

Quality and consumer preferences on Gayo Arabica coffee brew based on the blending formulation and brewing method

[Mutu dan konsumen terhadap seduhan kopi Arabika Gayo berdasarkan formulasi pencampuran bubuk kopi dan metode penyeduhan]

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ABSTRACT

Gayo Arabica coffee has three cultivars that farmers in the Gayo Highlands commercially manage: Timtim, Borbor, and Ateng Super. Coffee blending is necessary to optimize the quality of Gayo Arabica coffee brews. In addition to the blend formulation, the brewing method also affects the quality of the brew. This study aims to understand the quality of coffee brews and consumer acceptance of two blending formulations optimized from previous research, brewed using four different brewing methods. The research used a factorial randomized block design with two factors. The first factors were the Gayo coffee blend formulation, 25% Timtim + 50% Borbor + 25% Ateng Super and 50% Borbor + 50% Ateng Super. The second factor was the coffee brewing method consisting of 4 levels: manual brew, French press, V60, and espresso. Brew quality parameters included pH, total dissolved solids, antioxidant activity, and sensory attributes such as aroma, flavor, body, aftertaste, and overall. The results showed that the interaction between the coffee blend formulation and the brewing method did not significantly affect the flavor in the sensory test. The coffee blend formulation significantly affected aroma, aftertaste, body, and overall but did not significantly affect antioxidant activity (65.87-65.42%), total dissolved solids (1.35°Brix), and pH. The Simple Additive Weighing method ranking test indicated that the best treatment combination was found in the formulation of 25% Timtim + 50% Borbor + 25% Ateng Super brewed using the French press method.

Keywords: *Gayo Arabica, blending, brewing, cultivar, espresso, manual brew, V60*

ABSTRAK

Kopi Arabika Gayo memiliki tiga kultivar yang dikelola secara komersial oleh petani Dataran Tinggi Gayo yaitu Timtim, Borbor dan Ateng Super. Sebagai upaya optimasi kualitas seduhan kopi Arabika Gayo diperlukan pencampuran kopi. Selain formulasi campuran, metode penyeduhan juga mempengaruhi kualitas seduhan. Penelitian ini bertujuan untuk mengetahui bagaimana kualitas seduhan kopi dan penerimaan konsumen terhadap dua formulasi pencampuran hasil optimasi penelitian sebelumnya yang diseduh dengan empat metode penyeduhan berbeda. Penelitian menggunakan Rancangan Acak Kelompok Faktorial dan terdiri atas dua faktor. Faktor pertama adalah formulasi campuran kopi Gayo, 25% Timtim+50% Borbor+25% Ateng Super dan 50% Borbor+50% Ateng Super. Faktor kedua adalah metode penyeduhan kopi terdiri dari 4 taraf, yaitu manual Tubruk, *French press*, V60, dan espresso. Parameter kualitas seduhan meliputi pH, total padatan terlarut, aktivitas antioksidan, dan sensori atribut aroma, *flavour*, *body*, *aftertaste* dan *overall*. Hasil penelitian menunjukkan bahwa pada uji sensori, interaksi formulasi campuran kopi dengan metode penyeduhan tidak berpengaruh nyata terhadap *flavour*. Faktor formulasi pencampuran varietas kopi Arabika Gayo berpengaruh sangat nyata terhadap aroma, *aftertaste*, *body* dan *overall* tetapi tidak berpengaruh nyata terhadap aktivitas antioksidan (65,87-65,42%), total padatan terlarut (1,35°Brix) dan pH. Uji perankingan dengan metode Simple Additive Weighing menunjukkan bahwa kombinasi perlakuan terbaik terdapat pada formulasi 25% Timtim+50% Borbor+25% Ateng Super dengan metode *French press*.

Kata kunci: Arabika Gayo, espresso, kultivar, pencampuran, penyeduhan.

