The development of market segmentation of sorghum products as functional beverages

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The development of market segmentation of sorghum products as functional beverages

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Abstract. Sorghum is one of the plants that can be processed into functional beverages containing elements of nutrients or non-nutrients that provide positive effects on health of the body. A descriptive qualitative research, this study aims to obtain product formulation and to initiate the process of market segmentation analysis. The study was conducted in two stages. The first stage was optimization using a Two-Factor Randomized Block Design, with three replications. The first design was performed by applying Flavour Addition (R): R1 used Ginger Flavour and R2 used Pandan Flavour. The second design was performed by applying Sweetener Addition (P): P1 used Cane Sugar and P2 used Brown Sugar. The aspects observed included physical, organoleptic, and chemical aspects. When analyzing the data, organoleptic test was performed by using Friedman test while chemical test was performed by using variance analysis, followed by using 5% Duncan test. The second stage was introducing sorghum-based functional beverages as new products to the public to initiate the process of market segmentation analysis, and the results showed that product formulation had been successfully obtained and sorghum-based functional beverages as new products were accepted by 78.6% of consumers, including the quality in terms of physical, organoleptic, and chemical aspects.

1. Introduction

Sorghum as a potential food source supporting the diversification and food security programs, ranked 5th after wheat, rice, maize and barley. Each 100 g of sorghum contains 73 g of carbohydrate, 11 g protein, 3.3 g fat, 0.38 g vitamin B1, and 28 mg calcium minerals, 4.4 mg of iron and 287 mg of phospor. Sorghum also there are other advantages in terms of health, namely "gluten free", more fiber, antioxidants. And tannins. Benefits of sorghum for health, namely: as a nutritious food, high in fiber, good for digestion, can be as diabetes control, gluten free that can prevent celiac disease, contains good calcium for bone health, can improve circulation and red blood cell production, increase energy, and cancer prevention [1-4].

This research is a continuation of some researches that have been conducted by UWKS team since 2009 which aim to develop sorghum-based products, namely: sorghum cake and cookies [5-7], sorghum syrup [8-10], a variety of sorghum pastries and bread [11], sorghum noodles [12], sorghum rice and flake [13], a variety of soft bran sorghum cake and cookies [14].

Another potential of sorghum that has not been developed optimally is to process sorghum into functional beverages which contain elements of nutrients or non-nutrients that provide positive effects on health of the body [15,16]. This study examined deeper the white sorghum (KD4) in order to produce qualified functional beverage products that are acceptable by consumers, in terms of physical, chemical, and organoleptic aspects. The result of this research was expected to make sorghum become product of innovation and applied research which can be utilized by society and industry. The research was then continued by introducing the new products of sorghum-based functional beverages to the public using descriptive qualitative research method [17,18]. Aiming to obtain product formulation and to initiate the process of market segmentation analysis, this study was conducted in two stages. The first stage was the optimization of product quality and the second one was introducing the new products of sorghum-based functional beverages to the public.

2. Methods

This study used sorghum KD4 variety from Lamongan district, flavor enhancer (ginger and pandan), and sweetener (cane and brown sugar). In the first stage, optimization was performed by using a two-factor randomized block design (RBD), with three replications. The first design (Factor I) was performed by applying flavor addition (R) are as follows:

- R1 used Ginger Flavor
- R2 used Pandan Flavor

The second design (Factor II) was performed by applying sweetener addition (P) are as follows:

- P1 used cane sugar and
- P2 used brown sugar [19, 20].

The aspects observed included physical, organoleptic, and chemical aspects. When analyzing the data, organoleptic test was performed by using friedman test while chemical test was performed by using variance analysis. If there was a difference, the duncan test was then performed with a 5% confidence level. Furthermore, selection of alternatives was done to determine the best alternative process. The selection was performed based on the concept of value acquisition of expectation. The mathematical equations for the expected pay-off values are as follows [21]:

$$E_{pj} = \sum_{i=1}^{n} P(x_i) \cdot f(x_i, d_j) \quad (1)$$

Note:
Epj = The expected pay off value
P (xi) = Probability of basic state xi
xi = Different basic state
dj = Decisions are taken into account
f (xi, dj) = Acquisition on the basic state and decision dj

The functional beverage of sorghum is a beverage made from sorghum rice, the way of making can be seen in Figure 1.

