IIETA International Information and Engineering Technology Association
Advancing the World of Information and Engineering

Mathematical Modelling of Engineering Problems
Vol. 9, No. 6, December, 2022, pp. 1659-1668
Journal homepage: http://iieta.org/journals/mmep

The Product Acceptance Preferences of Gayo Arabica Coffee Brewing with Additional Fruit and Spices Variants

Rahmat Fadhil[1,2*], Murna Muzaifa[2,3], Diky Juliadi[3]

[1] Department of Agricultural Engineering, Universitas Syiah Kuala, Darussalam 23111, Banda Aceh, Indonesia
[2] Halal Research Centre, Universitas Syiah Kuala, Gedung Lab. Terpadu Lt. 2, USK, Jln. T. Syech Abdurrauf, Darussalam 23111, Banda Aceh, Indonesia
[3] Department of Agricultural Product Technology, Universitas Syiah Kuala, Darussalam 23111, Banda Aceh, Indonesia

Corresponding Author Email: rahmat.fadhil@unsyiah.ac.id

https://doi.org/10.18280/mmep.090627

Received: 1 May 2022
Accepted: 27 September 2022

Keywords:
coffee brewing, Gayo arabica, espresso, preference, product acceptance, simple additive weighting

ABSTRACT

There have been significant changes to coffee-drinking cultures worldwide regarding how and where to consume coffee. The increase in coffee enthusiasts, how to enjoy coffee is also growing, starting from the addition of milk, chocolate, and various kinds of mixtures that follow existing local trends and wisdom. The purpose of this study is to analyze the product acceptance preferences of Gayo arabica coffee brewing with additional fruit and spices variants using the Simple Additive Weighting (SAW) method. In this study, there were 5 products analyzed, namely a mixture of espresso with sap (nirapresso), a mixture of espresso with sweet orange (orangepresso), a mixture of espresso with lime (limaupresso), a mixture of espresso with lemongrass (serehpresso) and a mixture of espresso with nutmeg (palapresso). The espresso used in this study was 30 ml, with the addition of fruit and spice extracts of 30 ml, 45 ml, and 60 ml for each product. The results showed that the panellists had different preferences for each alternative type of brewing. The alternatives of each product were obtained that nirapresso had the highest acceptance preference for the addition of 45 ml of sap, orangepresso with the addition of 60 ml of sweet orange, lime with the addition of 60 ml of lime, lemongrass with the addition of 60 ml of lemongrass, and palapresso with the addition of 30 ml of nutmeg.

1. INTRODUCTION

In the last two decades, there has been a significant change in the culture of drinking coffee around the world, both in terms of how to consume it and where it is consumed. Nowadays, the development of coffee brewing varies greatly as coffee connoisseurs increase [1]. Espresso-based drinks such as *cappuccino*, *caffe 'late*, and *late machiato* are special offers at coffee shops and are widespread from Europe to America [2]. According to International Coffee Organization (ICO) data, from 2017 to January 2021, coffee consumption increased with an average annual growth of 1.1% [3]. One type of brewing favoured by coffee connoisseurs is espresso. Espresso is a drink almost like syrup produced using a brewing machine, usually using a pump motor drive, with the principle of forcing pressurized hot water through ground coffee beans [4]. The type of coffee used in the espresso brewing technique is usually arabica coffee. Especially in Indonesia, Arabica coffee which has a distinctive taste, is Gayo arabica coffee [5, 6]. As coffee enthusiasts increase, the way to enjoy coffee is growing, starting by adding milk, chocolate, and various kinds of mixtures that follow existing trends and local wisdom [7].

Differences in composition in mixing espresso become a challenge in finding the best taste to become a particular preference. One of the related studies that have been conducted by Asmono et al. [7] is about the assessment of preferences for arabica coffee with the addition of stevia leaf powder *(Stevia rebaudiana)*, the addition of stevia leaf powder to arabica coffee drinks has a very real effect on the level of consumer liking, which includes aroma and taste parameters, has a real effect on aftertaste parameters, and has no real effect on viscosity parameters. It means that the differences in the composition of espresso mixtures can be tested for acceptability based on factors that affect the taste of coffee (Gayo Arabica Coffee) [8]. The research of Asioli et al. [9] is also a strong foundation in this study in determining consumer preferences when consuming coffee based on certain factors, one of which is the type of brewing.

This study aims to analyze the product acceptance preferences of Gayo arabica brewing with the added fruit and spices variants so that this research can also be a recommendation for the needs of coffee connoisseurs. If coffee connoisseurs prefer a certain taste, they can choose a certain type of composition in brewing. Preference aims to determine the level of consumer preference for a product and the order of alternative acceptance of existing products using the Simple Additive Weighting (SAW) method. The SAW method is a decision-making system method that produces the best alternative recommendations from several alternative options [10].

2. MATERIAL AND METHODS

The Gayo arabica coffee used in this study was obtained directly from coffee farmers in Bener Meriah Regency, Aceh

Province, Indonesia, grown at 1,000-1,400 meters above sea level. The ingredients used were sap (*Arenga pinnata*), sweet orange (*Citrus sinensis*), lime (*Citrus aurantiifolia*), lemongrass (*Cymbopogon citratus*), and nutmeg (*Myristica fragrans*), which were obtained directly from local traditional markets. The coffee obtained was processed by full-wash processing and roasted at a medium level. The steps in this study were divided into three stages: product making, sensory testing, and decision-making using the SAW method.

2.1 Product making

The product making in this study was divided into three stages: making espresso as a base for mixing, extracting fruits and spices as a mixture, and mixing espresso with fruit and spice extraction.