Introduction

Coffee is known as one of Indonesia's leading non-oil and gas natural resources, with Arabica variety as a primary export commodity. In addition to Arabica (*Coffea arabica*), the coffee varieties that are commercially developed include Robusta (*Coffea canephora*) and Liberica (*Coffea liberica*) (Andini et al., 2021). Aceh is the center of Indonesia's Arabica coffee production. According to data from the BPS (Central Bureau of Statistics), coffee production in Aceh has increased yearly. In 2020, the coffee production in Aceh was 126,289 tons, while in 2021, the preliminary figure was 126,490 tons, and it is predicted to reach 127,464 tons in 2022 (Badan Pusat Statistik, 2021b, 2021a).

Blending coffee beans before grinding is an effort to diversify coffee products, enhancing the flavor complexity and improving the taste of the resulting coffee (Muttalib et al., 2012; Suwarmini et al., 2017; Wei & Tanokura, 2015). Coffee blending is often done spontaneously due to limited access and a lack of information regarding the flavor quality of local coffee (Abubakar et al., 2020). Each coffee cultivar generally has specific flavor qualities and superior attributes (Abubakar et al., 2017). Therefore, Hasni et al. (2023) emphasized the importance of information availability regarding the flavor quality of raw materials, particularly the coffee being blended. This information on the sensory characteristics of raw materials is essential for baristas to understand which flavor attributes they want to improve and enhance, leading to more informed decisions when determining the blending formulation (Mulato & Suharyanto, 2012). Research by Abubakar et al. (2019) showed that the three local Gayo Arabica coffee cultivars—Timtim, Borbor, and Ateng Super—planted at an altitude of 1,100–1,300 meters above sea level had cupping test scores using the Specialty Coffee Association of America (SCAA) method of 84.50, 85.25, and 85.50, respectively. Borbor and Ateng Super had better cupping test scores compared to Timtim.

The quality of brewed coffee is regarded as a manifestation of the good coffee handling process, from cultivation to brewing (Córdoba et al., 2021). Quality improvement can be achieved, among other things, through proper coffee plant care and good post-harvest handling (Farah, 2019; Piato et al., 2020). Coffee brew quality can also be improved through the process of blending coffee grounds before brewing. One effort to enhance the quality of Gayo Arabica coffee with scores above 85 (specialty-excellent grade) is by blending coffee based on data using model enrichment. Based on this urgency, Hasni et al. (2023) successfully optimized a mathematical linear model to formulate blends for three local Gayo Arabica coffee cultivars, namely: Timtim, Borbor, and Ateng Super.

This study produced seven valid mathematical models representing seven blending formulations. The validity of the models was measured as there were no significant differences between the calculated cupping test scores from the mathematical models and the cupping test scores from specialty coffee Q-graders for the same seven blend formulations. Of the seven tested formulations, two produced coffee brews with cupping test scores above 85: formulation I (25% Timtim, 50% Borbor, and 25% Ateng Super) and formulation II (50% Borbor and 50% Ateng Super). These two formulations are recommended as the optimum blending formulations for local Gayo Arabica coffee varieties. In the cupping test procedure, the coffee is brewed manually or using the Tubruk method. Consumers tend to enjoy coffee using various brewing techniques, both with machines or manually. According to Fadhil et al. (2021), each manual brewing method has its way of bringing out the best coffee flavors, so the choice of brewing method significantly affects the resulting taste quality. Therefore, researchers consider it necessary to study consumer assessments of the brew quality from the French press, V60, and espresso methods. These four methods were chosen based on their popularity and practicality (Fibrianto et al., 2018; Sunarharum & Farhan, 2020).

Brewing coffee using the Tubruk technique involves pouring boiling water at around 90–95°C into a cup containing coffee grounds. The French press is a coffee brewing tool that immerses coffee with slightly coarse particles (medium coarse) for 2–5 minutes to achieve optimal extraction (Espitia-López et al., 2019). The French press consists of a glass container with a plunger and filter on the top lid, producing coffee

without sediment (Fibrianto & Ramanda, 2018). The V60 is a manual coffee brewing tool (manual brew) that uses a stepwise extraction process (Asrina et al., 2021). Espresso coffee is brewed by extracting coffee beans with hot water forced through them under high pressure (Gonzales et al., 2018).

