

## The Preference for Palm Vitamin E Tocotrienols and The Willingness to Purchase Among Consumers in Peninsular Malaysia

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### Abstract

Palm vitamin E tocotrienols, also known as tocotrienol-rich fractions (TRFs), exhibit anti-inflammatory and antioxidant properties. These characteristics have been scientifically demonstrated to be beneficial to human health. Despite the well-known attributes of vitamin E tocotrienols and abundant credible scientific data on their benefits, there has been no research on the consumption of palm vitamin E tocotrienols from an economic standpoint, specifically on consumer preferences, attitudes, and their willingness to pay, especially in Malaysia. Therefore, this study aims to identify the factors influencing people's willingness to pay for palm vitamin E tocotrienols based on their preferences. This study used descriptive statistics and regression analysis with the aid of SPSS version 20.0. The study applied a quota sampling procedure, stratified by the population of states in Peninsular Malaysia. It was discovered that 419 vitamin users in Peninsular Malaysia only have a rudimentary understanding of the palm vitamin E tocotrienols' health benefits. The study discovered that tocotrienols in a flavoured chewable tablet are worth more to consumers. The likelihood of consumers purchasing tocotrienols would increase by 67.5% if tocotrienols were switched from capsules to flavoured chewable tablets. In addition, they were willing to pay an additional RM23.30 per bottle for tocotrienols in the form of a flavoured chewable tablet, which is 19.0% more than the retail price of tocotrienols in the form of a capsule. Nevertheless, they expected a significant price discount of RM48.89 (41%), if the tocotrienols were sold online. The findings of this study could be used as a source of reference for researchers in identifying future product development for the palm vitamin E tocotrienols that are appropriate to consumers' needs and preferences.

**Keywords:** consumers' preference, consumers' willingness to pay, palm vitamin E tocotrienols, Tocotrienols



## 1.0 Introduction

In this era, having a better quality of life is becoming a priority. Demand for vitamins, supplements, and other health-related products is increasing. According to Market Research (2020), more than 60% of people take a vitamin daily, with nearly 55% enticed to consume vitamins to improve their health or balance their diet. In the current scenario where people are constantly chasing time, people are always consuming chemically processed foods to curb hunger, which are often inexpensive and low in nutrients, which can increase the risk to a person's health (Amy Smith, 2020). However, healthy food should not be replaced by supplements in a person's daily diet (Dyquianco, 2014). It cannot fully supply all the nutrients and benefits of real food. As its name suggests, the role of a supplement is to complement in the event of any nutritional deficiencies. Hence, it is needed only in particular circumstances. Taking supplements requires advice and monitoring from experts. Inadvertently, intake of supplements can be harmful to the body. For example, excessive intake of vitamin A can cause headaches, liver damage, weak bones, and disabilities in a foetus (Larry E. Johnson, 2020).

Meanwhile, excessive consumption of iron can cause nausea and vomiting and damage the liver and other organs (Kelli, 2020). A product sold on the market, advertised on television, recommended by well-known celebrities, or promoted by muscular athletes does not guarantee safety and effectiveness. Consulting medical experts and professionals is the best choice before taking any supplements or vitamin products (Kelli, 2020). There are various supplements on the market, including vitamins, minerals, amino acids, enzymes, probiotics, fish oils, and many more. In addition, there are also various traditional plants that have been modified, formulated, and commercialised according to market needs. To market products to different societies and ages, manufacturers produce products in a variety of formulations. It is available in syrup for easy consumption; in pills, capsules, tablets, and sachets for effortless administration; and in the form of infant, child, and pregnant women's formula.

Palm oil is a rich source of vitamin E (Loganathan et al., 2021). It is rich in vitamin E, enhancing our immune system's ability. Palm oil also contains phytosterols, compounds in various plants, scientifically proven to help reduce cholesterol levels and the risk of cardiovascular diseases (Ge Baiet al., 2021). The nutritional content of palm oil provides various health benefits, such as improving brain function and



increasing overall health (Erica, 2018). With a composition of 30% tocopherols and the remaining 70% tocotrienols, the potential benefit of this crop has begun to be realised (Sen et al., 2007). Research on tocotrienols began to gain attention after demonstrating their health potential. Tocotrienols have a different biological structure and function as compared to tocopherols. It is also not as readily bioavailable as tocopherol, which is naturally present in most vegetable oils. It is a small component of plants and can be obtained from cereals such as rice bran, barley, rye, and wheat germ. As for plant oils, only palm oil and rice bran oil contain tocotrienols (Ahsan et al., 2015).

