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Principle component analysis of organoleptic acceptability on cocos™ emulsion product

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Abstract

Cocos™ Emulsion is new food emulsion product that made of virgin coconut oil (VCO). A sensory analysis was conducted among targeted consumers, which were 150 schoolchildren (age 4 - 12) and 100 adult panelists (age 21 - 60). The principle component analysis (PCA) was applied to assess the organoleptic acceptability of public and schoolchildren on this novel product. In summary, both adult and schoolchildren panelists showed a significant preference ($P < 0.05$) toward Cocos™ Emulsion than VCO for both sensory attributes of taste and odour, as it was palatable. The scores plot of sensory attributes among all panelists were found highly scattered around, indicating no age-dependent preference on the sensory rating of each attributes.

Introduction

Virgin coconut oil (VCO) is well known because of its therapeutic values. Some studies had reported that VCO has multiple health benefits including antihypercholestrolemia property, antinociceptive, anti-ulcer, anti-inflammatory, bone loss prevention as well as anti-hepatoprotective activity and etc. (Zakaria *et al*., 2010; Zakaria, Somchit, Mat Jais *et al.*, 2011; Zakaria, Rafiee, Somchit *et al.*, 2011; Hayatulina *et al.*, 2012; Selvarajah *et al.*, 2015). In general, virgin coconut oil has strong aroma and contains unsaponifiable matter (e.g. tocopherol), which proven to be good antioxidants (Dia *et al*., 2005; Seneviratne *et al*., 2009).

In this study, we have developed a new VCO emulsion based product, also known as Cocos™ Emulsion as daily nutritional food supplement for those dislike to consume VCO directly, mainly because of the strong aroma and oily taste. The Cocos™ Emulsion is expected to increase our body metabolism and immune system due to the presence of medium-chain fatty acids. The unique of medium-chain saturated fats structure present in VCO, can contribute a soft buttery texture of the formulated end product. In addition, Cocos™ Emulsion can also be consumed by people at all ages as energy booster and at the same time it has no side effects. It is burned immediately and do not convert into body fat or cholesterol, therefore do not affect blood cholesterol levels (Grimm, 2005). The main objective of this study is to investigate the organoleptic acceptability of the Cocos™ Emulsion among schoolchildren and adults.

Materials and Methods

Materials

VCO was purchased from Cocorosco Sdn. Bhd. (Johor, Malaysia). Potasium sorbate, citric acid and xanthan gum were purchased from Meilun Food Chemical Sdn. Bhd. (Selangor, Malaysia). Stevia and gum Arabic was purchased from StevisSugar Corporation (M) Sdn. Bhd. (Kuala Lumpur, Malaysia) and Markaids (M) Sdn. Bhd. (Selangor, Malaysia), respectively. Modified starch was obtained from San Soon Seng Food Industries Sdn. Bhd. (Selangor, Malaysia). Food grade flavouring agent was obtained from Reka Nutrition Sdn. Bhd. (Selangor, Malaysia).

Preparation of Cocos™ emulsion

A 200 mL of Cocos™ Emulsion product consists of VCO: gum arabic: xanthan gum: modified starch at a ratio of 9.4: 1.3: 1: 1.3 was prepared. Two types of

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Table 1. Five-point hedonic scale and its indication

Sensory Score	Description
1	Dislike Extremely
2	Dislike
3	Neither Dislike or Like
4	Like
5	Like Extremely

Abbreviations

Cocos™ Emulsion product were formulated with the only different in flavouring agent at a dosage of 0.5% (w/v) were prepared: a) Mango flavouring agent and b) Pineapple flavouring agent. The potassium sorbate (0.1%, w/v) and citric acid (0.08%, w/v) were selected to prevent microbial growth. A sufficient amount of Stevia (0.6% w/v), a natural sweetener was added into Cocos™ Emulsion product to mask the taste of VCO. The production of Cocos™ Emulsion was performed according to Khor *et al*.'s (2014) method.