Materials and method

Materials and equipment

The materials used in this study are Gayo Arabica green beans sourced from Bumi Ayu Village, Timang Gajah District (1,100–1,300 meters above sea level), processed using the semi-wash method. The coffee beans are differentiated by their cultivars: Timtim, Borbor, and Ateng Super, with a moisture content of 12–14%. The research equipment used includes a coffee roaster and grinder (Didacta Italia TA421D), an espresso machine (TA421D), a French press (plunger 600mL - XT01), V60, glassware, scales, filter paper, a thermometer, an electric kettle, an analytical balance, a UV-Vis spectrophotometer by Shimadzu, a refractometer by Shimadzu, and a pH meter.

Research method

This research uses a factorial randomized block design (RBD). The first factor (A) is the formulation of the Gayo Arabica coffee blend, which consists of two levels: formulation A1 (25% Timtim, 50% Borbor, 25% Ateng Super) and formulation A2 (50% Borbor, 50% Ateng Super). The second factor is the brewing method (P), which consists of 4 levels: P1 = Tubruk, P2 = French press, P3 = V60, and P4 = Espresso. Each treatment combination was repeated 3 times, resulting in 24 experimental units. The quality parameters studied include pH, total dissolved solids (TDS), antioxidant activity, as well as consumer acceptance and perception of the quality of the brewed Gayo Arabica coffee, covering aroma, flavor, body, aftertaste, and overall. The determination of the most preferred formulation by consumers was carried out using the Simple Additive Weighting (SAW) method.

Preparation of green coffee beans.

Green coffee beans (green beans) from the Timtim, Borbor, and Ateng Super varieties were collected from a single location, namely the village of Bumi Ayu, Timang Gajah (1,100-1,300 meters above sea level). The selected green beans had a moisture content of approximately 12-14%. The green beans of the three cultivars were sorted, with foreign objects and defective beans removed. The obtained coffee beans were, then, physically analyzed according to the Indonesian National Standard (SNI) 01-2907-2008.

Roasting and blending coffee

The three local Gayo Arabica coffee cultivars were weighed and roasted separately. The coffee was roasted at a temperature of 180-200°C for 11-14 minutes (medium to dark roast). After roasting, the coffee beans rested for 8 hours, then blended the three cultivars according to factor A, the coffee blending formulation. Once weighed according to the formulation, the coffee beans were mixed and were then packaged in standing pouches and stored at room temperature (25°C). The coffee beans were ground before being brewed and processed, with different grind sizes based on the brewing method factor.

Coffee brewing

- (a) **Tubruk** (Gardjito, 2011). The coffee grounds based on the blending formulation factor were ground coarsely. A cup of coffee requires 12 g of coffee grounds and is brewed with 150 mL of hot water at 90-98°C. It is then left for 10 minutes to extract the coffee and allow the grounds to fully settle.
- (b) **French Press** (Espitia-López et al., 2019). The coffee grounds based on the blending formulation factor were ground to a medium-coarse size. A total of 12 g of coffee grounds were placed into a French press, and 150 mL of hot water at 90-98°C was poured into the French press (ratio 1:15). It was then left for 3.5 minutes before stirring. The plunger was then inserted and slowly pressed down to

separate the coffee grounds at the bottom of the French press. The brewed coffee was poured into a cup, separating it from the grounds.

- (c) **V60 Brewing** (Kinasih et al., 2021). The V60 method was done by brewing coffee using a funnel-shaped tool with a 60° angle. A total of 12 g of coffee beans were weighed and then ground to a medium-coarse size. A coffee paper filter was moistened with water at 90-98°C. The coffee grounds were placed into the coffee paper filter, and the V60 tool was set up with a server cup underneath. Water was poured over the coffee grounds in three stages. First, 30 mL of water was poured and left for 30 seconds for extraction, a process called blooming. For the second pour add 50 mL, waiting until half of the water in the dripper has drained. The final pour added 70 mL of water, bringing the total to 150 mL.
- (d) **Brew Espresso** (Syarifuddin & Yusriyani, 2022). A total of 12 g of finely ground Gayo Arabica coffee beans were placed in the portafilter, tamped with a tamper, then attached to the portafilter to the group head of the machine (Rok Presso). Hot water at a temperature of 90°C was then poured into the top. Both levers were then slowly pulled upward, followed by pressing them down in a balanced, single motion.

