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# Physical Characteristic and Sensory Profile of Lampung Robusta Coffee at Various Roasting Degree

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**Abstract**

Lampung Robusta coffee is one of the valuable commodities in Indonesia. It also has a critical role in the national and international coffee trade. Numerous studies have explored the roasting process and its impact on coffee quality, highlighting its importance in determining physical and sensory attributes. This study investigates Lampung Robusta coffee's physical and sensory changes subjected to varying roasting degrees, including City roast (light roast), Full City roast (medium roast), and Italian roast (dark roast). The findings show that roasting levels significantly affect moisture content, colour, bulk density, total dissolved solids (% TDS & % Brix), and pH, with p-values <0.05. Sensory analysis shows that each roasting degree creates different sensory profiles, especially aroma. City roast has nutty aromas, Full City roast has floral, smokey, and earthy aromas, while Italian roast has chocolate and spices aroma. These attributes differ from ideal coffee attributes with herbal, caramel, and fruity aromas. The ideal product also described has a sweet taste, medium body, acidic aftertaste, and sweet aftertaste. These results provide a valuable reference for optimizing Lampung Robusta coffee's roasting process and product development to achieve consumer-preferred characteristics.

**Keywords:** Coffee, physical, roasting, Robusta, sensory

## INTRODUCTION

Robusta's adaptability to different climates and its role in specific coffee blends significantly increase its presence in the global market, as it now supplies 40% of the world's coffee. It is particularly vital in emerging markets and for home espresso blends in developed countries (Campuzano-Duque *et al*., 2021; Kath *et al*., 2020). However, Robusta coffee is often characterized by a stronger, more bitter flavour than Arabica coffee, which tends to be less appealing to many coffee consumers who consume single-origin coffee. The level of bitterness in Robusta coffee is strongly related to its higher caffeine content and lower sugar levels (Fioresi *et al*., 2021; Privat *et al*., 2008). Additionally, Robusta coffee contains considerable amounts of chlorogenic acids (CGAs), which are also linked to sensory attributes most people avoid, such as astringency and bitterness. Interestingly, the concentration of these acids is more influenced by the roasting level than the coffee variety itself, as prolonged roasting decreases CGAs, altering the sensory experience (Yeager *et al*., 2021).

In Indonesia, Robusta coffee stands out as a significant agricultural product, particularly in Lampung Province, one of the country's largest coffee-producing regions. It is recognized for its robustness to various environmental stresses while growing and significantly impacts the local economy and farmers livelihoods (Sudirman *et al*., 2021). Moreover, Robusta coffee in Lampung plants are a selected variety, harvested manually with a minimum proportion of 95% red cherries. This harvesting method produces high-quality coffee with a distinctive sensory profile (MIG-KRL, 2013). Furthermore, Lampung Robusta coffee is a significant source of anti-oxidant compounds coming from alkaloids, flavonoids, tannins, and phenolics, contributing to its health benefits and potential protective effects against various diseases for coffee consumers. Notably, its antioxidant activity stands out, demonstrated by an $IC_{50}$ value of 73.679 ppm, highlighting significant potential health benefits for coffee drinkers (Khairani *et al*., 2024).

Many factors influence the final quality of coffee, ranging from cultivation, post-harvest processing, and roasting to brewing. Among all these stages, roasting is one of the key processes that determines the coffee's sensory, physical, and chemical quality. A study by Ramanda *et al.* (2024) found that roasting temperature changes ash content, moisture content, and pH. That transformation ultimately shapes the coffee's taste and aroma. The roasting process also creates approximately 1,000 different aroma compounds, contributing to coffee's distinctive flavour, which gives the coffee drinking experience for consumers. The way coffee flavours are described can significantly affect consumer imagery, desire to taste, and willingness to pay. Descriptive language can help consumers imagine flavours more vividly, influencing their purchasing decisions (Hazebroek & Croijmans, 2021).