Despite the fact that all of the benefits of vitamin E tocotrienols are well known, tocotrienol studies accounted for less than 3% of all vitamin E publications (Peh et al., 2016). In contrast, more than 25,000 studies on tocopherol have been carried out (Kannappan et al., 2012). According to Chandran et al. (2006), a review of the NIH Computer Retrieval of Information on Scientific Projects (CRISP) database shows that funding for tocotrienol research represents less than 1% of all vitamin E research during the last 30 years. Tocotrienols were rarely figured in vitamin E research despite their relative superiority to tocopherol due to biases toward false accusations of palm oil's leading to deforestation and other anti-palm oil campaigns (AF Musa, 2021). However, Malaysia's tocotrienol-rich fraction (TRF) (hereafter referred to as palm vitamin E tocotrienols) is yet to bloom. To date, there are only seven (7) palm vitamin E tocotrienol producers in Malaysia, namely, Sime Darby Bioganic Sdn Bhd, ExcelVite Inc (formerly known as Carotech Inc.), Carotino Sdn Bhd, Supervitamins Sdn Bhd, Sarawak Oil Palm Nutraceuticals (SOP) Sdn Bhd, Hovid Bhd, Palm Nutraceuticals Sdn Bhd, and KLK OLEO-Davos Life Science Pte Ltd. More research and development is still needed to fully explore the benefits of tocotrienols, which can later be used in promotional activities for Malaysians. Thus, this study was specifically designed to understand consumers' preferences and willingness to pay for palm vitamin E tocotrienols.

The following sections present the literature review on consumers' preferences and attitudes toward vitamin E and palm tocotrienols, followed by research methodology, empirical results, and conclusion.



## **2.0 Literature Review**

### **2.1 Vitamin E**

Vitamin E is a vital nutrient for the human body and must be obtained through a daily diet since it cannot produce vitamin E on its own (Chandran et al., 2006). Vitamin E comprises four tocopherols (T) and four tocotrienols (T3) isomers. Palm oil is one of the most abundant natural sources of vitamin E (Dian et al., 2019). According to Gapor (2015), tocotrienols and tocopherols are homologues of vitamin E, and vitamin E is a fat-soluble natural antioxidant. Tocotrienols are vitamin E from palm oil and are known for their antioxidant properties and prevention of radical and oxidative damage. Aside from its primary antioxidant function, scientists around the world have discovered additional health-enhancing benefits of Vitamin E. For example, Vitamin E, especially tocotrienols, is cardioprotective (Ramanathan et al., 2018), anti-cancer (Aggarwal et al., 2010), prevents obesity and diabetes (Pang & Chin, 2019), nephroprotective (kidney system) (Rashid, 2015), and gastroprotective (digestive system) (Nur Azlina et al., 2017). Vitamin E is also important for bone metabolism and neurologic and brain development in the foetus and children under the age of three (Dian et al., 2017).

Despite all the studies on the health benefits of palm tocotrienols, very few research studies on the demand side of tocotrienols have been performed thus far. According to Menayang (2017), there is still a lack of understanding of tocotrienols in the healthcare community, and vitamin E tocopherols are more established than vitamin E tocotrienols. It might be due to the 40-year gap between the discovery of tocopherols and tocotrienols. The global market size for tocotrienols is estimated to be only 1% to 3% of the total vitamin E market (Yen, 2016). Despite increasing awareness of the importance of several vitamins in India, only 9% of Indian consumers are aware of the health benefits of vitamin E. While most individuals resort to vitamin E for numerous ailments, the true potential of vitamin E still experiences a lack of awareness on a large scale (Modor Intelligence, 2018). Many regulatory and safety authorities for food are relatively new to palm tocotrienols. In some countries, such as China and Korea, tocotrienols are not an approved ingredient, despite having similar chemical structure and biological activity as tocopherols and being recognised as safe by the US FDA (Yen, 2016). Increasing healthcare awareness and spending on vitamins and supplements globally are the key growth



drivers of the natural vitamin E market. According to the forecast, the demand for palm tocotrienol is anticipated to increase significantly and advance (Research & Market, 2017).