Sensory attribute intensity test

The sensory attribute intensity test used an intensity testing method with a 7-point scale (1 = very weak, 2 = weak, 3 = somewhat weak, 4 = just right/normal, 5 = somewhat strong, 6 = strong, and 7 = very strong) (Hunaefi et al., 2020). This test involved 30 consumers. The consumers were regular black (without milk) Gayo Arabica coffee drinkers with a consumption frequency of 1-2 cups per day. The sensory attributes of the brewed coffee evaluated by consumers included aroma, flavor, aftertaste, body, and overall perception of the coffee brew. These five attributes were selected as they are the basic sensory qualities for brewed coffee, and the definitions of these attributes were familiar to the consumers, as determined by the panelist selection process. Panelists were selected based on a form, with the requirement they regularly consume 2-3 cups of brewed coffee daily. The testing was divided into three sessions according to repetitions. In each test, panelists received 8 coffee brew samples with three random codes, one 150 mL glass of mineral water as a palate cleanser, and one cracker to neutralize the aftertaste between samples. The data of the sensory quality intensity test were processed using ANOVA according to the experimental design.

Hedonic test

The hedonic test used a 5-point liking scale (1 = strongly dislike and 5 = strongly like). This test was conducted with 30 black coffee drinkers (without sugar). The hedonic data obtained were processed using the Simple Additive Weighting (SAW) method. The SAW method was used for decision-making due to its ability to provide more accurate assessments, as it is based on pre-determined criteria values and preference weights (Hasni, et al., 2023).

Results and discussion

Antioxidant activity

Antioxidant activity of Arabica-Robusta espresso brews in this study ranged from 33.71% to 78.37%, with an average of 59.31%. This antioxidant activity is higher than that reported in the study by Hasni et al. (2023). The average antioxidant activity of the coffee brews, based on the formulation and brewing methods used, is presented in **Table 1**. The analysis of variance (ANOVA) revealed that neither the formulation nor the brewing method significantly impacted the antioxidant activity of the resulting coffee brews. Likewise, the post-hoc tests showed no significant differences ($p > 0.05$). Acidri et al. (2020) suggested that the lack of significant differences in antioxidant activity could be attributed to the fact that

the coffee blends originated from the same cultivars: Borbor, Ateng Super, and Timtim. All samples underwent the same post-harvest handling and roasting processes during the study. Other factors affecting the antioxidants present in the coffee samples were not observed in this study, such as ripeness, growing conditions, and storage environment. The results of the LSDT 0.05 post hoc test indicated that the four brewing methods did not show significant differences. However, the French press and V60 methods tended to produce brews with higher antioxidant levels. The French press and V60 methods yielded brews with DPPH antioxidant activity values of up to 82%. These antioxidant values for the French press and V60 were higher compared to simpler infusion methods like brewed coffee or espresso and mokapot, which had values of 78%-80%.

This is thought to be due to stronger extraction of chlorogenic acids from the coffee beans during these two brewing methods. Antioxidants in coffee brews are often identified as the amount of chlorogenic acid (CGA) (Wolska et al., 2017). Arabica coffee from the United States was subjected to medium roasting levels and brewed with a ratio of 7g of coffee grounds to 100 mL of water. The brewing was done manually using drip, French press, and espresso. The total CGA values obtained ranged from 83.7-93.4 mg/100 mL (dePaula & Farah, 2019).