2.2 Making espresso

Gayo Arabica coffee beans that had been roasted were ground using Macap M5 Coffee Grinder made in Italy with a fine fineness. Then the coffee powder was weighed as much as 18-25 grams and then brewed using La Pavoni Cellini Classic Espresso Machine E61 Group-Made in Italy with a range of 20-30 seconds.

2.3 Extracting fruits and spices

2.3.1 Sap

The sap extraction in this study was obtained by buying the sap directly from sap farmers.

2.3.2 Sweet orange

Sweet oranges were washed, cut longitudinally into two parts, and squeezed using an orange squeezer to get the juice [11].

2.3.3 Limes

The limes were washed, cut longitudinally into two parts, and then squeezed using a lime squeezer to get the juice [12].

2.3.4 Lemongrass

The lemongrass was cleaned, peeled off the outer skin that was not used, pounded until it emitted a lemongrass aroma, and then heated using boiling water in a ratio of 1:5 for 30 minutes filtered to get lemongrass boiled water [13].

2.3.5 Nutmeg

The cleaned nutmeg was peeled, and the flesh was taken, then boiled using boiling water for 10 minutes, then crushed using a blender and the addition of 1:3 water, and then filtered to get nutmeg juice [14].

2.4 Mixing espresso with fruits and spices

The fruit and spices extract composition consisted of 3 variations, namely 30 ml, 45 ml, and 60 ml. The composition of 30 ml of espresso was used as the base material for each mixing. This composition variation is the most common mixing composition used in serving coffee-based beverage products, especially the espresso brewing method. Variations in the composition of 30 ml, 45 ml, and 60 ml resulted from direct observations from several local coffee shops. Therefore, 5 products were obtained with an espresso base, namely nirapresso (sap and espresso), orangepresso (sweet orange and espresso), limaupresso (lime and espresso), serehpresso (lemongrass and espresso), palapresso (nutmeg and espresso).

2.5 Sensory testing

Sensory testing is a test that is carried out based on sensing that provides a stimulus and sensation to give the impression of approaching, away, liking, and disliking a product [15, 16]. The sensory test method used is the hedonic test, which is one of the testing methods in sensory analysis that aims to determine the level of preference and differences in the quality of a product [17]. The hedonic test in this study was carried out to identify the taste of various Gayo Arabica coffee brews based on predetermined parameters to obtain product acceptance preferences. The panellists used for the sensory testing were 9 individuals, with the following criteria [18].

- Has good knowledge about coffee, especially Gayo arabica Coffee;
- Likes coffee and is used to consuming Gayo arabica coffee;
- Can provide a sensory assessment based on the taste of the coffee taste;
- The sense of taste is in good condition and not in pain.

Panellists were selected through an interview process related to coffee consumption habits and basic knowledge of coffee taste attributes. Panellists who were selected based on the criteria were asked to fill in the weight of the criteria, namely the modified coffee taste parameter from SCAA [19]. The weight of the criteria was assessed based on the panellists' knowledge about the taste of coffee. The weighting of the criteria aimed to determine how much importance each parameter was used in assessing taste (Table 1). The weighting of the criteria had been carried out before the product was served. They were based on the understanding and knowledge of the panelists while being a connoisseur of Arabica coffee.

Table 1. Assessment of the weight of the taste criteria

No.	Parameter	Definition	Weight of Criteria (%)
1	Aroma	The aroma released from the brew when stirred or when it is dissolved.	…
2	Flavour	Combination of aroma, acidity, and aftertaste	…
3	Aftertaste	How long it lasts for a positive taste and aroma from the back of the mouth when swallowed or thrown away.	…
4	Defect	Product defects or deficiencies	…
5	Sweetness	The sweet taste that appears. The sweeter you feel, the higher the value given.	…
6	Bitterness	The positive bitter taste that emerges from the product.	…
7	Body	Product viscosity level	…
	TOTAL		100%

In the next stage, the panellists conducted a hedonic test. The panellists were presented with the type of Gayo arabica coffee brewed with the composition of the addition of fruits and spices. Panellists were asked to give preference to product acceptance for all types of brewing based on taste criteria.

For example, the panellists were served orangepresso, which consisted of 3 treatments, namely the addition of 30 ml, 45 ml and 60 ml sweet orange. The panellists identified each product and assessed each experimental unit until the whole product was served. The rating scale given was a hedonic scale, as shown in Table 2.

Table 2. Hedonic scale

Score	Preference
1	Really dislike
2	Dislike
3	Neutral
4	Like
5	Really like

2.6 SAW method

The SAW method is a straightforward and popular decision-making system method. The result of this method is to get a set of choices with the highest to lowest ranking values [20]. The basic concept of the SAW method is to find the total weight rating of each alternative on all attributes. The SAW method requires normalizing the decision matrix (X) proportional to all available alternative ratings [21].

The panelist's assessment results could not be directly multiplied by the weight of interest because the weight of interest used a scale of 0-1, while the panelist's assessment used a hedonic scale of 1-5. Hence, it was necessary to do a normalization matrix to uniform the rating scale for all panellists.

The normalization matrix was done by dividing each score by the criteria with the highest score. It can simply be described by the following formula [22]:

$$\text{Rij} = \frac{Xij}{\text{Max Xij}} \quad (1)$$

Rij: Normalized performance rating
Max Xij : Maximum value of each row and column

The results of the normalization matrix were then multiplied by the weight of the importance of each criterion using the following formula [23]:

$$\text{Vi} = \sum_{j=1}^{n} \text{wj rij} \quad (2)$$

where,
Vi: Ranking for each alternative
Wj: The weight value of each criterion
Rij: Normalized performance rating

The stages in the SAW method can be described in Figure 1.