Roasting alters key physical properties such as moisture content, colour, and particle size. Lighter roasting degrees are associated with better physical attributes and longer shelf life (Nakilcioðlu-Taþ & Ötleþ, 2019). Both the roast degree and roasting time significantly influence flavour. For instance, darker roasts and longer roasting times enhance bitterness while reducing acidity, fruitiness, and sweetness. The development time after the first crack, which refers to the time it takes for the coffee beans to reach a certain level of the roast after the first audible crack during roasting, has been identified as particularly critical for flavour (Münchow *et al*., 2020). Moreover, the degree of roasting significantly impacts the sensory quality of Robusta coffee, where the medium roasting degree has proven to enhance its sensory profile, especially when blended with Arabica coffee, as this combination improves the overall taste and aroma (Abubakar *et al*., 2020). Coffee consumers generally prefer to consume coffee roast at a medium level for their balanced flavour profile, including floral and fruity notes (Hu *et al*., 2020; Zhang *et al*., 2024). Based on various references and previous studies, the roasting degree gives significant impacts to coffee's physical and sensory properties, affecting consumer acceptance.

Despite Lampung Robusta coffee being a key commodity in Indonesia, and some studies have already evaluated the effect of different roasting temperatures, there remains limited information on how varying roasting degrees influence its physical and sensory characteristics. This insufficient knowledge challenges optimizing coffee quality to meet diverse consumer preferences. Therefore, the current study aimed to assess physical changes—such as moisture content, colour, bulk density, TDS (% TDS & % Brix), pH, and the sensory attributes resulting from different roasting degrees. Sensory analysis also emphasizes identifying the ideal sensory attributes of coffee that align with consumer preferences. This research may benefit by ensuring the production of high-quality Lampung Robusta coffee tailored to market demands.

## MATERIALS AND METHODS

### Materials

The research was conducted at "Laboratorium Terbaru" Food Science and Technology programme, Universitas Bakrie, Kallos Coffee Roastery and PT Selera Indah Perdana which was carried out from November 2023 to July 2024. The research used a completely randomized design, with the observed factor being the roasting level of Lampung Robusta coffee with three variations: City roast (light roast), Full City roast (medium roast), and Italian roast (dark roast). The selection of these three roasting degrees is based on the recommendations of the roaster, taking into account the characteristics of the green beans such as its density (664 g/L) and its initial moisture content (12%). Testing of physicochemical properties was carried out with three replicates for each sample. First grade green beans were obtained from Ulubelu District, Tanggamus Regency, Lampung Province which was harvested in August 2023 and processed with natural method.

### Methods

#### *Sample Preparation*

Roasting was done in three batches using a Maestro Coffee Roaster Machine with a maximum capacity of 5 kg. Roasting process each batch was about 2,5 kg. Then, roasted coffee was kept at room temperature for a few minutes until it was stable. After resting, the sample was put into a vacuum package and stored in a container before grinding. According to the SCA procedure, grinding was carried out until a particle size of 70-75% passes through a 20 mesh sieve (840 microns). This size was not overly fine or coarse, so it was generally easier to control brewing conditions. The brewing method followed the SCA test protocol with a minimum water temperature of 93 $^{o}$C and a water-to-coffee powder ratio of 150 mL: 8.25 g. There was improvisation in this technique where the filter was used to obtain a clearer sample. The usage of filter will not interfere with the evaluation as the panellists did not use the SCA form when conducting the sensory evaluation.

### Physical and Sensory Analysis

A 1-2 g sample was used to analyze moisture content. Then, the sample was dried using an oven at 105 $^{o}$C for 3 hours. After that, the sample was chilled in the desiccator and was weighed regularly until a constant weight was obtained. The colour of coffee beans is measured by the SCA Roast Color Classification System (Rabelo *et al*., 2021) using the Lebrew Agtron Meter. Agtron value testing is carried out on roasted coffee beans. The sample is placed on the test cup; then, the device is set to perform the test until the Agtron value is visible on the LCD screen. The bulk density of green beans and roasted coffee is calculated by measuring mass and volume, with the bulk density of coffee calculated as a function of mass per unit of volume. TDS and Brix tests are analysed using the Japan Pocket Brix and TDS Refractometer—Atago Pal-Coffee (BX/TDS). At the same time, acidity (pH) is measured by a pH meter at room temperature.

The sensory test uses the Check All That Apply (CATA) method (Ares *et al.,* 2014). The Check-All-That-Apply (CATA) method is a popular tool in sensory analysis for identifying ideal product attributes by allowing consumers to select applicable sensory descriptors from a list. This method is used to gather insights into consumer preferences and perceptions of product attributes. The method is a structured questionnaire used to evaluate the quality of coffee and other food products. Thirty-two untrained panellists (representing consumers) select terms from a list that are relevant to the sample being evaluated. The panellists are also asked to identify the sensory attributes considered ideal for coffee quality. The sensory attributes of coffee parameters include taste, aroma, body, and aftertaste.

