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The influence of temperature and duration of brewing on the sensorial value of Gayo Arabica wine coffee, a comparison of hedonic and cupping test methods

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ABSTRACT

Wine coffee tastes different from normal coffee drinks due to the fermentation process. This study conducted various temperatures and durations of brewing with the French press method, and the resulting Gayo Arabica wine coffee drink was analyzed with hedonic and cupping tests. Compared to the hedonic test, the cupping test can detect more accurately the effect of brewing temperature and duration on the organoleptic quality attributes of wine coffee. Based on the hedonic test carried out by semi-trained (ST) panelist, only colour attribute was statistically affected by the treatment. While based on the cupping test conducted by trained panelists of the Gayo Cupper Team, several attributes were statistically influenced by the treatment: flavour, aftertaste, overall and final score. In general, the results of both groups of untrained and trained panellists have a level of preference for the wine and coffee drinks produced. Both selected the same brew at a brewing temperature of 80-90 ^{0}C. This coffee has at least winey, tarty, short notes.

Keywords: Consumers; flavours; french press; hedonic; organoleptic.

1 INTRODUCTION

Coffee drinks have been known for a long time. One of the largest coffee producers is in Brazil, producing 69 million sacks (1 sack 60 kg) in 2020, based on data from ICO. (International Coffee Organization - ICO, 2021). There are many types of Coffea sp, but three are very famous and have a very high selling value: arabica, robusta and liberica. Each of these coffees has its characteristics.

Contrary to normal coffee processing, fermentation is intentionally conducted on red beans to produce wine coffee. This fermentation process is normally carried out for seven days and, in some cases, even for up to 40 days (Dairobbi et al., 2018) During the fermentation process, a taste and odour like wine are produced. Therefore, this type of coffee is called wine coffee (Sulaiman et al., 2022). A good level of coffee quality will have different tastes (Sulaiman et al., 2022).

After fermentation, the coffee is dried, roasted and milled under certain conditions. The level of consumer preference is greatly influenced by fermentation, drying, roasting level, the degree of grinding, and the brewing process. The wine coffee is roasted, which generally can be done in three groups, namely light, medium, and dark roasting (Abubakar et al., 2019).

The coffee brewing process can be done using the French press, drip, steam machine, and others (Angeloni et al., 2019). The brewing method greatly affects the organoleptic value of the wine-coffee drink. Therefore the organoleptic test is required to be conducted, such as the aroma, flavour, aftertaste, acidity, body, balance, sweetness, clean cup, uniformity, overall, and defect. This study aims to see that different degrees of roasting and the length of the fermentation process can affect the taste results that can attract consumers with the comparison of semi-trained and trained panelists.

2 MATERIAL AND METHODS

The materials used were red coffee beans taken from the Gayo highlands at an altitude of 1200 meters above sea level. The selected red beans are then cleaned and fermented at the specified time. Coffee beans are fermented aerobically using plastic media as a wrapper; after fermentation, the coffee beans were dried at room temperature without sunlight until the moisture content of the coffee beans was 11%. Then the coffee beans are hulled and aerated. The next stage of coffee is roasting coffee beans using a Wiliam edition type W3100IR machine. The tools used in brewing and consumer presentation are a French press, cupping spoon, cupping glass, thermometer, pH meter and analytical scales.

This study used a factorial Completely Randomized Design (CRD) with two factors, namely brewing water temperature (T) and brewing duration (W). Since the temperature quickly changed, therefore a range of temperatures was used. The brewing water temperature factor has three levels, namely T1= 60-70 °C, T2= 70-80 °C, and T3= 80-90 °C. The brewing duration factor also has three levels, namely W1 = 2 minutes, W2 = 4 minutes, and W3 = 6 minutes. The number of the experimental unit with three replications amounted to 27 experiments.

2.1 Procedure

This research was conducted through organoleptic testing by serving the coffee using a French press with a size of 360 ml (Angeloni et al., 2019) and (Specialty Coffee Association - SCAA, 2017). The water was heated to 70-80 Celcius, and the temperature was measured using a thermometer; then, 25 grams of lightly roasted coffee wine ground was poured into the carafe. As much as 345 ml of hot water was poured into the carafe with the brewing temperature and the duration according to the treatment; coffee temperature served at 50 celsius, approximately 2 to 4 minutes after brewing. The coffee was stirred slowly until the ground completely dissolved. The coffee plunger was the rod that connected the cover to the filter from the coffee press, and the plunger was pressed down slowly until it touched the very bottom of the chamber, and then the coffee was ready to be served. Samples generated from all treatments were analyzed in the form of an organoleptic test. Two panelists were used, 25 semi-trained panelists and three trained panelists from (Gayo Cupper Team).

