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Sensory Characteristics, Acceptability, and Antioxidant Activity of Sweet Sorghum [*Sorghum bicolor* (L.) Moench] Coffee Substitute Using Different Brewing Methods

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Abstract

The present study was undertaken to determine the most appropriate method for brewing sweet sorghum coffee substitute (SSCS) considering the sensory characteristics, general acceptability, and antioxidant activity of the brewed samples. Out of the four samples, SSCS brew produced using percolator and steep method were the most acceptable. Both methods resulted to brews with the most preferred color, mouthfeel, and bitterness. The degree of liking of the brew made using percolator and steep method was rated as "like moderately", with mean score ranged from 7.2 - 7.4. Furthermore, this study revealed that bitterness and aftertaste were the two prime characteristics influencing the acceptability of the SSCS. On the other hand, antioxidant activity is higher in the brew produced from percolator than using steep method. In conclusion, this study suggests the use of percolator to produce an acceptable and healthful sweet sorghum coffee substitute.

Keywords: *Coffee Substitute; Antioxidant; Sensory Characteristics; Sweet Sorghum; Brewing Methods*

Abbreviations

SSCC: Sweet Sorghum Coffee Substitute

Introduction

Sorghum has been a principal means of survival and an essential part of the diet for millions of people, particularly in semi-arid areas [1]. More than nutrients, sweet sorghum is also a rich source of various phytochemicals including tannins, phenolic acids, anthocyanins, phytosterols and policosanols. These phytochemicals have potential to significantly impact human health. Sorghum fractions possess high antioxidant activity *in vitro* relative to other cereals or fruits. These fractions may offer similar health benefits commonly associated with fruits [2].

Coffee plays an integral role in the lives of the Filipino people. Often, the very first thing one scrambles for in the morning is a hot cup of coffee to warm the stomach. This was evident in the increasing trend of Philippine coffee imports over the past years [3]. However, caffeine-sensitive individuals and other persons who refrain from taking caffeinated beverages resort to consuming coffee substitutes.

Coffee substitutes are the parts of roasted plants that are made into a product, which when added with hot water, provides a coffee-

like brew. They serve likewise as a coffee blend. Coffee substitutes, such as the coffee brew made of chicory or clear drinks prepared from roasted cereals [4], have been in the market for a long time. In 2014, Abacan and her colleagues [5] developed an acceptable coffee substitute form sweet sorghum. Based from the study, the sweet sorghum coffee substitute was characterized having dark brown color, aroma and flavor resembling to "rice coffee", and a coffee-like bitterness. The purpose of this study is determine the brewing method that would yield the most acceptable sweet sorghum coffee substitute brew with high antioxidant activity.

Materials and Methods

General procedure in making sweet sorghum coffee substitute

Sweet sorghum grains were dried, ground, and roasted at 226 ± 5°C. Afterwards, the powdered sorghum (< 0.420 mm) was roasted using convection oven (La Germania Model M64C71X) for 70 minutes [5].

Brewing

Drip method

For this method, a coffee maker was used. Water was allowed to boil before putting the ground roasted sorghum in the filter section of the coffeemaker. Brewing time in this method lasted for six minutes [6].

Percolator method

In this method, basket and stem were removed from the percolator first to pour fresh cold water and then boiled. After boiling, the percolator was then removed from heat. The basket with roasted sweet sorghum and the stem were placed back into the percolator. It was then again placed in moderate heat and percolate slowly for eight minutes [6].

Press method

In this method, plunger was removed first from the glass. Ground Sorghum coffee was placed at the bottom of the glass then added hot water. It was stirred and after 4 minutes the plunger was pressed down to separate the grounds from the extracted coffee.

Steep method

Hot distilled water at 92 ± 2°C and ground roasted sorghum were mixed in a glass pitcher, and allowed to brew for 3 minutes. The brew was filtered and transferred to a 1.6 L single thermal pot [5].