Table 1. Antioxidant activity and acidity of Arabica coffee brews based on coffee formulation and brewing method

Treatment Combination	Antioxidant Activity (%)	pH
25% Tea; 50% Coffee; 25% AT x Brewed	59.66 ± 1.08a	4.87 ± 0.05a
25% Tea; 50% Coffee; 25% AT x French Press	69.48 ± 1.19a	5.42 ± 0.46a
25% Tea; 50% Coffee; 25% AT x V60	72.70 ± 0.76a	4.81 ± 0.11a
25% Tea; 50% Coffee; 25% AT x Espresso	61.66 ± 1.08a	4.92 ± 0.14a
50% Coffee; 50% AT x Brewed	69.17 ± 0.98a	4.85 ± 0.03a
50% Coffee; 50% AT x French Press	73.62 ± 1.52a	4.96 ± 0.12a
50% Coffee; 50% AT x V60	67.64 ± 2.06a	4.98 ± 0.04a
50% Coffee; 50% AT x Espresso	51.23 ± 1.95a	4.96 ± 0.05a

T = Timtim, B = Borbor, AT = Ateng Super. Numbers followed by different letters in the same column are significantly different ($p < 0.05$) by LSDT. Values are the mean and standard deviation of three repetitions.

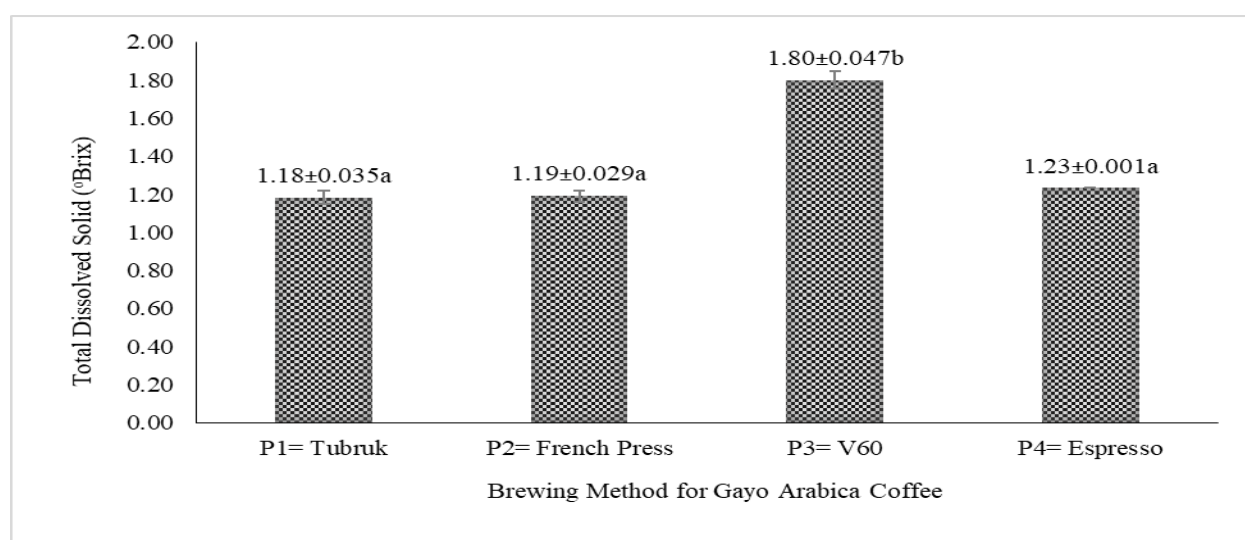


Figure 2. Effect of coffee brewing methods on total dissolved solids of Gayo Arabica coffee brew (values followed by the same letter indicating no significant difference), DMRT 0.05 test level 1 = 0.25, level 2 = 0.27, and level 3 = 0.28) KK = 18.81%

In Figure 2, the TDS values of the coffee brews from the brewed, French press, and espresso methods do not show significant differences. These three brewing methods use the same grind size, which is medium

coarse. This uniform grind size is suspected of influencing the TDS values of the resulting coffee brews. Furthermore, the brewed and French Press methods follow the same brewing principle, immersion, which refers to the dissolving or blending process. In this process, the coffee grounds come into direct contact with water and are left to steep. The only difference is that the final brew in the brewed method contains sediment, while the French press does not.