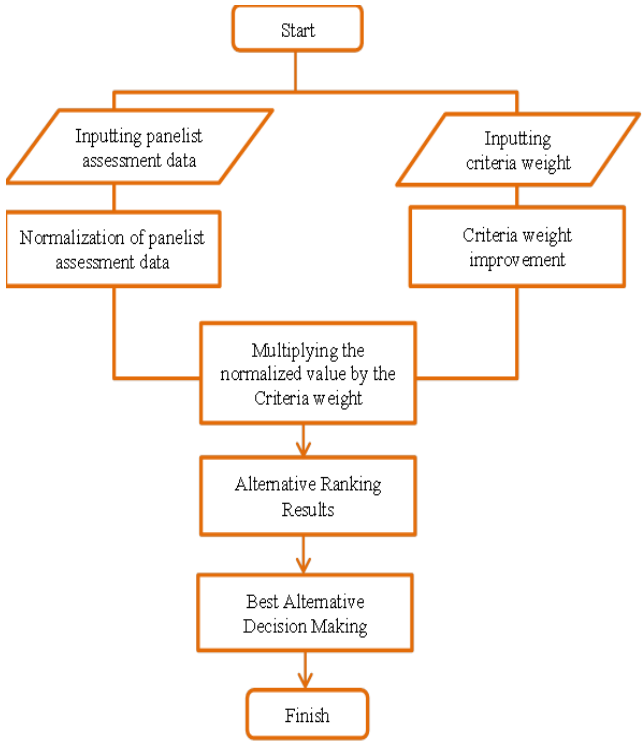

Figure 1. Stages in the SAW method [24]

3. RESULTS AND DISCUSSION

3.1 The taste weight criteria

The evaluation of the weight criteria of taste in percentages based on panelists' assessment showed that weighted aroma importance of 25%, flavour 22%, aftertaste 12%, defect 10%, sweetness 11%, bitterness 8%, and body 12% (Figure 2).

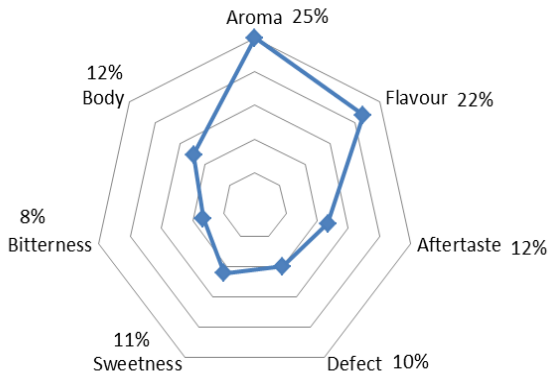

Figure 2. Criteria weight evaluation

In product acceptance, the aroma had an important role compared to other tastes. This was because the aroma of a food or drink can trigger the stimulation of the sense of smell, thereby increasing the attractiveness and taste of the drink or food. Fadhil and Agustina [25] stated that the results of the weight criteria obtained by aroma had the highest criteria importance weight compared to other tastes.

Furthermore, Navisah [26] reported that the flavour criteria had a higher level of importance than fragrance, sweetness, acidity and body. According to SCAA [19], the flavour itself is defined as a combination of aroma, acidity, and aftertaste. This shows that aroma and flavour are criteria that significantly influence coffee flavour parameters, so it is very reasonable if both had a higher importance weight value than other criteria.

The weight of the criteria is the magnitude of the importance of a criterion compared to other criteria. The weight of the criteria has an essential role in using the SAW method, where the multiplication of the normalized matrix with the weight of the criteria will affect the ranking of alternatives [27].

3.2 Matrix normalization

The matrix normalization process was carried out by dividing the scores of each alternative from each criterion based on the panelists' assessment (Table 3), with the highest score on each criterion.

The following is the process of how to normalize the matrix on each product.

3.2.1 Nirapresso

P1A1K1 = 3.89/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 1.00
P1A1K2 = 3.22/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.83
P1A1K3 = 3.22/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.83
P1A1K4 = 3.22/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.83
P1A1K5 = 3.22/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.83
P1A1K6 = 2.67/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.69
P1A1K7 = 3.33/n Max (3.89)(3.22)(3.22)(3.22)(3.22)(2.67)(3.33) = 0.86

P1A2K1 = 3.22/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.83
P1A2K2 = 3.89/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 1.00
P1A2K3 = 3.67/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.94
P1A2K4 = 3.33/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.86
P1A2K5 = 3.44/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.89
P1A2K6 = 3.44/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.89
P1A2K7 = 3.44/n Max (3.22)(3.89)(3.67)(3.33)(3.44)(3.44)(3.44) = 0.89

P1A3K1 = 3.44/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.86
P1A3K2 = 4.00/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 1.00
P1A3K3 = 3.44/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.86
P1A3K4 = 3.22/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.81
P1A3K5 = 3.56/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.89
P1A3K6 = 3.33/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.83
P1A3K7 = 3.33/n Max (3.44)(4.00)(3.44)(3.22)(3.56)(3.33)(3.33) = 0.83

3.2.2 Orangepresso

P2A1K1 = 3.11/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 1.00
P2A1K2 = 2.33/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 0.75
P2A1K3 = 2.33/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 0.75
P2A1K4 = 2.56/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 0.82
P2A1K5 = 2.67/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 0.86
P2A1K6 = 2.89/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 0.93
P2A1K7 = 3.11/n Max (3.11)(2.33)(2.33)(2.56)(2.67)(2.89)(3.11) = 1.00