## 2.2 Consumer Preferences and Willingness to Pay

A study on consumer preferences and product attributes is necessary to ensure a product's marketability. An analysis of the bell pepper market in the United States found that colour influenced consumers' purchasing decisions more than price and vitamin content (Frank et al., 2001). Evans (2008) also reported that in the study of watermelon purchasing behaviour in Alabama, flesh colour was the most critical attribute influencing buyers' decisions. Besides colour, the product's form also determines the acceptance of one's products. Jones and Francis (2000) found that consumers in cities in the United States preferred soft gels over other solid forms to ease swallowing. Other than these, the price of the vitamin, taste, availability, high vitamin content, easiness of preparation, and good packaging also influence the consumers' buying behaviour (Kolapo & Abimbola, 2020). The low-income group will generally use price as the basis for buying decisions (Glanz et al., 1998; Drewnowski & Darmon, 2005). All these factors must be considered while formulating the marketing strategy to ensure that the consumers can receive the products' benefits.

Apart from that, consumers have different preferences when it comes to purchasing platforms. Online purchasing expansion has given the most significant impact to the internet and essentially more choice to goods and services that will satisfy user utilisation, such as fast delivery, instant purchasing, lower prices, and broader selections of products and services (Zuroni et al., 2021; Marziah & Laily, 2015). In India, online grocery shopping is a relatively new phenomenon due to the expanding e-commerce industry, growing urbanisation, changes in consumers' lifestyles, and the tech-savvy younger generation who prefer to buy grocery products through online purchasing platforms (Prasad & Raghu, 2018).

A study on consumers' willingness to pay for palm tocotrienols has never been conducted before. Nevertheless, questions about which attributes of palm vitamin E tocotrienol products are highly preferred and valued by consumers need to be understood. Thus, the consumers' acceptance needs to be fulfilled and later expanded upon the marketability of this product. Therefore, this study aimed to



understand factors affecting consumers' willingness to pay for palm vitamin E tocotrienols, particularly in Peninsular Malaysia.

### 2.3 Conceptual Framework

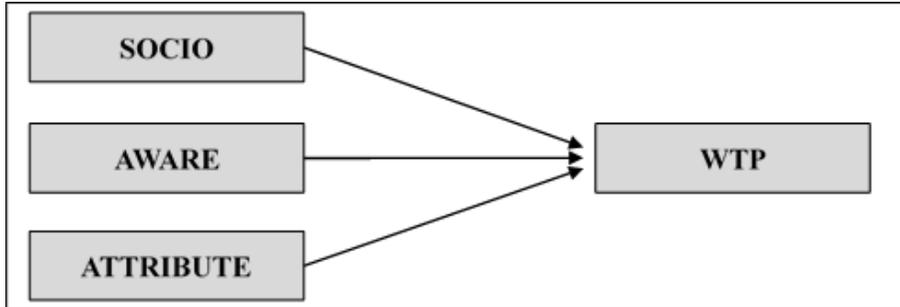


Figure 1 : A Research Framework for Willingness to Pay

The research approach employed in this study to explain factors influencing consumers' willingness to pay (WTP) for palm vitamin E Tocotrienols in Peninsular Malaysia is depicted in Fig. 1. In Peninsular Malaysia, various factors influence consumers' WTP for palm vitamin E Tocotrienols, including socio-demographic (socio), awareness (aware), and tocotrienol characteristics (attributes).