Sensory evaluation

The sensory evaluation was conducted at AEON shopping mall (Serdang, Malaysia). A sensory analysis was conducted among 150 schoolchildren (age 4 - 12) and 100 adults (age 21 - 60) to gauge the acceptability of Cocos™ Emulsion products. A total of 15 mL samples were presented in the small disposable plastic containers with cap, coded with 3 digit random numbers. The respective untrained panelists were asked to taste three coded distinctive samples, which were Cocos™ Emulsion with pineapple flavouring, Cocos™ Emulsion with mango flavouring, and the original VCO. All panelists were public shoppers regardless of gender and races. The survey was conducted in a public shopping mall located at Serdang, Selangor. A five-point hedonic test was employed in public consumers' sensory evaluation. To avoid confusion among public panelists, only taste and odour attributes were generated for sensory rating with a facial scale guidance, particularly for children panelists as listed in Table 1. Samples consisting of two types of Cocos™ Emulsion and one VCO were presented to the panellists in a regulated presentation sequence and randomized order. Panelists were reminded to rinse their mouth with the water provided between each samples to avoid sensory fatigue. The experimental results were analysed using Minitab software (Minitab Version 14.1). All of the data were expressed as the mean values ± standard deviations of triplicate measurements. Two-way analysis of variance (ANOVA) with a 5% significance level was used to detect significant differences ($P < 0.05$) between the mean values. Principle component analysis (PCA) was used to study the interaction among the sensory attributes for children and adults panelists and was performed with XLSTAT software (Version 2013).

Table 2. Sensory scores for VCO and Cocos™ Emulsion samples for both children and adult panelists

Sample	Children (4-12 years old)		Adults (21-60 years old)	
	Taste	Odour	Taste	Odour
Cocos™ emulsion with pineapple flavouring	$3.75 \pm 1.14^{b}{}_{A}$	$4.13 \pm 0.81^{b}{}_{B}$	$3.51 \pm 0.86^{b}{}_{A}$	$4.06 \pm 0.62^{b}{}_{B}$
Cocos™ emulsion with mango flavouring	$4.11 \pm 1.03^{c}{}_{B}$	$4.03 \pm 0.94^{b}{}_{B}$	$3.53 \pm 1.07^{b}{}_{A}$	$3.66 \pm 1.06^{a}{}_{A}$
VCO	$2.48 \pm 1.15^{a}{}_{A}$	$2.96 \pm 1.15^{a}{}_{B}$	$3.01 \pm 1.06^{a}{}_{B,C}$	$3.36 \pm 1.05^{a}{}_{C}$

Each value in the table represents the mean ± standard deviation from the ratings from 150 children and 100 adult panelists, respectively. Means within each column with different subscripts are significantly ($P < 0.05$) different for group category. Mean with each row with different superscripts are significantly ($P < 0.05$) different for product tasting.

Results and Discussion

In this study, principle component analysis (PCA) was performed to simplify the interpretation of the relationships between sensory attributes of various emulsion samples. Table 2 presents the mean ratings of all sensory attributes in both VCO and Cocos™ Emulsion samples. All Cocos™ Emulsion samples were shown significantly different ($P < 0.05$) than VCO samples for taste and odour attributes regardless children or adults. Among children panellists, results obtained indicating that most children preferred the taste of Cocos™ Emulsion with mango flavouring than pineapple flavouring. The degree of liking for VCO sample on the taste and odour attributes was comparatively low among children panelists. This phenomenon indicated that majority of the children dislike the oily taste of the VCO. The significant preference towards Cocos™ Emulsion product compared to VCO also showed the potential of Cocos™ Emulsion to be marketed among children to improve their health. In the group of adult panellists, most consumers are consuming VCO regularly and know the benefits of VCO. Not surprisingly, adult panelists could accept the VCO taste as well as odour significantly ($P < 0.05$) than children panelists. However, the rating on VCO samples were shown significantly ($P < 0.05$) lower among adult panellists if compared to the Cocos™ Emulsion. Cocos™