P2A2K1 = 2.89/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.90
P2A2K2 = 2.89/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.90
P2A2K3 = 2.89/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.90
P2A2K4 = 2.78/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.86
P2A2K5 = 2.89/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.90
P2A2K6 = 3.22/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 1.00
P2A2K7 = 3.11/n Max (2.89)(2.89)(2.89)(2.78)(2.89)(3.22)(3.11) = 0.97

P2A3K1 = 2.89/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 0.90
P2A3K2 = 2.78/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 0.86
P2A3K3 = 3.22/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 1.00
P2A3K4 = 2.56/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 0.79
P2A3K5 = 3.22/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 1.00
P2A3K6 = 3.11/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 0.97
P2A3K7 = 3.00/n Max (2.89)(2.78)(3.22)(2.56)(3.22)(3.11)(3.00) = 0.93

3.2.3 Limaupresso

P3A1K1 = 3.78/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 1.00
P3A1K2 = 2.56/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 0.75
P3A1K3 = 2.33/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 0.75
P3A1K4 = 2.89/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 0.82
P3A1K5 = 2.67/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 0.86
P3A1K6 = 3.00/n Max (3.78)(2.56)(2.33)(2.89)(2.67)(3.00)(3.00) = 0.93

P3A1K7 = 3.00/n Max (3.78)(2.56)(2.33)(2.89)(2.67) (3.00)(3.00) = 1.00

P3A2K1 = 3.67/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.90
P3A2K2 = 2.89/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.90
P3A2K3 = 3.11/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.90
P3A2K4 = 2.89/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.86
P3A2K5 = 3.33/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.90
P3A2K6 = 2.89/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 1.00
P3A2K7 = 3.44/n Max (3.67)(2.89)(3.11)(2.89)(3.33) (2.89)(3.44) = 0.97

P3A3K1 = 3.67/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 0.90
P3A3K2 = 3.00/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 0.86
P3A3K3 = 3.56/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 1.00
P3A3K4 = 3.11/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 0.79
P3A3K5 = 3.44/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 1.00
P3A3K6 = 3.00/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 0.97
P3A3K7 = 3.33/n Max (3.67)(3.00)(3.56)(3.11)(3.44) (3.00)(3.33) = 0.93

3.2.4 Serehpresso
P4A1K1 = 3.44/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 1.00
P4A1K2 = 2.89/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.84
P4A1K3 = 2.78/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.81
P4A1K4 = 3.00/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.87
P4A1K5 = 3.11/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.90
P4A1K6 = 2.67/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.77
P4A1K7 = 3.22/n Max (3.44)(2.89)(2.78)(3.00)(3.11) (2.67)(3.22) = 0.94

P4A2K1 = 3.44/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 1.00
P4A2K2 = 2.89/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.84
P4A2K3 = 3.11/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.90
P4A2K4 = 3.11/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.90
P4A2K5 = 3.00/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.87
P4A2K6 = 2.89/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.84
P4A2K7 = 3.33/n Max (3.44)(2.89)(3.11)(3.11)(3.00) (2.89)(3.33) = 0.97
P4A3K1 = 3.22/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 1.00
P4A3K2 = 3.22/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 1.00
P4A3K3 = 2.89/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 0.90
P4A3K4 = 3.00/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 0.93
P4A3K5 = 2.89/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 0.90
P4A3K6 = 2.78/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 0.86
P4A3K7 = 2.89/n Max (3.22)(3.22)(2.89)(3.00)(2.89) (2.78)(2.89) = 0.90

3.2.5 Palapresso
P5A1K1 = 2.22/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.91
P5A1K2 = 1.67/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.68
P5A1K3 = 2.00/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.82
P5A1K4 = 2.22/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.91
P5A1K5 = 2.11/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.86
P5A1K6 = 2.33/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 0.95
P5A1K7 = 2.44/n Max (2.22)(1.67)(2.00)(2.22)(2.11) (2.33)(2.44) = 1.00

P5A2K1 = 2.67/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 1.00
P5A2K2 = 1.89/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.71
P5A2K3 = 2.22/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.83
P5A2K4 = 2.33/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.88
P5A2K5 = 2.11/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.79
P5A2K6 = 2.33/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.88
P5A2K7 = 2.22/n Max (2.67)(1.89)(2.22)(2.33)(2.11) (2.33)(2.22) = 0.83

P5A3K1 = 2.67/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.86
P5A3K2 = 2.22/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.71
P5A3K3 = 2.22/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.71
P5A3K4 = 2.67/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.86
P5A3K5 = 2.33/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.75
P5A3K6 = 3.11/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 1.00
P5A3K7 = 2.56/n Max (2.67)(2.22)(2.22)(2.67)(2.33) (3.11)(2.56) = 0.82

3.3 Normalized matrix result

The results of the normalized matrix for each Gayo arabica coffee brewed product with the addition of fruit and spice variants are as shown in Table 4.

