CONSUMERS' PREFERENCE AND WILLINGNESS TO PAY FOR RED PALM OIL AS ALTERNATIVE COOKING OIL: CHOICE-BASED CONJOINT ANALYSIS

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Abstract

Indonesia's heavy reliance on palm cooking oil has significant implications for national food security. The 2022 palm oil shortage exposed vulnerabilities in supply chains, triggering sharp price volatility, panic buying, and reduced access for low-income households. In response, Red Palm Oil (RPO) emerges as a potential alternative, offering enhanced nutritional value through β-carotene and vitamin E. However, market acceptance of RPO remains limited, primarily due to low consumer awareness and resistance to its distinct red color compared to conventional cooking oil. This study aims to analyze consumers' willingness to pay (WTP) for RPO and to evaluate the effectiveness of differentiated marketing strategies, including health-claim labeling and integrated nutritional and processing information, in improving consumer acceptance. A choice-based conjoint analysis was employed, and preferences were estimated using a conditional logit model based on data from 200 household respondents in Brebes, Central Java. The experimental design utilized fractional factorial and orthogonal arrays to construct choice sets. The results reveal that intrinsic attributes, such as red color and strong taste, negatively influence consumer preferences. In contrast, extrinsic attributes, particularly the combination of nutritional and processing information labels along with health claims, significantly enhance consumer acceptance (β= 0.513) and increase willingness to pay (WTP = Rp 18,876). These findings highlight the importance of effective labeling strategies and consumer education in promoting RPO adoption. Strengthening information delivery through integrated labeling can serve as a key policy and marketing instrument to support food diversification and improve nutritional outcomes in Indonesia.

Keywords: Consumer Preference, Food Security, Health Claim, Red Palm Oil, Willingness to Pay.

INTRODUCTION

As the world major producer of palm oil industries, Indonesia has been overjoyed the crude palm oil (CPO) production economic prowess. In domestic markets, CPO has been processed as the palm cooking oil with a yellow-light color utilized as the most common conventional cooking oil. Based on the national census (SUSENAS), the palm cooking oil has become an essential households' consumption product by a consistent increase every year, which reflected its major role in supporting the food consumption for the Indonesia consumers. It was noteworthy to mention that palm cooking oil as the major source of households' consumption for supporting a basic daily food, besides a small portion of coconut oils which commonly offered healthier ingredients, however with much higher prices; unaffordable for majority of Indonesia consumers.

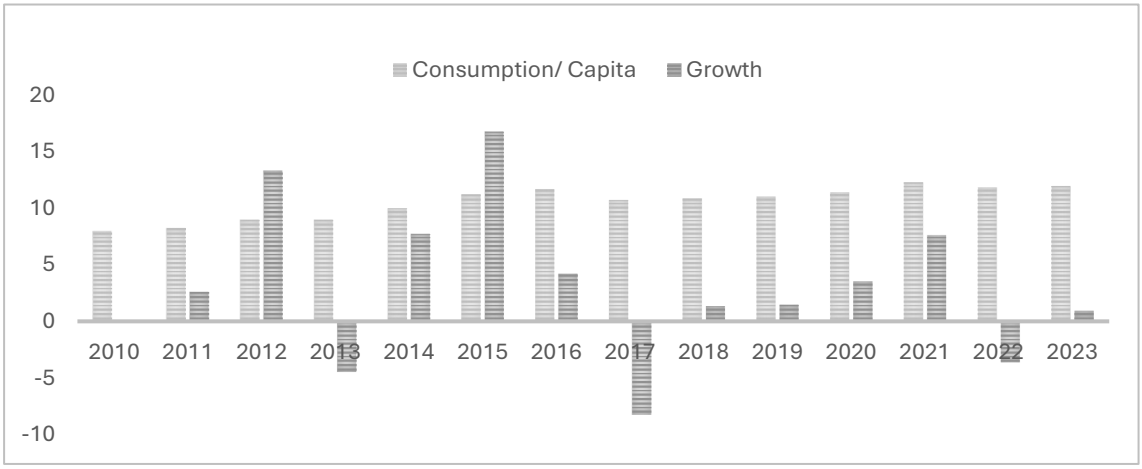

Figure 1
Household annual consumption of Conventional Palm Cooking Oil (in Litters)
Source: Badan Pusat Statistik, (2023)

Based on above-portrayed figure, it was confirmed that palm cooking consumption was essentially needed for the consumers with a steady increase in household per capita consumption in each year. Moreover, we could note during several years, the growth of consumption has declined. This decline was associated with the scarcity of palm cooking oil, as the last occurrence was in 2022 where massive numbers of Indonesia consumers faced phenomenon of scarcity, where majority of oil palm firms tend to sell in the export market due to its more earning potential. Thus, it causes imbalance in the domestic supplies especially for cooking oil productions. A study of (Nur & Darmawati, 2022) pronounced the occurrence of palm cooking oil scarcity caused an pressure on price specifically during the end of 2021 to the early quarter of 2022. Despite Indonesia government efforts including by escalating export taxes and relaxing biodiesel production, the scarcity of palm cooking oil remained during 2022 (Rahmayanti et al., 2022). This leads to a massive challenge not only to individual consumers, but also for industries with heavily dependance on palm cooking oil. As consequences, it causes panic buying behavior with resulted a skyrocketing price in the palm oil market, from only Rp 14.000 to Rp 15.000 between 2020 and 2021, to elevate up to Rp 21.971 during 2022 (Kementerian Pertanian, 2023).

An intense of skyrocketing price with limited number of palm oil production in the market could cause a chaotic food security in the Indonesia consumers, especially household who is massively dependent on the consumption of palm cooking oil. (Levy & Wiggins, 2008) confirmed the rising food price would affect both directly and indirectly, especially poor society, where poor households would be struggling to cope with higher costs of foods. Meanwhile, (Gustafson, 2013) clarified households that faced with high prices, drought, economic crises and other shocks would limit their access to food in a variety of ways. Moreover, shocks such as these can result in poverty traps, whereby a short-term event causes permanent damage.

A concept of food security by (Peng & Berry, 2018) defined four dimensions of food security consisted of (1) availability of food produced locally and imported from abroad, (2) accessibility where the consumers could reach and afford to purchase food, (3) utilization where the individual must be able to eat adequate amounts both in quantity and quality in order to live a healthy and full life to realize his or her potential, and eventually (4) stability which deals with the ability of the nation and household to withstand shocks caused by both natural disaster or man-made crisis. Therefore, amid this situation of palm cooking oil scarcity, Indonesia government has launched the program in producing a novel palm cooking oil, called the red palm oil (RPO). By the establishment of RPO factory since 2024, the government attempted to introduce an added value program for the farmers' group in North Sumatera Province (setkab.go.id, 2024). Unlike the conventional palm oil which produced by the large firms and milling, this red palm cooking oil (RPO) would lead the smallholder farmers to enhance their capacity in producing alternative source of palm cooking oil for Indonesia domestic consumers. In addition, the red palm cooking oil has the potential to be promoted as a healthy source of food diversification of palm oil, which offers more essential nutrients compared to the conventional ones. A vast majority of exceptional scholars have presented their arguments on RPO's benefits in particular as a source of micronutrients. (Rice & Burns, 2010) claimed RPO was the richest naturally source of *beta-carotene* which required on human body to convert into usable vitamin A (*retinol*), consequentially it could avoid the population at risk of vitamin A deficiency. Following prior studies, (Tan et al., 2021) illuminated due to relatively short-processing distillation, RPO retained its *beta-carotene* and vitamin E which could overcome vitamin A deficiency, promoted heart health and contained anti-cancer properties. Whereby (Andreu-Sevilla et al., 2009) renounced RPO as a suitable development for functional foods with a high concentration of oxidative stability to extend its longevity of shelf life. Moreover, on the comparison study of (Van Stuijvenberg et al., 2001) reclaimed that RPO contained in a biscuit produced as effective as a biscuit with a synthetic *beta-carotene* in improving vitamin A status of children.

Reflecting to all above-mentioned findings, the authors believe that RPO production initiative by Indonesia government could enlarge the availability of food consumption of household in palm cooking oil as a diversified oil product but contained high essential nutrients, therefore it could promote more health status of domestic consumers through the consumption of RPO cooking oils. However, regardless of its health benefits, caution arose in the market demands, where this novel product of cooking oil has not been widely acknowledged by majority of domestic consumers. Currently, Indonesia domestic consumers mostly have familiarity on yellow-light colored palm cooking oils with a small market segmentation of coconut cooking oils, otherwise the red palm oil (RPO) was nearly unthinkable as a source of cooking oil particularly due to its red color presence

unlike the conventional palm oil patterns. This could cause a diverse perspective of consumers' insight as well as their intention towards RPO purchasing decision due to lack of information dissemination and product knowledge received by consumers. (Wang & Hazen, 2016) indicated that consumers' purchase intention was affected by products' perceived value, otherwise negatively influenced by perceived risk. The perceived value was most affected by quality knowledge. While on another study, (Al-Idrus et al., 2021), emphasized that the product knowledge with service quality could levitate the competitive advantage of a product and consumers' satisfaction.