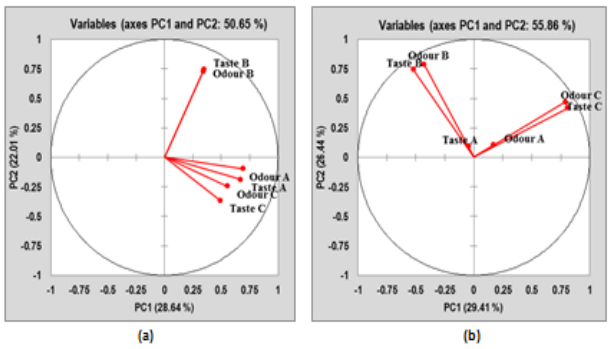

Figure 1. Principal component analysis of taste and odour attributes for all sensory evaluation samples: a) children panelists; b) adult panelists
(Abbreviations: A = Cocos™ Emulsion with pineapple flavouring; B = Cocos™ Emulsion with mango flavouring; and C = VCO sample)

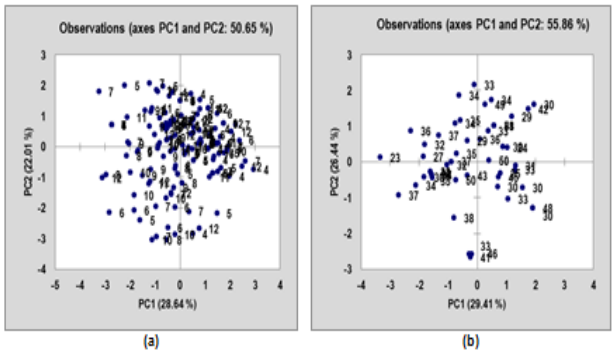

Figure 2. Score plot of taste and odour attributes for all sensory evaluation samples: a) children panelists; b) adult panelists (numbers indicated the age)

Emulsion with pineapple flavouring received the highest odour scores among all samples, the similar findings also observed in children panellists.

Based on the PCA plot for children panelists, both odour and taste of Cocos™ Emulsion with pineapple flavouring and VCO sample were found to be negatively related to the taste and odour of Cocos™ Emulsion with mango flavouring (Figure 1a). In the loading plot for adult panellists, it was found that both odour and taste attributes of Cocos™ Emulsion with mango flavouring were negatively correlated to VCO sample. Both Cocos™ Emulsion with different flavouring showed a closely correlation between odour and taste attributes sensory score except for VCO sample (Figure 1b). From PCA plot analysis, VCO emulsion with mango flavouring was shown to be clearly distant from VCO emulsion with pineapple flavouring, indicating that there was a distinct degree of liking among consumer panelists towards particular emulsion products.

The score plot of the taste and odour attributes among children and adults panelists with their age labelled in the multivariate space of the principal components is shown in Figure 2a-b. The scores among the children and adults were found highly scattered around all four areas. This finding indicated that there was no specific age-related preference towards taste and odour attributes among all sensory sample in children and adult panellists.

Conclusion

Cocos™ Emulsion was developed to overcome the oily taste and strong coconut aroma with the aim to encourage more consumers to enjoy the multiple health benefits of VCO. Public survey on the consumer acceptability study of both adult and children panelists had shown a significant preference ($P < 0.05$) towards Cocos™ Emulsion than VCO samples for both sensory attributes of taste and odour and no age-dependent on each sensory rating preference of taste and odour was also observed. This finding had indicating good public response towards Cocos™ Emulsion and showed a great potential of Cocos™ Emulsion to be commercialized as new food supplement, particularly for young generation who dislike to consuming VCO directly because of its oily taste and coconut aroma smell even though it is well known as therapeutic oil for maintaining good health.

Acknowledgement

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Conflict of Interest

The authors report no conflicts of interest.

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