Table 3. Recapitulation of panelists' assessment results

No	Product (P)	The Concentration of Fruits and Spices (A)	Criteria (K) 1 Aroma	2 Flavour	3 Aftertaste	4 Defect	5 Sweetness	6 Bitterness	7 Body
1	Nirapresso	30 ml (1)	3.89	3.22	3.22	3.22	3.22	2.67	3.33
		45 ml (2)	3.22	3.89	3.67	3.33	3.44	3.44	3.44
		60 ml (3)	3.44	4.00	3.44	3.22	3.56	3.33	3.33
2	Orangepresso	30 ml (1)	3.11	2.33	2.33	2.56	2.67	2.89	3.11
		45 ml (2)	2.89	2.89	2.89	2.78	2.89	3.22	3.11
		60 ml (3)	2.89	2.78	3.22	2.56	3.22	3.11	3.00
3	Limaupresso	30 ml (1)	3.78	2.56	2.33	2.89	2.67	3.00	3.00
		45 ml (2)	3.67	2.89	3.11	2.89	3.33	2.89	3.44
		60 ml (3)	3.67	3.00	3.56	3.11	3.44	3.00	3.33
4	Serehpresso	30 ml (1)	3.44	2.89	2.78	3.00	3.11	2.67	3.22
		45 ml (2)	3.44	2.89	3.11	3.11	3.00	2.89	3.33
		60 ml (3)	3.22	3.22	2.89	3.00	2.89	2.78	2.89
5	Palapresso	30 ml (1)	2.22	1.67	2.00	2.22	2.11	2.33	2.44
		45 ml (2)	2.67	1.89	2.22	2.33	2.11	2.33	2.22
		60 ml (3)	2.67	2.22	2.22	2.67	2.33	3.11	2.56

Table 4. Normalized matrix result

Brewing	Aroma	Flavour	Aftertaste	Defect	Sweetness	Bitterness	Body
Nirapresso	1.00	0.83	0.83	0.83	0.83	0.69	0.86
	0.83	1.00	0.94	0.86	0.89	0.89	0.89
	0.86	1.00	0.86	0.81	0.89	0.83	0.83
Orangepresso	1.00	0.75	0.75	0.82	0.86	0.93	1.00
	0.90	0.90	0.90	0.86	0.90	1.00	0.97
	0.90	0.86	1.00	0.79	1.00	0.97	0.93
Limaupresso	1.00	0.68	0.62	0.76	0.71	0.79	0.79
	1.00	0.79	0.85	0.79	0.91	0.79	0.94
	1.00	0.82	0.97	0.87	0.94	0.82	0.91
Serehpresso	1.00	0.84	0.81	0.87	0.90	0.77	0.94
	1.00	0.84	0.90	0.90	0.87	0.84	0.97
	1.00	1.00	0.90	0.93	0.90	0.86	0.90
Palapresso	0.91	0.68	0.82	0.91	0.86	0.95	1.00
	1.00	0.71	0.83	0.88	0.79	0.88	0.83
	0.86	0.71	0.71	0.86	0.75	1.00	0.82

Table 5. Alternative ranking results for each product

Alternative	Aroma	Flavour	Aftertaste	Defect	Sweetness	Bitterness	Body	Total	Ranking
Nirapresso									
30 ml	0.250	0.180	0.097	0.083	0.092	0.057	0.105	0.863	3
45 ml	0.207	0.217	0.110	0.086	0.098	0.074	0.108	0.900	1
60 ml	0.215	0.217	0.100	0.081	0.099	0.069	0.102	0.883	2
Orangepresso									
30 ml	0.250	0.163	0.088	0.082	0.095	0.077	0.122	0.877	3
45 ml	0.224	0.194	0.105	0.086	0.100	0.083	0.118	0.910	2
60 ml	0.224	0.187	0.117	0.079	0.111	0.080	0.114	0.912	1
Limaupresso									
30 ml	0.250	0.147	0.072	0.076	0.078	0.066	0.097	0.787	3
45 ml	0.250	0.171	0.099	0.079	0.101	0.066	0.115	0.880	2
60 ml	0.250	0.177	0.113	0.085	0.104	0.068	0.111	0.909	1
Serehpresso									
30 ml	0.250	0.182	0.094	0.087	0.100	0.065	0.114	0.892	3
45 ml	0.250	0.182	0.105	0.090	0.097	0.070	0.118	0.912	2
60 ml	0.250	0.217	0.105	0.093	0.100	0.072	0.110	0.945	1
Palapresso									
30 ml	0.227	0.148	0.095	0.091	0.096	0.080	0.122	0.859	1
45 ml	0.250	0.153	0.097	0.088	0.088	0.073	0.102	0.851	2
60 ml	0.214	0.155	0.083	0.086	0.083	0.083	0.100	0.805	3

3.4 Alternative ranking

The alternative ranking process was carried out by multiplying the results of the normalization matrix with the results of the evaluation of the criteria weights by the panellists, namely, aroma (25%), flavour (22%), aftertaste (12%), defect (10%), sweetness (11%), bitterness (11%), and body (12%). The ranking of each product based on the alternatives of each type of brewing are shown in Table 5.

3.5 Product acceptance preferences

Overall, the panellists have different acceptances of the various alternatives of Gayo Arabica coffee brewing with the added fruit and spices. The fruits and spices used as mixed ingredients were the main factors that made panellists have different acceptance levels for each alternative. Each type of fruit and spice had a characteristic taste that would affect the panelists' preference for the product based on the concentration of the mixture. This is supported by the research of Fauzi et al. [28], where the panelists' preference for instant coffee brewing had different product acceptance preferences based on the type and variation of mixing carried out. Meanwhile, research by Agustina et al. [29] stated that using the decision-making system method had succeeded in determining several alternatives based on panellist assessments, especially in selecting alternative product acceptance. The decision-making system is a method that aims to find the best alternative or choice from several existing alternatives [30]. Based on calculations using the SAW method, the best alternative for each type of brewing is as follows:

3.5.1 Nirapresso

Nirapresso with an alternative addition of 45 ml of Sap was the most preferred mixing composition by panellists based on an assessment with a 0.207 aroma, 0.217 flavours, 0.110 aftertastes, 0.086 defect sweetness 0.098, 0.074 bitterness, 0.108 body, and a total of 0.900. Overall, the alternative addition of 45 ml of Sap was superior to each parameter. compared to other alternatives. Still, adding 60 ml of Sap was ahead of other alternatives in the sweetness parameter. In the aroma parameter of the alternative, the addition of 30 ml of Sap was better than other parameters. The addition of 30 ml of Sap with 30 ml of espresso base made the aroma of Sap not too strong. This was because the 1:1 formula between Sap and espresso created a balance in each parameter. Kartika et al. [31] stated that panelists preferred slightly flavored products with Sap in the study of making functional drinks based on palm sap.