### Statistical Analysis

Statistical data analysis is carried out using the Analysis of Variance (ANOVA) method and partial correlation analysis between parameters using the SPSS version 16.0 program. Then, the Least Significant Difference (LSD) further test is carried out to determine the differences between treatments and if the analysis results obtained had a significant difference at $p \leq 0.05$ (Rabani & Fitriani, 2022). Furthermore, the XLSTAT software is used to analyse sensory data. Principal Coordinate Analysis (PCA) was used to illustrate the relationship between sensory profiles and the ideal sensory attribute criteria expected by the panellists (consumers).

## RESULTS AND DISCUSSIONS

### Physical Characteristic of Roasted Coffee

The physical characteristics of the coffee are presented in Table 1. In general, various roasting degrees significantly influence (with a p-value <0.05) the value of colour, bulk density, TDS (% TDS & % Brix) and pH. The data presents consistent trends that align with the typical effects of roasting on physical change of coffee. Darker roasts (e.g., Italian Roast) has lowest moisture content, darkest color, lowest bulk density, and highest TDS (% TDS & % Brix) and pH value. These physical changes indicate transformations due to numerous reactions during roasting, such as evaporation, Maillard reactions, caramelization, and pyrolysis.

Research data demonstrate that the trend of moisture content value indicates that as the roasting level intensifies, the moisture content of roasted coffee beans decreases;

Table 1. Physical characteristic of Lampung Robusta coffee

| Physical characteristic | City roast | Full City roast | Italian roast |
|---|---|---|---|
| Moisture content (%) | 1.51 ± 0.50 [a] | 0.89 ± 0.21 [ab] | 0.74 ± 0.03 [b] |
| Color (Agtron value)* |  63.7 ± 7.9 [a] |  51.6 ± 3.2 [b] |  30.8 ± 1.9 [c] |
| Bulk density (g/L) | 390.03 ± 15.07 [a] | 335.80 ± 13.69 [b] | 283.50 ± 3.09 [c] |
| TDS (%) | 1.08 ± 0.04 [a] | 1.28 ± 0.02 [b] | 1.43 ± 0.03 [c] |
| Brix (%) | 1.36 ± 0.05 [a] | 1.62 ± 0.03 [b] | 1.79 ± 0.04 [c] |
| pH | 5.57 ± 0.07 [a] | 5.73 ± 0.16 [a] | 6.08 ± 0.07 [b] |

Note : Different letters indicate significant differences.
*Agtron scale of Lebrew Agtron Meter for City roast is 55–65, Full City roast is 45–55 and Italian roast is 25–35.

these phenomena are likely due to prolonged exposure to heat, which evaporates the amount of water from the coffee bean. The reduction of moisture content is also associated with increasing the value of brittleness and fragility of the beans (Yusibani *et al*., 2023). The water component in coffee beans begins to evaporate in the initial phase of roasting, where free water will evaporate first. Then, in the first crack phase, bound water will evaporate. Evaporation of water in roasting produces vapor in the form of gas. The amount of gas will increase as the roasting temperature increases, increasing the pressure in the coffee bean cells, which causes cracks during the roasting process. This phase is crucial for determining the roast degree and is often used as a marker for transitioning from the drying phase to the development phase of roasting (Münchow *et al*., 2020; Yergenson & Aston, 2020).

Table 1 show that the colour represents a clear pattern of decreasing Agtron value as the roasting process increases. Multiple hypotheses have been proposed to explain the mechanisms responsible for the colour modification of coffee beans during roasting. Widely accepted theory describes that the first phase of roasting is the evaporation of certain compounds that are most sensitive to heat such as volatile compounds and water. This phase is marked with the change of colour of the green bean to pale yellow. At this moment, the Maillard reaction begins to occur which will form a brown colour. This reaction will then continue in the second phase, which is the initial stage of roasting where sucrose will decompose into glucose and fructose, then react with free amino acids and amino acids derived from protein degradation. The full brown color of the coffee beans will then be formed in the first crack phase or the second stage of roasting. Followed by the second crack stage, the color of the beans will change to dark brown. The color of the beans will change to a blackish brown color as the amount of cellulose compounds (complex carbohydrates) in the cell increases (Asiah *et al*., 2023). In addition, the Maillard reaction, caramelization, and pyrolysis are key chemical processes that contribute to the color change during roasting. These reactions involve interactions between sugars and amino acids, leading to the formation of brown pigments and affecting the aroma and flavour of the coffee (Mehaya & Mohammad, 2020).