2.2 Data analysis

2.2.1 Semi-trained (ST) panelist

A semi-trained panelist analyzed the wine coffee samples with an organoleptic (hedonic) test based on colour, taste, aroma, texture, and aftertaste. This organoleptic test was carried out to determine the preference level of semi-trained panelists who are coffee connoisseurs in Banda Aceh-Indonesia. A questionnaire was given to the panelist with an assessment scale ranging from 1-5: 1 = strongly disliked, 2 = disliked, 3 = neutral, 4 = liked, and 5 = strongly liked. The higher the value given, the higher the panelist's preference for the sample.

2.2.2 Gayo cupper team (GCT) panelist

Trained panelist Gayo Cupper Team (GCT) conducting cupping tests based on aroma, flavour, aftertaste, acidity, body, balance, uniformity, clean cup, sweetness, and overall according to SCAA standards. In This study, the quality of coffee wine produced was observed base on the quality of coffee beans (SCAA, 2017). Three certified coffee graders conducted the cupping test from the Gayo Cupper Team. A cupping test ware conducted on all 27 samples.

The assessment scale of each quality attribute ranged from 1-10. A cupping test is a sensory test based on a complete picture of the properties of the sensory device on the product being tested. The panelist selected to perform this sensory analysis must be well-trained, also known as copper. Coffee taste is very difficult to be measured with tools. Therefore copper as a panelist becomes a benchmark in coffee taste testing, completed with quality attribute guidelines (cupping test) as in Table 1.

Table 1: The quality scale of cupping test assessment attributes (SCAA, 2017).

Quality Scale			
6.00 *(Good)*	7.00 *(Very Good)*	8.00 (*Excellent)*	9.00 *(Outstanding)*
6.25	7.25	8.25	9.25
6.50	7.50	8.50	9.50
6.75	7.75	8.75	9.75

The research data obtained were then analyzed using Analysis of Variance (ANOVA). If there is a real effect on the treatment, then the analysis is continued by using further tests, namely DMRT (Duncan Multiple Range Test)

3 RESULTS

a. Organoleptic (Hedonic) Test by Semi-Trained (ST) Panelist

The development of the organoleptic test by a semi-trained panelist is presented in Table 2.

The results showed that the right temperature for serving coffee wine using a French press was at a brewing temperature of 70-80 °C with different brewing durations, depending on the desired organoleptic quality parameter (Batali et al., 2020). The results showed that the interaction effect between temperature and brewing duration on colour (hedonic test) (values followed by the same letter indicate no significant difference, this can be seen in Figure 1.

b. **Cupping Test by Gayo Cupper Team (GCT) Panelist**

The results of the cupping test conducted by the Gayo Cupper Team (GCT), can be seen in Table 3, with brewing conditions for aroma, flavour, aftertaste, acidity, body, balance, uniformity, clean cup, sweetness, overall, and final score.

After the cupping test process is carried out, then the results of the cupping records are collected, the results of this cupping can be seen in Table 4. The results of tests carried out with statistics show the interaction of the interaction factors of temperature and brewing duration on taste (cupping test) can be seen in Figure 2.

All samples brewed at a temperature of 60-70 °C (T1) with a brewing duration of either 2, 4, or 6 minutes had no winey notes detected. However, wine coffee with brewing temperatures of 70-80 °C (T2) and 80-90 C (T3) got winey cupping notes, respectively. Furthermore, wine coffee with a brewing temperature of 70-80 °C (T2) with a brewing duration of 2, 4, and 6 minutes had gummy cupping notes, making them different from others. Finally, wine coffee with a brewing temperature of 80-90 °C (T3) and a brewing duration of 2, 4, and 6 minutes is characterized by tarty and short cupping notes. According Figures 3, 4,

and 5 show that the brewing time on aftertaste, overall and Final Score showed non-significant differences in levels. However, these results show an increasing trend value. The final score shows that the brewing time value of 2 minutes is different from 4 and 6 minutes, but 4 and 6 minutes show the same value.

Table 2: Result of the organoleptic (hedonic) test with score (1-5).