3.5.2 Orangepresso

Orangepresso with an alternative composition of 60 ml sweet orange was the most preferred by the panellists based on an assessment with 0.224 aromas, 0.187 flavours, 0.117 aftertastes, 0.079 defects, 0.111 sweetness, 0.080 bitterness, 0.114 body and 0.912 in total. The addition of 45 ml of sweet orange had a total score that was not too far away from the addition of 60 ml of sweet orange. The panellists preferred adding 60 ml of sweet orange because the sweet and fresh citrus taste characteristics dominated and covered the bitter character of the coffee. According to Pertiwi [32], in his research on consumer preferences for functional drinks with sweet orange extract, panellists preferred oranges with sweet, peel, and citrus characteristics.

3.5.3 Limaupresso

Limaupresso with an alternative composition of 60 ml of lime was the most preferred by the panellists based on an assessment with a 0.250 aroma, 0.177 flavours, 0.113 aftertastes, 0.085 defects, 0.104 sweetness, 0.068 bitterness, 0.111 body and a total of 0.909. Limes had a distinctive taste in the resulting sour taste. Chodijah et al. [33] stated that more addition of lime juice it can cover the taste of defects or flavours that the panellists disliked during the sensory test. Adding 60 ml was the most preferred alternative for panellists due to the combination of freshness and distinctive sour taste that dominantly caused a freshness effect, compared to other alternatives, where the slight addition of lime did not result in the expected freshness.

3.5.4 Serehpresso

Serehpresso with an alternative composition of 60 ml lemongrass was the most preferred by the panellists based on an assessment with a 0.250 aroma, 0.217 flavours, 0.105 aftertastes, 0.093 defects, 0.100 sweetness, 0.072 bitterness, 0.110 body and a total of 0.945. The panellists preferred the alternative of adding 60 ml due to the characteristics of Lemongrass, which has a strong aroma and a spicy taste of Lemongrass; if the addition were less than 60 ml, the aroma and distinctive taste of Lemongrass would still be covered with the character of the espresso flavour. According to Ariffah [34], in his research on lemongrass extract drinks with a mixture of stevia leaf extract, panellists had different preferences for each variation of the mixture.

3.5.5 Palapresso

Palapresso with an alternative composition of 30 ml nutmeg was the most preferred by panellists based on an assessment with a 0.227 aroma, 0.148 flavour, 0.095 aftertaste, 0.091 defects, 0.096 sweetness, 0.080 bitterness, 0.122 body, and 0.859 total. Panellists preferred the alternative of adding 30 ml of nutmeg extract because nutmeg is a type of spice that has a strong aroma and taste; the exceeded addition of it would eliminate the characteristic taste of coffee. Alif and Tiadeka [35] stated in their research on formulations for making instant herbal drinks that formulations with the addition of more nutmeg were preferable to formulations with less nutmeg. This was inversely proportional to the acceptance results from palapresso products, where panellists preferred the addition of less nutmeg. Of course, this happened because of the difference in the essential ingredients of palapresso, which was coffee. The addition of too much nutmeg was not suitable for the coffee connoisseurs.

Based on the results above, the best alternative from each type of brewing can be described as the composition of the formulation as shown in Figure 3, Figure 4, Figure 5, Figure 6, and Figure 7.

Figure 3. Formulation of nirapresso

Figure 4. Formulation of orangepresso

Figure 5. Formulation of limaupresso

Figure 6. Formulation of serehpresso

Figure 7. Formulation of palapresso

4. CONCLUSION

The assessment of product acceptance preferences of Gayo arabica coffee brewing with the addition of fruit and spice variants succeeded in finding the best alternative for each type of brewing. Nirapresso with 30 ml of espresso and 45 ml of juice, orangepresso with 30 ml of espresso and 60 ml of sweet orange, limaupresso with 30 ml of espresso and 60 ml of lime, serehpresso with 30 ml of espresso, 60 ml of lemongrass, and palapresso with 30 ml of espresso and 30 ml of nutmeg. Each Gayo arabica coffee brew with fruit and spice variants had different product acceptance preferences, so this research can also be a recommendation for the needs of coffee connoisseurs. If coffee connoisseurs prefer certain flavours, they can choose specific types of compositions in brewing. Using the SAW method in this study solved the problem of finding the best alternative for each type of Gayo Arabica coffee brewing with the addition of fruit and spices variants, making it easier to make product acceptance decisions from some available alternatives.

This research was limited to the formulation of the composition of mixing the brewing of Gayo arabica coffee with fruit and spice variants that developed in local communities. In addition, mixing Gayo arabica coffee in the form of espresso with fruit and spice variants still uses original ingredients, not derivative products such as fruit syrup, fruit flavoring, or spice flavoring. Therefore, the diversity of fruits and spices can continue to be developed again, including by using derivative products (synthetic foods) from other fruits and spices. In addition, in using the SAW method, comparisons can also be made with other decision-making methods, so that the development of various decision-making methods in the product acceptance preference assessment system is wide open.

ACKNOWLEDGEMENT

The authors would like to thank DRTPM Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi, and Lembaga Penelitian dan Pengabdian kepada Masyarakat USK for the support of the Penelitian Terapan Kompetitif Nasional for the 2022 fiscal year Number 145/E5/PG.02.00.PT/2022.