The first factor is socio, which is believed to affect consumer behaviour towards vitamin E from palm oil. It was supported by studies by Gil et al., (2000) and Lockie et al., (2006) that socio-economic factors like age, gender, education level, family size, and income level are essential in determining the WTP. The second factor is awareness, consisting of three (3) dimensions: usage of vitamins, awareness, and knowledge of tocotrienols among the consumers. According to Alba and Hutchinson (1987), knowledge of products among consumers is affected by the type and quality of information available to them. If the level of knowledge is low or there are doubts about the product's knowledge or information, consumers perceive a risk in buying the products, which could hinder their WTP. The last factor is an attribute consisting of four (4) dimensions: type, the active ingredient, platform of purchase, and price of the tocotrienols. Ranasingha et al. (2019) used attributes of colour, size, shape, firmness, and price in determining WTP for pear, pomegranate, grape, and orange in Sri Lanka. Meanwhile, in Rwanda, Temesgen Bocher et al. (2019) used scent, taste, colour, the 'right' amount of sugar, and aftertaste for orange fleshed sweet potato (OFSP) juice. Thus, face-to-face

interviews were conducted to understand factors affecting consumers' willingness to pay for palm vitamin E tocotrienols in Peninsular Malaysia.

### 3.0 Methodology

This study follows a quota sampling procedure, stratified by the population of states in Peninsular Malaysia. The minimum sample size for this study was determined using the following standard sample size determination formula for a finite population (Keller, 2008; Berenson et al., 2014):

$$n = \frac{n_0 N}{n_0 + (N-1)}; \quad n_0 = \left( \frac{Z_{\alpha/2}}{ME} \right)^2 p(1 - p)$$

Where:

- n = required sample size
- n<sub>0</sub> = sample size for infinite population
- N = population size
- Z<sub>α/2</sub> = Z critical value at chosen confidence level
- P = proportion of population
- ME = margin of error

Taking the population of Peninsular Malaysia at 25 million, with the confidence level set at 95%, the margin of error at 5%, and the proportion of the population at 50%, the minimum number of respondents to be interviewed in this study is 385 respondents. However, in this study, 419 respondents aged more than 18 years old were interviewed. The interview session was held in a selected shopping mall in Peninsular Malaysia in 2019.

Consumers' preferences for vitamins and palm vitamin E tocotrienol characteristics were gathered as part of the data collection process. Extensive focus group discussions preceded the survey and a pilot assessment to see if the attributes and levels chosen for tocotrienols are appropriate and straightforward to comprehend. The survey wording and layout were modified following the discussions to improve readability. A pilot study was conducted online on 104 respondents to test the preliminary empirical results suggested by the survey.

After that, the survey was conducted in 27 retail malls in Peninsular Malaysia using face-to-face interviews. In total, 419 people



took part in the interview session. Experienced and well-briefed enumerators conducted the interview sessions.

Then, the data was analysed using descriptive statistics and regression analysis with the aid of SPSS version 20.0. The descriptive statistics, including frequencies and cross-tabulation, give simple summaries of the sample. Meanwhile, the regression analysis using a binary logistic model determines factors affecting consumers' willingness to pay for tocotrienols.

The binary logistic model evaluates relationships between a dichotomous dependent variable and metric and non-metric independent variables. For this analysis, this model estimates the respondents' probability of agreeing to pay for a series of tocotrienol products, given the information on the attributes of the products.

The specifications of the model are as follows:

$$\frac{P_y}{1-P_y} = e^{\alpha + \sum_{i=1}^n \beta_i(\text{socio}) + \sum_{i=1}^n \delta_i(\text{aware}) + \sum_{i=1}^n \theta_i(\text{attribute})} \quad (1)$$

Where:

- $P_y$  =Probability of respondent willing to pay for tocotrienols products
- $1 - P_y$  =Probability of respondent not willing to pay for tocotrienols products
- socio =Socio-demographic variables
- aware =Variables on respondents' usage, awareness, and knowledge of vitamins and tocotrienols
- attributes =Variables on attributes of the tocotrienols
- $\alpha$  =Constant
- $\beta_i, \delta_i, \theta$  =Coefficients

The experimental design for this study involves 15 choice sets. Assuming that consumers' behaviour is homogenous, the choice sets were divided into three (3) blocks, in which every block contains only five (5) choice sets. Each choice set has three (3) quality attributes and one (1) price attribute. As explained in Table 1, each quality attribute has three (3) to four (4) levels of choices, while the price attribute has thirteen (13) levels.



