Consumen Preference Analysis of UMM Analog Rice in Malang - Indonesia

Anas Tain[1*], *Livia* Windiana[1], *Istis* Baroh[1], *Damat* Damat[1], *Mutammimatur* Rahmah[1], and *Effendi* Andoko[2]

[1]Departement of Agribusiness, University of Muhammadiyah Malang, Jl. Raya Tlogo Mas No 246, Malang 65144, East Java, Indonesia
[2]College of Agriculture and Natural Resources, National Chung Hsing University, Agricultural Environment Science Building, South District, Taichung City, Taiwan 402

Abstract. The analog rice produced by UMM is made as a functional food by prioritizing good nutrition to make consumers healthy who consume it. The research objective is to analyze the characteristics of UMM analog rice consumers and the factors that influence consumer preferences for UMM analog rice in Malang. The research used a qualitative and quantitative approach by surveying 50 panelists in Malang City. Data were analyzed descriptively and factor analysis using SPSS. Consumer preferences of UMM Analog Rice are influenced by eight factors, namely product characteristics and health benefits, consumer income and personal factors, product preferences and roles, health perception and value factors, historical and promotional factors, price and marketing influence factors, marketing location factors, and product advantage factor. Product characteristics and health benefits are the factors that most influence consumer preferences for UMM Analog Rice in Malang. Product characteristics are the values contained in a product that describe the product. Originality/Value – UMM analog rice was introduced for diabetes mellitus sufferers. This study brings awareness to the importance of consuming nutritious and safe products for health.

Keywords: Artificial rice, consumer characteristics, diabetes melitus, functional food, healthy rice.

1 Introduction

Carbohydrates are needed by the body as a source of energy. Carbohydrates come from tubers, beans, and cereals or grains [1]. The Indonesian community consumes carbohydrates from rice (*Oryza sativa* L.), sago (*Metroxylon sagu* Rottb.), sweet potatoes (*Solanum tuberosum* L.) corn (*Zea mays* L.), cassava (*Manihot esculenta* Crantz.), and taro

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* Corresponding author: anas@umm.ac.id

(*Colocasia esculenta* (L.) Schott.). This is strengthened by the statement of The Indonesian Agency for Agricultural Research and Development that the development of rice production in Indonesia from 1993 to 2015 experienced an average growth of 2.08 % annually [2]. The results of the study of staple food consumption show that in 2017 rice consumption reached 29.13×10^6 t and decreased by around 0.2 % compared to 2016 which reached 29.18×10^6 t. The average per capita consumption of rice per day was around 3 g d^{-1} per person in 2012, 2014, 2015, and 2017 [3].

The high interest and consumption of rice from the community encourages producers to develop types of rice that are sold as diverse products. The type of rice that is most in demand by the public is white rice because it is easy to obtain at a relatively affordable price and has a fluffier texture and good taste. The habit of Indonesian people consuming white rice has an impact on the difficulty of people switching to new types of staple food. Based on color, rice can be classified into several types, such as white rice, black rice, brown rice, and glutinous rice [4].

Community dependence on rice can lead to the risk of rice supply deficiency in the future due to crop failure or natural disasters. The food diversification program has succeeded in reducing the amount of rice consumption and increasing the consumption of other food sources by processing these other food sources [5]. Analog rice or artificial rice is a processed product with a shape resembling the grains of rice in general [6–8].

Consumer characteristics have an important role in determining consumer taste. Consumers will choose and use a product based on their taste and desires to consume the product. Consumer behavior in buying a product can be influenced by the popularity of the brand, benefits, quality, and packaging of the product offered.

Analog rice used in this study is analog rice developed by the University of Muhammadiyah Malang (UMM). The basic ingredients for making this analog rice are arrowroot starch (*Maranta arundinacae* L.), palm starch – sago (*M. sagu*), seaweed (*Gracilaria* sp.) puree, and mocaf flour (modified cassava flour). Arrowroot tubers contain a carbohydrate source that has a low glycemic index (GI = 14) compared to other types of tubers [9, 10]. Seaweed has low-fat content and is rich in fiber, so it can be used as one of the main ingredients in low-fat diet foods [11, 8]. Analog rice produced by UMM is not made to compete with conventional rice but is made as a functional food by prioritizing good nutrition so that it can be healthy for consumers who consume it [7, 8, 10]. The raw materials and benefits contained in analog rice make the price of analog rice more expensive than white rice in general. Therefore, the target consumers of UMM analog rice are the upper middle class. There are still a few studies related to analog rice, especially those that discuss the preferences of analog rice consumers in Malang. The purpose of this study is: (i) to analyze the characteristics of UMM analog rice consumers in Malang, and (ii) to analyze the factors that influence consumer preferences for UMM analog rice in Malang.