RFERENCES

[1] Khamitova, G., Angeloni, S., Borsetta, G., Xiao, J., Maggi, F., Sagratini, G., Vittori, S., Caprioli, G. (2020). Optimization of espresso coffee extraction through variation of particle sizes, perforated disk height and filter basket aimed at lowering the amount of ground coffee used. Food Chemistry, 314: 126220. https://doi.org/10.1016/j.foodchem.2020.126220

[2] Morris, J. (2013). Why espresso? Explaining changes in European coffee preferences from a production of culture perspective. European Review of History: Revue Européenne D'histoire, 20(5): 881-901. https://doi.org/10.1080/13507486.2013.833717

[3] ICO [International Coffee Organization]. (2021). Prices for Arabica coffee in July 2021 surged to the highest levels since November 2014 as severe frost hit Brazilian coffee farms, while concerns grow over weather phenomena in other producing countries. Coffee Market Report, 2021. Available: https://www.ico.org/documents/cy2020-21/cmr-0721-e.pdf, accessed on August 1, 2021.

[4] Apiletti, D., Pastor, E. (2020). Correlating espresso quality with coffee-machine parameters by means of association rule mining. Electronics, 9(1): 100. https://doi.org/10.3390/electronics9010100

[5] Fadhil, R., Maarif, M., Bantacut, T., Hermawan, A. (2018). Formulation for development strategy of gayo coffee agroindustry institution using interpretive structural modeling (ISM). Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 66(2): 487-495. https://doi.org/10.11118/actaun201866020487

[6] Nasution, I.S., Delima, D.P., Zaidiyah, Z., Fadhil, R. (2022). A low cost electronic nose system for classification of Gayo Arabica coffee roasting levels

using stepwise linear discriminant and K-Nearest Neighbor. Mathematical Modelling of Engineering Problems, 9(5): 1271-1276. https://doi.org/10.18280/mmep.090514

[7] Asmono, S.L., Kristiawan, A.B., Handayani, H.T., Kusumaningtyas, R.N. (2021). Addition of Stevia Leaf Powder to Arabica coffee drinks on the level of consumer preference. Jurnal Ilmiah Inovasi, 21(1): 27-32. https://doi.org/10.25047/jii.v21i1.2631

[8] Fadhil, R., Sulaiman, M.I., Farhan M.R. (2022). Decision-making system for acceptance of Gayo Arabica coffee steeped products with a mixture of herbs using the MOORA method. International Journal of Design & Nature and Ecodynamics, 17(2): 263-271. https://doi.org/10.18280/ijdne.170213

[9] Asioli, D., Næs, T., Granli, B.S., Almli, V.L. (2014). Consumer preferences for iced coffee determined by conjoint analysis: An exploratory study with Norwegian consumers. International Journal of Food Science & Technology, 49(6): 1565-1571. https://doi.org/10.1111/ijfs.12485

[10] Devi, S., Sihotang, H.T. (2019). Decision support systems assessment of the best village in Perbaungan sub-district with the Simple Additive Weighting (SAW) method: Decision support systems assessment of the best village in Perbaungan sub-district with the Simple Additive Weighting (SAW) method. Jurnal Mantik, 3(3): 112-118. https://iocscience.org/ejournal/index.php/mantik/article/view/334.

[11] Kusuma, H.R., Ingewati, T., Indraswati, N., Martina, M. (2007). Pengaruh pasteurisasi terhadap kualitas jus jeruk pacitan. Jurnal Ilmiah Widya Teknik, 6(2): 142-151. https://dx.doi.org/10.33508/wt.v6i2.1241

[12] Hidayati, N.A., Santoso, S., Saparudin, S., Fakhrurrozi, Y., Susanti, I., Wempi, D.S.P., Zasari, M., Mega, R., Sitorus, R., Nurtjahya, E. (2013). Tumbuhan obat Suku Sawang. Tumbuhan Obat Bangka Belitung. UBB Press, Pangkalpinang. http://repository.ubb.ac.id/id/eprint/3225.

[13] Widiastuti, A., Harismah, K. (2022). Minuman fungsional dari serai (Cymbopogon citratus) dan Pemanis Stevia. Available from: https://www.semanticscholar.org/paper/MINUMAN-FUNGSIONAL-DARI-SERAI-(Cymbopogon-citratus)-Widiastuti-Harismah/623de2abf532c24a95833c4059425621d4f4001c.

[14] Indriaty, F., Assah, Y.F. (2015). Addition effect of sugar and fruit extractto the quality of nutmeg meat juice. Jurnal Penelititian Teknologi Industri, 7(1): 49-60. https://doi.org/10.33749/jpti.v7i1.4683

[15] Hidayati, S., Sartika, D., Sutoyo, S., Fudholi, A. (2022). Predict the shelf life of instant chocolate in vacuum packing by using Accelerated Shelf Life Test (ASLT). Mathematical Modelling of Engineering Problems, 9(2): 443-450. https://doi.org/10.18280/mmep.090220

[16] Singh-Ackbarali, D., Maharaj, R. (2014). Sensory evaluation as a tool in determining acceptability of innovative products developed by undergraduate students in food science and technology at The University of Trinidad and Tobago. Journal of Curriculum and Teaching, 3(1): 10-27. https://doi.org/10.5430/jct.v3n1p10

[17] Tarwendah, I.P. (2017). Comparative study of sensory attributes and brand awareness in food product: A review. Jurnal Pangan Agroindustri, 5(2): 66-73. https://jpa.ub.ac.id/index.php/jpa/article/view/531.