Sample	T1W1	T1W2	T1W3	T2W1	T2W2	T2W3	T3W1	T3W2	T3W3
Brewing condition	60-70°C 2 minute	60-70°C 4 minute	60-70°C 6 minute	70-80°C 2 minute	70-80°C 4 minute	70-80°C 6 minute	80-90°C 2 minute	80-90°C 4 minute	80-90°C 6 minute
Aroma	2.64	2.85	2.69	2.67	2.71	2.81	2.69	2.67	2.65
Texture	3.08	3.31	3.35	3.35	3.32	0.14	3.35	3.31	3.88
Color	2.89	3.35	3.33	3.37	3.37	3.31	3.45	3.47	3.49
Flavor	3.31	3.41	3.48	3.42	3.52	3.48	3.48	3.47	3.49
Aftertaste	2.87	3.31	3.25	3.24	3.09	3.13	3.16	3.19	3.20

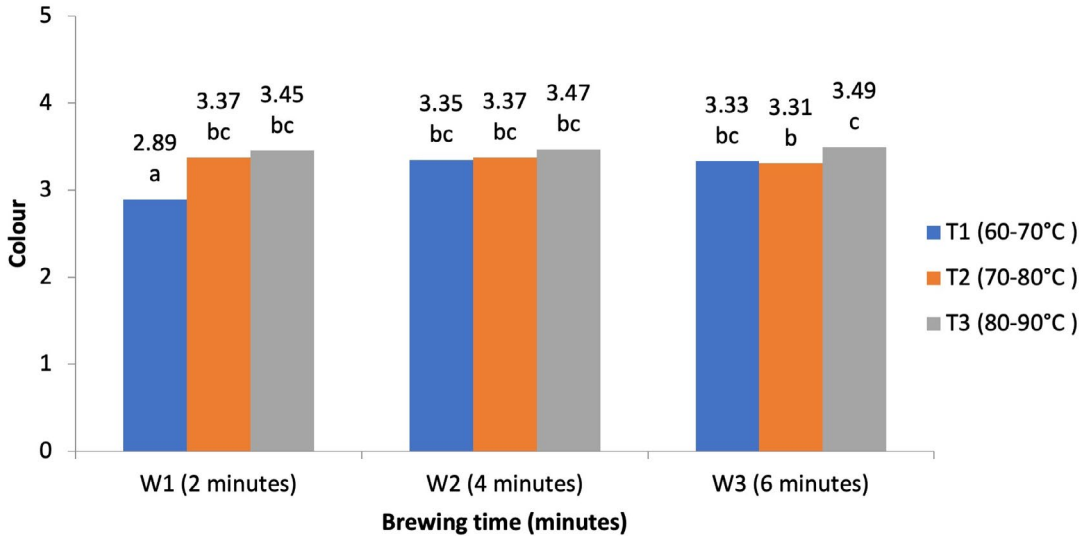

Figure 1: Effect of interaction between temperature and brewing duration on colour (hedonic test) (value followed by the same letter shows no significant difference, DMRT value 0.05 level P2 = 0.1499, P3 = 0.1573, P4 = 0.1620, P5 = 0.1652, P6= 0.1675, P7= 0.16941, P8= 0.1701, P9= 0.1718).

Table 3: Result of the Gayo Cupper Team (GCT) with a score (1-10).

Sample	T1W1	T1W2	T1W3	T2W1	T2W2	T2W3	T3W1	T3W2	T3W3
Brewing condition	60-70 °C 2 minute	60-70 °C 4 minute	60-70 °C 6 minute	70-80 °C 2 minute	70-80 °C 4 minute	70-80 °C 6 minute	80-90 °C 2 minute	80-90 °C 4 minute	80-90 °C 6 minute
Aroma	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Flavor	7.00	7.08	7.08	7.25	7.58	7.58	7.66	7.50	7.66
Aftertaste	6.66	6.92	7.00	7.00	7.17	7.17	7.08	7.42	7.50
Acidity	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Body	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Balance	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Uniformity	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Clean cup	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Sweetness	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Overall	7.00	7.00	7.08	7.17	7.42	7.42	7.42	7.50	7.66
Final Score	8.02	80.50	8.07	8.09	8.16	8.17	8.17	8.19	8.23

Table 4: The result of the cupping notes.

No	Sample	Brewing condition	*Cupping notes* result
1	T1W1	60-70°C (2 minute)	*Fruity, flat, clean*
2	T1W2	60-70°C (4 minute)	*Fruity, flat, nutty, clean*
3	T1W3	60-70°C (6 minute)	*Fruity, flat, greenish, clean*
4	T2W1	70-80°C (2 minute)	*Winey, tarty, short, sour, gummy*
5	T2W2	70-80°C (4 minute)	*Winey, good, gummy*
6	T2W3	70-80°C (6 minute)	*Winey, better, gummy*
7	T3W1	80-90°C (2 minute)	*Winey, tarty, short, sour, mango*
8	T3W2	80-90°C (4 minute)	*Winey, tarty, short, sour, mango, guava*
9	T3W3	80-90°C (6 minute)	*Winey, tarty, short, smooth, salty, underripe*