Table 1 : Attributes and Levels

Attribute	Level
Type	Capsule, Flavoured Chewable Tablet, Flavoured Syrup, Flavoured Powder
Active Ingredient	100 mg/60s, 200 mg/30s, 50 mg/120s
Platform of Purchase	Pharmacy, Direct Sales, Online Sales
Price	RM100, RM110, RM120, RM130, RM135, RM140, RM145, RM150, RM155, RM160, RM165, RM170, RM180.

## 4.0 Findings

### 4.1 Descriptive Analysis

Based on the survey as tabulated in Table 2, the majority of the respondents were Malay (83.3%), followed by Chinese (12.4%), Indian (3.6%), and others (0.7%). Most of the respondents were from Johor (13.6%), followed by Selangor (12.6%), Perak (9.8%), and Kedah (9.5%); 68.3% of them were female, and 31.7% were male. The majority of the respondents were aged 30–39 years old (29.1%) and had a degree (30.3%) and Sijil Pelajaran Malaysia (28.9%). Of the 419 respondents interviewed, 40.1% worked in the private sector, 24.8% were government servants, and 12.4% were self-employed. The monthly income of the respondents was between RM2,000–RM4,999 (40.7%), less than RM2,000 (39.0%), and more than RM8,000 (9.1%).

Table 2 : General Information of Respondents

Category	Percentage (%)	Category	Percentage (%)	Category	Percentage (%)
<u>State/Location</u>		<u>Gender</u>		<u>Monthly income (RM)</u>	
Selangor	12.6	Male	31.7	< 2000	39
Kuala Lumpur	3.8	Female	68.3	2000 – 4999	40.7
Negeri Sembilan	4.8	<u>Race</u>		5000 – 7999	10.8
Melaka	4.8	Malay	83.3	8000 – 10 999	5.5
Perak	9.8	Indian	3.6	11 000 – 13 999	1.4
Kedah	9.5	Chinese	12.4	≥ 14 000	2.2
Perlis	2.4	Others	0.7	<u>Employment Sector</u>	
Pahang	7.4	<u>Age</u>		Government	24.8
Terengganu	5.0	> 20	4.8	Private	40.1
Kelantan	7.2	20 – 29	28.4	Self-employed	12.4
Johor	13.6	30 – 39	29.1	Housewife	8.8



Category	Percentage (%)	Category	Percentage (%)	Category	Percentage (%)
Penang	7.2	40 – 49	16.0	Retirement	7.6
<u>Educational</u>		50 – 59	13.6	Others	6.2
Primary or no formal education	1.7	≥ 60	8.1		
SRP & PMR	3.8				
SPM	28.9				
STPM, Certificate, Diploma	28.4				
Degree	30.3				
Master & PhD	6.9				

Table 3 shows that only 14.1% of the respondents consumed vitamin E; meanwhile, the majority of them consumed vitamin C (61.0%). Most of them consumed vitamins seven (7) times a week (54.6%). Regarding consuming the vitamin, 24.3% of the respondents decided to eat it alone. Other factors that influence respondents to consume the vitamin are family (20.8%), friends/co-workers (17.1%), medical doctors (11.9%), pharmacists (8.4%), and others (17.3%). Most of them were taking the vitamin because of physical weakness (31.5%), sporadically, without any particular pattern (25.3%), and periodically throughout the year (21.8%). Regarding the amount of vitamin consumed, it was based on the indication in the product information leaflet (45.4%), the seller's advice (29.8%), and trainer/coach's advice (17.6%). Most of the vitamin users bought the vitamins from pharmacies (72.2%), direct sales (11.4%), and online (6.5%). The respondents spent their money on vitamins for less than RM100 per month and were willing to pay RM100–RM199 per month (43.0%).



