

Consumers' willingness to pay for functional rice: a survey from Indonesia

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Abstract

Rice, especially the pigmented varieties, contains a higher level of melatonin (N-acetyl-5-methoxytryptamine), which is used in treatment for sleeping disorders and for improving mood. It has potent antioxidant properties, anti-obesity, and anti-inflammatory, thus potential as the basis for functional food development. The purpose of the study was to examine how the various rice attributes and demographic characteristics affect the willingness to pay of Indonesian consumers on functional rice. Multi-Factor Categorical Design (MFCD) and Balanced Incomplete Block Design (BIBD) have been used to study multiple non-quantitative factors, including different rice varieties and health benefits information on the label (x_1 , 3 levels: white rice, brown rice-label, and red rice-label), price (x_2 , 2 levels: low and high), and rice producers (x_3 , 3 levels: international brand, established national brand, and new national brand). Data collection was administered through an online questionnaire survey to 204 respondents, living in four major Indonesian islands: Java, Bali, Sumatra, and the Moluccas. The results showed that despite the health benefits of the melatonin contained in the whole brown and red rice, Indonesian consumers still preferred conventional white rice over the aforementioned rice varieties. Price was recognized as the main attribute affecting the selection of functional rice, whilst rice producers gave less impact on willingness to pay. The results indicated that cultural value, consumers' knowledge of melatonin, consumers' health status, and consumers' income were the sources of heterogeneity in consumers' willingness to pay for functional rice.

1. Introduction

There has been a noticeable expansion in the global food market over the past decade. Food, which previously eaten to satisfy hunger and to provide nutrients for the body, nowadays has been marketed with additional health benefits. This novel food, labeled as a functional food, prevents nutrition-related diseases and improves the physical and mental well-being of the consumers (Siró *et al.*, 2008). The growing interest among consumers who believe that food improves health and quality of life have raised potential markets for functional food.

To date, there are several definitions for functional foods that ranged from the very simple to the more complex. Extracting the summary of twenty-six different definitions of functional food, four general concepts are

identified: the nature of food, health benefits, functions, and regular consumption. Furthermore, a working definition of functional food was formulated: "A functional food is, or appears similar to, a conventional food. It is part of the standard diet and is consumed on a regular basis, in normal quantities. It has proven health benefits that reduce the risk of specific chronic diseases or beneficially affect target functions beyond its basic nutritional functions (Doyon and Labrecque, 2008).

Rice (*Oryza sativa*) is the third most grown cereal crop in the world. In Indonesia, rice is the utmost staple food with a yearly consumption of more than 46,000 KT (FAO, 2017). Hence, rice is extremely important, not only to satisfy hunger but also to provide nutrients for the population of Indonesia. Several health-benefited substances have been identified in rice and these include melatonin (Setyaningsih *et al.*, 2014). Melatonin (N-

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acetyl-5-methoxytryptamine) is an indoleamine that is synthesized from the essential amino acid L-tryptophan. It has various essential activities in the body that gives positive health advantages. Melatonin is involved in the regulation of circadian rhythms and sleep-wake patterns; therefore, it is helpful in limiting sleep disorders due to jet lag and shift work (Spiegelhalter *et al.*, 2017). It is used for the treatment of insomnia and it increases total and quality of sleep time (Ferracioli-Oda *et al.*, 2013). Concomitantly, melatonin has been shown to improve mood in the context of resynchronization of the altered circadian rhythms (Lanfumej *et al.*, 2013). Additionally, the compound has also been linked to a wide range of functions, including antioxidants (Bonfont-Rousselot and Collin, 2010), anti-obesity (Szewczyk-Golec *et al.*, 2017), and anti-inflammation (Mauriz *et al.*, 2013).

The level of melatonin decreases gradually in each step of rice production, particularly after milling processes to remove the bran layer of rice grain. The whole grain (brown) rice, as well as pigmented (red and black) varieties contain higher levels of melatonin than the polished (white) grain. The level of melatonin in these unpolished rice grains is maintained in the final product because there is no bran removal process (Setyaningsih *et al.*, 2014; Setyaningsih *et al.*, 2016). Henceforth, consumption of whole grain (brown, red, and black) rice has additional functional benefit.

