Sensory, chemical, and nutritional characteristic of coffee-chocolate instant drink (chocomix-fee) from Nglanggeran, Gunungkidul, Yogyakarta

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Abstract. Cocoa (*Theobroma cocoa*) is one of the potential commodities in Indonesia. There are many cocoa fields in Yogyakarta, and one of cocoa field is Nglanggeran, Gunungkidul. Diversification product must be done to increase the economy value of local chocolate from Nglanggeran. The aim of this research is to determine sensory, chemical, and nutritional characteristic of Chocomix-Fee. Chocomix-Fee is instant drink made from chocolate powder and coffee powder. Chocomix-Fee made with four different coffee powder addition (22%,20%,18%,16%). Sensory test results indicated that the most referred product was Chocomix-Fee that made from 16% coffee powder addition. The selected Chocomix-Fee contain water content about 2.11%, ash content about 1.41%, fat content 6.83%, protein content about 7.29%, and carbohydrate content about 82.37%. Chocomix-Fee contain polyphenol about 49.55 mg GAE/g sample and antioxidant activity about 56.35%. Chocomix-fee is packaged using metallized package with a weight about 25 grams per sachet. The energy obtained by consuming chocomix-fee drinks is 105 kcal / 25 g product

1. Introduction
Cocoa (*Theobroma cocoa*) is an important product and highly consumed in several countries. Cocoa is one potential commodities in Indonesia because it has high economic value and can high contribute to economic sector. Indonesia is the third largest cocoa producing country in the world after Ivory Coast and Ghana [1, 2]. The main producing area of cocoa is Sulawesi island and the remaining Indonesian cocoa production takes place in North Sumatra, West Java, and Papua, with some small production areas in Bali, Flores, and other islands. As one of the cocoa-producing countries, Indonesia must be able to compete with other cocoa-producing countries by increasing the quality of cocoa beans and cocoa products. Cocoa has many benefit in health because it contain high polyphenols and antioxidant activity [3,4]. Some of the beneficial effects of polyphenols are such as anti-carcinogenic, anti-atherogenic, anti-ulcer, anti-thrombotic, anti-inflammatory, anti-microbial, immune modulating, analgesic effects. One of the cocoa producing areas in Gunungkidul district is Nglanggeran, Patuk. Nglanggeran also known for tourism village because ancient mountain and Nglanggeran Ponds were located in Nglanggeran. Post-harvest processing technology of cocoa beans in Nglanggeran is still limited. Processing of cocoa into intermediate product (chocolate powder, chocolate fat or chocolate paste) or end product (chocolate instant drink, chocolate bar) in Indonesia is mostly controlled by large companies, while cocoa
processing by farmers is still minimal [5]. One of cocoa product diversification that potential to developed is instant chocolate drinks which blend with coffee powder (Chocomix-Fee). Coffee is one of the most popular beverages in the world. Coffee also contain polyphenol and antioxidant capacity [6]. Some researcher reported about blending coffee with cocoa powder to make an instant drink [7,8]. ‘Chocomix-Fee” is instant drink made from Nglanggeran chocolate powder and coffee powder. The aim of this research is to determine the sensory, chemical, and nutritional characteristic of Chocomix-Fee.

2. Materials and Methods

2.1. Materials

The materials used in the research were cocoa powder obtained from Nglanggeran, Gunungkidul, coffee powder, skim milk, and sugar obtained from local market. The tools used for Chocomix-Fee were blending machine, cabinet dryer, tray, digital scales, and metallize packaging.