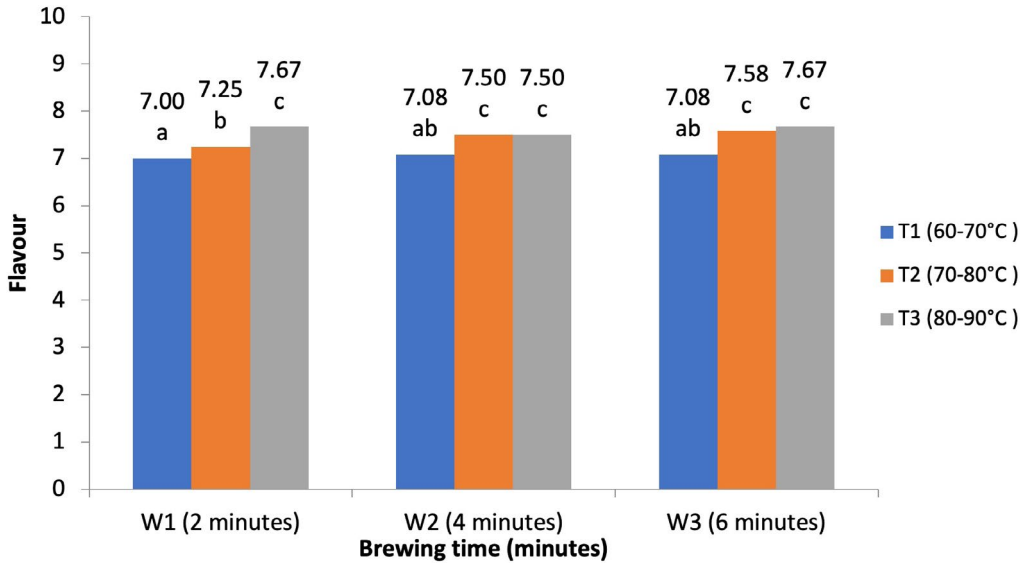

Figure 2: The effect of the interaction factor of temperature and brewing duration on flavour (cupping test) (the value followed by the same letter indicates a non-significant difference in level, DMRT0.05 value P2 = 0.1845, P3 = 0.1936, P4 = 0.1998, P5= 0.2033, P6= 0.2062, P7= 0.2084, P8= 0.2101, P9= 0.2114).

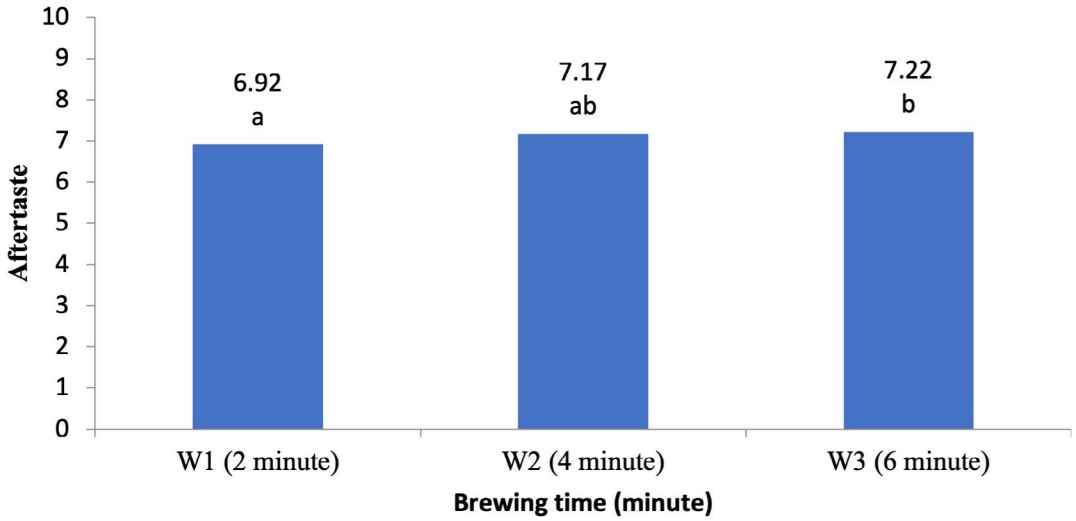

Figure 3: Effect of brewing time on aftertaste (values followed by the same letter indicate differences in levels that are not significant) DMRT0.05 level P2 = 0.2021, P3 = 0.2120.