2 Research method

2.1 Study area

The special characteristics defined in this study include housewives who live in Malang, housewives who are interested in and willing to consume analog rice and have middle to upper social class status and need to maintain stable health. The number of samples used in

this study was 50 samples that met the criteria based on the specified characteristics. The sample came from housewives in Malang, who previously had or did not know about analog rice products. A brief explanation related to analog rice and also giving analog rice in raw and cooked forms was carried out by the researchers before the panelists filled out the questionnaire in the hope that the panelists were interested and willing to consume analog rice.

2.2 Sampling design and procedures

The sampling technique applied in this research is non-probability sampling with a quota sampling method [12]. Quota sampling is a sampling technique where the sample to be taken is determined by the data collector and the amount has been determined [13]. This technique was chosen because the researcher used a certain amount as the target for sampling by considering the specific characteristics that have been determined.

2.3 Sample description

The panelists consisted of 50 housewives living in Malang City, Indonesia. According to SNI number 01-2346 of 2006 [14], the minimum number of standard panelists is six, whereas the minimum number of non-standard panelists is thirty. There are various steps involved in choosing the panel members, starting with (i) the interview stage, when candidates must have interest in sensory organoleptic testing and willingness to participate. (ii) The decision-making phase of the screening process. (iii) The selection process requires a healthy physique, no ENT issues, no color blindness, and no mental health issues. (iv) Practice phase: Try the analog rice and provide feedback. (v). The capability test phase. The panelists came from Pandawangi Park Housing, Pandanwangi Green Park, Sulfat Garden, Permata Jingga, Bukit Cemara Tujuh, and Green Hills. Housewives are the main determinants of the family's staple food consumption. The housewives were given cooked and uncooked UMM Analog Rice for assessment. Panelist characteristics include variables including age, income, occupation, highest level of education, and number of family members.

2.4 Measurement of variables

The variables were measured using measurement items structured in a questionnaire. The development of the instrument was based on an extensive review of existing measurement scales and empirical evidence for the study variables. The instrument was pilot tested to ensure validity and reliability. Consumer preferences have variables, including higher health scores (X1.1), health aspect (X1.2), healthy lifestyles (X1.3), fluffy texture (X1.4), good smell and taste (X1.5), good quality (X1.6), guaranteed cleanliness (X1.7), shape resembling rice in general (X1.8), exact grain size (X1.9), whole grain shape (X1.10), attractive natural color (X1.11), brand (X2.1), Competent human resource research results (X2.2), quality and health benefits (X2.3), accepted and favored by middle and upper class consumers (X2.4), promotion (X3.1), raw materials affect the price (X4.1), affordable prices (X4.2), the price is proportional to the benefits (X4.3), marketing in supermarkets (X5.1), marketing in traditional market (X5.2), ease of cooking (X6.1), guaranteed halal

(X7.1), accepted and liked by all ethnicities and religions (X7.2), household income (X8.1), accepted and favored by all social classes (X9.1), consumer income effect (X10.1), number of family members (X10.2), consumed by all ages (X10.3), daily staple food (X10.4), processed foods or snacks (X10.5), health motivation (X11.1), food diversification is good to develop (X11.2), successful food diversification (X11.3), analog rice knowledge (X11.4), and food diversification for healthy food (X 11.5)

2.5 Analytical framework

This study used quantitative analysis in the form of factor analysis with a quantitative analysis tool, namely SPSS. Factor analysis in this study uses exploratory factor analysis (EFA) to find the structure of a variable. The first stage of factor analysis is examining the correlation matrix. The analysis used to measure the correlation between variables is KMO MSA (Kaiser Meyer Olkin Measure of Sampling Adequacy). Factor analysis can be continued if the KMO MSA value is more than 0.5. MSA (Measure of Sampling Adequacy) analysis. The factor analysis process can be continued if the MSA value in each variable is greater than 0.5. Then, factor extraction using principal component analysis. A variable is considered capable of explaining a factor if it has an extraction value greater than 0.5. The third step is factor rotation to get a simpler structure using the varimax (variance of maximum) method. The last step is the interpretation of factors after obtaining valid factors [15].