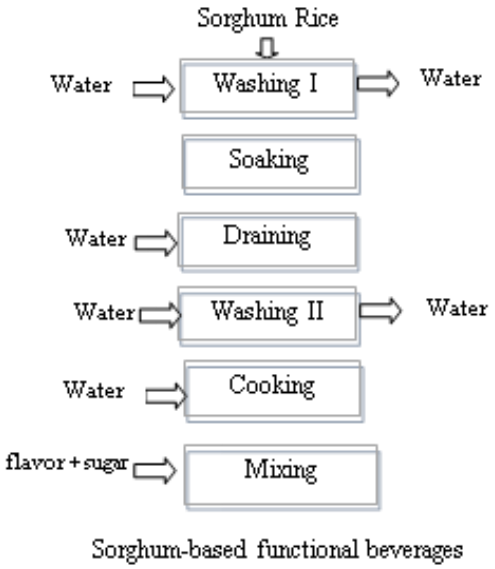

Figure 1. Flowchart sorghum-based functional beverages processing.

Note: sorghum rice washed thoroughly, then done soaking for about 8 hours, drained, and then washed again until clean. Then done cooking and continued to be added with the flavourings and sugar (according to treatment) to produce a functional drink sorghum.

In the second stage, the new products of sorghum-based functional beverages were then introduced to the public to initiate the process of market segmentation analysis using descriptive qualitative research methods. The credibility of the data was confirmed through triangulation with the following criteria: market potential, product uniqueness, product performance, product quality, consumer acceptance, and customer satisfaction [22-25]. At this stage, the study was conducted in Surabaya, East Java, Indonesia in which the respondents were stratified random sampling selected by region and gender.

3. Results and discussion

The results of sorghum-based functional beverages for organoleptic test (with taste, colour, and flavour parameters) and Friedman test are presented in Table 1, chemical test in Table 2, and probability in Figure 1, and alternative selection (value of expectation) in Figure 2.

Table 1 shows that the highest score for taste, colour, and flavour parameters is obtained from the treatment of R2P2. Friedman test results show that the taste parameter is significantly different (Sig 0.022 < 0.05), while the colour parameter (Sig 0.065> 0.05) and flavour parameter (Sig 0.116> 0.05) are not significantly different. This means that for taste parameter, sorghum-based functional beverages are influenced by flavour enhancer and sweetener factors.

Table 1. The results of organoleptic test.

Treatment	Organoleptic Test					
	Taste		Colour		Flavour	
	Score	Friedman Test	Score	Friedman Test	Score	Friedman Test
R1P1	4,55	Sig 0,022	4,48	Sig 0,065	4,48	Sig 0,116
R1P2	4,52		4,50		4,45	
R2P1	4,60		4,60		4,50	
R2P2	4,70		4,60		4,60	

Table 2. The results of chemical test.

Treatment	Chemical test			
	Fibber		Carbohydrate	
	Factor R	Factor P	Factor R	Factor P
R1P1	2,24 b	2,18	19,50 b	22,69 b
R1P2				
R2P1	2,11 a	2,18	31,81 a	27,64 a
R2P2				

Table 2 shows that carbohydrate test results indicate that the value of carbohydrate is equal to 18,13-34,40. The results of variance analysis show that the value of carbohydrate of sorghum-based functional beverages is Sig 0,00 <0,05. This means that the value of carbohydrate is significantly different, but there is no interaction in which Sig 0.781> 0.05. The value of carbohydrate is also significantly different on the treatment of R (flavour enhancer) wherein Sig 0.00 <0.05 and on the treatment of P (sweetener) wherein Sig 0.00 <0.05. Duncan Test results show different letters. This means there are significant differences among the treatments.