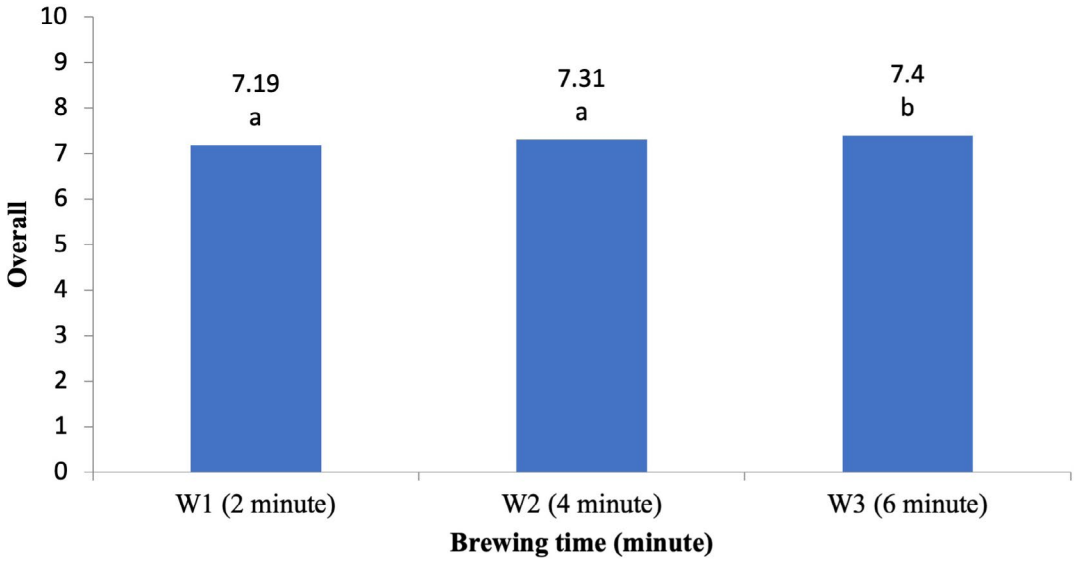

Figure 4: The effect of brewing time on overall (values followed by the same letter indicate differences in levels that are not significant) DMRT0.05 level P2 = 0.2021, P3 = 0.2120.

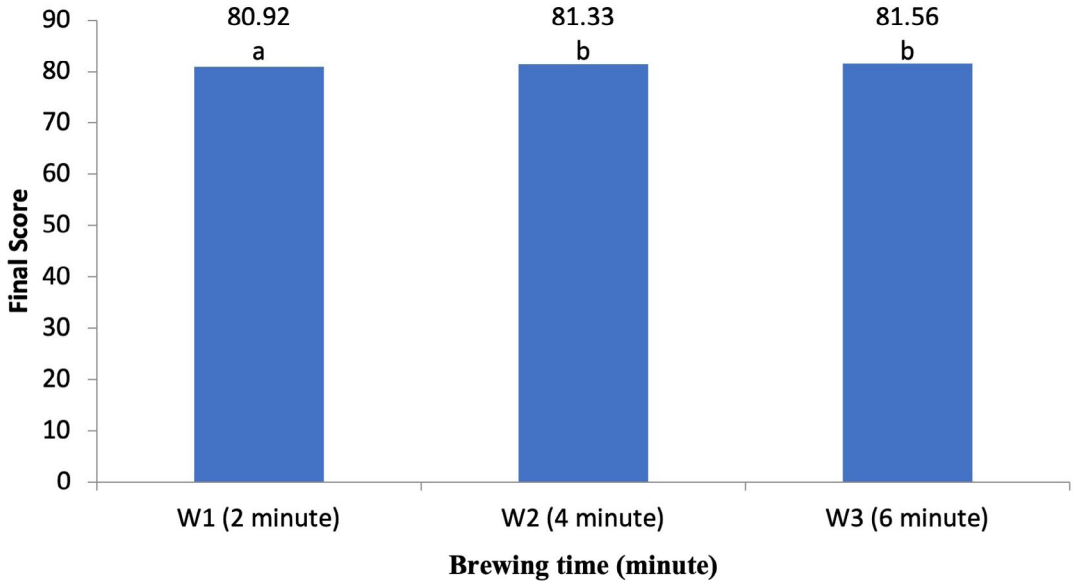

Figure 5: The effect of brewing time on the final score (values followed by the same letter indicate differences in levels that are not significant) DMRT0.05 level P2 = 0.3957, P3 = 0.4152.

4 DISCUSSION

4.1 Organoleptic (Hedonic) Test by Semi-Trained (ST) Panelist

The resulting data (Table 2) shows that the brewing temperature according to consumer preferences (hedonic test) is 70-80 °C with a brewing duration of 2, 4, and 6 minutes. Getting wine coffee with the highest colour and flavour scales of organoleptic quality parameters required 4 minutes of brewing. However, it took only 2 minutes of brewing duration for texture and aftertaste. To get the distinctive aroma of coffee wine, it took 6 minutes of brewing duration so that the aroma produced would be maximal.