The data also highlights a noticeable bulk density shift occurring between roasting levels. As the roasting temperature increases, the bulk density of coffee beans decreases. Studies explore the loss of moisture and other volatile compounds during roasting (Odžakoviæ *et al*., 2019; Yusibani *et al*., 2023). The porosity of roasted coffee beans increases with roasting, which is related to the expansion and structural changes in the beans as loss of moisture content and other volatile components (Yusibani *et al*., 2023). Coffee beans mass decreases, and volume increases starting from the first phase, the drying stage. The volume of coffee beans will expand and cause the rupture of weak cell walls in the first crack phase due to the evaporation of bound water in coffee bean cells. In the first crack phase, pyrolysis also occurs, which is the decomposition of organic compounds such as chlorogenic acid and trigonelline into fractions of simple carbon compounds in the gas or solid phase. The gas from the pyrolysis reaction will then remain in the strong cell walls of the coffee beans. The gas pressure will increase with increasing roasting temperature and time, eventually breaking down the cell wall (Asiah *et al.*, 2023). The result of bulk density in line with research that has been done by Yulianti *et al*., 2023, where the bulk density of Robusta coffee beans ranges from 309 to 357 g/L, depending on the roasting method and roasting duration.

The roasting degree significantly affects the physicochemical properties of roasted coffee beans, including TDS and Brix values. TDS and Brix values have an almost linear correlation where the TDS value is equal to 0.85 Brix value (Gomez, 2019). Liang *et al.,* (2021) stated that TDS is a good indicator of coffee quality, where the TDS value of good coffee is in the range of 1.25%. This value is quite the similar with TDS value of Lampung Robusta coffee. The data also shows that the TDS and Brix values increase with the higher roasting rate due to the chemical composition of the coffee changes, impacting these measurements (De Oliveira Silva *et al*., 2024). At the same mass coffee bean, a darker roasting level has a larger surface area, which means more possibility of contact with hot water during the brewing process. In addition, during the roasting process, the mass of the coffee will decrease, and the volume will increase, causing the coffee beans to become more porous. High porosity indicates the opening of cells in coffee beans, which affects the solubility rate of solids during the brewing process. Porosity can also be an intrinsic property that maps physical properties affected by extraction (Al-Shemmeri *et al*., 2024).

Table 1 illustrates the shift of pH value that indicates reduced acidity with increasing roasting intensity. The change in pH value is a result of various chemical reactions during the roasting process, including the decomposition of chlorogenic acids, which are key contributors to acidity (Kim *et al*., 2024). Another study found that Robusta coffee beans roasted using a standard technique at 180 °C for 9–10 minutes resulted in a pH of approximately 5.3, indicating a moderate level of acidity (Dharmawan *et al*., 2018). Over time, roasting levels at low temperatures will produce more dominant acids due to acidic compounds in coffee not having time to evaporate. A high roasting level can evaporate more acidic compounds in the coffee to increase the pH value. In the early stages of roasting, the acidity of the coffee beans will increase due to the formation of formic acid and acetic acid (Divis *et al.,* 2019). However, at the first crack stage, the acidity decreases due to the degradation or evaporation of compounds formed in the previous phase (Asiah *et al*., 2023).

## Correlation among Physical Characteristics

A positive correlation among parameters indicates directly proportional values, while a negative correlation can mean inversely proportional values. The coefficient interval in the range 0.00–0.199 indicates a very low correlation, 0.20–0.399 low, 0.40–0.599 moderate/medium, 0.60–0.799 strong, 0.80–1.000 Robust (Pratomo & Gumantan, 2020).

Table 2 shows that the parameters have different correlations. Moisture content, color, and bulk density have positive correlations.