Table 3 : Information on Vitamin Usage

Information	Percentage (%)	Information	Percentage (%)
<u>Type of vitamins</u>		<u>Circumstances to take vitamin</u>	
Vitamin A	4	Physical weakness	31.5
Vitamin B	10.9	Periodically throughout the year	21.8
Vitamin C	61	Association with sports activities	3.7
Vitamin D	6	Sporadically, without any particular pattern	25.3
Vitamin E	14.1	Others	17.6
Vitamin K	0.7	<u>How to specify the amount of vitamin that should be taken?</u>	
Multivitamin	26.6	Based on the seller's advice	29.8
Others	29.2	Based on trainer/coach advice	17.6
<u>Consumed vitamin per week</u>		Based on the indication in the product information leaflet	45.4
Once a week	8.4	Based on information on the internet	10.7
Two times a week	9.9	Calculated based on body weight	3.2
Three times a week	12.9	Arbitrarily	11.7
Four times a week	6.7	<u>Purchasing platform</u>	
Five times a week	3.2	Pharmacy	72.2
Six times a week	3	Supermarket	2.5
Seven times a week	54.6	Online Sales	6.5
14 times a week	1.2	Direct Sales	11.4
<u>Factors to take vitamins</u>		Others	7.4
Friend/co-workers	17.1	<u>Monthly expenditure for vitamins (RM)</u>	
Medical doctor	11.9	<100	51.1
Trainer/coach	2.2	100–199	31.8
Pharmacist	8.4	200–299	10
Family	20.8	≥300	7
Internet	3.7	<u>Willingness to pay for vitamins a month (RM)</u>	
Media advertising	6.7	<100	31.2
Itself	24.3	100–199	43
others	4.7	200–299	15.1
		≥300	10.8

Generally, 70.2% of the respondents knew about vitamin E. 46.8% know that vitamin E comes from natural or synthetic sources, as indicated in Table 4. However, only 14.8% know about the natural vitamin E type, tocotrienols, and tocopherols. Thus, they are unaware that vitamin E tocotrienols work better than vitamin E tocopherols. Palm oil is one of the richest sources of tocotrienols, and other benefits



include preventing strokes, Parkinson's, and Alzheimer's, and reducing cancer risk. After being explained by the enumerators, most respondents agree that palm vitamin E tocotrienols are necessary at all ages and are essentially harmless. Regular palm vitamin E tocotrienol intake can reduce the risk of chronic diseases and cancer.

Table 4 : Knowledge of Vitamin E

Question	Percentage (%)
1. Do you know what vitamin E is?	70.2
2. Do you know that vitamin E comes from either natural or synthetic sources?	46.8
3. Are you aware that there are two types of naturally occurring vitamin E, i.e., tocotrienols and tocopherols?	14.8
4. Are you aware that palm oil is rich in both forms of vitamin E, i.e., tocotrienols and tocopherols?	15.5
5. Are you aware that vitamin E tocotrienols work better than vitamin E tocopherols?	7.9
6. Are you aware that palm oil is one of the richest sources of tocotrienols?	14.3
7. Do you know that vitamin E tocotrienols are a source of antioxidants that help reduce cell damage caused by free radicals?	14.3
8. Do you know that vitamin E tocotrienols can help slow the ageing process, accelerate wound healing, and reduce scarring?	18.1
9. Do you know that vitamin E tocotrienols can help protect brain cells from stroke, Parkinson's, and Alzheimer's?	14.6

#### 4.2 Consumer Preferences for Vitamin Forms

Various forms of vitamins are available on the market, such as tablets, capsules, and powder. Table 5 shows the consumer preferences for the form of the vitamin. Most of the respondents prefer to consume vitamins in capsules (43.9%), followed by flavoured chewable tablets (31.5%), flavoured liquid syrup (28%), and lastly, a flavoured powder (32.5%). This finding parallels with the study by Pooja (2022), where 80% of the women in Chennai preferred and were satisfied with the vitamin in the form of a capsule. It is also supported by a study conducted by Ibrahim et al. (2012) that shows 52.9 % of the consumers who visited community pharmacies in Baghdad, Iraq preferred capsules among other oral solid dosage forms.