The probability value also indicates the importance of a basic condition. The greater the probability of a basic condition, the more important the basic condition is. Consecutively, the taste parameter (25%) is the most important parameter, then the colour (22%), aroma (21%), value of carbohydrate (18%), and value of fibber (14%) parameters (Figure 2).

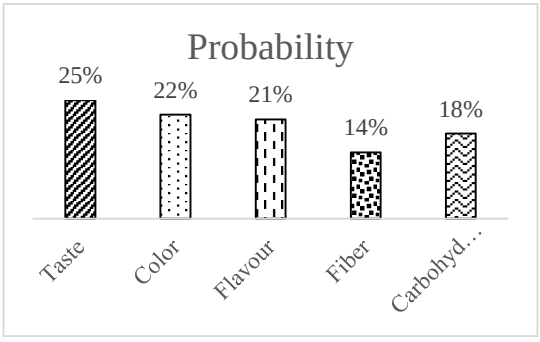

Figure 2. The results of probability.

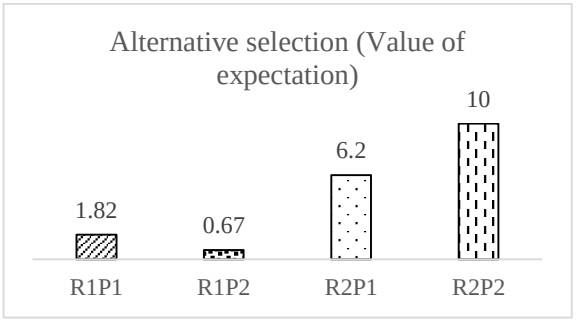

Figure 3. The results of alternative selection.

Figure 3 shows that alternative selection is performed by calculating the value of expectation, in which the alternative treatment firstly selected is the treatment that has a value of 10, that is R2P2 (R2 = Pandan Flavour, P2 = Brown Sugar). The second selected treatment is the one having the expected value of 6.20, that is R2P1 (R2 = Pandan Flavour, P1 = Sugar Cane). This suggests that the combination of pandanus and brown sugar treatment from functional drinks is preferred [26, 27], pandanus in addition to the flavour effect also contains antioxidants [28].

Furthermore, the second stage of research was conducted by introducing the new products of sorghum-based functional beverages to the public using descriptive qualitative research method, with the following criteria: market potential, product uniqueness, product performance, product quality, consumer acceptance, and consumer satisfaction. The study was conducted in Surabaya, East Java, Indonesia wherein the respondents were randomly and structurally selected by region and gender. The introduction of the products was carried out by producing the new products, distributing them to consumers, distributing brochures containing information about the products so that potential customers better understand them, collecting feedback from the market, investigating the response from the market, and investigating the suitability of product size.

The results of product introduction indicated that 78.6% of consumers accept the products, 12.4% of them were neutral, and 9% of them had not opinion about functional beverage sorghum-based products.

Selection of sorghum-based products becomes a special topic, and this activity is part of entrepreneurship program is also supported by a series of research and community service activities conducted continuously by Center for Sorghum Entrepreneur (CSE)-UWKS since 2009 up to now. The community service materials are formulated in paperwork's and are used in community development activities in the area around sorghum farming, In addition, CSE-UWKS also builds and develops Sorghum Entrepreneur Unit (SEU) within the community in the sorghum production center and in the new potential market area for sorghum processed products. SEU groups that have been founded are: SEU seeds, SEU rice, SEU flour, as well as SEU processing units (various cakes, bread, rice, catering), and the results of functional drinks research as the new SEU [29, 30, 31].

4. Conclusion

The results of this study indicated that to obtain formulations and new products of qualified sorghum-based functional beverages in terms of the physical, organoleptic, and chemical aspects can be performed by combining the best treatment of R2P2 and the second best treatment of R2P1. In addition, this research had also succeeded to get the appropriate technology that can be applied and used by the community. The process of marketing initiation showed that 78.6% of consumers accept the new products, 12.4% of them were neutral, and 9% of them had not been able to accept the sorghum-based functional beverage products. Ultimately, the new products can support food diversification program and open up opportunities for sorghum industry.

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