3 Results and discussion

3.1 Analysis of factors affecting consumer preferences for UMM analog rice in Malang

Analog rice is a program of the ministry of agriculture that was created to reduce the dependence of public consumption on conventional rice (paddy) and efforts to diversify tubers. Rice is one of the staple foods commonly consumed in Indonesia. Analog rice can be used as a solution for food diversification or as a new food source. Analog rice is artificial rice that has a shape and texture resembling rice but is made using non-rice local food ingredients such as tubers or other cereals by utilizing extrusion technology [16]. The ingredients for making analog rice must be chosen properly because the ingredients determine the nutritional content and characteristics of the analog rice produced.

The advantage of analog rice is not only having a shape and texture resembling rice in general. Another advantage of analog rice is the nutritional content of analog rice which can be designed using a variety of raw materials, so that it has the desired functional properties such as low GI (Glycemic Index) value, high dietary fiber, total phenol, and resistant starch. Another advantage of analog rice is that it can be cooked and consumed like conventional rice from paddy. Analog rice can be cooked using a rice cooker and consumed like eating rice with side dishes.

The analysis used to measure the correlation between variables is KMO MSA (Kaiser Meyer Olkin Measure of Sampling Adequacy) — Table 1 with a quantitative analysis tool, namely SPSS. The first step is to check the correlation matrix.

Table 1. KMO dan Bartlett's test.

Kaiser-Meyer-Olkin measure of sampling adequacy.		. 606
	Approx. Chi-Square	1545.748
Bartlett's test of sphericity	Df	630
	Sig.	.000

Table 1 shows the KMO MSA value is 0.606. The KMO MSA value is more than 0.5, which means that the data is more than adequate, and all variables have an influence on consumer preferences for UMM Analog Rice in Malang. This is strengthened by a significant value of less than 0.05 which means that there is a correlation between variables and is feasible for further analysis. The next step is to look at the anti-image matrices table on the anti-image correlation to find out which variables can be processed further, and which variables must be excluded.

The factor analysis process can be continued if the MSA value in each variable is greater than 0.5 by looking at the value of the variable in the number marked a. The anti-image matrices table on the anti-image correlation shows the variables X4.2, X 10.1, and X10.4, while variable X11.4 has an MSA value below 0.5 which means the variable must be eliminated to not be included in the factor analysis. The variables excluded are the "analog rice knowledge" variable (X 11.4) because it has the lowest value.

This study uses principal component analysis by looking at the communalities table which shows wheather the variables studied are able or unable to explain the factors. A variable is considered capable of explaining a factor if it has an extraction value greater than 0.5. The variable that has the highest value is "number of family members" with a value of 0.885. This value can be interpreted as 88.5 % of the variable "number of family members" can be explained by the formed factors. Meanwhile, the variable that has the lowest value is "marketing in supermarket" with a value of 0.611. This value can be interpreted as 61.1 % of the "marketing in supermarket" which can be explained by the formed factors. The smaller the value of communalities, the weaker the relationship with the factors formed.

3.2 Discussion

3.2.1. Factors forming consumer preference for UMM analog rice in Malang

Consumer characteristics are personalities that shape consumers in obtaining and using an item [17]. Consumer characteristics can be divided into three types: geographic, demographic, and psychographic characteristics. Geographical characteristics are the classification of the market into different geographical units such as provinces, regions, or villages [17]. Marketers must pay attention to the suitability of the product to be marketed to the needs of the community who will be the target of sales. Demographic characteristics are group classification based on age, life cycle, gender, number of families, income, occupation, religion, education, and nationality [17]. Psychographic characteristics are related to psychological factors that can shape consumers. Psychology can be used to measure consumer lifestyles by analyzing consumer activities, opinions, and interests [17].

Consumer behavior is the study of how individuals, groups, and organizations select, purchase, and use, and how goods, services, ideas, or experiences satisfy their needs

and wants. Consumer behavior has a close relationship with the decisions taken by someone in competition and the determination to obtain and use goods and services. Consumer behavior to purchase a product or service is influenced by cultural, social, and personal factors [18].

