

## Article

# Evaluation of Proximate, TDS and pH Differences Among Argopuro Ground Coffee Varieties

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**Abstract:** Recent reports show a significant global rise in demand for ground coffee, highlighting a trend towards specialty brews. This interest has led to research on coffee's chemical properties that influence flavour. Key characteristics include proximate content, total dissolved solids (TDS), and pH levels. This study examines the chemical traits of ground Robusta and Arabica coffee from the Argopuro area, produced by Teaching Factory Coffees Processing, Politeknik Negeri Jember. This study used Robusta and Arabica coffee processed using natural, wet methods and were roasted at medium to dark levels. The analysis included key parameters: proximate analysis for total moisture and ash content (gravimetric method) and total fat content (Soxhlet method), additionally, pH measurements were taken with a pH meter, and total dissolved solids (TSS) were evaluated using a refractometer. Employing a non-factorial Completely Randomized Design (CRD), the study focused on the two coffee types: Arabica and Robusta Argopuro. Data analysis was rigorously conducted using an independent sample t-test. The findings clearly indicate that the type of coffee has a significant impact on the proximate content: water, ash and fat content and pH levels of the ground coffee, but not significant impact on TDS.

**Keywords:** Argopuro; Ground Coffee; Proximate; Robusta

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## 1. Introduction

Coffee is a plantation commodity with high economic value. As an export commodity, coffee plays an important role in increasing the country's foreign exchange. Diversification and business of coffee products continue to develop, including in Indonesia. Coffee beans are produced from coffee plants which are used as a beverage that has a distinctive aroma and taste after roasting. Coffee consumption in the world, especially in Indonesia, is increasing every year. The development of coffee production in the international market tends to increase every year. Indonesia's large coffee trade potential is faced with various challenges one of which is the increasing level of competition between producing countries to fight for import share in the international market.

The most coffee varieties grown in Indonesia are Arabica and Robusta. This is because Robusta and Arabica coffee can adapt to the climatic conditions of their development areas, namely Indonesia. The percentage of coffee data planted in Indonesia is 90% for Robusta coffee and 10% for Arabica coffee. [2] In several studies that have been conducted, Robusta coffee varieties (*Coffea canefora* L) have shown strong resistance to disease attacks. Therefore, Robusta coffee is one of the types of coffee that is widely cultivated in Indonesia and is one of the superior commodities. Robusta coffee also has a more bitter taste characteristic and contains higher caffeine levels compared to Arabica coffee. Arabica varieties are known to be more susceptible to pests genetically, but are superior in acidity levels and flavour diversity [3]. The difference in flavour produced from brewed coffee is determined by many factors. The taste of coffee is influenced by the processing process. In addition, the drying method also has a significant effect on the physical characteristics and flavour of the resulting green beans [4] Arabica and Robusta coffee also experience different harvesting times and post-harvest processing.

The post-harvest processing processes referred to are the dry process [5] and the wet process [6]. These differences result in differences in the chemical characteristics of the coffee beans. Different chemical compositions provide different roasted coffee flavours. [7] Explains that Arabica coffee has a flavor and taste that is preferred by consumers compared to Robusta coffee. The high quality of Arabica coffee flavor causes the commercial value of this coffee to also be high, this allows for blending between Arabica and Robusta coffee in terms of sales. The blending process is necessary to optimize the flavors of each coffee. This allows certain types of coffee but from different regions (different varieties) to be mixed. Differences in coffee bean varieties have been identified from the chemical composition, especially the composition of large molecular weight fractions and volatile components in both roasted bean and ground coffee products.

TEFA Polije Coffee Product Processing is a Teaching Factory that produces superior products in the form of Robusta and Arabica ground coffee under the SIP trademark. The characteristics of each type of coffee significantly affect quality and consumer acceptance. Therefore, it is important to characterize the resulting ground coffee to understand the physical, chemical, and sensory properties of the product. This characterization includes various parameters, such as colour, aroma, taste, water content, particle fineness, and the content of other bioactive compounds. This information is not only important for ensuring product quality, but also forms the basis for developing quality standards, optimizing production processes, and marketing strategies..

## **2. Materials and Methods**

### **2.1 Place and time**

This research was held in the Agricultural Product Processing Laboratory, Politeknik Negeri Jember, in July-September 2025. Analysis of research parameters was conducted at the Integrated Testing Service Unit, Faculty of Agricultural Technology, University Jember.