The similarity in this process is believed to result in brews with similar total dissolved solids. Immersion is a brewing technique where the coffee grounds are fully submerged in water for a certain period during extraction (Sunarharum et al., 2014).

Consumer acceptance of Gayo Arabica coffee brew quality

The quality of the coffee brew can be assessed based on the intensity of aroma, flavor, body, aftertaste, and overall perception. The scores given by the panelists can be seen in Table 2. The results of ANOVA indicate that the formulation factor, brewing method factor, and their interaction significantly affect ($p \leq 0.05$) the hedonic scores for aroma, body, aftertaste, and overall perception, as shown in Table 2.

Table 2. Consumer acceptance scores for aroma intensity, body, aftertaste, and overall quality of coffee brew

Treatment Combination		Result of The Hedonic Test			
		Aroma (n=3)	Body (n=3)	Aftertaste (n=3)	Overall (n=3)
A1	P1 (Tubruk)	4.82±0.44 ^b	3.47±0.60 ^{ab}	3.94±0.53 ^{ab}	3.80±0.85 ^{ab}
	P2 (French Press)	4.71±0.34 ^b	4.01±0.27 ^b	3.94±0.26 ^b	3.96±0.65 ^{ab}
	P3 (V60)	4.49±0.35 ^b	3.93±0.52 ^b	3.54±0.99 ^b	3.67±1.06 ^{ab}
	P4 (Espresso)	3.85±0.54 ^{ab}	3.89±0.41 ^b	3.11±0.85 ^b	3.16±0.69 ^{ab}
A2	P1 (Tubruk)	3.53±0.36 ^a	3.43±0.50 ^a	2.72±0.26 ^a	2.87±0.58 ^a
	P2 (French Press)	4.43±0.84 ^b	3.71±0.33 ^b	4.27±0.52 ^b	3.75±0.43 ^{ab}
	P3 (V60)	4.73±0.42 ^b	4.14±0.22 ^b	3.68±0.57 ^b	4.08±0.79 ^b
	P4 (Espresso)	4.36±0.34 ^b	4.45±0.29 ^b	3.90±0.27 ^b	3.77±0.44 ^b

A1 = 25% Timtim; 50%; Borbor; 25% Ateng Super. A2 = 50% Borbor; 50% Ateng Super. Number followed by different letters in the same column indicate significant differences ($p < 0.05$). Values represent the mean and standard deviation from three repetitions.

Table 2 shows that formulation A2 results in coffee brews with significantly lower aroma, body, aftertaste, and overall scores than other treatments. The difference between formulations A1 and A2 lies in the fraction of Ateng Super in A2 compared to formulation A1. Formulation A1 uses three cultivars with percentages of 25% Timtim, 50% Borbor, and 25% Ateng Super. Formulation A2 uses 50% Borbor and 50% Ateng Super. According to Abubakar et al. (2020), the characteristics of blended coffee brews are greatly influenced by the sensory profile of the proportion of each raw material. The larger the fraction, the greater the potential of raw material characteristics to affect the quality of the brew. Brews made from the Ateng Super cultivar are reported to have lower aroma and body scores (5.40 and 6.75) compared to the aroma and body of brews made from the Borbor (6.90 and 7.67) and Timtim (6.60 and 7.36) cultivars (Hayati et al., 2012; Hulupi et al., 2013). Aroma and body are important parameters in determining coffee brew quality. Aroma is perceived through the sense of smell, while body refers to the viscosity of the coffee (Tarigan et al., 2015; Towaha et al., 2014). A thick body is characterized by a rich, full taste with strong intensity, whereas a light body can also offer a pleasant mouthfeel (Saleh, 2020). The viscosity of coffee brews is caused by the content of lipids and polysaccharides dissolved in the coffee solution. Based on the brewing methods, the Tubruk method results in coffee brews with the lowest intensity of aroma, body, aftertaste, and overall perception, significantly different from the other brewing methods. This is likely because Tubruk coffee is brewed by simply pouring hot water over coffee grounds without any equipment. In contrast, methods like espresso and pour-over involve extraction processes that enhance the aroma and body of the coffee.