Table 2. Correlation among physical characteristics

| Variable | Moisture content | Color | Bulk density | TDS | Brix | pH |
|---|---|---|---|---|---|---|
| Moisture content | 1.000 | 0.836 | 0.819 | -0.818 | -0.817 | -0.737 |
| Color | 0.836 | 1.000 | 0.954 | -0.934 | -0.932 | -0.938 |
| Bulk density | 0.819 | 0.954 | 1.000 | -0.981 | -0.982 | -0.936 |
| TDS | -0.818 | -0.934 | -0.981 | 1.000 | 1.000 | 0.861 |
| Brix | -0.817 | -0.932 | -0.982 | 1.000 | 1.000 | 0.861 |
| pH | -0.737 | -0.938 | -0.936 | 0.861 | 0.861 | 1.000 |

Moisture content, color, and bulk density negatively correlate with TDS (% TDS & % Brix) and pH, while TDS (% TDS & % Brix), and pH have a positive correlation. Robust positive correlations occurred between moisture content and color, moisture content and bulk density, color and bulk density, TDS (% TDS & % Brix), TDS and pH, and TDS (% TDS & % Brix) and pH.

## Sensory Profiles

### Correspondence analysis

The screen plot in Figure 1 illustrates the connection between the ideal sensory attributes of coffee and the sample's original sensory attributes detected by panellists. Ideal attributes represent something desired, demanded, or desirable (Worch *et al*, 2013). Sensory analysis from consumer panellists shows that none of the three samples closely align with the ideal, where each sample occupies a different quadrant. The ideal product is in quadrant IV and characterized by attributes such as medium body, caramel aroma, fruity aroma, sour aftertaste, sweet aftertaste, herbal aroma, and sweet taste. During roasting, coffee beans undergo several chemical reactions, including pyrolysis, the Maillard reaction, and caramelization. These reactions lead to the degradation of several compounds, such as chlorogenic acids and sucrose, and the formation of new compounds, like quinic acids, N-methylpyridinium, and melanoidins, which contribute to the coffee's aroma and colour (Tarigan *et al*, 2022). At the beginning of the roasting process, water evaporates, which causes changes in the bean's structure and pressure build-up. This stage is crucial for developing the coffee's texture and forming cracks in the bean matrix, which are associated with the release of aromatic compounds (Fadai *et al*., 2018).

The sample of City roast is in quadrant III and exhibits sensory attributes of floral aroma, nutty aroma, astringent aftertaste, and watery body. Linalool is a compound known for its floral scent and is more concentrated in certain types of coffee, such as natural process, than washed process. The presence of linalool contributes significantly to the floral notes in coffee aroma (Vezzulli *et al*., 2023). Moreover, pyrazine compounds, particularly 2,3,5-trimethylpyrazine, are key contributors to the nutty aroma of roasted coffee. Those compounds are formed during roasting as a product of the Maillard reaction (Ascrizzi & Flamini, 2020; Liang *et al*, 2022). In addition, the initial moisture content of green beans also plays a role, with higher moisture levels leading to more intense and pleasant aromas (Nebesny & Budryn, 2006). Compounds such as caffeoylquinic acids (CQAs) which undergo transformations during roasting are significant contributors to the astringency of coffee (Tang *et al*., 2020).

The sensory attributes distribution of Full City roast is in quadrant II, which includes smoky aroma, earthy aroma, sour taste, bitter taste, bitter aftertaste, and dry aftertaste. The degree of roasting influences the concentration and presence of these volatile compounds. Medium to dark roasts tend to have higher levels of sulphur compounds, which can enhance the smoky and earthy aromas (Kim *et al*., 2018; Zakidou *et al*., 2021). Volatile thiols, despite their low concentration, have a significant impact on the smoky and roasty notes of coffee due to their low odour thresholds (Dulsat-Serra *et al*., 2016). Pyrazines also contribute to the smoky aroma and impart earthy notes to coffee. Their presence results from the same Maillard reaction during roasting (Liang *et al*., 2022; Zakidou *et al*., 2021). Chlorogenic acid lactones formed during roasting are another group of compounds known to contribute to the bitter taste of coffee (Kaiser *et al*., 2013). Under more severe roasting conditions, quinic acid derivatives degrade to form 4-vinylcatechol oligomers, contributing to a harsher bitter taste. These oligomers are generated through the oligomerization of 4-vinylcatechol released from caffeic acid moieties (Blumberg *et al*., 2010).