Therefore, amid consumers' limitation on RPO product knowledge, promoting a novel product of RPO as alternative of food diversification in domestic markets would be a real adversity given the internal perception of potential consumers as well as the risk aversion behavior of consumers towards a novel product with unfamiliarity. Consequentially, it could hinder the potential market of RPO given its abundance benefits, unless producers could depict what consumers' needs on the products as consumers' preferences. Thus, our study attempted to discover the consumers' preferences on purchasing decision of RPO cooking oils as an alternative food source. To study the consumers' preferences, we conducted the conjoint analysis aimed at obtaining the most promising attributes of RPO cooking oil which are relevant to improving consumers' acknowledgment on the RPO's benefits. Furthermore, as the government intentionally promoted the RPO as an alternative source of micronutrient by abundance of vitamin A and E, hence we perceived that the promotional effects of healthy status of RPO product could be a salient strategy in escalating the consumers' preferences towards RPO purchasing decisions. A health claim has been estimated as a better marketing strategy and a medium of consumers' concerns to evaluate the quality of products. (Plasek & Temesi, 2021) studied the role of extrinsic features particularly the health claims (nutritional claim) such as *"rich in Vitamin C"* which portrayed the use of claims could elevate the credibility of product compared to not displaying the product's claim. This was in line with another study pronounced by (Sadrmousavigargari et al., 2022) to identify the importance of nutrition information label where consumers are found to signify their willingness to pay for product with salt and fat alerts.

Aside of nutritional information claims, our study also referred to (Deliza et al., 1999) assessed the label of product information and manufacturing process on consumers' purchasing decision, due to increasing evidence of consumers' risk perception associated with any potential hazard given the different processing ways. They argued that developing a functional food with a clear label of health benefits would be likely providing positive consumers' responses given their attitudes towards risk aversion. Prominently, a mounting body of works have supported the food benefits' label as essential role on consumers' purchasing decision, such as (Jin et al., 2019) promoting the use of sustainable label and traceability information for purchasing intention, (Machiels & Karnal, 2016) investigating the visual of naturalness to affect product evaluation, where in specific, consumers with more health consideration would be more acceptable. In addition, (Javeed et al., 2022) unveiling the extrinsic cues importantly nutritional label and precautionary health-warning label as supporting factor related to perceived product quality, eventually (Aguilar & Cai, 2010) confirmed that products with certification have favorable effect on consumers' preference compared to non-certified.

Though scholars have flourished a wide range of studies on food labeling with a certain message to consumers, nevertheless the specific study on red palm oil (RPO) consumers'

preference is limited particularly in the context of nutritional food label and message delivered to consumers. In contrast, we only found few studies highlighted on conventional cooking oil products, such as (Gracia, 2023; Mtimet et al., 2013; Bernabéu & Díaz, 2016; Topcu, 2009) identified consumers' preferences on olive oil, while (Maharani et al., 2021) undertaken their study on common palm cooking oil in Indonesia which specified their study on brands, price, volume, type of packaging, and color of palm oil. As aforementioned studies, none of them are concerning in the RPO as a novel cooking oil specifically in Indonesia domestic market. Thereof, to fulfill the literature gap as well as drive the promising attributes utilized as proper marketing strategies of RPO, this study aimed to investigate the consumers' preferences under the main attributes of health-claim labelling and nutritional information label as well as product's intrinsic cues. Eventually, the study's findings would ameliorate producers' capacity and strategies to set up essential attribute on RPO product, prior to national-wide marketing of RPO products among Indonesia domestic consumers.

MATERIALS AND METHODS

Locus of Study and Data Collection

This study focused on the province of Central Java, specifically on Brebes District. The selection of Brebes as case study of Red Palm Oil (RPO) study due to the consumers' characteristics. As revealed by the Indonesia government that the RPO would be marketed throughout the nation-wide consumers, thus understanding the consumers' preferences would be an essential background to support feasibility study on marketing RPO cooking oil products. Brebes District, as a part of Central Java Province, is categorized as a low-middle income district which could represent the diverse of consumers' characteristics especially related to the cost and the risk behavior towards new products. Unlike other cities and districts in Central Java Province, those are relatively having more economic prowess to which potentially could access to alternative cooking oils other than the palm oil such as the virgin coconut oils where usually excessively expensive for the consumers with other specific satisfaction attributes. Thus, selecting the regions which potentially reflect the ideal consumers' target for RPO would be essential. In addition, we assumed that consumers in Brebes have various concerns regarding the upcoming RPO cooking oils, where usually they have been flooded with yellow-light color oils as conventional palm cooking oil. The concerns might include (1) the cost of RPO cooking oils, (2) the unusual red color, (3) the risk preference, and (4) the health concern of the new product. Therefore, a case study of Brebes consumers' preferences would reinforce the marketing strategies for the producer farmers before spreading the marketing scale to nation-wide scales.

Eventually, the data have been collected from February to March 2025, as many of 200 respondents participated to cover the consumer preferences of RPO attributes. The sampling selection method was random sampling with respect to the selected regions within Brebes District. Respondents were the households who usually cook their food at home with the conventional palm cooking oils. The data then analyzed using choice-based conjoint analysis through *R* software following orthogonal design along with a choice-based conjoint analysis.

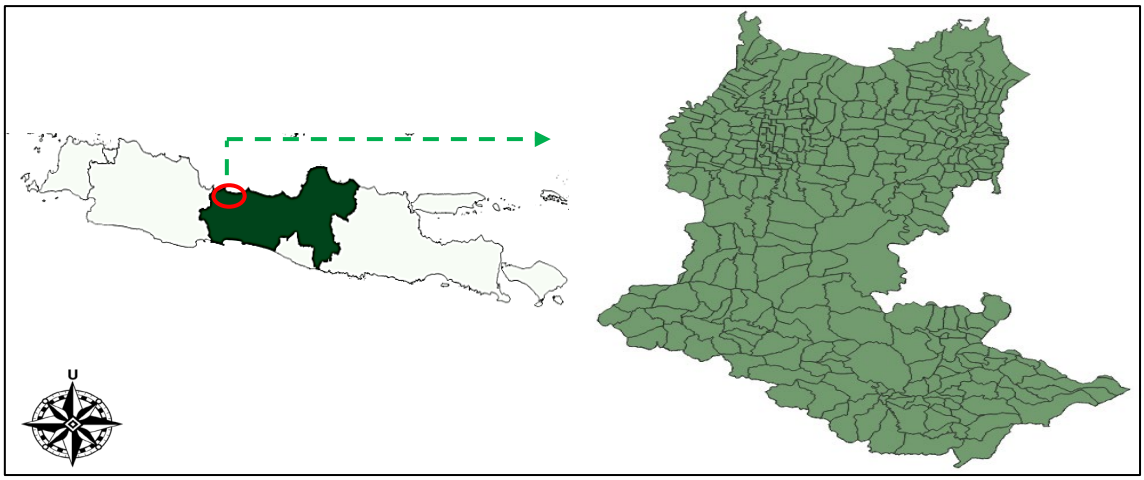

Figure 2
Maps of Locus of Study and Data Collection: Brebes District

Experimental Design: A Choice-Based Conjoint Analysis

The targeted product in this study was Red Palm Oil (RPO) which has been produced by certain farmers' group in North Sumatera Province. This production was initiated by the government in 2024 to promote a novel palm cooking oil as an alternative of demanded product by households. In experimental design, our procedures of research contained the 2 following overviews for respondents. *Firstly,* (1) we attempted to show the RPO cooking oil physically to the respondent as an overview of the product appearance with its red-bright color that is uncommon compared to the conventional palm cooking oil (Yellow-light color). The showing of physical RPO product was intended to evaluate its physical color and aroma (intrinsic cues) aimed to present primarily a real experience for the respondents. *Secondly,* (2) we set up the label of (1) health-claim, and (2) nutritional content information in front and back of the packaging to be evaluated. These figures were fictitiously designed by the researcher to be an optional set for the respondents to select their preference in terms of extrinsic cues. In addition, to prevent the biased result from the spillover effect of households' mouth-to-mouth information leakage to other neighborhoods, we attempt to give the commitment letter procedure before the recruiting process of participant as well as informing the data collection was on purpose for the study only without revealing their true identities.

Furthermore, after the evaluation of real RPO product and packaging design, we proceed respondents to select their preferences related to the attribute selection choice of RPO product. Regarding the attributes and level on table 2 above, we calculated based on the original factorial design which reflected as many as 24 (2 x 2 x 3 x 2) options of combination for revealing the preferences. However, 24 options of choice combination (full factorial design) would be considered as an abundance of choice sets for the respondents which might escalate respondents' choice biased. Therefore, to obtain the efficient option of choice sets, we attempted to run the fractional factorial design, following a rotation design in *R* software (Alcaire et al., 2021). Fractional factorial design were documented for the most common experimental design to gain the efficiency (Eggers, et al., 2022), which could be tested using the correlation matrix of all assumed main and interation effects. The fractional factorial design were more appropriateed to be utilized in consumers' preference research, where in full factorial design, some options

might not be representative enough to reveal the market demand itself given its uncommon option, thus we have to maximize the *"orthogonality"* subject to eliminate the possibility of obtaining invalid judgement (Steckel et al., 1991). We therefore followed the *R*-package of *DoE.base* and used *oa.design* to find orthogonal array design for our choice sets based on the attributes and levels where we have 4 attributes with each has level of (2, 2, 3, 2). As shown in the appendix table 1, we found that the fractional factorial design obtained 12 set of choice options to represent effcient design of choice sets following the orthogonal arrays design (oa.design) by (Aizaki, 2012) with the package of *DoE.base*.