### **2.2 Processing of coffee beans**

**Ground Coffee Preparation:** The process of converting coffee beans into ground coffee encompasses three primary stages: post-harvest processing, roasting, and grinding. A more detailed examination of each stage reveals the intricacies involved in this transformation. **Post-Harvest Processing:** Post-harvest processing refers to the procedure of converting coffee cherries into green coffee beans. This study evaluates two types of coffee samples that were processed utilizing distinct methods. The Arabica coffee was subjected to the full washed (wet) processing method, while the Robusta coffee underwent the natural (dry) processing method. The stages of wet processing encompass several critical steps, including the sorting of coffee beans, pulping, fermentation, washing, drying, hulling, and subsequent drying. In contrast, dry processing does not utilize water in its method. During dry processing, the coffee cherries are laid out under

the sun to dry, after which the dried beans are hulled and further dried. The resulting green beans must be sun-dried until they achieve a maximum moisture content of 12.5%, in compliance with the standards established in SNI 01-2907-2008.

## 2.3 Research Parameters

### *Proximate analysis*

The different proximate compositions of ground coffee, including moisture content, ash and fat content, were estimated by following standard procedures described by different American Association of Cereal Chemists and Association of Official Agricultural Chemists protocols (AOAC).

#### *1.1.1 pH*

Quantitative analysis of the acidity levels in Arabica and Robusta coffee brews was conducted using a pH meter to determine the pH values. The brewing process involved a coffee-to-water ratio of 1:15 (w/w), where 10 grams of coffee were combined with 150 grams of water heated to 93°C. Once the mixture reached room temperature, the acidity levels were measured using the pH meter. This methodology provided precise measurements of acidity, allowing for a clear comparison between the two coffee types.

#### *1.1.2 Total Dissolved Solids*

The sample preparation process involved brewing coffee utilizing a 1:15 (w/w) ratio. Specifically, ten grams of ground coffee were combined with 150 grams of water at a temperature of 93°C. Total dissolved solids (TDS) measurements were obtained by applying a sample of the brewed coffee onto the surface of a refractometer and recording the results in °Brix. To ensure the reliability of the findings, the analysis was conducted three times for each sample.

## 2.4 Research design

This study consisted of two independent sample groups. Data analysis of the observation results was conducted using an independent sample t-test by comparing the average values between Arabica and Robusta ground coffee for each parameter (coffee brew's pH, Total Dissolved Solids (TDS), moisture content, ash content, fat content, and protein content). The average value was considered significant at the level of 5% ( $p < 0.05$ ).

## 3. Results and Discussion

### **Chemical Characteristics of Ground Coffee**

Proximate characteristics are a basic analysis to determine the chemical composition of a food ingredient, including ground coffee. This analysis generally includes parameters such as water content, ash content, fat content, protein content, carbohydrate content, and in some cases crude fiber content. Although ground coffee is not the main source of nutrition in daily consumption patterns, proximate characteristics are still important to assess because they are directly related to quality, storage stability, as well as product taste and safety [8]. Ground coffee is a coffee product whose processing is divided into three main stages, namely: roasting, grinding and packaging. Roasting determines the colour and taste of the coffee product to be consumed, while grinding is the process of refining the coffee particles to produce coarse, medium, fine, and very fine coffee.

**Table 1.** Chemical Characteristics of Ground Coffee

| Presentation (%) |               |             |             |
|------------------|---------------|-------------|-------------|
| Coffee varieties | Water content | Ash content | Fat content |
| Arabika          | 5,019±0,01    | 4,966±0,019 | 12,835±0,04 |
| Robusta          | 1,550±0,00    | 5,556±0,010 | 11,310±0,00 |

Based on Table 1 explains the proximate characteristics of ground Arabica and Robusta coffee, including water content, ash content, fat content, protein content, and

carbohydrate content. Water content is the most important content to consider in food products, because it can affect the sensory characteristics, freshness, and shelf life of a product [9]. The water content in ground coffee products needs to be known because it affects the taste and the product's resistance to microorganisms. High water content can cause the growth of bacteria, mold, and yeast, which can ultimately reduce quality and cause changes in the ground coffee. Based on the table above, the water content of ground Robusta and Arabica coffee in this study ranged from 1.55% to 5.02%. There are significant differences in the water content of ground coffee produced based on the type of coffee variety. The high percentage of water content in ground coffee from Arabica varieties is likely due to the fermentation process carried out by soaking the coffee after pulping. In addition, [10] added that several factors that influence the water content of processed coffee beans include air and environmental humidity, as well as the loss of dry horn skin when still in the form of rice coffee beans before roasting. Despite significant differences in the two coffee samples, the moisture content of both samples meets the standards for ground coffee products. According to SNI 01-3542-2004, the maximum moisture content permitted for ground coffee is 7%. Therefore, it can be concluded that all ground coffee samples tested met the quality standards set by SNI.