Colour

Based on further testing of DMRT 0.05, as seen in Figure 1, the lowest colour scale was obtained by T1W1 wine coffee (brewing temperature 60-70 °C, brewing duration 2 minutes), which was 2.89. On the contrary, the highest colour scale was obtained by T3W3 wine coffee (brewing temperature 80-90 °C, brewing duration 6 minutes), which was 3.49. As shown in Figure 1, The higher the temperature

and the time of brewing, the more the panelists' preference for the colour of wine coffee also increases. This is presumably because more substances are extracted with the higher temperature and the brewing time. The colour of wine coffee can be influenced by the climate of the production area, coffee variety, maturity level, or aging. This aging can be exemplified during fermentation while setting the rod beans in a container (Wintgens, 2012).

Flavour

The result of the semi-trained panelists' assessment showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the flavour of wine coffee. However, according to (Sunarharum; Farhan, 2020), the difference in sensory quality of coffee is caused by many factors, such as coffee variety, geographical location, climate, altitude, processing methods, post-harvest handling, storage and roasting processes. (Fadhil et al., 2021).

Aroma

The aroma of coffee generally arises from roasting. (Fitriyah et al., 2021) added that the aroma that appears after roasting is caused by fermentation and the presence of enzymes that help reduce the acidity of the coffee, resulting in a pleasant aroma when brewed. Two compounds affect steeping coffee's taste: volatile and non-volatile compounds. Volatile compounds are compounds that easily evaporate and emit the original aroma of the product compound; this can affect the aroma of roasted coffee as for non-volatile compounds, namely compounds that play a role in the taste of steeping coffee, such as caffeine and protein. Thus, the panelist's preference for the aroma of coffee wine in this study (2.64 – 2.85) is more related to the roasting process. A very strong aroma is smelled when the coffee is roasted at temperatures above 200°C, but the roasting process can reduce the levels of chlorogenic acid. The darker the colour of the roasted coffee beans, the lower the chlorogenic acid content. (Belay; Gholap, 2019).

Texture

The result of the semi-trained panelists' assessment showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the texture of wine coffee. The texture results from a combination of several physical properties, namely size, shape, amount, and other elements that can be felt by the senses of touch and taste, including the importance of taste and sight. (Midayanto; Yuwono, 2014). Food products' texture forms the physical stimuli between the oral cavity and food products. In the hedonic test, the surface is assessed as the thickness or body felt by the panelist while drinking the coffee.

Aftertaste

The results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the aftertaste of wine coffee. The lowest aftertaste value was 2.87, and the highest was 3.31 (neutral). The aftertaste is the taste produced after drinking coffee. This research showed that the aftertaste of wine coffee is still in the normal category.

4.2 Cupping Test by Gayo Cupper Team (GCT) Panelist

The cupping test conducted by the Gayo Cupper Team panelist ensures that the wine coffee is acceptable to consumers. The panelist is well-trained. The cupping test can produce a final score that will determine the quality level of the coffee being tested.

Aroma

Aroma is the odour possessed by a beverage or food product that is sourced from the volatile compounds that the product has. Aroma plays an important role in the food industry as a trigger for flavoring to increase consumer interest. Organic acids play an important role in forming the aroma and taste of coffee. The higher organic acid in Gayo arabica coffee allows Gayo arabica coffee to be better than Javanese arabica coffee (Saputri et al., 2020).

All wine coffee samples got the same aroma value of 7.50. Based on the quality scale of cupping test assessment attributes (Table 3), all samples were included in the very good quality category. However, the results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the aroma of wine coffee. The variance results showed the temperature and brewing time factors and their interaction.

As seen in Table 4, the wine coffee samples with a brewing temperature of 60-70˚C (T1) at 2, 4, and 6 minutes of brewing duration got the same notes regarding fruity and flat. Fruity is included in the enzymatic aroma of the coffee, while other examples of enzymatic aroma are flowery and herby. Fruity notes can be caused by the height of the coffee growing area (Seninde; Chambers, 2020) and the bean samples in this research were from a room with an altitude of 1200 m above sea level.

Only coffee wine samples brewed at a temperature of 60-70 C (T1) produced flat notes. The flat is caused by several factors, such as long storage beans, bad storage conditions, and the volatile compounds in the coffee that have been evaporated. In addition, the temperature can also affect the flatness of wine coffee. This happens in the roasting process, which can be called under development. This occurs at a too-high temperature and causes the outside coffee beans to burn while the inside is still not cooked enough.

Further, in Table 4, the wine coffee samples with a brewing temperature of 70-80˚C (T2) at 2, 4, and 6 minutes of brewing duration got the same notes in terms of winey. Winey is an aroma that arises because of wine coffee's sour taste or acidity. Winey is also defined as fruit ripeness that is suitable and delicious in coffee.