Furthermore, we proceed to articulate the choice task for respondents by deviding into 2 alternative choice sets with a none of selection choices, where each of respondents would be assigned as many as 12 choice tasks. As the table shown below, we illustrated a sample of choice task for respondents.

Table 1
A sample of Choice Task for Respondents

No	Attributes	Product 1	Product 2	
1.	Effluent Color	Neutral	Red Color	**None of them**
2.	Taste & Aroma	Light Taste & Aroma	Strong Taste & Aroma	
3.	Nutrient Content	Nutrient Only Information	No Label	
4.	Health-Claim Label	With Health Claim	No Health Claim	
I prefer to buy:		☐	☐	☐

Experimental Procedures

The fundamental process of experimental procedures was the primarily recruitment process of respondents. As the figure of procedure below, we attempt to explain the step-by-step procedures to gauge the appropriated preference of consumers on RPO cooking oil product.

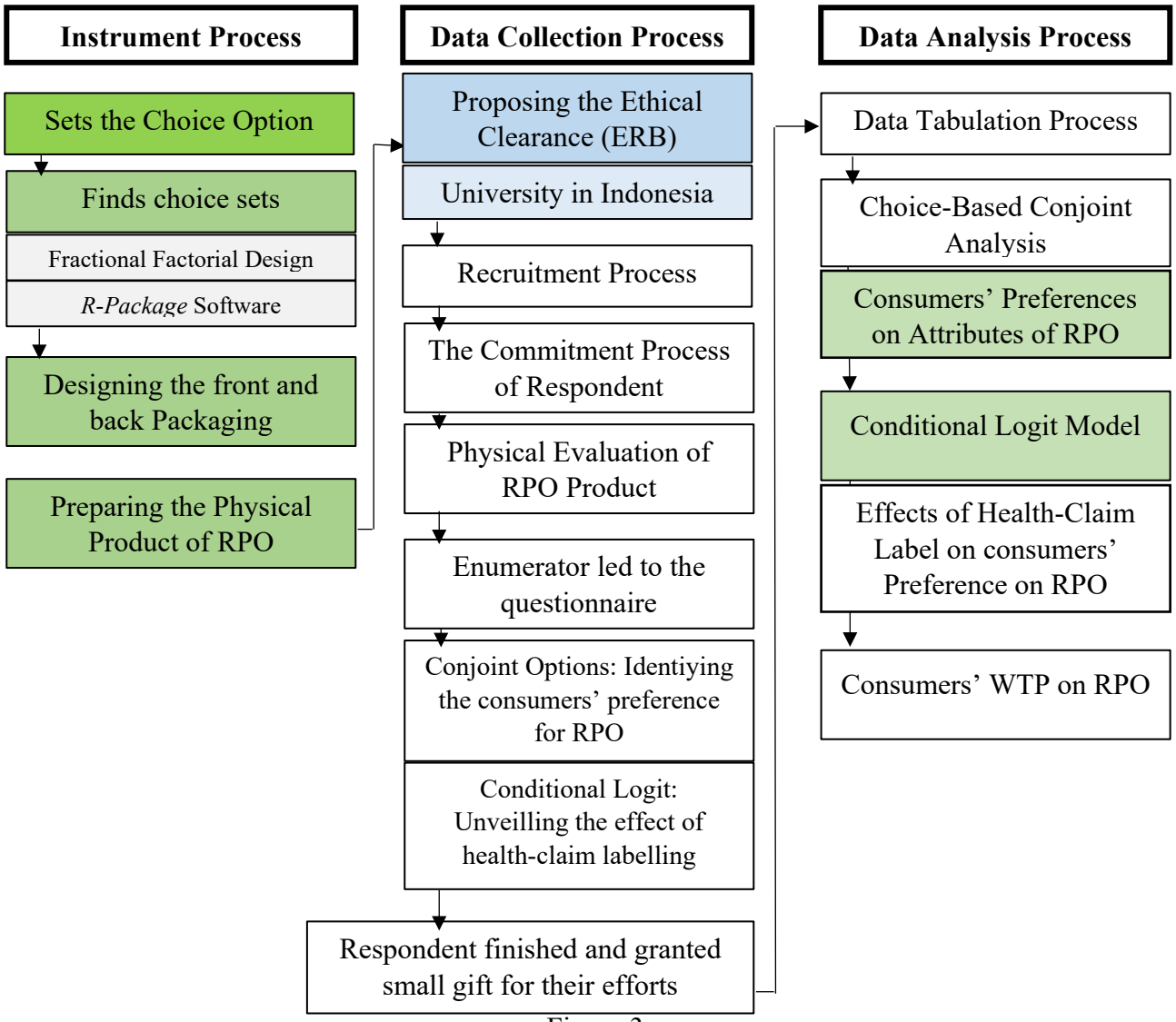

Figure 3
The Experimental Process of Study

Empirical Framework: Choice-Based Conjoint

Discrete choice experiment is the common measure of consumers' preference where in this case the preference of a novel product called red palm cooking oil (RPO) among Indonesia consumers as a target market. A discrete choice experiment was basically referred to a random utility theory which was stated to maximize the consumers' utility (Jürkenbeck & Schulze, 2024), given the rational decision-making process on the product selection among others. Furthermore, as our objective is to elicite the consumers' preferences by selecting one of three optional choices by 2 optional products with no-choice option provided to represent their out of option. A no-choice option was obvious element in choice behavior in a real market as recommended by (Loureiro & Umberger, 2007), where instead asking directly the consumers' willingness to pay for a product, in this application consumers were asked to select their alternative between choice set of attributes regarding the RPO or either select none of the options. Following application, we essentially applied the basic assumption of random utility theory where individuals

compared the alternatives accoriding to a utility function which was decomposed into a deterministic (V) and a stochatisc (ε) part (Bronnmann & Asche, 2017), which further individuals would tend to choose an alaterntaive that provided highest level of utility. In this case, the utility represented as U from alternative i received by individuals n in a such time of choice situation t.

$$U_{nit} = V_{nit} + \varepsilon_{nit} \quad (1)$$

Note: V_{nit} was a utility function in the model to elicite the individuals' utility, with ε_{nit} was a random error terms to represent unobservable factors outside the model.

In the context of consumers' perspective, the process of utility maximization would be a selection of product alternative that provide highest utility. Thus, if the consumers select the product i over the alternative product j, then it could be estimated that U_{nit} is the highest utility attainable by consumers from among other j products, represented by statistical model with probability situation (P_{ij}) (Loureiro & Umberger, 2007).

$$P\ (i|J) = Pr\ (V_{nit} + \varepsilon_{nit} \geq V_{njt} + \varepsilon_{njt});\ i \neq J \quad (2)$$

$$P\ (i|J) = Pr\ (\varepsilon_{nit} - \varepsilon_{njt} \geq V_{njt} - V_{nit});\ i \neq J \quad (3)$$

Note:
P (i|J) : Probability chosen i from among J alterantives
V_{nit} : Utility value from alternative i for individu n
ε_{nit} : Error terms form alternative i
V_{njt} : Utility value from alternative j for individu n
ε_{njt} : Error terms from alternative j

Conditional Logit Model: Attributes Affecting Consumers' Preferences

Following our estimation of choice-based conjoint analysis, we further conduct the measurement in analyzing the effects of attributes specifically the health-claim label on consumers' preference for red palm cooking oil (RPO). Therefore, the conditional logit model was deployed for this study which was presumed as one most frequent form of discrete choice in the application of choice experiment study (Widyawati et al., 2023), due to its flexible specification to comprehend the consumers' preferences (Tavárez & Álamo, 2021). The conditional logit model would evaluate an initial assessment to observe how far the selected attributes affected on decision-making process of consumers' preferences choice experiment (Tavárez & Álamo, 2021). Moreover, referring to exceptional calculation of (Aizaki, 2012), the probability of individuals (n) in selecting such an alternative i from a choice set C_n in the conditional logit model could derived as follows:

$$(P_i) = \frac{exp(Vin)}{\sum exp\ (Vjn)} \quad (4)$$

Note:
V_{in}: a systematic component of utility for product i
V_{jn}: a systematic component of utility for product j

The conditional logit model required to fulfill the goodness-of-fit measure which was well-known as ρ^2 (rho-squared) (Aizaki, 2012):

$$\rho^2 = 1 - (LL_b / LL_0) \quad (5)$$

Note: LL_b and LL_0 were the log likelihood values at convergence and at the start respectively.