2.2. Methods

Research methodologies consist of two stages: Chocomix-Fee making and characterization the sensory, chemical, and nutritional composition of the product. Chocomix-Fee was made with blending coffee powder, cocoa powder, skim milk, and sugar with composition as described in Table 1.

| Sample | Coffee Powder (%) | Cocoa powder, Skim milk, sugar (%) |
|--------|-------------------|-----------------------------------|
| A      | 22                | 78                                |
| B      | 20                | 80                                |
| C      | 18                | 82                                |
| D      | 16                | 84                                |

Chocomix-Fee was made with four different addition of coffee powder, i.e. 22%, 20%, 18%, and 16%. Addition higher and/or lower addition of coffee (> 22% and/or < 16%) had not acceptable from previous research. Cocoa powder was mixed with coffee powder, cocoa powder, skim milk, and sugar using blending machine during 15 minute, then sieved (1 mm sieve size). Chocomix-Fee then packed in metallize pack. Characterization of the product has been carried out including sensory, chemical, and nutritional analysis. Sensory properties using hedonic test were determined with attributes: color, taste, odor, and overall acceptance [9]. Selected product from sensory analysis then tested for chemical analysis consist of water content [10], protein content [10], fat content [10], ash content [6], carbohydrate by difference, polyphenol and antioxidant activity [11,12]. Nutritional analysis was done with measured the calorie value. The design of the experiment used was a completely randomized design (CRD). Statistical data were analyzed using the software of SPSS version 16 with One Way Anova method with a significant level of 5% in comparison of means using Duncan method.

3. Results and Discussion

3.1 Sensory Analysis

Sensory properties are some of the most important factors on consumer liking and preference; thus, it is very important to determine factors affecting the product attributes, acceptance, and preference, especially for foods and drinks [13]. Sensory analysis of four Chocomix-Fee formulation with attributes i.e. color, odor, taste, and overall acceptance were done as shown in Table 2. The same superscript symbol in the same column indicate that sample are not significantly different at a significance level of 95%. Sensory analysis was conducted with 22 panelist using hedonic scale 1-5, which 1 = very dislike; 2 = dislike; 3 = a little like; 4 = like; 5 = very like. Panelist were random and untrained who were interested in participating in research, were not disease and allergies to chocolate and coffee drink.
Table 2. Sensory analysis of chocomix-fee

| Sample | Color       | Odor          | Taste       | Overall Acceptance |
|--------|-------------|---------------|-------------|--------------------|
| A      | 3.91±0.68a  | 3.32±1.04ab   | 2.64±0.95a  | 2.95±0.95a         |
| B      | 3.59±0.90a  | 3.00±0.75a    | 2.73±0.93a  | 2.86±0.88a         |
| C      | 3.68±0.89a  | 3.18±0.85ab   | 3.00±0.97a  | 3.05±0.84ab        |
| D      | 4.00±0.75a  | 3.59±0.79b    | 3.23±1.19a  | 3.59±0.95b         |

Values are expressed as mean ± standard deviation. The same superscript symbols in the same column indicate that sample are not significantly different at a significance level of 95%

As seen in Table 2, all sensory parameter indicated that the highest score was sample D, with lowest addition of coffee powder. For color and taste parameter, addition of coffee powder with different concentration did not change the product color and product taste significantly. The odor of sample D was significantly different with sample B. The highest overall acceptance score was sample D that significantly different with sample A and B. From sensory analysis, it can be concluded that the selected product was sample D, with addition of 16% coffee powder. The selected product is then analyzed including chemical and nutritional properties.

3.2. Chemical Characteristic
Chemical characteristic of selected Chocomix-Fee (D) can be shown in Table 3.

Table 3. Chemical characteristic of selected chocomix-fee

| Chemical Characteristic | Content (% wet basis) |
|-------------------------|-----------------------|
| Water content           | 2.11±0.10             |
| Ash content             | 1.41±0.03             |
| Fat                     | 6.83±0.40             |
| Protein                 | 7.29±0.39             |
| Carbohydrate            | 82.37±0.53            |