Ash content measurements are conducted to determine the purity of a product from a particular commodity. [11] Ash content consists of the water-free inorganic solids produced by the combustion of organic compounds. Ash content consists of inorganic and mineral components contained within a material. [12] Ash content in ground coffee is an indicator of the presence of useful minerals, hazardous metal contamination, or other contaminants during the production process. High ash content in ground coffee is caused by the composition of the coffee itself and the presence of contaminants introduced during handling. Based on the data above, the ash content of ground Arabica and Robusta coffee is 4.97–5.56%. There is a significant difference in the ash content of the ground coffee from these two types of coffee. Based on the SNI 01-3542-2004 requirements for ground coffee, the maximum ash content is below the 5% (w/w) limit. This indicates that the ground coffee from the Robusta variety exceeds the 5% maximum standard. According to [11] differences in ash content in ground coffee are due to uneven picking, which leads to inconsistent quality. Suboptimal drying can be the biggest factor in bacterial contamination or other contaminants. Furthermore, ash content can also determine the quality of the final product, namely ground coffee. High ash content indicates contamination during the production process, which can come from sand, soil, or other types of dirt.

Fat content measurements showed significant differences in ground coffee samples. Several factors influence fat content, one of which is the roasting process. The roasting process changes the chemical composition of coffee beans due to the Maillard reaction and the degradation of chemical compounds during roasting. One compound that undergoes changes due to the roasting process is fat. Fat is one of the chemical components in coffee that shapes its flavor and can have both beneficial and harmful effects on the health of coffee drinkers. Table 1 above shows that the fat content in ground coffee ranges from 11.31 to 12.84%. This is in accordance with research [13] which explains that the fat content contained in ground coffee is 11-16%. In additional [14] explains that the characteristics of coffee, including fat, are influenced by several factors such as type/variety, geographic characteristics, post-harvest processing methods, roasting degree, brewing method, and decaffeination process. Environmental conditions at the altitude where coffee grows, such as temperature, rainfall, and oxygen availability, play an important role in shaping the flavor profile of the resulting coffee.

Based on Table 2 explains the characteristics of brewed Arabica and Robusta ground coffee. In coffee there are organic acids and chlorogenic acids that have an influence in bringing out the taste of coffee. This produces a sour taste in the resulting coffee brew.

**Table 2.** Characteristics of Coffee Brewing

| Coffee varieties | pH           | TDS (°Brix)  |
|------------------|--------------|--------------|
| Arabika          | 4,630±0,040a | 3,966±0,005a |
| Robusta          | 5,496±0,040b | 4,200±0,529a |

The pH above shows the acidity level in the resulting coffee brew. Based on Table 2 above, the pH parameter shows a significant difference. The pH value produced in Arabica brew shows a smaller number, this makes Arabica brew more acidic. This is in accordance with research [15] explaining that several organic acids such as citric acid, malic acid, and acetic acid in Arabica coffee have higher content than Robusta coffee. In addition, malic acid in Arabica coffee has a higher content which forms a fruity character and sweet flavor in Arabica. In addition, coffee or coffee plants that grow in highlands such as Arabica coffee contain higher levels of acid compounds than coffee grown in lowlands, namely Robusta. [16] also explains that Arabica coffee has a relatively more acidic taste than Robusta coffee and Liberica coffee. [15] Found that the total acid content of Arabica coffee was higher, at 1.06%, compared to Robusta coffee, at around 0.76%.

The Total Dissolved Solids (TPT) value represents the amount of sugar contained in the material, particularly sucrose [17]. This study also found that the TPT values for the coffee brews were not significantly different, ranging from 3.9 to 4.2 °Brix. This explains the lack of significant differences in the TPT values for brewed samples from both Robusta and Arabica coffee varieties..

#### 4. Conclusions

The chemical characteristics of ground coffee from Robusta and Arabica varieties showed significant differences in moisture content, ash content, and fat content. In general, the chemical characteristics of the ground coffee met Indonesian National Standard (SNI) standards, except for the ash content in Robusta coffee, which exceeded the standard limit. Brewing analysis revealed a significant difference in pH between the two varieties, while total dissolved solids (TDS) did not show a significant difference.

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