The aroma intensity of coffee brews using each brewing method is influenced by the duration of direct contact between water and coffee grounds, the temperature of the water used, and the type of pressure applied during the brewing process (Cordoba et al., 2020; Fibrianto & Ramanda, 2018). Generally, aroma is formed and reaches its optimum point during the wetting phase, which is the process where hot water contacts and is absorbed by the coffee grounds. This wetting process occurs at the beginning of brewing, typically 3-5 minutes after the coffee grounds are brewed with water at 90-100°C (Batali et al., 2020). Volatile components and gases evaporate upon contact with hot water, allowing the aroma to be extracted from the coffee and dissolved in the brew (Muslimin, 2021). Therefore, espresso and V60 pour-over methods are considered to produce stronger aromas compared to other brewing methods due to the pressure applied in the espresso technique and the blooming and gradual extraction process in the pour-over or V60 methods (Kinasih et al., 2021).

Significant differences are found only in the body of the coffee brew from the Tubruk method (A1P1 and A2P1) compared to the brews from both coffee mixture formulations brewed using the other three methods. In the French press method, coffee is combined with hot water without any medium or equipment, but after being left to steep for a while, the plunger is pressed down, separating the coffee grounds and resulting in a brew that is thicker and denser compared to Tubruk. In the V60 method, the brewing technique involves slowly pouring water, leading to a gradual extraction process and longer contact time between the coffee grounds and water during pouring. The espresso method, on the other hand, uses relatively high pressure in a vacuum, producing a brew with a thicker texture. Espresso also uses very finely ground coffee, allowing the grounds to pass through the filter (portafilter) easily. The V60 method employs coarser coffee grounds with paper filter brewing, resulting in a clearer coffee filtrate (Setiawan et al., 2023; Syarifuddin & Yusriyani, 2022). The results obtained from these three brewing methods vary due to the different techniques used and the resulting final products.

Aftertaste refers to the taste and aroma originating from the roof of the mouth and the back of the mouth, lingering after the coffee is discarded or swallowed. The less taste remains, the better the rating (Saleh, 2020; Tari et al., 2022). Aftertaste is the flavor that lingers in the mouth and throat. Testing for aftertaste attributes in coffee samples is identified during the first sip of the brew (Saleh, 2020). The bitter taste of caffeine content can influence the overall flavor attributes, including the aftertaste in coffee brews (Kreuml et al., 2013). Table 2 shows that panelists give nearly uniform ratings for the aftertaste of coffee brews from formulations A1 and A2, particularly those brewed using the French press, V60, and espresso methods.

The French press and Tubruk methods are brewing techniques based on immersion, where hot water soaks the coffee for a certain period. The French press differs from other methods because it does not use paper filters or cones. The result is a rich, smooth flavor with a slight oiliness and a preferred aftertaste (Espitia-López et al., 2019; Setiawan et al., 2023). This method can also lead to more oils from the coffee grounds dissolving in the brew, resulting in a heavier texture or body.

Best consumer acceptance using the simple additive weighting method

The SAW (Simple Additive Weighting) method was used to determine the best treatment in this study. This decision-making approach considers the importance of each criterion used as a reference in the decision-making process. The SAW method is employed for decision-making to provide more accurate assessments based on the criteria values and predetermined preference weights (Hasni et al., 2023). Each criterion is assigned a weight, then calculated in a normalized matrix multiplication with the criteria weights that can influence the ranking results of alternatives (Pamučar et al., 2018). In testing consumer acceptance of the quality of coffee brews produced in this study, panelists were asked to assign weights to five sensory attributes tested (aroma, flavor, body, aftertaste, and overall), with a total sum of weights of 100%. This percentage weight describes the importance of these sensory attributes to consumers. The

larger the weight assigned, the greater the influence of that sensory attribute on determining consumer acceptance and preference (Hasni et al., 2023). Evaluation of the taste criteria weights in percentage based on panelist assessments shows that the aroma criterion has an average importance weight of 22.9%, flavor 22.2%, body 15.6%, aftertaste 17.5%, and overall 21.7%.

