Consumer acceptance and purchase intent of fresh water fish product developed by MARDI

(Penerimaan pengguna dan niat membeli terhadap produk ikan air tawar yang dibangunkan oleh MARDI)

Rashilah Mohamad*, Muhamad Faireal Ahmad*, Ahmad Zairy Zainol Abidin* and Rokiah Mohamad**

Abstract
A consumer acceptance study was undertaken to determine attributes influencing acceptance and purchase intent of fresh water fish products developed by MARDI. A number of statistical techniques such as analysis of variance (ANOVA), multivariate analysis of variance (MANOVA), descriptive discriminant analysis (DDA) and logistic regression analysis (LRA) were employed to determine crucial underlying attributes that influence preference and purchase intent. ANOVA and MANOVA were employed to find out whether there was significant difference between products reviewed. ANOVA considered each attribute individually while MANOVA considered all attributes simultaneously. It was found that all products were significantly different. Subsequently, DDA was performed to identify which attributes contributed to the difference. Attributes taste and overall acceptability were responsible for the difference in the consumer preference. DDA indicated that taste with pooled within canonical structure of 0.904796 was the important attribute, followed by overall acceptability with pooled within canonical structure of 0.897147 in determining customer preference towards fresh water fish products developed by MARDI.

Introduction

Fresh water fish products are gaining popularity among Malaysian consumers (Che Rohani et al. 2009). Developing products from fresh water fish is an important down stream activity that could add value to its economic value and could possibly widen its market boundry. Malaysian Agriculture Research and Development Institute (MARDI) has developed several fresh water fish products which are of high quality, free from unfavourable odour and have high protein content which is easily digestable. They are an alternative cheaper source of protein and can be considered as healthy food suitable for all ages. Fresh water fish products developed by MARDI have been accepted by MARDI's trained panellists but in order to ensure success in marketing these products, a consumer acceptance study should be undertaken to determine how consumers perceived these products and the important attributes that they considered

*Economic and Technology Management Research Centre, MARDI Headquarters, Serdang, P.O. Box 12301, 50774 Kuala Lumpur, Malaysia
**Food Technology Research Centre, MARDI Kuala Terengganu, P.O. Box 3, 20700 Kuala Terengganu, Terengganu, Malaysia
E-mail: rashilah@mardi.gov.my

prior to purchasing these products. Therefore, the objectives of this study were to identify major attribute(s) influencing acceptance and to predict their purchase intent.

Methodology
The products
The fresh water fish products reviewed were breaded patin fillet (product 1), restructured tilapia fillet (product 2), catfish kebab (product 3) and tempura patin (product 4) (*Table 1*). All products were prepared from fresh water fish fillet except for restructured fillet which was prepared from remnant or by-product of tilapia fillet processing.

Consumer acceptance test
A total of 768 consumers participated in this study. They were presented with four coded samples of products 1, 2, 3 and 4 following the randomized block design which means that each respondent sampled all the four products one after another. Respondents were also served plain water to cleanse their palettes between samples.

Each respondent has to evaluate the four samples for taste, colour, size and overall acceptability based on the 5-point Likert scale, 1 being dislike extremely, 3 is neither like nor dislike and 5 is like extremely. Purchase intent was rated using the 2-point hedonic scale yes or no. Data was collected based on a structured questionnaire distributed to all respondents participating in the study.

Statistical data analysis
Data were analysed using SAS version 9 (SAS Institute Inc. Cary, North Carolina, USA). The statistical analyses performed

were Analysis of Variance (ANOVA), Multivariate Analysis of Variance (MANOVA), Descriptive Discriminant Analysis (DDA) and Logistic Regression Analysis (LRA) (Amporn 2007).

ANOVA was performed to determine respondents acceptability of each product's attributes. MANOVA was performed to determine if there was any significant difference when all attributes were simultaneously considered. It is a technique that can be used as an extension of the ANOVA procedure where more than one variable was tested to detect differences in groups across multiple dependent variables at the same time. DDA was used to determine the most discriminating attribute(s) in terms of consumer perceptions and LRA was performed to predict purchase intent using the odd ratio estimate (Allison 1999). The odd ratio is the non-negative number with a value that is greater than one when a success is more likely to occur than a failure (Bond 2002).