As for the conditional logit model, it was presumed the ratio of the probability of selecting between alternatives was not affected by adding or removing the alternatives. Thus, it was required to fulfil this assumption in conditional logit model well-known as the interdependence of irrelevant alternatives (IIA) implying that the preferences between individuals were homogenous or the variances associated with a random term of utility on each alternative were identical (Tavárez & Álamo, 2021). Furthermore, in terms of sample size selection, we followed the study from (McFadden, 1972). As it was pioneered by (McFadden, 1972), the conditional logit model could be deployed to provide estimators which were efficient and normally distributed in asymptotically large samples, thus it was suggested to obtain the sample size for a minimum of 100 or 200 where the bias of the maximum likelihood estimator were acceptably small, even for extreme selection of probabilities. Eventually, 200 respondents, within Brebes District, Central Java, Indonesia, were selected to run the choice experiment and depict their willingness to pay for RPO cooking oil.

$$U_{ni} = \beta_0 + \beta_1 HealthClaim_{ni} + \beta_2 Taste\text{-}and\text{-}Aroma_{ni} + \beta_3 NutritionalInfo_{ni} + \beta_4 Color_{ni} + \varepsilon_{ni}$$

Note:
U_{ni} = Total utility obtained by individual n from his selection of choice i
β = coefficient value of main factors' impact on utility
δ = effect value of controlled factors' impact on utility
ε = error terms of unobservable factors
n = characteristics of individu
i = specific attributes of alternative product choice

As above-mentioned main model of consumers' preferences, we depict the model of conditional logit to estimate the factors affecting consumers' preference on RPO product with a health-claim label. In this model, we include the main attributes as our main variables such as (1) health-claim label preference observed by a dummy of health-claim label availability on the packaging, (2) taste and aroma as a dummy of consumers' preference for light or strong taste and aroma, and (3) the nutritional information also as a dummy whether the availability of nutritional information would escalate the consumers' preference on RPO product, finally (4) our main concern on intrinsic attribute of effluent color would be a prominent decision making for consumers to levitate their preferences on RPO product, since the red effluent color that may stick to the food would discomfort consumer to raise their preference.

Willingness to Pay (WTP) on RPO Product

On the following estimation, we further conduct the willingness to pay (WTP) using the similar pattern of double-bounded model. In regards to the money elicited on the model, we refer to the government intention to lower the price of RPO given its subsidy. However, since the product of RPO has not been available in the market, hence the price is yet unknown. Thus, we applied the fictitious price to set the RPO price lower than the

conventional palm oil price as the baseline. The conventional palm oil price currently reached as much Rp21.000,- or around ₩2.000,-, therefore we would like to set the RPO market price about Rp2.000,- lower, which is Rp19.000,-. In this choice set, we would provide the following price, whether the consumers are willing to pay the higher price as much as Rp21.000,- as the identical price of conventional palm oil price, or if they are not willing to pay at the 1st choice set, whether they are willing to pay the lower price in the following choice set as much Rp17.000,-. This price was often associated with the low price for cooking oil with no brands. Please refer to the following table of double bounded procedures (please refers to appendix of questionnaire).

In addition, we suspect an essential need to control such variables besides the socio-demographic factors within the respondents. It assumed that controlling consumers' healthy lifestyle as well as their behavior would be a paramount measure to control the factors which might give rise to their potential consumption on RPO cooking oil (WTP). Importantly, we also include specifically the consumers' risk behavior where as stated in the study of (Ding, et al., 2022; Lusk & Coble, 2005), while we included the prior knowledge about RPO product as well as consumers' perception towards a health-claim label for a product.

Table 2
Dichotomous Choice of Consumers' Willingness to Pay (WTP)

No	Initial Price	1st Choice	Following Price	2nd Choice
1	Rp19.000	□ Yes □ No	Rp21.000	□ Yes □ No
			Rp17.000	□ Yes □ No

Note: The consumers could opt if they are willing to pay the RPO or even out of choice

Table 3
Socio-Demograpic and Control Variables

No.	Variables	Definition	Unit	References
Socio-Demographic				
1.	Income	A monthly-basis income	IDR/ Month	(Bronnmann & Asche, 2017; Plasek et al., 2021; Bou Fakhreddine & Sánchez, 2023; Tønnesen et al., 2022; Dreist et al., 2025)
2.	Age	The age of respondents	Age	
Consumers' Behavior Controls				
3.	Risk Preference Behavior	A risk aversion behavior towards a novel product specifically cooking oils	Scale	(Nie et al., 2021; Ding, et al., 2022; Lusk & Coble, 2005)
4.	Healthy Lifestyle on Consumption	A preference on healthy food consumption	Dummy	(Roe et al., 1999; Gama et al., 2025; Kantola et al., 2023; Grant & Gallardo, 2021; Ali & Ali, 2020)

Consumers' Prior Knowledge and Cooking Oil Consumption Behavior			
5. Familiarity (Prior Knowledge)	Do consumers have prior knowledge about RPO products before the data collection process?	Dummy	(Hong et al., 2022; Biondi & Camanzi, 2020; H. J. Jin & Han, 2014)
6. Consumption Frequency	The consumption of cooking oil in a monthly basis	Litter/Month	(Bou Fakhreddine & Sánchez, 2023; Bou Fakhreddine & Sánchez, 2023; Hong et al., 2022)

Note: the detailed explanation inserted on the survey questionaire

Literature on Red Palm Oil (RPO)

Red Palm Oil (RPO) was experimented and discovered by scholars since decades where various studies had acknowledged its promotional health benefits in particular of Vitamin A to substantially increase retinol level in population with marginal vitamin A deficiency (Kritchevsky, 2000). Based on physicochemical properties, (Tan et al., 2021) obtained that red palm oil, red palm olein, and crude red palm oil contained free fatty acids as much 0.1%, 0.1% and 11.4% respectively, with carotenoids as one of the key compounds highly retained after a special refining process of RPO making its color shined bright red. It was contrary with the presence of palm cooking oil which was normally accepted by market demands by a yellow-light color due to a long process of bleaching and deodorization. Consequentially, it caused a removal of such important nutrients which are essentially prominent for consumers. Therefore, the discovery of RPO was prominently to fulfill the nutrient deficiencies on palm cooking oil. RPO provided a highly nutritious premium vegetable due to its provision on carotene, vitamin E, as well as, ubiquinone, and phytosterols (Nagendran et al., 2000). Furthermore, (Esterhuyse et al., 2005) renounced the dietary of RPO could improve functional recovery in hearts supplemented with RPO, where both antioxidants and fatty acids might essentially play a role in the cardioprotective mechanisms.

As figure shown below, we illustrated the main differences in processing stages of RPO and conventional palm oil for cooking oil purposes. The processing was started by (1) the bunch reception from the smallholders with grading and threshing process, a process of removing fruit from bunches of palm oil. (2) Sterilization was the forthcoming process by inactivating and removing the enzymes to avoid free fatty acids (FFA) through high-temperature steams with a result of soft and loose the fruit structure to ease the process of (3) digestion and (4) extraction of oils. Thus, on post process, it removes the mesocarp (flesh) and the kernel (seed) of palm oils to which continues to the oil extraction process. The process of palm oil extractions could be under the dry method process by a mechanical press of hydraulic or by wet process through using water to draw the oil from the fruits. The following process is (5) clarification of oils where a mixture of oil, water, and solids from the bunch fibers then being transported to the tank with a clarification of oils based on the density of materials (Tan et al., 2021).

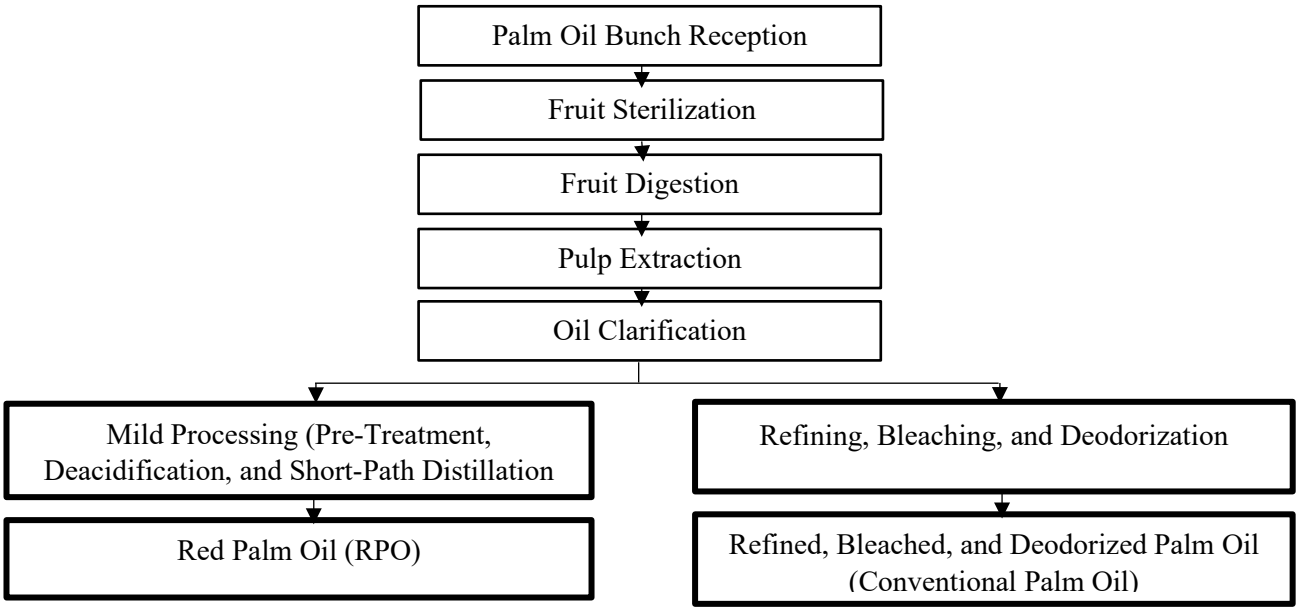

Figure 4
The Primary Process of RPO and Conventional Palm Cooking Oils
Source: (Tan et al., 2021).