Furthermore, Italian roast in quadrant I have a chocolate aroma, the aroma of spices, and a bold body. Darker roasts are associated with increased bitterness and decreased acidity, fruitiness, and sweetness. These changes contribute to a bolder body, as the flavours become more pronounced and the mouthfeel richer (Münchow *et al*., 2020). Another study carried out by Seninde *et al*. (2020) stated that the degree of roasting affects the sensory characteristics of Robusta coffee, including its bitterness and aroma. Darker roasts generally result in a more bitter taste, which is a characteristic feature of Robusta coffee. The roasting degree also influences flavour's profile by changing concentration of organic acids and chlorogenic acids. As the roasting degree increases, the concentration of these acids decreases, affecting the overall sensory experience (Yeager *et al*., 2021). Different roasting methods and degrees result in varying profiles of volatile compounds, which contribute to the coffee's aroma (Budryn *et al*., 2018). Based on the results of this sensory evaluation, it is possible to create a product which has sensory attributes close to the ideal by blending coffee beans roasted at different roasting degrees. However, the appropriate blending ratio that closely matches the ideal product characteristics requires further research.

## Comparisons Between Samples and Ideal Product

The placement of the ideal-product question in CATA surveys can influence the results. When asked before product evaluation,

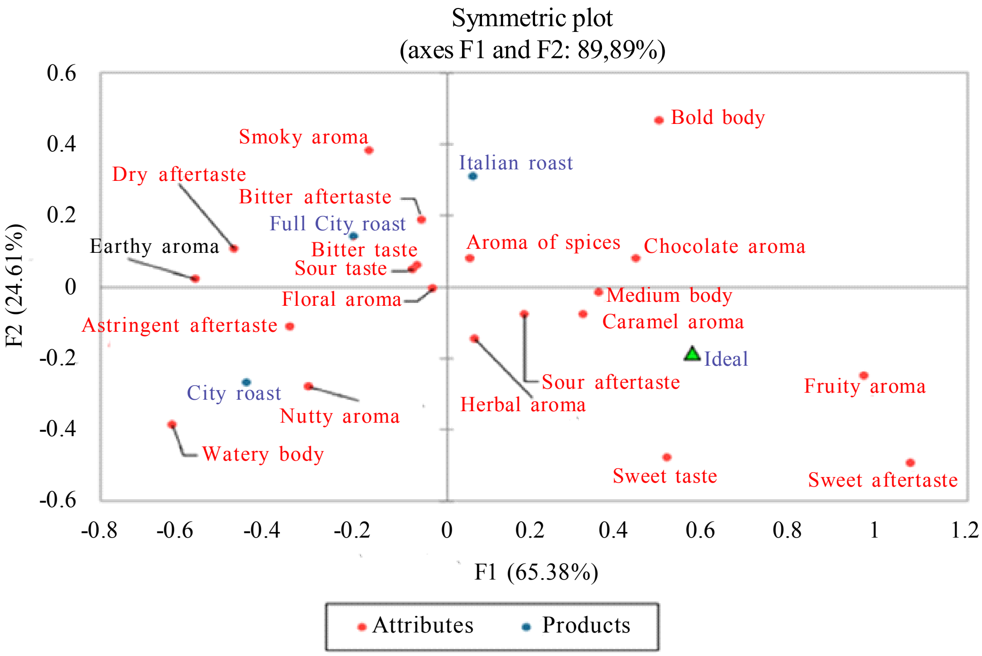


Figure 1. Symmetrical plot representation for sensory profiles of coffee samples from different roasting degree

consumers provide more authentic and compelling descriptions. When asked after, responses tend to be more analytical and specific, which can help identify desired and unwanted attributes more clearly (Amorim *et al*., 2023). Based on Figure 2, it is observed that City roast exhibits an enhanced intensity in attributes such as medium body, bold body, sweet aftertaste, and fruit flavour. A sweet taste is frequently identified as a desirable attribute in coffee. This includes both the initial taste and the aftertaste (Hunaefi & Marusiva, 2021). In contrast, the attributes of a watery body and earthy flavours are diminished. A watery body is less desirable, indicating a preference for a fuller texture (Kurniawan *et al*., 2024).