Two major characteristics, sensory and non-sensory, have been identified as factors that contribute to consumers' food choices. Sensory characteristics, especially the taste, have been claimed to be the most critical variables directing consumers' food choice (Verbeke, 2006; Urala and Lähteenmäki, 2007). While non-sensory characteristics such as brand, claim, price (Ares *et al.*, 2010), and convenience (Urala and Lähteenmäki, 2003) also likely to affect the consumers' food choice.

The notion that there may be individual differences in the extent to which they are likely to buy products with functional properties (Frewer *et al.*, 2003), determines factors that influence consumers' willingness to buy functional food in Indonesia is important. This research examined the influence of different levels of information through the acceptance and willingness to pay using a survey. Therefore, the aims of this study were to study how the various rice attributes and demographic characteristics affect the willingness to pay of Indonesian consumers on functional rice.

2. Materials and methods

2.1 Participants

A total of 204 participants lived in Indonesia's main

islands, namely Sumatra, Java, Bali, and the Moluccas, partook the online survey. Non-probability sampling with convenience choice and snowball sampling was used in this study. The age of participants was chosen between 20 and 55 years old because a person with that range of age was responsible for food grocery shopping in the household. The participants used their electronic devices to complete the online questionnaire.

2.2 Questionnaire and research design

The consumer data were collected through an online consumer questionnaire survey. Before being administered, the initial version of the questionnaire was validated on a pilot sample of 10 respondents which two of them were experts. The final version of the questionnaire consisted of a structured and unstructured questionnaire. The questionnaire was divided into four parts.

The participants filled in a questionnaire on their willingness to pay for functional rice over multiple non-quantitative factors. Three attributes were used in this study: label (x_1 , 3 levels), price (x_2 , 2 levels), and rice producers (x_3 , 3 levels). The attributes and levels used in the study are summarized in Table 1. Considering the number of product attributes and levels, a multi-factor categorical design generated 18 functional rice profiles. These profiles were presented to consumers using pictures on the online questionnaire (Figure 1).

Table 1. Rice product attributes and level considered for willingness to pay analysis

Attribute	Levels	Description of levels
Type of Rice	3	1. Regular: White rice 2. Functional: Brown rice labelled with a 3. Functional: Red rice labelled with a
Price	2	1. Low 2. High
Rice Producers	3	1. International brand 2. Established national (Indonesian) brand 3. New national brand



Figure 1. Some examples of rice labels used in the survey

The picture depicted a rice label which contains the brand name, producer, rice variety, and claim for melatonin's health benefit, product weight, and price. Consumers could also see the appearance of rice product through transparent packaging. A rating was applied, requesting respondents to rate each picture with a metric willingness to pay in the scale of 1 to 7 (1 = No, I will not buy at all, 7 = Yes, I will always buy).

Prices were set according to what observed in the market for polished (white), whole grain (brown), and pigmented (red) rice products. The two alternatives differed in terms of the price of white, brown and red rice grains were as follows: 11,100 IDR/kg and 19,950 IDR/kg; 24,075 IDR/kg and 36,990 IDR/kg; 13,500 IDR/kg and 44,990 IDR/kg respectively.

To get a clear understanding regarding the willingness to pay of rice consumers when alternatives were provided, six rice products out of 18 profiles were presented to each participant using a Balanced Incomplete Block (BIB) design (ISO 2011). The participants were then required to evaluate the six rice products on the basis of the willingness to pay in a way as a consumer evaluating some products on the market shelf. The BIB design was employed because it was not advisable to rank all the 18 functional rice profiles in one assessment. Therefore, a subset of samples is selected so that, in the BIB design, every sample and all possible pairs of two samples were evaluated in an equal number of times. From the initial 18 functional rice profiles ($t=18$), a subset of six profiles ($k=6$) was chosen. The BIB design generated 51 blocks ($b=51$) of six profiles. Every sample was replicated 17 times ($r=17$) and each pair of samples was evaluated 5 times ($I=5$). This design was repeated four times. A ranking test is more appropriate over the scoring to assess this aspect. Respondents were asked to rank all of the six-point scale profiles (1 = I am willing to purchase, 6 = I am less willing to purchase).