The wine coffee samples with a brewing temperature of 80-90˚C (T3) and a brewing duration of 2.4 and 6 minutes got the same notes of winey and tarty. Tarty is explained as the sharp sour aroma of brewing coffee (Sulaiman et al., 2022). This is a delicious taste and often appears in wine and coffee.

Flavour

The flavour is a complete and intact stimulus from a combination of taste, aroma, texture, and mouthfeel (Sunarharum; Farhan, 2020). The flavour value of wine coffee in this research ranged from 7.00 – 7.66. Based on the quality scale of cupping test assessment attributes (Table 4), all samples were included in a very good quality category regarding their flavour.

As can be seen in Figure 2, the lowest flavour scale was obtained by T1W1 wine coffee (brewing temperature 60-70˚C, brewing duration 2 minutes), which was 7,00. However, this score, based on further testing of DMRT 0.05, is no different from T1W2 and T1W3. On the contrary, the highest colour scale was obtained by T3W1 wine coffee (brewing temperature 80-90˚C, brewing duration 2 minutes) and T3W3 (brewing temperature 80-90˚C, brewing duration 6 minutes), which was 7.67. Based on further testing of DMRT 0.05, this score is no different from T2W2, T2W3, and T3W2.

One of the factors that affect the flavour of coffee is multisensory perception. Multisensory perception interprets food products involving the human senses; a harmonious atmosphere affects the hedonic responses to food and drink. The taste of coffee is influenced by the planting period until the final phase, namely brewing. Volatile acids in coffee can affect flavour, especially from the aroma released, including carboxylic acids, phenolic acids, and other acids that are formed during the roasting process (Purnamayanti et al., 2017) and extracted during the brewing process. According to Sunarharum and Farhan (2020), the quality of the taste of good coffee can be described from the combination of flavours, aromas, and bodies that complement each other as well as complementary stimuli and pleasant stimuli when the coffee is drunk.

Aftertaste

The aftertaste value of wine coffee in this research ranged from 6.66 – 7.50. The brewing temperature has a significant effect on the aftertaste of coffee wine. The lowest value is given for coffee wine with a brewing temperature of 60-70˚C (T1), while the highest is for a brewing temperature of 80-90˚C (T3). Based on the quality scale of cupping test assessment attributes (Table 4), all samples were included in the good-very-good quality category regarding their aftertaste.

According to Figure 3. Brewing duration tends to give increase the aftertaste of coffee wine. The aftertaste value given to wine coffee with a brewing duration of 6 minutes (W3) is 7.22, significantly different from the lowest W1 one (brewing duration of 2 minutes), which is 6.92. The temperature, time, and pressure applied during brewing are critical points that need to be considered in brewing techniques (Fibrianto; Ramanda, 2018).

Acidity

Based on the Cupper in Gayo Cupper Team, the acidity of wine coffee in this study was included in the very good category. Acidity describes acid as a preferred taste and sour as a disliked taste. Acidity in coffee is characterized by the sweet, delicious, and fresh fruit taste when sipping coffee (SCAA, 2017)

Body

The body is a heavy or light sensation felt by the mouth, especially the tongue and the roof of the mouth; this is a combination of oil suspended in liquid and dissolved solids in the material (SCAA, 2017). All wine coffee samples got the same body value, namely 8.00. Based on the quality scale of cupping test assessment attributes (Table 3), all samples were included in the excellent quality category regarding their flavour. However, the results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the body of wine coffee.

Balance

Balance balances various aspects, namely flavour, aftertaste, acidity, and body (SCAA, 2017). All wine coffee samples got the same balance value, namely 7.00. Based on the quality scale of cupping test assessment attributes (Table 4), all models were included in the very good quality category regarding their balance. The variance results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the balance of wine coffee.

Uniformity

Uniformity is the uniformity of aroma and taste in every drink cup (SCAA, 2017). All wine coffee samples got the same uniformity value, namely 10.00. Based on the quality scale of cupping test assessment attributes (Table 3), all samples were included in the outstanding quality category regarding their uniformity. The variance results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the uniformity of wine coffee.

Clean cup

The clean cup shows no negative values from the beginning, from taste to aftertaste (SCAA, 2017). All wine coffee samples got the same pure cup value, namely 10.00. Based on the quality scale of cupping test assessment attributes (Table 4), all samples were included in the outstanding quality category regarding their clean cup value. The variance results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the clean cup of wine coffee.

Sweetness

Sweetness is the sensation of pleasant sweetness in coffee caused by the sweetness of carbohydrates (SCAA, 2017). All wine coffee samples got the same sweetness value, namely 10.00. Based on the quality scale of cupping test assessment attributes (Table 4), all samples were included in the outstanding quality category regarding their sweetness. The variance results showed that the brewing temperature and duration factors and their interaction had no significant effect ($P > 0.05$) on the sweetness of wine coffee.