Figure 3 shows that Full City roast shows an improvement in attributes such as sweet aftertaste, sweetness, and caramel aroma. In contrast, the attributes of smoky aroma, earthy aroma, and dry aftertaste should be minimized. Figure 4, indicates that coffee obtained from Italian roast has attributes of sweetness that need to be increased, while smoky and earthy aroma should be reduced to meet ideal attributes. The smoky aroma in coffee is primarily attributed to compounds like 2-methoxy-5-vinylphenol, which can increase significantly during storage, especially under conditions of higher temperature and moisture. This compound, along with others like 2-methoxy-4-vinylphenol, contributes to a clove-like, intense, smoky odor often

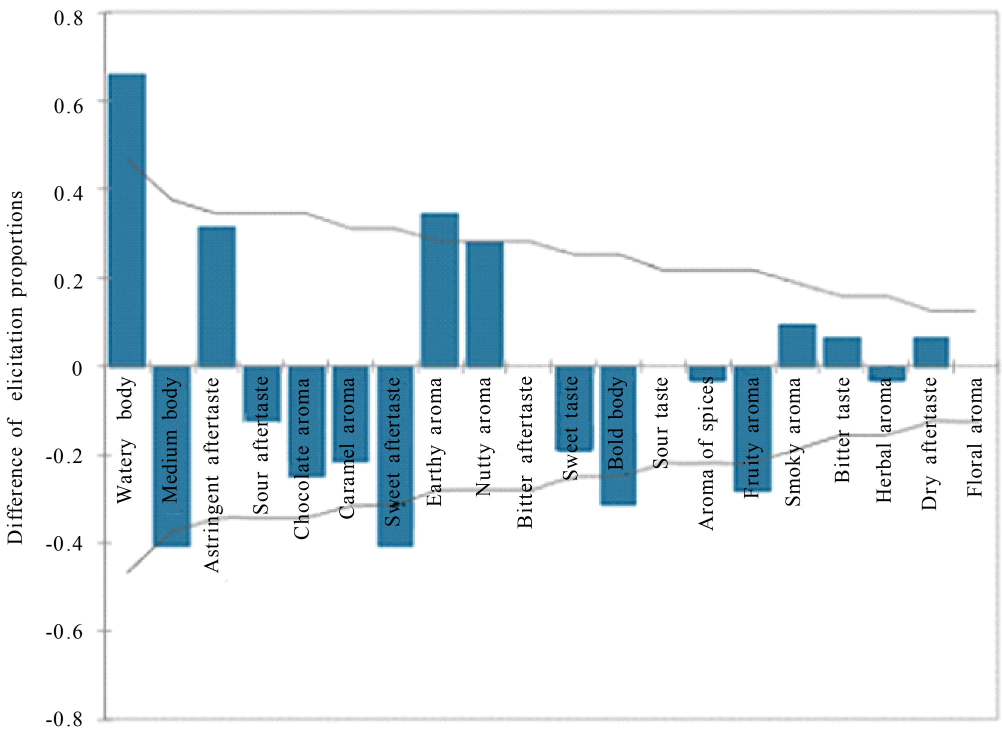


Figure 2. Comparison between City roast and comparison of coffee attributes between City roast and the ideal product

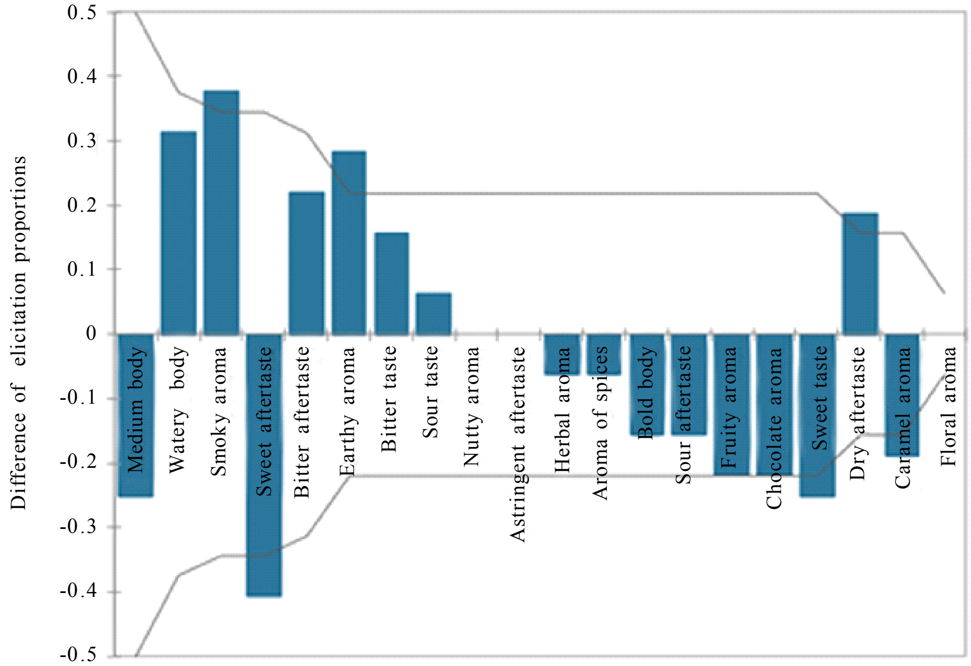


Figure 3. Comparison between Full City roast and comparisan of coffee attributes between Full roast and the ideal product