Results and discussion
ANOVA, MANOVA and DDA
The purpose of analysis of variance or ANOVA is to test for significant differences between means. It provides a statistical test of whether or not the means of several groups are all equal. In terms of taste, products 1 and 4 were not significantly different with a mean score slightly more than 4.0 (*Table 2*). Products 2 and 3 were significantly different from each other and from products 1 and 4. The mean score of taste for products 2 and 3 were 3.0 and 3.3 respectively. As for attributes size, colour and overall acceptability, both products 1 and 4 were on the same category. The

Table 1. Attributes of the four fresh water fish products

	Product	Colour	Size (cm) (thickness x width x length)
Product 1	Breaded Patin fillet	Bright golden yellow	1 x 3 x 4
Product 2	Restructured Tilapia fillet	Golden yellow	2.5 x 3 x 5
Product 3	Catfish kebab	Reddish-black	1 x 2 x 3
Product 4	Patin tempura	Whitish-yellow	1.5 x 3 x 5

Table 2. Mean score for consumer acceptability for fresh water fish products

Attribute	Product 1	Product 2	Product 3	Product 4
Taste	4.01 ± 0.89a	3.04 ± 1.16c	3.29 ± 1.20b	4.03 ± 0.92a
Size	4.03 ± 0.87a	3.61 ± 1.00b	3.19 ± 1.17c	4.11 ± 0.85a
Colour	4.05 ± 0.84a	3.41 ± 1.08c	3.11 ± 1.19d	3.97 ± 0.91b
Overall acceptability	4.13 ± 0.76a	3.34 ± 1.03b	3.37 ± 1.11b	4.12 ± 0.86a

Mean and standard deviation from 768 respondents based on 5-point Likert scale
Mean values in the same row not designated by the same letter were significantly different
($p < 0.01$)

Table 3. Multivariate statistics and F approximation

MANOVA Statistics	Test criteria and F approximation				
	Value	F Value	Numerator DF	Denominator DF	Pr > F
Wilk's Lambda	0.6399	93.13	12	6080.2	<0.0001
Pillai's Trace	0.3900	85.94	12	6900	<0.0001
Hotelling-Lawley Trace	0.5161	98.80	12	4017.2	<0.0001
Roy's Greatest Root	0.4025	231.44	4	2300	<0.0001

Table 4. Canonical structure r's describing differences among three fresh water fish products

Attribute	Can1	Can2	Can3
Taste	0.904796	–0.364981	–0.115606
Size	0.767306	0.515105	–0.374446
Colour	0.822290	0.346651	0.448593
Overall acceptability	0.897147	–0.087680	0.052832
Cumulative variance explained	73.04%	98.60%	100%

attributes size and colour for products 2 and 3 were significantly different, while for attribute overall acceptability, they were not significantly different based on their mean scores.

MANOVA can be an appropriate statistical technique when an ANOVA-like analysis is desired for more than one dependent variable. The goal of the MANOVA is to test whether mean differences among the groups (independent variable) on a combination of dependent variables are likely to have occurred by chance. This is achieved by creating a single dependent measure from a combination of all dependent measures that maximizes the between group differences (Davis 2003). Simply put, MANOVA was performed to determine if there was any significant difference when all attributes of products reviewed were simultaneously considered.

MANOVA results produced a F value of the Wilks' Lambda statistic of 93.13 ($p < 0.001$) which indicated that all the four products were significantly different when all the four sensory attributes were evaluated simultaneously (*Table 3*).

Subsequently DDA was performed to determine which attributes were significantly underlying the differences among the products reviewed (Huberty 1994). DDA results showed the canonical structure r's which identified construct that largely account for groups' attributes difference (*Table 4*).

The first dimension of Can1 of the pooled within group with 73% variance explained, revealed that taste, with canonical correlation of 0.905 was the most important attribute that contributed to the underlying differences among products reviewed. The next most important attribute that accounted

for underlying differences was overall acceptability with canonical correlation of 0.897. Therefore, taste and overall acceptability were the most important attributes responsible for explaining the underlying differences among products reviewed. Results of Can2 and Can3 were not considered due to relatively low score of cumulative variance explained i.e. 25.96% for Can2 and 1.40% for Can3.

Logistic Regression Analysis (LRA) on purchase intent

LRA was used to predict purchase intent by using odd ratio estimate. The odds are a non-negative number with a value that is greater than 1.0 when a success is more likely to occur than a failure (Bond 2002). In this study, a success was intention to purchase the product.

Based on LRA for purchase intent, overall acceptability was the most important attribute with an odd ratio of 1.439, (p <0.0001). Therefore, for every one point increase in overall liking score based on the 5-point Likert scale, the probability of the product being purchased would be 1.4 times higher than not being purchased. Taste was the next most important attribute with an odd ratio estimate of 1.294 (p <0.0001), which indicated that for every one point increase in taste score based on the 5-point Likert scale, the probability of the product being purchased would be 1.3 times higher than not being purchased, *ceterus peribus*, (*Table 5*).