Basically, the red palm oil (RPO) obtained from the mild processing of CPO, while the conventional palm oil obtained by refined, bleached, deodorized processing. Thus, under relatively short-step process, the RPO could offer more potential nutrients for dietary and vitamin deficiency solutions compared to the conventional palm oil.

Table 4
The Nutrient Contents of RPO and Conventional Palm Oil

No.	Nutrients	Red Palm Oil	Conventional Palm Oil
1.	Carotenoids	High levels, including β-carotene and α-carotene, contributing to its red color (Loganathan et al., 2017)	Negligible amounts due to refining processes that remove these compounds (Loganathan et al., 2017)
2.	Vitamin E (Tocopherols and Tocotrienols)	Rich in tocopherols and tocotrienols, potent antioxidants beneficial for health (Loganathan et al., 2017)	Contains lower levels of vitamin E, primarily tocopherols, with reduced tocotrienols after refining (Loganathan et al., 2017)
3.	Fatty Acids	Approximately 50% saturated fats (mainly palmitic acid), 40% monounsaturated fats (oleic acid), and 10% polyunsaturated fats (linoleic acid); similar to conventional palm oil (Mancini et al., 2015)	Similar fatty acid profile: 50% saturated fats, 40% monounsaturated fats, and 10% polyunsaturated fats (Mancini et al., 2015)
4.	Antioxidants	Contains various antioxidants, including carotenoids and vitamin E, which may contribute to health benefits (Loganathan et al., 2017)	Lower antioxidant content due to the removal of these compounds during refining (Loganathan et al., 2017)

Previous Studies

Intrinsic Attributes for Consumers' Preference on Red Palm Cooking Oil

The study on consumers' preference is essentially to depict the market demands with respect to products' attributes. Specifically for this research analysis, we consider including a prominent attribute of intrinsic value inside RPO which established consumer desirable preferences. RPO intrinsic value was expected to become a criterion of consumers to signal the quality of products. Intrinsic value involved the physical composition of products to represent the product itself and could only be evaluated through the consumption by consumers (Jiménez-Guerrero et al., 2012). It included the product composition (nutrient ingredients), flavor, design, color, and other internal value or taste inside the product. Specifically, (Verbeke et al., 2005) divided the intrinsic attributes into 2 categories, which based on *"search"* and *"experience"*. Typically, search attributes were available at the moment of consumers' shopping by seeing the color preference, fat cover, etc. Meanwhile, experience attributes could be predominantly evaluated only upon consumption such as taste, tenderness, flavor, and aroma of products. Intrinsic cues of attributes could determine the purchasing behavior of consumers. The product's color, as studied by (Racette et al., 2024) elucidated the color of product could present a significant effect on consumers' perceptions. On their study on cheese products, it was revealed the light-orange color of cheese was selected as the most promising consumers' preference where its color could be perceived as *"naturalness"*. Another study on cooking rice related to color presence evaluation by (Jeesan & Seo, 2020) emphasized that color cues could affect the ratings of attribute intensity, liking, willingness to eat, and emotional responses on the product. It was identical with (Chonpracha et al., 2020) where the visual cues could significantly affect consumer emotions, hedonic perception, purchasing intention. Followed by exceptional study of (Rosenau et al., 2023) on the context of aquaculture product confirmed the change in color would not deter consumers away from the unfamiliar colored product, but only when the information about the potential benefits on the product is available.

Aside from essential color preference, another RPO intrinsic cues required to evaluate is the taste and aroma, where RPO's essences typically formed a strong taste and aroma of palm oil, which could be evaluated on after taste during its consumption. (Tan et al., 2021) renounced the RPO would have slightly a distinctive taste and odor, as a consequence of the mild processing of refining steps of RPO which could not remove the volatile compounds. This caused RPO obtained very strong and distinctive color, odor, and taste as well as aroma (Rice & Burns, 2010; Burri, 2012; Loganathan et al., 2017). Therefore, an evaluation of taste and aroma would be prominently induced the consumers' preferences whether this strong taste associated with the mild processing steps, but produce higher nutrition would be accepted by the consumers. A flourished study by (Isaskar et al., 2021) reconfirmed that sensory expert was responsible for providing sufficient information about relationship between product and the consumers. (Nguyen et al., 2019) portrayed among the attributes of taste, health concern, price, serving style, and restaurant staff, the most impactful factor in food satisfaction was the taste of food which could lead to the consumers' willingness to return as well as the marketing of word-of-mouth to others. It was identical with other findings (Siregar et al., 2022) in terms of taste of product, while (Chen et al., 2024) possessed the confirmation of positive correlation between consumers' preference for the aroma and their willingness to pay for a product. Furthermore, (Clark, 1998) concluded that there was strong relationship evidence

between taste and flavor with consumers' food choice. As the importance of controlling personal characteristics of consumers, therefore, we attempted to observe the influential factors that affect consumers' choice by including personal characteristics of consumers such as the acceptance on flavor criteria towards food consumption (strong taste or aroma) to render their behavior on RPO purchasing behaviors. We detailed this observation on the following chapter of conditional logit analysis as a complementary of conjoint analysis.

Extrinsic Attributes of Consumers' Preference on Red Palm Cooking Oil

Unlike the intrinsic cues or attributes of products, the extrinsic cues are not part of the product, yet containing relation to the product (Fetai et al., 2017). It could be such as product brand, price, certificate of origin, store name, packaging, manufacturing reputation, and other cues that could represent a product value. Defining and discovering the extrinsic cues of the product is prominent to depict how consumers could generate the value of the products given their evaluation on the value attached to the product. (Blackmore et al., 2021) explicitly asserted extrinsic cues were linked to information attached within the product, which the most common is the labelling as a conventional way in presenting product-relevant information to consumers. Through extrinsic cues, along with intrinsic value, consumers are usually generating their expectations and perception on the product. Thus, the relevant information related to products provided at the point of sales would become a pivotal effect on consumer buying decision (Boccia et al., 2024). In addition, (McLeod et al., 2023) renounced the consumers' reveal preference changed for each label as more information was provided. The food labels should represent foods' core value to escalate consumer preference on the product, where in our study the core value of RPO promoted by the government was the health benefits.

As the most common way to present the product value, labelling has become an essential pattern used by the firms to attach the products' values to the consumers. There were a wide range of studies discovering the effect of labelling on the consumers' preferences specifically as explored by (Gichuyia et al., 2024) on the safe pork product label, (Boccia et al., 2024) studied on the level of naturalness, (Homwongpanich et al., 2024) estimated the mozzarella cheese label, (Toklu et al., 2020) unveiled the importance of halal certificate label on meat products, (Lai et al., 2018) underpinning the effect of animal welfare and environmental information label on pork products, (Cardona et al., 2023) focused on the certificate of control measure to preserve food safety and quality, while (Tran et al., 2022) specifically evaluated the aquaculture food safety certification. Based on foregoing studies, they identified the effects of food labelling on common consumption products, which are mainly meat, fish, and pork as well as other artisanal products such as cheese. Nevertheless, as Indonesia is focusing on the production of red palm oil, thus we attempt to involve the labelling attributes on the RPO product, specifically related to the health claims where precedent studies have been explored its potential benefits in terms of nutrients and its promotional purpose as functional food alternatives compared to conventional palm cooking oils. As following sub-chapter, we elucidated our concern on health-claim label for RPO cooking oils which could potentially enhance the marketing process of RPO among the household consumers who are unfamiliar with this type of bright-red color product. (McLeod et al., 2023) determined that consumers' purchasing decisions were affected by their preferred food value or food quality attributes, which one of them was nutritious value of the product associated with the health benefits.

Attribute Selection for Consumers' Preference

As our objectives concerned on the consumers' preference towards a novel product of red palm cooking oil (RPO), hence we attempted to draw prominent cues both intrinsic and extrinsic based on the proper characteristics of RPO itself. In the intrinsic cues, we selected the color as the preference value due to RPO color effect after cooking process, whether the effluent of red color attached to the food after cooking would be considered as a threat for the consumers during the cooking activities. In addition to the taste and aroma of RPO cooking oil experienced by the consumers. Usually, the conventional palm cooking oils have rendered a slight taste and aroma of palm oil, but this novel cooking oil of RPO is attributed to attach stronger taste and aroma due to the processing method with gain more nutrients to affect its taste and aroma. Moreover, in terms of extrinsic cues, as we pinpointed the effect of health-claim label with the nutrient content, thus we attempt to gauge the value of certain health-concerned label for deriving consumers' preference. Our consideration is due to the promotional benefits of RPO which contain an abundance of antioxidants and vitamins that possibly raised the consumers' intention, consequentially affect to their purchasing behaviors. In addition to the RPO processing method which relatively novel by short stage of process, therefore, the study of (Grant & Gallardo, 2021) inspired our choice design by adding the attributional level of processing method highlight combined with nutritional contents aimed to present the more natural process to the consumers. The findings of (Grant & Gallardo, 2021) revealed the pivotal point on providing consumers with information about a new technology and the resulting benefits to reduce perceived risks and increase consumer acceptance of a novel product. Furthermore, the inspired study also pronounced by (Alcaire et al., 2021) to aclaim that the health-nutritional claim would ameliorate the effects on consumers' choice for the milk and snack products. It indicated that nutritional claims have a higher relative impacts than only showing the nutrition contents in the front of product packaging which possibly release more attention to consumers with more health awareness on their consumption. Therefore, as the RPO cooking oil has been intended to be an alternative source of cooking oil with more nutrient promoted by Indonesia government, the study of consumers' preferences underpinning the health-claim effect would be an essential role prior to its wider promotion to the nation. As the table shown below, we detailed the proposed attributes and levels to depict consumers' preferences on RPO cooking oil.