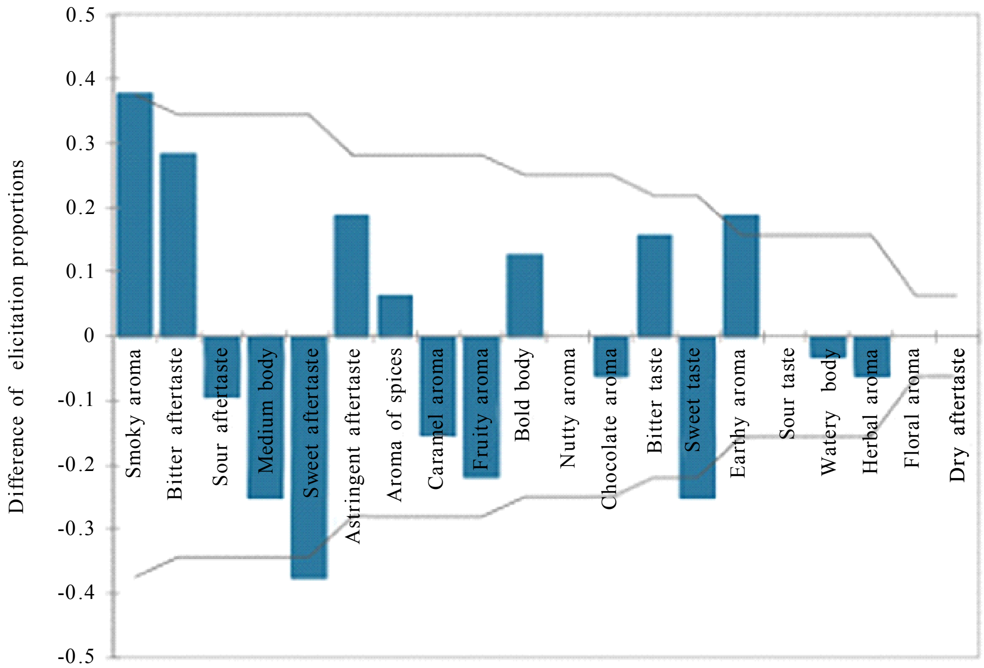


Figure 4. Comparison between Italian roast and comparisan of coffee attributes between Italian roast and the ideal product

perceived as undesirable by consumers (Scheidig *et al*., 2007). This information is helpful in product development for identifying ideal sensory profiles and guiding product reformulation. It helps in understanding consumer preferences and the sensory attributes that drive liking (Ares *et al*., 2014; Ramos *et al*., 2021). The results are new insights to optimize Lampung Robusta coffee's roasting process and new product development to fulfill consumer expectations.

## CONCLUSIONS

The roasting degree significantly influenced the value of color, bulk density, pH, TDS (% TDS & % Brix), in which the p-value was <0.05. Based on the correlation test, a positive correlation occurred between moisture content, color, and bulk density. Moisture content, color, and bulk density negatively correlated with TDS (% TDS & % Brix), and pH. Meanwhile, TDS (% TDS & % Brix), and pH have a positive correlation. Based on the research results, different roasting degrees can affect the Lampung Robusta coffee sensory profiles. The higher the roasting degree, the more the body's bold attribute is felt. On the contrary, the lower the degree of roasting, the body's watery attributes are felt. According to the panellist's evaluation, the ideal attributes are a product that has the sensory attributes of herbal aroma, caramel aroma, fruit aroma, sweetness, body medium, acid aftertaste, and sweet aftertaste. However, none of the three samples tested had the same sensory characteristics as the ideal product. Each roasting degree has distinctive sensory characteristics. The results of this sensory evaluation suggest that it is possible to produce Lampung Robusta coffee product with sensory attributes near the ideal by blending with other coffee beans from different varieties or origin. However, determining the optimal blending ratio that best aligns with the ideal product characteristics requires further investigation.

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## CONFLICT OF INTEREST

All authors have no conflict of interest.

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