The third part of the questionnaire included a list of queries to analyze respondents' attitudes towards food consumption. The perception of healthy eating habits and lifestyle was tested by providing questions related to their agreement level on this issue (using a 7- and 5-box scale). The consumption frequency of polished white rice, whole-grain or brown rice, pigmented red and black rice was asked by asking respondents to indicate if specific statements reflected their habits. In addition, the respondents were asked to choose the statement that reflects their sleeping disorder in which refers to melatonin deprivation.

The last part of the questionnaire investigated the sociodemographic characteristics of the respondents.

Age, gender, marital status, origin and place of living, occupation, educational level, housing asset, and household purchase frequency were asked. Table 2 compares respondents from the survey and the Indonesian populations based on demographic variables. Compared with national data, the data collected in this online survey was a reasonably representative sample.

Table 2. Demographic characteristics of the survey participants and the Indonesian populations

Variable	Respondents from the survey	Indonesia
Island		
Java	53.92%	52.13%
Bali	6.37%	1.63%
Sumatra	21.56%	8.82%
The Moluccas	18.13%	1.11%
Age		
Between 20 and 30 years old	80.88%	43.55%
Between 31 and 40 years old	14.21%	34.04%
Between 41 and 55 years old	4.90%	23.40%
Gender		
Male	38.72%	50.50%
Female	61.27%	49.50%
Marital status		
Single	76.47%	99.98%
Married	23.53%	0.02%
Occupation		
Private employee	24.02%	-
Undergraduate student	44.61%	2.45%
Entrepreneur	8.33%	10.34%
Civil worker	8.82%	1.72%
Housewife	2.45%	-
Unemployed	1.96%	10.00%
Education		
Primary and secondary school	0.98%	40.36%
High school	15.68%	37.49%
University degree	83.33%	58.47%
Income		
Low and middle level	89.21%	80.00%
High level	10.78%	20.00%

2.3 Data analysis

To understand better which rice attributes affect consumers' willingness to pay, a one-way ANOVA analysis had been applied with Friedman-type statistic and Fischer's LSD was applied. The statistical analyses were performed using STATGRAPHICS Centurion XVI (Statpoint Technologies, Inc., USA).