Table 5
The Selection of Attribute for RPO Product Preferences

No.	Attributes	Level	Reference
Intrinsic Cues			
1.	**Effluent color after cooking**	1. Red color effluent sticks to food after cooking; 2. Neutral color	(Chonpracha et al., 2020; Altmann & Trinks, 2023; Racette et al., 2024; Rosenau et al., 2023).
2.	**Taste and Aroma**	1. Strong Taste and Aroma; 2. Light Taste and Aroma.	(Blackmore et al., 2021; Nadathur & Carolan, 2017; Clark, 1998; Nguyen et al., 2019).
Extrinsic Cues			
1.	**Nutrient Content Information**	1. Highlighted Combined Label of Processing Method and Nutrient-Enriched Contents (abundance of Vitamins);	(Alcaire et al., 2021; Grant & Gallardo, 2021; Nazzaro et al., 2024; Boccia et al., 2024; Homwongpanich et

No.	Attributes	Level	Reference
	(Nutrient Contents with Information of processing method)	2. Highlighted Label only on Nutrient-Enriched Contents 3. No Highlighted Label	al., 2024; Tønnesen et al., 2022; Gama et al., 2025; Bou Fakhreddine & Sánchez, 2023; Kaur et al., 2017; Hong et al., 2022; Plasek & Temesi, 2021)
2.	**Health-Claim Label**	1. Healthier Cooking Oil with enriched Antioxidants and Vitamin A & E; 2. No Label	(Alcaire et al., 2021; Baker et al., 2021; Biondi & Camanzi, 2020; Garg & Govind, 2021; Carfora et al., 2022; Dolgopolova et al., 2021)

Research Framework

Based on the upcoming program of Indonesia government to promote RPO cooking oil in nationwide market, therefore the study of marketing research specifically on consumers' preferences would be a salient procedure prior to the product release in the national market. As we concerned on the unfamiliarity as well as consumers' risk behaviors on a novel product of RPO which possess uncommon red color appearance, thus understanding the preference of consumers including what attributes of the product that could maximize consumers' utility. Hence, the promotional health-claim label and information could be a spear of RPO marketing strategies.

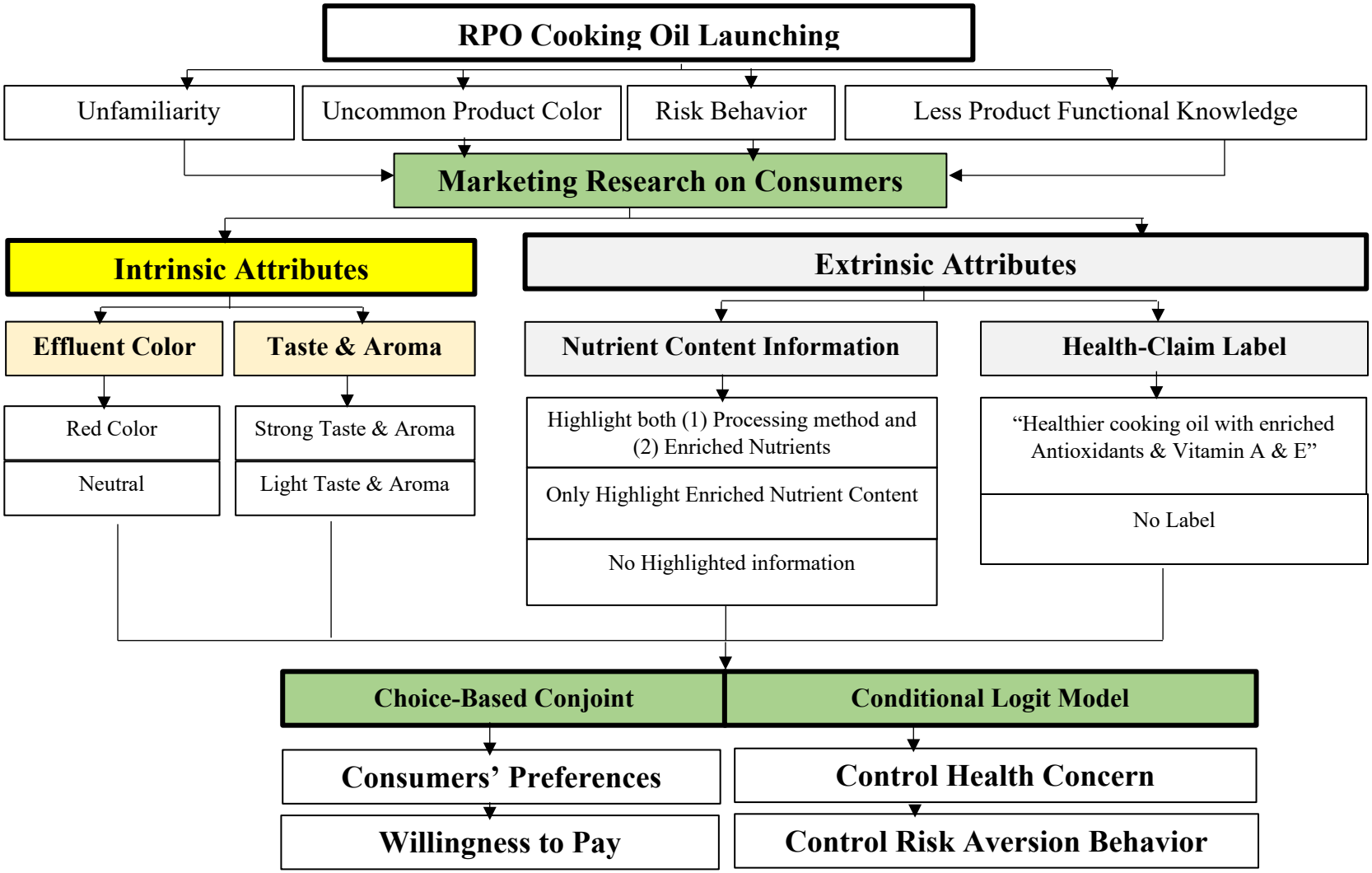

Figure 5
Research Framework of RPO Consumers' Preferences

RESULT AND DISCUSSION

Consumers' Preference for Red Palm Cooking Oil (RPO)

Our study had been conducted the survey on potential consumers of red palm oil (RPO) which mainly covers the household, represented by the housewife that commonly responsible for the domestic consumption. As below table, we portrayed the result of conditional logit model utilized *mlogit* coding with reflecting both (1) effects coding and (2) dummy variable coding.

Table 6
Consumers' Preferences on Red Palm Oil (RPO) Product

Attribute	Level	Effects Coding			Dummy-Variable Coding		
		Coef.	SE	Sign.	Coef.	SE.	Sign.
Color	Red Color	-0.603	0.061	***	-0.603	0.061	***
	Neutral (base category)	0.603					
Taste Aroma	Strong	-0.425	0.049	***	-0.425	0.049	***
	Flavorless (base category)	0.425					
Nutrition Label	Nutrition + Processing Method Label (Base)	1.780			1.228	0.075	***
	Only Nutrition Label	-0.551	0.075	***	0.677	0.067	***
	No Label	-1.228	0.075	***			
Health Claim Label	with claim	0.513	0.062	***	0.513	0.062	***
	no claim (base category)	-0.513					

Note: 0.001***, 0.05**, 0.10*

Based on table, we could confirm the effect of red color effluent has render the negative effect on consumers' preference of RPO product, while it followed by the strong taste and aroma by (-0.603) and (-0.425) respectively. In contrast, essentially the health claim (0.513) and nutrition label (1.228) could perform positively to consumers' preference. This indicates that the product's physical appearance in terms of packaging should consider the positive importance of attributes, which constitute health claim label and nutritional label with processing method of red palm oil (RPO) to affect the consumers' preferences. In accordance with the attributes of RPO product, we attempt to depict the relative importance of product in addition to the part-worth utility. As below figure 5-7, we represented the result of relative importance of attributes, where among all attributes, the nutrition label perceived as the most essential feature of RPO for the consumers. However, the government should be considering the physical appearance of RPO products in terms of Effluent Color that relatively affects as the most negative feature for RPO product. Our findings pronounced that the RPO marketing potential would be hampered practically due to the red color influences which might be perceived uncommon and relatively avoided by the potential consumers. It was an identical discovery with (Andrianto et al., 2012) to renounce the market awareness of RPO as a novel product was only 5.71% with the market potential was yet diminutive under 1%. The lack of consumers' awareness would establish a real burden on the market since Indonesia consumers frequently consumed the yellow light color palm oil, while the red color of RPO deliver a dubious perception on the purchasing decision. Thus, it caused the RPO remained underutilized in the local market by consumers' lack of awareness (Mohamad

Shah et al., 2022), where in our findings it was color as the essential negative burden on the consumers' preferences.