Table 6 depicted the correct prediction rate or hit rate of purchase intent. Correct prediction is the correct classification of an unknown unit of product either being purchased or not being purchased (Amporn 2007).

Based on full LRA model with four sensory attributes, purchase intent could be predicted with 65% accuracy. Taste alone could be used to predict purchase intent with 54.8% accuracy while overall acceptability alone, colour alone and size alone could

Table 5. Parameter estimates, probability, odd ratio estimates for predicting purchase intent of fresh water fish products

Attribute	Estimate	Pr > X^2	Odd
Taste	0.2574	<0.0001	1.294
Size	0.0316	0.5552	1.032
Colour	0.0022	0.9694	1.002
Overall acceptability	0.3642	<0.0001	1.439

Table 6. Correct prediction (hit rate) of purchase intent

Full Model (4 Variables)	65%**
A Single-Variable Model	
Taste	54.8%**
Size	48.9%**
Colour	50.5%**
Overall acceptability	53.5%**

**Based on LRA at p <0.0001

predict purchase intent with 53.5, 50.5 and 48.9% accuracy respectively.

Conclusion and recommendation

It can be concluded that all the four products were well accepted. Product 4 was most preferred for the taste and Product 1 for the size (1.5 cm thick, 3 cm wide and 5 cm long). The bright golden yellow Product 1 gained the highest mean score for colour. In terms of overall acceptability, respondents preferred Product 1 followed by Product 4, Product 3 and Product 2. By comparing products attributes' mean scores, ANOVA technique indicated that there were significant differences of preference in all the four products reviewed when each attribute was considered individually. The MANOVA results supported the ANOVA results when all attributes were simultaneously considered.

DDA revealed that the most important attributes responsible for the difference were taste and overall acceptability. Both attributes also yielded heavy weight and significant (p <0.0001) with odds of 1.439 for overall acceptability and 1.294 for taste when logistic regression analysis

was performed. This indicated that the probability of the product being purchased would be 1.4 times higher than not being purchased, for every one point increase in overall liking score based on the 5-point Likert scale. As for taste, for every one point increase in taste score based on the 5-point Likert scale, the probability of the product being purchased would be 1.3 times higher than not being purchased.

Apart from determining the odds and identifying critical attributes influencing purchase intent, LRA was also able to determine the correct prediction rate of purchase intent. When considering the full model i.e. taking into account all attributes simultaneously, the correct prediction rate of the purchase intent was 65%. The correct prediction rate of the purchase intent was 54.8, 53.5, 50.5 and 48.9% for taste, overall acceptability, colour and size, respectively. Consumers considered taste and overall acceptability as the two most important attributes in their products' preference and purchase intent. Therefore, these attributes should be given special emphasis in product development and improvement prior to commercialization.

Acknowledgement

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Abstrak

Penerimaan pengguna terhadap produk ikan air tawar yang dibangunkan oleh MARDI telah dikaji. Objektif utama adalah untuk mengenal pasti atribut yang penting dan diutamakan oleh pengguna dalam menentukan penerimaan dan niat untuk membeli produk yang dikaji. Beberapa teknik analisis statistik iaitu *'analysis of variance'* (ANOVA), *'multivariate analysis of variance'* (MANOVA), *'descriptive discriminant analysis'* (DDA) and *'logistic regression analysis'* (LRA) telah digunakan bagi tujuan tersebut. Teknik ANOVA dan MANOVA digunakan untuk menentukan sama ada terdapat perbezaan ketara antara produk daripada sudut penerimaan pengguna terhadap produk tersebut. ANOVA mengambil kira jika terdapat perbezaan ketara apabila tiap-tiap atribut dikendalikan berasingan, sementara MANOVA mengambil kira perbezaan apabila semua atribut dikendalikan serentak. Kedua-dua analisis statistik tersebut menunjukkan terdapat perbezaan ketara antara produk daripada sudut penerimaan pengguna. Seterusnya analisis DDA dilakukan untuk menentukan atribut yang menyebabkan perbezaan ketara tersebut. Didapati bahawa atribut rasa dengan nilai statistik struktur 'pooled within canonical', 0.904796 dan penerimaan keseluruhan, 0.897147 ialah dua atribut yang amat diutamakan oleh pengguna semasa menentukan penerimaan dan niat untuk membeli produk yang dikaji.