3. Results and discussion

3.1 Willingness to pay analysis

The willingness to pay survey explores how

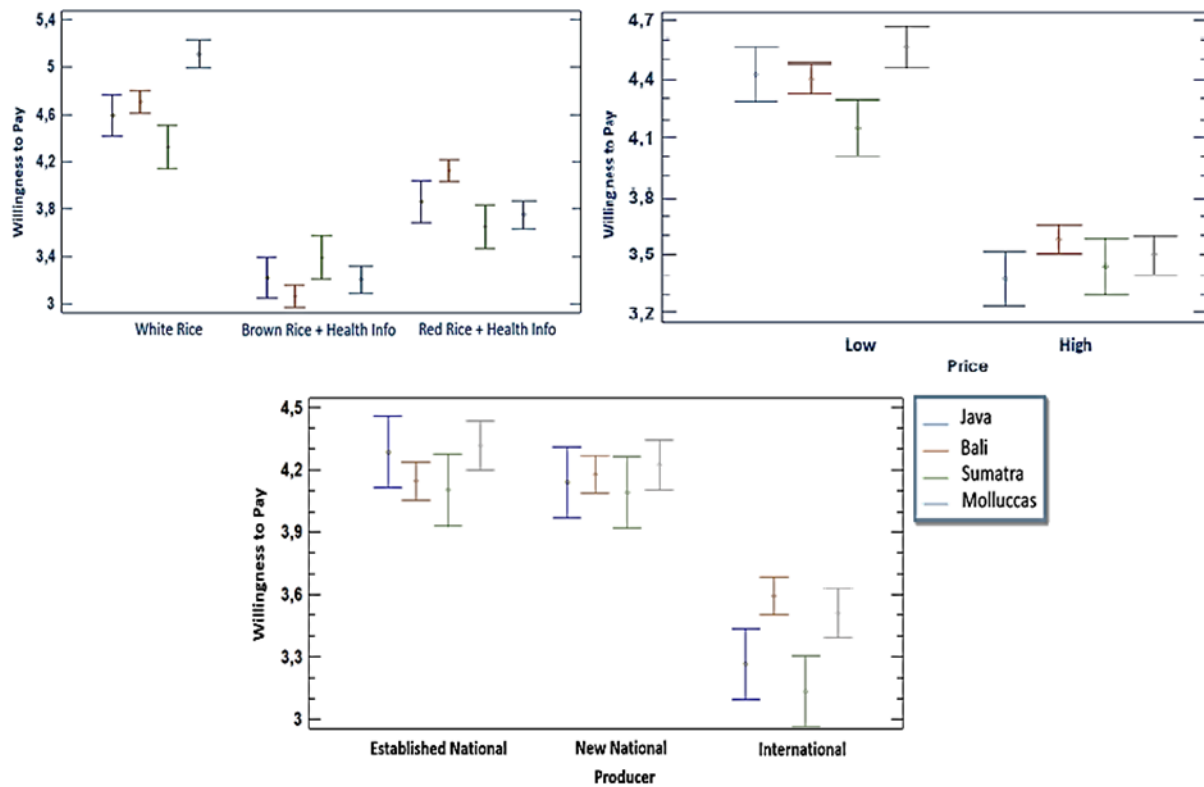


Figure 2. Influence of rice attributes on consumers' willingness to pay in Java, Bali, Sumatra, and the Moluccas islands for functional rice

Indonesian consumers value rice attributes and make their functional rice choices. Result in Figure 2 suggests that Indonesian consumers' willingness to pay was affected by the price, producer, and type of rice, while the presence of melatonin's health benefits on the label did not contribute a significant effect on their willingness to pay. Although the rice consumers in four islands significantly preferred polished white rice over the other types of rice, people in the Moluccas had a higher willingness to pay for polished white rice than those in Java, Bali, and Sumatra.

Indonesian consumers were most likely to buy rice at a lower price. Consumers in the Moluccas had the highest willingness to pay for rice at a low price while consumers in Sumatra had the lowest. The difference response might occur due to the difference in the regional minimum wage. On average, the regional minimum wage in Sumatra is higher than in the Moluccas (SI, 2017). People with higher incomes are more likely to afford the higher price of functional rice. Thus, the consumers in Sumatra were less willing to pay for the rice products at a low price than the consumers in the Moluccas.

In terms of rice producers, there was no significant difference between the new and the established national (Indonesian) producers for Indonesian consumers. Consumers in Java, Bali, Sumatra, and the Moluccas preferred national than the international rice producers. Interestingly, a positive willingness to pay for the

international producer was discovered in Bali. This finding indicates that the Balinese were more open to the international market. It was a fair result taking into consideration that Bali is the island of Indonesia with the highest international tourists.

3.2 Interaction of attributes affecting willingness to pay functional rice

The price could likely influence the consumers to purchase a rice product. In this study, the relationship between price and types of rice on the willingness to pay was examined in the four islands. The result showed that regardless of the price, Indonesian consumers are more likely to prefer white rice over brown rice with a health claim (Figure 3). From the previously reported studies, Indonesian consumers have a significant preference for whiter or more polished rice products due to producing better palatability characteristics (Unnevehr *et al.*, 1992; Swastika, 2012). It is general knowledge in Indonesia that there are hurdles to the consumption of brown rice since the grain is considered as poor-quality rice. The brown grain was considered to have a hard texture, chewy, and not appealing appearance (Mohan *et al.*, 2017). Moreover, the willingness to pay for brown rice could also be associated with cultural values. The lack of awareness among Indonesian consumers on the benefit of brown rice might influence their willingness to pay.