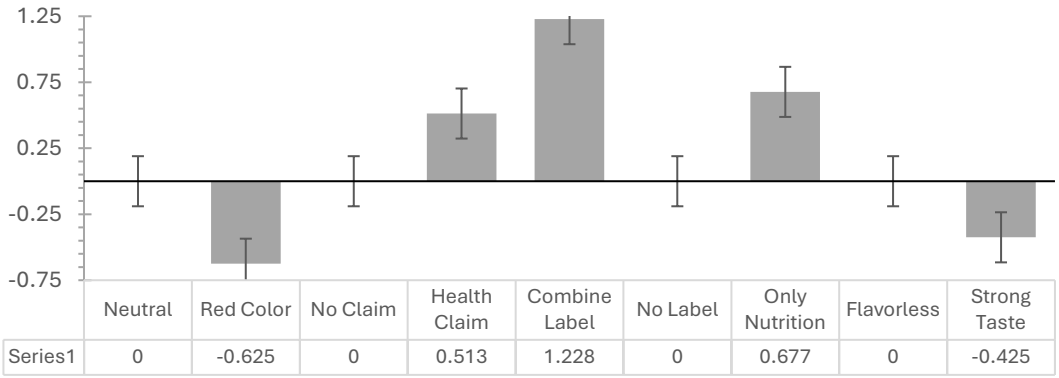

Figure 6
Dummy-Coded Part-worth Utility

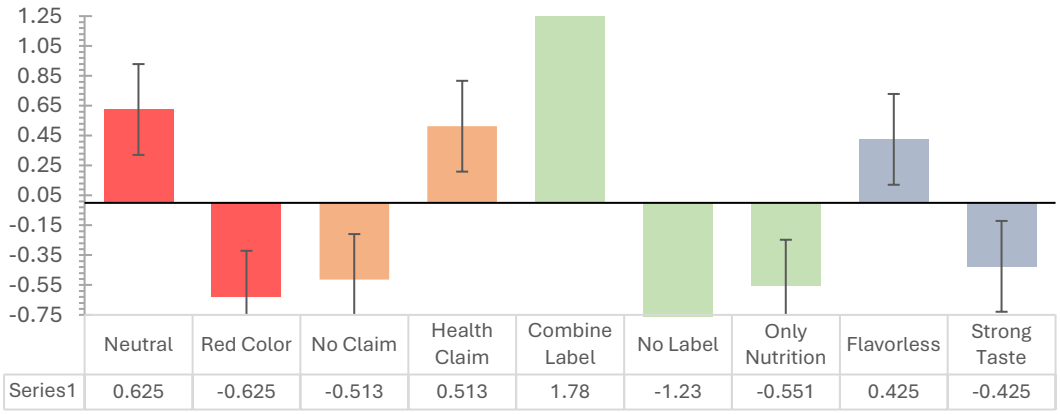

Figure 7
Effects-Coding Part-worth Utility

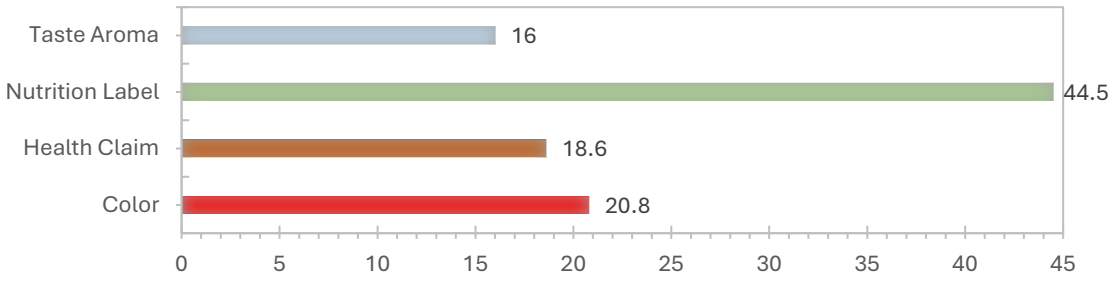

Figure 8.
Relative Importance of Attributes for RPO Product Preferences

Predominantly, the dummy-coded Part-worth utility constituted the comparison between attribute and the based attribute. While, the effects coded of Part-worth utility compared all the level within an attribute. Furthermore, both intrinsic attributes of (1) Effluent of red color and (2) the strong taste and aroma inflicted an inverse reception from the

consumers by (-0.625) and (-0.425). By this finding, we could confirm that the neutral color of palm oil (0.625) was more preferred by consumers which was similar to conventional yellow-light palm oil in the market. In contrast, the extrinsic attributes levitated more receptance on consumers. The nutritional label represented by the combined nutritional information and processing method on the back of packaging has been preferred more by consumers to possess (1.228) and (1.780) of utilities. Eventually, the health-claim label raised the consumers' preference by (0.513).

The Effect of Attribute on RPO Product Preference

As we conducted the study on the household of consumers which mainly consumed conventional palm cooking oils, we could portray the most potential factors to affect consumers to step up their purchasing from conventional palm cooking oil to Red Palm Cooking Oil (RPO). However, since the government initiated the production of RPO since the mid of 2024, the widespread of RPO market on national scare was scarce with a limited amount of consumers' awareness to the product know-how of RPO product. Therefore, following our analysis, we estimated the factors that affect the consumers' preference on RPO. As following chapters, we depicted the result regarding the effect of our attributes on consumers' preference, followed by the estimations on segmented market reflected by controlling the main considered other control factors. We assumed that the segmented market estimations would ameliorate the marketing strategies, importantly the discoveries of preferences between the familiar and unfamiliar consumers to RPO. Consumers that possessed more familiarity (product knowledge) of RPO would tend to receive better on the physical appearance of RPO color and taste, while more concern on the health benefits of RPO nutrients. Therefore, as below findings, we portray the factors associated with consumers' preferences on RPO.

Table 7
Effect of Attributes on Consumers' Preference of RPO Product

Attribute	Coef.	SE	Significant
Red Color	-0.754	0.063	***
Taste Strong	-0.544	0.051	***
Combine Label	1.030	0.080	***
Only Nutrition Label	0.494	0.071	***
Health Claim	0.259	0.070	***

Note: 0.001***, 0.05**, 0.10*

Based on the logit model of attributes affecting consumers' preferences on RPO product, the result showed identical result with the utilities preferred by the consumers. Both Red Color Effluent (-0.745) and Strong Taste and Aroma of RPO (-0.544) render a negative significant influence on consumers' preference of RPO product. In general, consumers would relatively avoid buying the RPO product due to the red color influence as they referred to the unhealthy physical appearance of cooking oil, while they ordinarily consume a clear yellow-light cooking oil. Thus, the red color of RPO would constitute a negative perception which was identical to the used cooking oils. This physical property burden of RPO color appearance was in tandem with an explored study of (Ismail et al., 2020) which studied on the sensory evaluation of red palm olein (RPOL) essence on the beverage. They proclaimed that the beverage appeared red and yellow due to the presence of RPOL and it displayed a lower score in sensory properties than commercial beverage. Another study on consumers' perception for RPO product as functional food elicited by

(Tai et al., 2022) defined the perceived risk negatively affected consumer purchase intention of RPO as functional food. Untrusted and uncertainty become the main factors which affect consumers' choice of RPO as a novel functional food.

Nevertheless, though the consumers possessed a certain uncertainty towards RPO products, however the government could embrace their marketing strategies through food labelling. Food label as it illustrated the functional features and benefits of product could improve the consumers' attention on purchasing decision. Therefore, our studies renounced the similar pattern of food labelling benefits, where both (3) nutritional label with combined label (1.030) and only nutritional label (0.494), and (4) health-claim label (0.259) have been profound to escalate the consumers' preferences on RPO product. Our findings could represent similar patterns of a amounting body of works, such as (Yang et al., 2020) elicited consumers' willingness to pay trough nutritional information where consumers would have more positive purchasing intention a product with the nutrition information, nevertheless it depended on the consumers' personal health awareness. Food label was essential for the consumers' perception towards a food, as (Priya & Alur, 2023) eminently promoted food label which provided information on food packaging and eventually supported consumers make informed choices about food consumption. On following study, (Asafari et al., 2024) reinstated that food label was a likewise of marketing spears which could deceptively boost consumers' desire to purchase specific food product. Thus, it was crucial to ensure that labels were accurate as those provided essential information about products. Eventually, our findings support the usage of (1) health-claim label and (2) nutritional information label on the RPO packaging to raise the consumers' preferences to be more trusted and depicted the health value of RPO.

Consumers' Willingness to Pay (WTP) for Red Palm Cooking Oil

The consumers' willingness to pay (WTP) was estimated under the similar pattern of double-bounded measure, where consumers possessed the feature to select the first option given the price (19.000 Indonesia Rupiah (IDR)), followed by (21.000 IDR) and (17.000 IDR) depending on their choice, or even (None of them) as 0 to represent their willingness to pay on RPO product. Based on our model, we have elicited the consumers' WTP as much 18.876 IDR (refers to table 8), which was below the initial price set up, but upper the least price of 17.000 IDR. As the following table 7, several eminent factors have been unveiled to affect the consumers' WTP on RPO product.