Consumer taste is an important component that must be considered by marketers because consumers will buy a product based on the level of consumer desire for an item. Consumer taste has a subjective nature depending on the consumer. Consumer taste can change from time to time. Increased consumer taste for a product can increase the amount of demand for the product, and vice versa, decreased consumer taste for a product reduces the amount of demand for the product. If the consumer's taste for a product is high, it will increase consumption and consumer purchasing decisions for the product.

Consumers have preferences in making choices to meet their needs. Preferences have a linkage with comparisons between objects. Consumer preference is a person's choice of liking or disliking the goods or services consumed [19].

According to Rochaeni [20], preference for food products is a picture of someone's attitude towards food, and someone can describe someone's attitude towards food, and someone can make a choice from products that have at least two different types of food. The purpose of understanding consumer preferences is to continue sustainably marketing strategies so that the goods or services being marketed are in demand.

The result of factor analysis shows that there are eight new factors form consumer preferences for UMM Analog Rice in Malang.

(i)   Product characteristics and health benefits factor

The first factor that influences consumer preferences for UMM Analog Rice in Malang is product characteristics and health benefits. This factor has an eigenvalue of 13.684 with the highest loading value of 0.709 on its original variable, that is "fluffy texture". Fluffy texture affects consumer preferences for UMM Analog Rice in Malang because food texture affects consumer taste and enjoyment when consuming the food. According to. Noviasari *et al.* [21], Analog rice texture is starting to be liked because it resembles the texture of rice in general. The organoleptic quality of analog rice (fluffy texture, fragrant, good taste, and white color) greatly affects the acceptance and attractiveness of analog rice which is the main consideration in purchasing analog rice [21].

The quality of food products is very important for producers as well as food sellers. External factors included in it are size, shape, color, consistency, texture, and taste [22]. A product must have good quality, unique, and attractive appearance so that consumers can be interested in buying the product because the factors in the product are one thing that consumers pay attention to in making decisions [23].

(ii)   Consumer income and consumer personal factor

The lowest loading value of 0.361 was obtained by the "household income" variable. Various needs must be met by each consumer. Primary needs are types of needs that must be met by humans to maintain their lives [24]. One example of a primary need is food consumed daily. The size of the consumer's income, the staple food is one of the products that must be consumed every day. According to Yamamura [25], income influences preferences. Households with high incomes will have a wider preference for carbohydrate sources compared to low-income households. Analog rice consumers are people who are

aware of the importance of health so that the price becomes a consideration after fulfilling the health desires, then the right consumers are the middle and upper classes. According to Atmaja [26], The purchase of analog rice arises because of the special need to consume it, such as maintaining health and being used as diet food.

(iii) Liking and product role factor

This factor has an eigenvalue of 2.117. The highest loading value is 0.781 on the variable "processed food or snack". The position of analog rice is used as processed food or snack because most consumers still have a dependence on conventional white rice that has been consumed so far and require adaptation to consume new staple foods. According to Rizki *et al.* [27], The existence of analog rice has not been able to be equated with conventional rice which is positioned as the staple food of the majority of Indonesian people. According to Burkard *et al.* [28], on the socio-cultural side, dependence on rice is shown by the view of the Indonesian people that "You haven't eaten if you haven't eaten rice". In addition, analog rice offers a higher price than conventional rice so not all social classes accept analog rice products because they think that there are staple foods at lower prices even though the benefits are different. Changes in food preferences have a dynamic nature along with changes in education level, income, number of household members, or age [29].

(iv) Perception and health values factor

This factor has an eigenvalue of 1.877. The highest loading value is 0.743 on the origin variable of "shaped like rice in general". One of the steps for the succeeding of analog rice as a staple food is the need for similar characteristics of analog rice to rice in general to facilitate consumer acceptance. Analog rice is an alternative food that is healthy, safe, and has physical and functional properties similar to conventional rice [30]. According to Budijanto [21], The advantage of analog rice is that it not only has a shape resembling rice in general, but analog rice can also be cooked and consumed like conventional rice.

(v) History and promotion factor

This factor has an eigenvalue of 1,457. The variable "competent human resource research results" gets the highest loading value of 0.825. Human resources can be a source of competitive advantage for the company. Consumers assume that products derived from competent human resource research in the field have authentic results [31] because they have been tested for their content and benefits for consumers [32, 33].