Overall

Overall, the panelist Field SCAA (2017) assesses the aspects of the coffee (SCAA, 2017). The overall value of wine coffee in this research ranged from 7.00 – 7.66. Based on the quality scale of cupping test assessment attributes (Table 3), all samples were included in the very good quality category regarding their overall value. The variance results showed that the temperature and brewing duration had a significant effect ($P \leq 0.05$) on the overall value of wine coffee. However, the interaction of both factors did not significantly impact ($P > 0.05$).

The higher the brewing temperature, the overall value of the wine coffee tends to increase; According to the DMRT 0.05 test results, there was no difference between the overall values of T2 and T3. The lowest overall value was wine coffee with a brewing temperature of 60-70˚C (T1). The high temperature and pressure can extract more water-soluble components, such as caffeine, chlorogenic acid, nicotinic, melanoidin, and volatile hydrophilic compounds (Vignoli et al., 2014).

The multisensory perception of coffee can also be influenced by various aspects, such as coffee variety, storage conditions, roasting temperature, grinding process, brewing method, and brewing water temperature (Ross et al., 2006).

The higher the brewing duration, the overall value of the wine coffee also tends to increase. The overall value of wine coffee with a brewing time of 6 minutes (W3) was 7.40 (Figure 4). This was significantly different from the lowest overall value for brewing duration of 2 minutes (W1) and 4 minutes (W2), which were 7.19 and 7.31, respectively. At the same time, the overall value of W1 is not different from W2.

Final score

The final score of wine coffee in this research ranged from 80.02 to 82.23 show in figure 5. According to (Meilgard et al., 2006), Arabica coffee, with a final score of > 80.00, is categorized as specialty coffee, and identical to that of Robusta coffee, it is classified into the fine robusta category. The variance results showed that the temperature and brewing duration had a significant effect ($P \leq 0.05$) on the final score of wine coffee. However, the interaction of both factors did not significantly impact ($P > 0.05$).

The higher the brewing temperature and brewing duration, the higher the final score of the wine coffee in this study; however, based on further testing of DMRT 0.05, there was no difference between T2 (brewing temperature 70-80˚C) and T3 (brewing temperature 80-90˚C), as well as between W2 (brewing duration 4 minutes) and W3 (brewing duration 6 minutes).

4.3 Comparison of the result of the Hedonic and Cupper Test

Based on the hedonic test carried out by semi-trained panelists, the treatment statistically affected only colour attributes. The most preferred colour was the interaction of T3W3 (brewing temperature 80-90˚C, brewing duration 6 minutes). This is presumably because more substances are extracted with the highest temperature and brewing time. Melanoidin is one of the substances responsible for the colour of coffee (Grainger et al., 2009).

Based on the cupping test conducted by trained panelists of the Gayo cupper team, there are several attributes of wine coffee which statistically influenced by the treatment, namely flavour, aftertaste, and overall and final score. The highest colour scale was obtained by the interaction of T3W1 (brewing temperature 80-90˚C, brewing duration 2 minutes) and T3W3 (brewing temperature 80-90˚C, brewing duration 6 minutes). Regarding aftertaste, the highest scale was obtained by T3 (brewing temperature of 80-90˚C) and W3 (brewing duration of 6 minutes), respectively. Regarding overall value, the highest ranking was obtained by T2 (brewing temperature 80-90˚C) and T3 (brewing temperature 80-90˚C), as well as W2 (brewing duration 4 minutes) and W3 (brewing duration 4 minutes). Regarding the final score, the highest scale was obtained by T3 (brewing temperature of 80-90˚C) and W3 (brewing duration of 6 minutes), respectively.

5 CONCLUSIONS

Compared to the hedonic test, the cupping test can detect more accurately the effect of brewing temperature and brewing duration on the organoleptic quality attributes of wine coffee. Based on the hedonic test carried out by semi-

trained panelists, the treatment statistically affected only colour attributes. While based on the cupping test carried out by trained panelists of the Gayo cupper team, there are several attributes of wine coffee which statistically influenced by the treatment, namely flavour, aftertaste, and overall and final score. Generally, semi-trained and trained panelists prefer wine coffee produced at a brewing temperature of 80-90 ^{0}C. This sample has at least winey, tarty, short notes.

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7 AUTHORS' CONTRIBUTION

IS wrote the manuscript and performed the experiment, **IF** supervised the experiment and co-worked the manuscript, and **IS** reviewed and approved the final version of the work, **RS** conducted all statistical analyses.

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