The result in Figure 3 indicates that consumers in Java, Bali, and the Moluccas would be more willing to

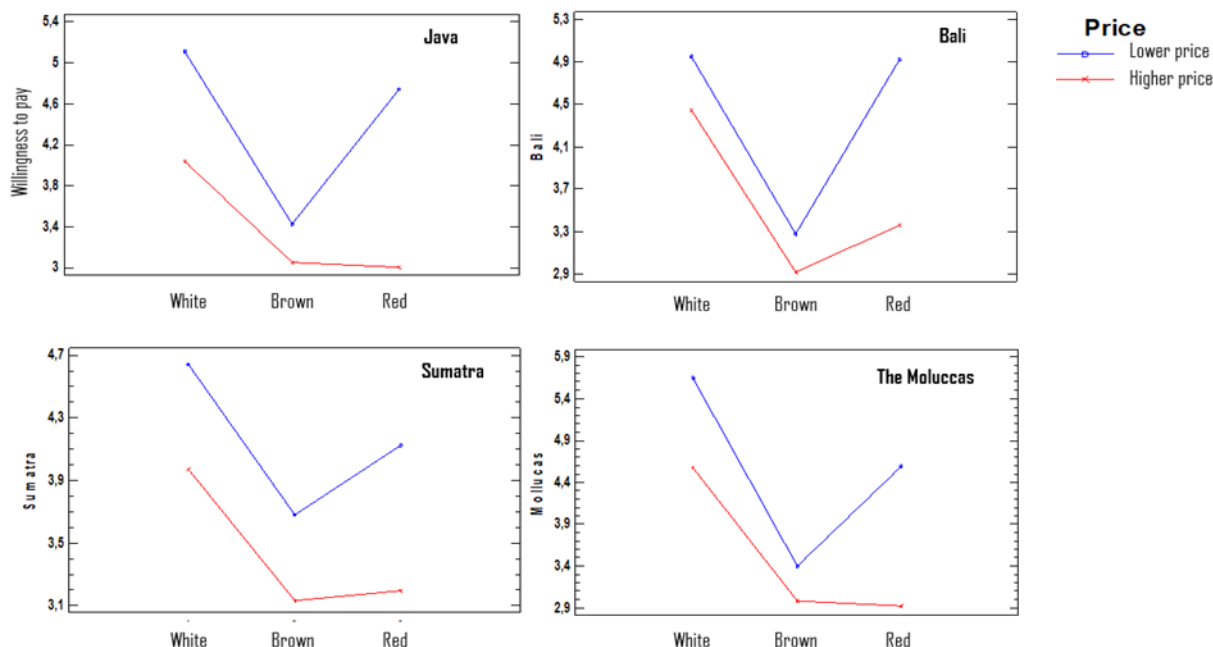


Figure 3. Interaction of price and type of rice on consumers' willingness to pay for functional rice.

pay for red rice with functional properties provided that the price was low. In addition, at a low price, the willingness to pay for the white and red rice was not significantly different ($p < 0.05$). This result could imply that consumers would buy functional red rice if the price was as low as conventional rice. The finding is relevant to a survey conducted in Denmark and England. The consumers expected functional foods to have the same price as conventional foods (Jonas and Beckmann, 1998). Another explanation is that the Indonesian consumer could not identify melatonin as a functional property on functional rice. Henceforth, they would not be willing to pay a higher price for functional rice if they are not convinced of the benefit of the product.

3.3 Effect of demographic on consumers' willingness to pay

The influence of demographic provided further insight into consumers' willingness to pay. Table 3 reveals that age, gender, marital status, occupation, and education levels did not significantly account for the willingness to pay ($p > 0.05$) of Indonesian consumers for functional rice. On the other hand, income had a significant impact on consumers' willingness to pay ($p < 0.05$).