Table 8
Contingent Valuation Method (Double-Bounded) for RPO Product WTP

Variable	Coef.	SE	P-value
Age	4.936	8.551	0.564
Income	.197	.085	0.021**
Family Size	-109.973	57.695	0.057*
Education level	88.574	94.145	0.347
Employment	-145.838	198.488	0.462
Risk Attitude 1	-55.409	89.563	0.536
Risk Attitude 2	234.462	72.083	0.001***
Risk Attitude 3	200.188	74.538	0.007***
Healthy Lifestyle Consumption	110.535	75.483	0.143
Palm Consumption Frequency	89.713	57.560	0.119
Familiarity	2655.982	655.020	0.000***
Health Claim	219.542	491.550	0.655
Nutrition Label	265.321	361.982	0.464

Variable	Coef.	SE	P-value
Taste and Aroma	559.074	173.355	0.001***
Effluent Color	-781.068	256.363	0.002***
Cons	17666.24	688.458	0.000

Note:

(1) Risk Attitude Behavior 1 to 3: evaluate the self-report measure on consuming food, food risk perspective, and food safety behavior. Please refer to the survey questionnaire.

(2) Health Claim, Nutrition Label, Taste and Aroma, and Effluent Color are dummy for consumers' preferences regarding those attributes. Please refer to the survey

Table 9
Consumers' Willingness to Pay (WTP) for RPO Product

	Coef.	SE	P-value
WTP	18876.81	79.80	0.000

Accordingly, the findings showed that such variables have been prominently affecting to the consumers' WTP on RPO product. Nevertheless, in this finding, we would focus on specific important variables such as (1) familiarity of RPO product by the consumers which represented positively by (2655.982), (2) attached attributes of RPO (Health Claim, Nutrition Label, Taste and Aroma, and Effluent Color) product which were slightly diffed to the prior estimates on consumers' preference. Effluent color was as expected result by negative influence (-781.068) to the consumers' WTP which was identical result with previous estimates on our consumers' preference. The effect of red color attached in the product of RPO would become a real adversity for producers to promote in the markets, since the consumers were not familiar with the blood-like color palm oils. In the aforementioned studies of (Ismail et al., 2020) evaluated the physical properties of RPO that could impact on lowering the score of sensory analysis, while (Purnama et al., 2020) reinstated that commonly the Southeast Asia market unlike the direct consumption of unrefined palm oil (RPO) due to its red color and relatively strong taste which was less familiar by the consumers. It was reconfirmed by (Hasibuan & Ijah, 2018) the organoleptic tasting revealed the lower of favorability value on the sensory testing due to its reddish color of RPO followed by a distinctive smell of carotene and tastes slightly unpleasant by the panelist. Thus, our study has renounced the commonly identified threat of red color attached to the RPO product for the consumers. Eventually, (3) the Risk Attitude 2 and 3 attached the effect by positive influence by (234.462) and (200.188). Risk Attitude 2 reflected as consumers' preference on eating new food as a scale of risk, while Risk Attitude 3 reflected as consumers' thought on food safety. When consumers consider they are relatively considering themselves as people that rarely think about food safety, that reflected more likely as risk takers, their WTP was estimated to increase.

Essentially, we are interested in the effects of consumers' familiarity factor regarding their previous knowledge about RPO product. As it was promoted by the government only in the last year (2024), thus the consumers might not receive enough information about the RPO product. As consequences, the finding claimed a limited familiarity on RPO product would affect to a certain reduction on consumers' WTP. In contrast, consumers who possessed more information and better understanding about RPO product knowledge, they would be relatively open to buying the RPO with an increase of WTP. It was identical to a mounting body of works by scholars to proclaimed the similar

response of product know-how and familiarity on the consumers' willingness to pay (WTP). As studied by (Foster et al., 2022) the product knowledge together with perception of risk would have a positive and significant effect on using the technologies of E-wallets. Meanwhile, the study on purchasing decision of fruits had been explored by (Dewi et al., 2021) to reinstate the effect of consumers' familiarity on the products which rendered a positive influence on purchasing intention. In the following study of water fee WTP, (Thorvaldson et al., 2010) confirmed an identical effect of self-reported water knowledge on the support fee willingness to pay (WTP). Thus, investing in a program knowledge might expectedly levitate the households' WTP higher fee for the water initiatives. Accordingly, other flourished studies have been promoting an essential role of product knowledge as well as the familiarity on the consumers' WTP, such as (Park & Stoel, 2005) concerned on the brand familiarity associated with consumers' purchasing decision on apparel, which was in tandem with findings from (Elsya & Indriyani, 2020) to affect repurchase intention, while (Lundberg, 2019) explored the willingness to donate program, where both knowledge of biodiversity and familiarity of the flagship were associated with an increase of WTD to ecosystem program. Thus, according to our findings on familiarity that escalated the consumers' WTP on RPO product, we could claim that the government role in expanding further promotion of RPO would be essential. As this product would become the palm oil smallholders and cooperatives, therefore assistance of government bodies would be required to maintain the product preferred qualities as our findings on the intrinsic attributes of RPO, while expand the marketing exposure regarding the RPO product specifically in terms of its health and nutritional benefits.

Goodness of Fits

Regarding the goodness of fits checking, at *first*, we check the VIF value to measure the multicollinearity of variables. Followed by several measures of goodness of fits. The VIF values based on the measurement were identified <10 VIF value to represent the data was secure from the multicollinearity. While in terms of goodness of fits (Pseudo R^2) the model possessed (0.10) for the conjoint analysis, and (0.214) for contingent valuation method. Furthermore, the AIC and BIC showed the value (394.81) and (448.89). Followed by Peason's R (0.314)*** with level of significance, and Kendall's tau value (0.372)*** with level of significance.

CONCLUSION

The importance of this study was essentially to provide understanding in consumers' preference regarding a novel product of Red Palm Cooking Oil (RPO). As the government initiated to establish the smallholders' RPO production since 2024, nevertheless the market awareness of RPO on Indonesia consumers was lack. Thus, based on our study, we could portray that Indonesia consumers' preferences on RPO cooking oil were influenced by several factors. 2 intrinsic attributes of RPO product (1) Red Color and (2) Taste and Aroma have been associated with a negative effect towards consumers' preference. In contrast, 2 extrinsic attributes of (3) Nutrition Label and (4) Health-Claim Label would escalate the consumers' preferences. Part-worth utility analysis considers the most influential attributes, explained as below details: (1) Combine Label of Nutrition and Processing Method represented as the most preferred attribute to escalate the consumers' preference by (1.228); (2) Only Nutrition Label followed the utility as it renders a positive influence by (0.677) compared to the baseline of No Label; (3) The

Health-Claim Label reinforced the consumers' preferences by (0.513) to reflect its prominent effect as the source of benefit claim attached on the front-pack label; (4) The Red Color of RPO put a complexity on consumers' preferences by a threat of negative source (-0.625); (5) It further followed by Strong Taste and Aroma which was relatively avoided by the consumers (-0.425).

Regarding the consumers' willingness to pay (WTP), we exploited the consumers' WTP reached a slightly below the initial price, which was 18876.81 IDR. This indicated that consumers valued below the initial price due to such burden with immense consideration in the physical properties of RPO. Yet, the Color of RPO remained the case of negative burden for the consumers to increase their WTP (-781.068). While importantly, the Familiarity of RPO product by the consumers could escalate the willingness to pay (2655.982). Hence, consumers that already possess prior knowledge about RPO products with its essential benefit of nutrition, would be having more opportunities to the purchasing decision on RPO products.

RECOMMENDATIONS

According to these findings, several recommendations could be elicited for the government as well as palm oil smallholder farmers as they are the main stakeholders which produced the unrefined palm oil associated with strong taste and red color. (1) The physical properties of RPO should be undertaken through the exploration of sensory testing to discover the less of RPO' strong taste as well as the luminance of RPO red color; (2) Importantly, the labelling strategies (Health Claim and Nutrition Label) on the front-and-back packaging should be discovered by the government to find a proper packaging model prior to a massive market expansion in the national scale marketing, a specific study on the packaging with food labelling would be an essential escalation attempt to raise proper consumers' awareness through convenient packaging model; (3) Importantly, the findings on familiarity impact should be one of the baseline for government to attach in the promotional progress on potential consumers. The media analysis along with the promotional content and pathways are required to be conducted such as a appropriated marketing content through cooking demo as well as intense social media marketing to increase the branding of RPO product in the markets.

LIMITATIONS

This study has attempted to discover the consumers' preferences along with the willingness to pay (WTP). However, this study was (1) lack to discover the direct willingness to pay through conditional logit model which inserted the price on the attributes. Thus, consumers could not compare the selection of choice task that compares the price in the attributes. Following our findings on WTP regarding familiarity, thus it would be an ameliorating estimation if (2) future study could discover the effect of information treatment (nudge) on the willingness to pay (WTP) of Red Palm Cooking Oil (RPO). Moreover, (3) a wide range of consumers heterogeneity could be included in future studies as it could own the perspective of segmented market share by using such clustering models such as rural and village consumer clusters which could represent more realistically the demand of RPO on real market situation.

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