Table 5 : Consumer Preferences for Vitamin Forms

Form	Choice (%)			
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
Capsule	<b>43.9</b>	10.9	10.9	7.7
Flavoured chewable tablet	12.9	<b>31.5</b>	19.9	20.3
Flavoured liquid syrup	14.6	20.3	<b>28.0</b>	23.8
Flavoured Powder	5.7	17.6	23.6	<b>32.5</b>

#### 4.3 Factors Affecting Consumer Willingness to Pay for Tocotrienols

The model summary shown in Table 6 indicates that the model satisfies the Binary Logistic Model acceptability tests and can effectively explain factors affecting consumers' willingness to pay for tocotrienols. The standard errors for variables included in the analysis are far below 2.0, indicating no evidence of multicollinearity or other numerical problems among the independent variables. The statistically significant  $\chi^2$  for the omnibus test of model coefficients suggests that, collectively, the explanatory variables included in this analysis are valuable predictors for distinguishing between those who were willing to pay for tocotrienols and those who were not. The classification accuracy rate computed by SPSS was 69.8%, which was more significant than the proportional by chance criteria of 69.5% (the model's accuracy rate is more than 25% higher than the by chance accuracy rate). Thus, it shows that the explanatory variables may be useful predictors for differentiating survey respondents who are prepared to pay for tocotrienols from those who are unwilling to pay.

Table 6 : Factors Affecting Consumer Willingness to Pay for Tocotrienols

Variables	$\beta$	S.E.	Wald		Exp ( $\beta$ )
Constant	3.103	0.25	153.564	***	22.254
Combination (combination 1 as a base)			121.728	***	
Combination 2	-0.904	0.167	29.194	***	0.405
Combination 3	0.265	0.173	2.342		1.304
Combination 4	-0.745	0.164	20.755	***	0.475
Combination 5	0.386	0.171	5.094	**	1.471
Combination 6	-0.641	0.184	12.178	***	0.527
Combination 7	-0.117	0.166	0.496		0.89



Variables	$\beta$	S.E.	Wald		Exp ( $\beta$ )
Combination 8	-0.205	0.187	1.193		0.815
Combination 9	-0.105	0.155	0.455		0.901
Combination 10	-0.045	0.153	0.088		0.956
Combination 11	-0.93	0.169	30.318	***	0.395
Combination 12	-0.722	0.163	19.631	***	0.486
Combination 13	0.203	0.17	1.424		1.225
Combination 14	0.057	0.162	0.126		1.059
Combination 15	-0.771	0.164	22.028	***	0.463
Form ( <i>Capsule as a base</i> )			110.921	***	
Flavoured Chewable Tablet	0.516	0.104	24.622	***	1.675
Flavoured Liquid Syrup	-0.191	0.11	3.008	*	0.826
Flavoured Powder	-0.721	0.108	44.718	***	0.486
Active Ingredient (100 mg/60s as a base)			3.716		
200 mg/30s	-0.081	0.096	0.712		0.922
50 mg/120s	-0.153	0.08	3.641	*	0.858
Purchasing Platform ( <i>Pharmacy as a base</i> )			131.028	***	
Direct Sales	-0.449	0.094	22.562	***	0.638
Online Sales	-1.087	0.096	127.145	***	0.337
Price	-0.022	0.002	192.501	***	0.978
Model summary:					
Sample size	6,285				
$\chi^2$ (model)	667.178.***				
25% improvement over the by chance accuracy rate	69.5%				
Classification accuracy rate	69.8%				

Note: \*\*\* Significant at 99%; \*\* Significant at 95%; \* Significant at 90%

The binary logistic model suggests that out of four (4) product attributes included in the model, the active ingredient per serving was not significantly considered by the consumers when making purchasing decisions. Consumers' purchasing decisions for tocotrienols are influenced negatively by price. According to the study, for every Ringgit Malaysia increase in the price of tocotrienols, consumers are 2.2% less likely to pay for tocotrienols. In other words, for every Ringgit Malaysia



decrease in price, consumers will be willing to pay for tocotrienols by 2.2% more.

Consumers prefer tocotrienols in the form of flavoured chewable tablets rather than capsules. However, tocotrienols in flavoured liquid syrup and flavoured powder were even less preferred. This finding is equivalent to the study by Den Uyl et al. (2010). The study also found that by changing tocotrienols from capsules to flavoured chewable tablets, consumers will likely purchase more tocotrienols by 67.5%. However, by switching from capsules to flavoured liquid syrup or flavoured powder, the possibility of consumers purchasing tocotrienols will decline by 17.4% and 51.4%, respectively.