In general, taste dominates and plays a crucial role compared to other flavor attributes in product acceptance. This is because taste is a primary factor in food product selection for most consumers. The better the taste of the product, the greater the tendency for consumers to like it and decide to purchase it. Additionally, Table 3 shows the average preference scores given by panelists for the five sensory attributes of the produced coffee brews. The panelists gave neutral scores for aroma, flavor, body, and aftertaste while expressing a preference for the overall impression of the Gayo Arabica coffee brew.

Table 3. Description and percentage weight of each attribute of Gayo Arabica coffee brew

Parameter	Description	Weight of criteria (%)	Average Scores
<i>Aroma</i>	The aroma emerges and is detected by the sense of smell immediately after the coffee is brewed.	22.9	4.43
<i>Flavor</i>	The combination of sensory sensations felt on the tongue along with the aroma inhaled through the nose when the coffee enters the mouth.	22.3	4.55
<i>Body</i>	The taste or texture sensation felt while drinking coffee and when the coffee is between the tongue and the roof of the mouth. A thicker body usually receives a higher score.	15.6	4.54
<i>Aftertaste</i>	The positive and pleasant taste sensation (taste and aroma) originates from the back of the mouth and the duration of that taste sensation after swallowing the coffee.	17.5	4.54
<i>Overall</i>	The overall ranking reflects the overall aspects of the coffee sample as recognized by each evaluator.	21.7	5.01
Total		100	

Subsequent calculations were performed through data normalization. The normalization process involves dividing the scores of each alternative for each criterion by the highest value for that criterion. After that, the alternative ranking is conducted by multiplying the normalized matrix results by the average percentage weights of the criteria listed in Table 4. The products of the weight matrix and the average hedonic scores are then summed up. The total value closest to 1.00 is considered the sample with the highest preference.

Table 4. Results of multiplying the weight matrix and average hedonic scores using the SAW Method

Treatment	<i>Aroma</i>	<i>Flavor</i>	<i>Body</i>	<i>Aftertaste</i>	<i>Overall</i>	Total	Ranking
A1P1	0.205	0.220	0.137	0.166	0.197	0.926	6
A1P2	0.220	0.2182	0.135	0.168	0.201	0.943	1
A1P3	0.202	0.219	0.148	0.157	0.210	0.937	3
A1P4	0.220	0.219	0.147	0.156	0.196	0.938	2
A2P1	0.220	0.190	0.150	0.156	0.197	0.913	8
A2P2	0.212	0.213	0.143	0.170	0.192	0.931	4
A2P3	0.220	0.196	0.143	0.156	0.208	0.923	7
A2P4	0.209	0.208	0.150	0.162	0.199	0.929	5

Overall, the panelists had varying acceptance levels for each alternative product presented. The interaction between the coffee blend formulation and brewing method was the main factor causing the differences in panelists acceptance levels for each attribute. Each variation in the blend interaction has specific flavor characteristics that influence taste and the panelists' preference for the product. Based on the calculations using the SAW method, the best alternative in the hedonic test for each formulation and brewing method of Gayo Arabica coffee is the treatment with the formulation of 25% Timtim + 50% Borbor + 25% Ateng Super using the French press method.

Conclusion

The blend formulation and brewing method of Gayo Arabica coffee affect consumer ratings of the sensory attributes of the coffee infusion, except for flavor. The coffee infusion from formulation A1, consisting of 25% Timtim, 50% Borbor, and 25% Ateng Super, was rated by panelists as having a stronger aroma, body, aftertaste, and overall quality when brewed using the French press method. The infusion from formulation A2, consisting of 50% Borbor and 50% Ateng Super, was rated better when brewed with the French press and V60 methods. The best value based on the SAW method in the hedonic test for each blend formulation and brewing method of Gayo Arabica coffee was treatment A1P2, which corresponds to the formulation of 25% Timtim, 50% Borbor, and 25% Ateng Super brewed using the French press method.

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