[18] Fadhil, R., Nurba, D. (2019). Comparison of Gayo Arabica coffee taste sensory scoring system between Eckenrode and Fuzzy-Eckenrode methods. IOP Conference Series Earth and Environmental Science, 365(1): 012040. https://iopscience.iop.org/article/10.1088/1755-1315/365/1/012040.

[19] SCAA [Specialty Coffee Association of America]. (2015). SCAA protocols cupping specialty coffee. Specialty Coffee Association of America, California.

[20] Goodridge, W.S. (2016). Sensitivity analysis using simple additive weighting method. International Journal of Intelligent Systems and Application, 5: 27-33. https://doi.org/10.5815/ijisa.2016.05.04

[21] Anggraeni, E.Y., Huda, M., Maseleno, A., Safar, J., Jasmi, K.A., Mohamed, A.K., Hehsan, A., Basiron, B., Ihwani, S.S., Embong, W.H.W., Mohamad, A.M., Noor, S.M., Fauzi, A.M., Wijaya, D.A., Masrur, M. (2018). Poverty level grouping using SAW method. International Journal of Engineering & Technology, 7(2): 218-224. http://dx.doi.org/10.14419/ijet.v7i2.27.11948

[22] Waziana, W., Irviani, R., Oktaviani, I., Satria, F., Kurniawan, D., Maseleno, A. (2018). Fuzzy simple additive weighting for determination of recipients breeding farm program. International Journal of Pure and Applied Mathematics, 118(7): 93-100.

[23] Syamsuddin, S., Rahim, R. (2017). Study approach technique for order of preference by similarity to ideal solution (TOPSIS). International Journal of Recent Trends in Engineering & Research, 3(3): 268-85. https://doi.org/10.23883/IJRTER.2017.3077.GZXDL

[24] Purba, R., Sihotang, H.T. (2019). Decision support systems recipient Program Keluarga Harapan (PKH) In Durian Kec. Pantai Labu Kab. Deli Serdang with the Simple Additive Weighting (SAW) Method. Jurnal Mantik, 3(3): 91-98. https://iocscience.org/ejournal/index.php/mantik/article/view/325.

[25] Fadhil, R., Agustina, R. (2019). A multi-criteria sensory assessment of Cucumis melo (L.) using fuzzy-Eckenrode and fuzzy-TOPSIS methods. Foods Raw and Materials, 7(2): 339-347. http://doi.org/10.21603/2308-4057-2019-2-339-347

[26] Fadhil, R., Safrizal, S., Khathir, R., Navisah, P. (2023). Sensory assessment of taste of various varieties of Gayo Peaberry Arabica coffee using the Analytical Hierarchy Process (AHP) method. Siberian Journal of Life Sciences and Agriculture. http://dx.doi.org/10.21177/1998-4502-2022-14-2-263-268

[27] Pamučar, D., Stević, Ž., Sremac, S. (2018). A new model for determining weight coefficients of criteria in MCDM models: Full Consistency Method (FUCOM). Symmetry, 10(9): 393. https://doi.org/10.3390/sym10090393

[28] Fauzi, M., Novijanto, N., Rarasati, D.P. (2019). Organoleptic and physicochemical characteristics of coffee-ginger bag on variation of coffee roasting level and ginger powder concentration. Jurnal Agroteknologi, 13(1): 1-9. https://doi.org/10.19184/j-agt.v13i01.8370

[29] Agustina, R., Mustaqimah, M., Fadhil, R., Devianti, D. (2020). Sensory evaluation of Pliek-U quality using

Fuzzy-Topsis method. Acta Technologica Agriculturae, 23(4): 161-167. https://doi.org/10.2478/ata-2020-0026
[30] Wang, Y.J. (2019). Interval-valued fuzzy multi-criteria decision-making based on simple additive weighting and relative preference relation. Information Science, 503: 319-335.
[31] Kartika, K.A., Candra, K.P., Yuliani, Y. (2017). Pengaruh Formulasi Nira Aren (Arenga Pinnata Merr.) dan Ekstrak Jahe Merah (Zingiber Officinale Var. Rubrum) Terhadap Sifat Kimia Dan Sensoris Minuman Jahe Merah Instan (Effect of Sugar Palm (Arenga pinnata Merr.) Sap and Extract of Red Ginger (Zingiber officinale var. Rubrum) Formulation on Chemical and Sensory Properties of Red Ginger Instant Beverage). Jurnal Teknik Pertertanian Universitas Mulawarman, 12(1): 21-25.
[32] Pertiwi, S.R. (2016). Preference mapping squeezed orange powder drinks with variations in serving temperature using sensomaker software. Jurnal Agroindustri Halal, 2(2): 073-080. https://doi.org/10.30997/jah.v2i2.455
[33] Chodijah, C., Herawati, N., Ali, A. (2020). Pemanfaatan Wortel (Daucus Carota L.) Dalam Pembuatan Es Krim Dengan Penambahan Jeruk Kasturi (Citrus Microcarpa B.). Jurnal Sagu, 18(1): 25-38. http://dx.doi.org/10.31258/sagu.v18i1.7865
[34] Ariffah, C.W.N. (2018). Antioxidative activity and sensory quality drinks lemongrass leaf extract (Cymbopogon citratus) and stevia leaf extract (Stevia rebaudiana), Jur. Teknologi Hasil Pertanian, Fak. Teknologi Pertanian, Univ. Jember, Jember. https://repository.unej.ac.id/handle/123456789/96185.
[35] Alif, H.H., Tiadeka, P. (2019). The making of instant herbal drink bir pletok. Journal of Herbal, Clinical and Pharmaceutical Science (HERCLIPS), 1(1): 26-29. http://dx.doi.org/10.30587/herclips.v1i01.1074