Consumers preferred to buy tocotrienols through the pharmacy rather than through direct or online sales platforms. It was found that consumers were 36.2% and 66.3% less likely to purchase tocotrienols from direct and online sales platforms than pharmacies.

#### 4.4 Implicit Price of Non-Monetary Attributes

The assumption is that the change is made only to the particular attribute while other variables remain unchanged. The average consumer's willingness to pay for the change in the attribute is illustrated in Table 7. The study found that, in general, consumers were willing to pay an additional RM23.30 for tocotrienols in the form of flavoured chewable tablets compared to capsules. Meanwhile, if the change is from capsule to flavoured liquid syrup or flavoured powder, consumers expect a discount of RM8.60 and RM32.43, respectively. If the changes were made regarding the purchasing platform from pharmacy to direct or online sales, consumers would expect a discount of RM20.18 and RM48.89, respectively.

Table 7 : The Estimated Implicit Price of Non-Monetary Attributes

Non-Monetary Attribute	Implicit Price (RM)
Form of Tocotrienols (changed from Capsules)	
To Flavoured Chewable Tablets	23.20
To Flavoured Liquid Syrup	-8.60
To Flavoured Powder	-32.43
Purchasing Platform (changed from Pharmacies)	
To Direct Sales	-20.18
To Online Sales	-48.89



## 5.0 Conclusion and Recommendations

This study found that the general awareness of vitamin E was high amongst vitamin users. However, the consumption of vitamin E itself was low. On the other hand, the awareness of tocotrienols and their health benefits was shallow amongst vitamin users. On the contrary, after receiving information about the health benefits of tocotrienols during the interview session, about 60% of the respondents indicated a positive perception of palm vitamin E tocotrienols. At the same time, most of the remaining respondents were neutral.

Amongst the attributes of the tocotrienol products tested in this study, consumers of vitamins would be willing to pay an extra RM23.30 per bottle for tocotrienols in the form of flavoured chewable tablets, or 19% extra from the retail price of the tocotrienols in the form of capsules, which are currently sold at RM120 per bottle. In contrast, they expected a price discount of RM8.60 (7%) and RM32.43 (27%) for tocotrienols in the form of flavoured liquid syrup or flavoured powder, respectively. They also anticipated a significant price reduction if the tocotrienols were offered online (RM20.18, or 41%) and for direct sales (RM48.89, or 17%) on marketplaces. Consumers showed no significant preference for the number of tocotrienols in the packaging, regardless of the variance.

The study also found that the local consumers' awareness and knowledge of palm vitamin E tocotrienols are low. Therefore, it is recommended that publicity and promotion should be given to this high-value-added product derived from palm oil. Hence, consumers could be made aware of this product's health benefits, thus increasing their acceptance of this product. It is suggested that the scientists, researchers, and companies involved in product development and marketing explore other forms of palm vitamin E tocotrienols' attributes and other platforms for selling products that could meet consumers' preferences.

To promote the usage of palm vitamin E tocotrienols, the Malaysian Palm Oil Board (MPOB) launched a Tocotrienol Consumption Promotion Programme among MPOB's staff and their spouses in 2013. The programme has been continued repeatedly, and the response has been very encouraging. It was initially targeted at the MPOB staff aged more than forty (40) years old, but was extended to the MPOB staff aged less than forty (40) years old and their spouses. This programme is part of the tocotrienols promotional activities with



collaboration between MPOB, the Ministry of Plantation Industry and Commodities (MPIC), and industry players (Malay Mail, 2020).

This survey covers Peninsular Malaysian consumers' willingness to pay; it does not include Sabah and Sarawak consumers. As a result, this survey will not be used to describe the overall Malaysian consumer's willingness to pay. Furthermore, the research was carried out in shopping malls with pharmacies due to budgetary and human resource constraints. As a result, this study does not rule out the possibility that the study's findings are skewed toward the pharmacy.

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