Values are expressed as mean ± standard deviation

The chemical characteristic of selected Chocomix-Fee product based on wet basis was 2.11% water content, 1.41% ash content, 6.83% fat content, 7.29% protein content, and 82.37% carbohydrate content. Based on dry basis, the chemical characteristic was 1.44% ash content, 6.97% fat content, 7.44% protein content, and 84.14% carbohydrate content. The results showed that the carbohydrate content of Chocomix-Fee was 82.37% in wet basis and 84.14% in dry basis. The high content of carbohydrates in instant chocolate-coffee beverage products due to the contribution of other constituent ingredients, that was sugar. Formulation of Chocomix-fee include 15-20% chocolate powder, 15-20% coffee powder, 5-10% skim milk, and 55-65% granulated sugar. Chocomix-Fee contain fat about 6.83% in wet weight and 6.97% in dry weight. The fat content of Chocomix-Fee was lower than instant chocolate drinks with the addition of sweeteners which fat content about 16-18% [14]. The difference in fat content due to differences material and formulation used. About fatty acid composition, Riberio et al [8] reported that coffee which blend 3% cocoa powder contain 44% saturated fatty acids, 11% monounsaturated fatty acids, and 45% polyunsaturated fatty acids.

Functional analysis including polyphenol and antioxidant activity of Chocomix-Fee, coffee powder, and cocoa powder were done as shown in Table 4. As shown in Table 4, Chocomix-Fee product contain polyphenol about 49.55 mg GAE/g and antioxidant activity about 56.35%. The higher polyphenol and antioxidant activity of Chocomix-Fee related to the basic ingredient : cocoa powder and coffee powder. Higher antioxidant activity due to polyphenol content [15]. From Table 4, it shown that polyphenol content and antioxidant activity of cocoa powder was higher than coffee powder. Polyphenol content of cocoa powder was 49.28 mg GAE/g sample. Hii et al [5] reported that cocoa powder contain polyphenols
about 45.30-60.20 mg GAE/g. Awe et al (2013) reported that total phenolic content of the cocoa, Hibiscus flower extract, and ginger beverage blends ranges from 11–21 mg GAE/g [16]. Cocoa and its derived products (cocoa powder, cocoa liquor, and chocolates) contain varied polyphenols contents and has antiradical capacity [17]. Three main groups of cocoa polyphenols can be distinguished namely the catechins (37%), anthocyanins (4%), and proanthocyanidins (58%) [5]. Phenolic compounds are major plant secondary metabolites. They are found in rather large quantities in plant based foods and beverages and considered beneficial for human health. The key role of phenolic compounds as scavengers of free radicals is emphasized in several reports [18,19]. High antioxidant activity of Chocomix-Fee can increase antioxidant intake of humans, and may protect from diseases as oxidative events in vivo may play a role in the pathogenesis of many diseases which includes cancer, cardiovascular diseases and arthritis [20,21]. Beside content polyphenol and antioxidant activity, cocoa and coffee beverages also contain caffeine [22].

| Sample          | Polyphenol Content (mg GAE/g) | Antioxidant Activity (%) |
|-----------------|-------------------------------|--------------------------|
| Chocomix-Fee    | 49.55±0.05c                   | 56.35±0.07b              |
| Cocoa powder    | 49.28±0.08b                   | 57.03±0.06c              |
| Coffee powder   | 41.36±0.05a                   | 39.04±0.01a              |

Values are expressed as mean ± standard deviation. The same superscript symbols in the same column indicate that sample are not significantly different at a significance level of 95%

### 3.3. Nutritional value

Nutritional value of the product can described by measure the calorie value and nutritional adequacy that shown in Figure 1.

Chocomix-Fee is packaged using metallized package with a weight about 25 grams/sachet. The serving size of chocomix-Fee was 105 kcal. Queiroz et al [23] reported serving size of sorgum drink was 126.5-128.3 kcal.

### 4. Conclusion

The most preferred Chocomix-Fee from sensory analysis is chocomix with addition of 16% coffee powder. The selected Chocomix-Fee contain water content about 2.11%, ash content about 1.41%, fat content 6.83%, protein content about 7.29%, and carbohydrate content about 82.37%. Chocomix-Fee contain polyphenol about 49.55 mg GAE/g sample and antioxidant activity about 56.35%. Chocomix-Fee is packaged using metallized package with a weight about 25 grams per sachet. The energy obtained by consuming chocomix-Fee drinks is 105 kcal / 25 g product.
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