Table 3. ANOVA summary of demographic profile on consumers' willingness to pay

No	Demographic Profile	ANOVA ($p < 0.05$)
1	Age	0.064
2	Gender	0.192
3	Marital status	0.242
4	Occupation	0.644
5	Education	0.309
6	Income	0.038*

* indicates significant at $p < 0.05$

Although it has been reported that consumers care more about their health and take preventive action when growing older (Ares *et al.*, 2010), there was only a moderate relation between the age of Indonesian consumers and willingness to pay for functional rice ($p = 0.064$). With respect to gender, a previous study reported that women had a more favorable interest in functional food than men (Verbeke, 2005). However, this generalization could not be applied to Indonesian consumers. As well as the gender, the willingness to pay for the functional rice was not affected by the level of education. A former study reported that respondents with higher levels of education have only a slightly more positive attitude towards functional foods (Urala and Lähteenmäki, 2007).

Interestingly, Indonesian respondents with high-level income were willing to pay more for functional rice compared to low and medium level income. This suggests that the additional price associated with functional rice with health benefits were more affordable for higher-income consumers.

3.4 Consumer preference towards functional rice products in Indonesia

The preference experiment explores how consumers value and make trade-offs among the selected attributes. Table 4 presents the ranking results of Indonesian consumers' willingness to pay for rice with a different type of rice, price, and producer. Product with lower rank showed that it was more preferred by the consumers. Indonesian consumers in four islands ranked white rice with both low and high prices, and both new and established Indonesian brands as their top preference. There was no significant difference in rating for

Table 4. Ranking test result

Product	Type of Rice	Price	Producer	Rank						
3	White	Low	Established Indonesian brand	65	a					
16	White	Low	New Indonesian brand	85	a	b				
17	Red	Low	Established Indonesian brand	87	a	b				
8	White	High	Established Indonesian brand	93	a	b	c			
7	Red	Low	New Indonesian brand	99	a	b	c	d		
11	White	High	New Indonesian brand	109		b	c	d	e	
2	Brown	Low	New Indonesian brand	112		b	c	d	e	
4	White	Low	International	118		b	c	d	e	f
12	Brown	Low	Established Indonesian brand	123		b	c	d	e	f
15	Brown	High	New Indonesian brand	131			c	d	e	f
5	Brown	High	Established Indonesian brand	132			c	d	e	f
13	White	High	International	134				d	e	f
14	Red	Low	International	134				d	e	f
9	Red	High	New Indonesian brand	135				d	e	f
6	Brown	Low	International	137				d	e	f
10	Red	High	Established Indonesian brand	144					e	f
1	Red	High	International	147					e	f
18	Brown	High	International	157						f

Rank sums with no letters in common are significantly different at the 5% significance level (Lrank = 40.17).

established Indonesian brands and new Indonesian brands (LSD < 40.17). The preference for red and brown rice with both new and established Indonesian brand was the same if the price was low. Whereas, red and brown rice products at a high price, regardless of the producer, were least preferred by consumers.

The Indonesian consumers preferred the national (new or established) brand over the international one. A previous study revealed a similar result for the Italian consumer (Ares *et al.*, 2010; Annunziata and Vecchio, 2013). This interesting finding opens new functional rice market opportunities for Indonesian producers. The importance of brand familiarity needs to be emphasized. On top of that, the most effective strategy to make Indonesian consumers choose functional rice over the conventional one is by reducing the price of functional rice products.

4. Conclusion

The findings from this study provide interesting corroboration on how Indonesian consumers in four different islands appraise functional rice. Although they generally preferred conventional white rice, Indonesia consumers' willingness to pay for functional rice was significantly affected by the price. Another variable, rice producers, also had relative importance to the willingness to pay, which the consumers preferred the national over international producers. This finding opens potential opportunities to reinforce the Indonesian producer on functional rice.

Conflict of interest

The authors declare no conflict of interest.

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