The lowest loading value is 0.525 on the origin variable "accepted and favored by middle and upper-class consumers". Segmentation among social classes has a small influence on consumer preferences for UMM Analog Rice in Malang because the factor that influences consumer preferences for a product is consumer taste. If consumers like a product and feel satisfied with the product, then consumers will consume the product in the future. According to Simon and Usunier [34], and Bahety *et al.* [35] If a product can meet the wants and needs of consumers, then consumers will buy the products offered. Consumer needs and desires are varied and can change due to the factors that influence consumers in making purchases [36].

(vi) Price influence and marketing factor

This factor has an eigenvalue of 1.319. The highest loading value of 0.795 is obtained by the original variable "affordable price". According to Silaningsih and Utami [37], price is one of the determinants in product selection that will affect purchase intention. Price affordability is one of the considerations for consumers to consume a product. According to Zulaicha and Irawati [23], Products with good quality and affordable prices would have many enthusiasts, if the products offered are not following the prices offered, consumers will think twice about buying those products.

The original variable "marketing in supermarkets" has the lowest loading value of 0.497. Consumers want the marketing affordability of analog rice products, not only in supermarkets but can be reached offline or online [38]. Strategic business locations can attract consumers [39]. The ease of transactions offered by online stores attracts consumers to choose the store as an option in shopping because it can help consumers who have busy activities to shop without incurring costs [40].

(vii) Marketing location factor

This factor has an eigenvalue of 1.297. This factor only has 1 original variable, namely "marketing in traditional markets" which has a loading value of 0.770. Traditional markets have their uniqueness because sellers and buyers meet or bargain directly, and prices are not fixed depending on the expertise of consumers in bargaining [41]. Purchasing products in traditional markets has several advantages, such as conscientious consumers will get cheaper product prices compared to modern markets [42]. Another advantage of traditional markets is that consumers can compare prices from several sellers so that consumers get the product they want at a cheaper price [43, 44].

(viii) Product advantage factor

This factor has an eigenvalue of 1.138. The highest loading value is 0.622 on the origin variable "consumed by all ages". Quality products and high prices make consumers switch to substitute products with similar benefits and lower prices. Companies set prices for various considerations, it is better if the pricing is adjusted to the value, benefits, and quality of the product [45, 46].

The factors that most influence consumer preferences for UMM Analog Rice in Malang are product characteristics and health benefits because they have the highest eigenvalue of the 8 factors formed. Product characteristics are the values contained in a product that describes the product. If a product has characteristics following the wishes and needs of consumers, then the product tends to be in demand and needed by consumers. A Characteristic of a product is a product description that forms consumer trust towards the product [47]. UMM Analog Rice is a functional food, made from arrowroot starch, palm starch, seaweed (*Gracilaria* sp) puree, and mocaf flour (modified cassava flour) which can provide health value for consumers based on the ingredients contained in the product. According to Loebis *et al.* [48], Rice from analog rice with the basic ingredient of mocaf has a higher calorific value and nutritional content compared to the nutritional content of general rice.

4 Conclusion and recommendation

Conclusion: Consumer preferences of UMM Analog Rice in Malang are influenced by eight factors, namely; i) product characteristics and health benefits factor with variables "fluffy texture" and "healthy lifestyle", ii) income and consumer personal factor have variables "food diversification is good to develop" and "household income", iii) liking and role of product factor have the variables "processed food or snack" and "accepted and favored by all social classes", iv) the perception and health value factors have the variable "shape resembling rice in general" and "easy to cook", v) history and promotion factors have variables "competent human resource research results" and "accepted and favored by middle and upper class consumers", vi) price influence and marketing factor have variables "affordable prices" and "marketing in supermarkets", vii) the marketing location factor has a variable that is "marketing in traditional markets", and viii) the product advantage factor have variables "consumed by all ages" and "comparable prices listen a benefit".

Recommendation: (i) Panelists hope there will be a taste for analog rice so it doesn't have a taste that tends to be bland, (ii) Eliminate the pungent smell of analog rice when cooked because the Panelists don't like the aroma, (iii) Future research is expected to examine more deeply the marketing analysis of analog rice.

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