PCB). These variables were extracted from the factor analysis. Table 9 shows the result of multiple regression analysis.

**Table 9.** Multiple regression analysis result.

| Variable | Unstandardized Coefficient | | Standardized Coefficient | t-value | Sig. |
|---|---|---|---|---|---|
| | B | Standard Error | Beta | | |
| **(Constant)** | 3.814 | 0.017 | | 220.151 | 0.000*** |
| **Subjective norms** | 0.091 | 0.017 | 0.192 | 5.242 | 0.001*** |
| **Awareness** | 0.250 | 0.017 | 0.529 | 14.413 | 0.002*** |
| **Attitude** | 0.073 | 0.017 | 0.154 | 4.197 | 0.004*** |
| **Perceived Behaviour Control (PCB)** | 0.169 | 0.017 | 0.358 | 9.749 | 0.003*** |
| $R^2$ | 0.468 | | | | |

Note: ***Significant at 1% level of significance

As shown in Table 9, $R^2$ of the model was 0.468, indicating that the combination of independent variables (subjective norms, awareness, attitude, perceived behavioural control) has explained 46.8% of the variation in the dependent variable (consumers' behaviour towards fraudulent dietary supplements). These four independent variables have a positive relative contribution to consumers' behaviour towards fraudulent dietary supplements. The first factor, awareness with $\beta$ = 0.250 and $p$ = 0.002 was significant at 1% level of significance. This finding signified that the greater is the consumers' awareness, the greater consumers' behaviour to avoid consuming dietary supplements fraud by 0.250. This finding was in line with Ishak and Zabil (2012) who argued the relationship between consumers' awareness and behaviour is very important and change in human behaviour and decision

making (Chartrand, 2005). The second factor perceived behavioural control (PCB) with β = 0.169 and $p$ = 0.003 was significant at 1% level of significance. This indicated that when there is an increase in perceived behavioural control (PCB), consumers tend to have high behaviour in avoiding fraudulent dietary supplements by 0.169. As indicated by Armitage and Conner (2001), perceived behavioural control (PBC) has a direct influence on the behaviour. The third factor was subjective norms with $\beta$ = 0.091 and $p$ = 0.001 and significant at 1% significance level. Therefore, an increase in the influence of people from the surrounding such as family members, friends, and others, the more influence consumers' behaviour shall have towards fraudulent dietary supplements by 0.091. This finding further confirmed that subjective norms will influence social pressure either to perform or not to perform a behaviour (Ajzen, 2002). The attitude, the fourth factor was significant at 1% level of significance ($\beta$ = 0.073, $p$ = 0.004). Hence, an increase in a positive attitude has led to the improvement of consumers' behaviour towards fraudulent dietary supplements by 0.073. Pelsmacker *et al*. (2006) argued that people with a positive attitude towards a product tend to buy the product. Based on the results, the estimated multiple regression model can be represented by the following equation: -

$$\text{Behaviour} = \begin{array}{c} 3.814 + 0.091 \text{ x (subjective norms)} + 0.250 \text{ x (awareness)} + \\ 0.073 \text{ x (attitude)} + 0.169 \text{ x (perceived behavioural control)} + \epsilon \end{array} \quad (2)$$

## 5. Conclusion

The dietary supplements have become consumers' diet component because of its several functions and effectiveness. Consumers' awareness towards a better lifestyle has increased thus, they tend to be more concerned about their food consumption. This study revealed most consumers were aware of the fraudulent dietary supplements in the market. This is further confirmed by the significant correlation between knowledge and attitude, indicating that consumers who had adequate knowledge tend to have a favourable attitude towards fraudulent dietary supplements. Socio-demographic profiles such as age, race, religion and education level were significantly associated with consumers' behaviour towards fraudulent dietary supplements. Consumers' awareness was revealed as the factor that highly influenced consumers' behaviour towards dietary supplements. This study implies that the prevention for fraudulent activities are able to reduce the number of consumers who have been affected from adverse effects by consuming the fraudulent dietary supplements. The manufacturers of dietary supplements need to play a major part in the market by practicing high integrity in responding to the increasing demand from consumers by maintaining the quality, originality and effectiveness of the supplements with the warning of minor side or adverse effects. The government and relevant authorities also need to

continuously educate consumers on the effects of consuming fraud dietary supplements by organizing various programs or activities to spread the information regarding fraudulent dietary supplements in Malaysia and increase consumers' awareness towards fraudulent dietary supplements. Besides, the government's roles are important to eradicate fraudulent dietary supplements in the market and to continuously monitor the dietary supplements available and sold in the market to be properly labelled and fully certified by the Pharmaceutical Enforcement Division in the Ministry of Health, Malaysia. Apart from that, the consumers shall also have the opportunity to alert and notify the Ministry of Health or relevant authorities, if they discover any dietary supplement under the suspicion of fraudulent or victimised through dangerous side or adverse effects of any dietary supplement.

This study has revealed many interesting results, nevertheless, it has many limitations that must be considered. First, only a few numbers of fraudulent dietary supplement cases were reported, which unable to capture the real situation in Malaysia. Second, it is difficult to identify dietary supplement products in Malaysia because many producers tend to name their products with different terms like 'food supplements', 'health products', 'health supplements' 'traditional products', 'tonic drinks' and 'Chinese medicines'. Thus, this study suggests that proper guidelines and policies on dietary supplements should be improved by the relevant authorities, while these authorities should provide a complete database to be accessible via online application and from their mobile devices.

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