Sensory evaluation

Sensory acceptability test was conducted to determine the most acceptable brew from the four methods used. Thirty-five coffee drinkers were invited to evaluate the four samples in terms of color, aroma, flavor, bitterness, aftertaste, body and general acceptability using the 9-pt Hedonic scale. Two sessions were conducted, with the same environmental conditions, to evaluate the characteristics and acceptability of all samples. The first session were consist of samples from drip and steep methods while the second was for press and percolator methods.

Analysis of Antioxidant Activity

The total free radical scavenging capacity of sorghum brew-methanolic extract was estimated by the DPPH using the modified method of Shimada., *et al* [7]. One (1) mL of the extract was adjusted to 5 mL volume with the addition of distilled water. Freshly prepared, 1 mL

DPPH solution (0.1 mM in absolute methanol) was mixed with the extract. The reaction mixture was shaken well and held for 30 min at room temperature, and the absorbance of the resulting solution measured at 517 nm against a reagent blank. The radical scavenging activity was measured as a decrease in the absorbance of DPPH, and expressed as percent radical quenching compared to that without the extracts.

Statistical Analysis

All statistical analyses were performed by using SPSS program. Kruskal-Wallis test was used to determine mean differences for the sensory characteristics and general acceptability while Pearson rank of coefficient used for correlation analysis. A probability value of $p < 0.05$ was considered significant among the tests.

Results and Discussion

Ground sweet sorghum were brewed differently using drip, steep, press and percolator methods after roasting at 226 ± 5°C for 70 minutes. Different brews were evaluated in terms of color, aroma, mouthfeel, bitterness and aftertaste as well as the general acceptability. Thirty-five coffee drinkers served as panel in this study.

Table 1 shows that the sweet sorghum brew made from the steep and percolator methods had the highest degree of liking among the brews from different methods in terms of color. The brews from the two methods were moderately liked by the respondents with a mean score of 7.49 + 0.95 and 7.26 + 1.40, respectively. Next to it is the brew using the press method which had a mean score equivalent also to "like moderately" (6.71 + 1.49). The brew from the drip method had the lightest color, hence, the least acceptable color (5.40 + 1.50). Among coffee grounds, the color is released when coffee is brewed with hot water. The length of and direct contact of water with the ground coffee contributes to the strong color of coffee. Steep, percolator and press methods of brewing allowed the water to have a direct contact with the powder at 3, 8 and 4 minutes, respectively resulting to a more preferred coffee color. Although the brewing time in drip method is 6 minutes, there is a very short contact time between the water and the roasted powder with water seeping through the powder only once, thus resulting to the lightest color when compared to the three other sweet sorghum brews produced.

Treatments	Color	Aroma	Mouthfeel	Bitterness	Aftertaste	General acceptability
Drip	5.40 ± 1.50^{c}	6.20 ± 1.28^{a}	7.00 ± 1.19^{ac}	5.89 ± 1.76^{b}	6.71 ± 1.47^{a}	6.49 ± 1.44^{c}
Steep	7.49 ± 0.95^{a}	6.66 ± 1.16^{a}	7.03 ± 1.12^{ab}	6.57 ± 1.44^{a}	6.77 ± 1.22^{a}	7.23 ± 0.81^{ab}
Press	6.71 ± 1.49^{b}	6.83 ± 1.49^{a}	6.74 ± 1.04^{bc}	6.49 ± 1.22^{ab}	6.66 ± 1.16^{a}	6.77 ± 1.06^{bc}
Percolator	7.26 ± 1.40^{ab}	6.29 ± 1.53^{a}	7.34 ± 1.19^{a}	7.06 ± 1.28^{a}	7.09 ± 1.10^{a}	7.37 ± 1.14^{a}

Table 1: *Mean scores of the different sensory characteristics and general acceptability of sweet sorghum coffee[1,2].*

[1]Range of scores: 9 - Like Extremely; 8 - Like Very Much; 7 - Like Moderately; 6 - Like Slightly; 5 - Neither Like nor Dislike; 4 – Dislike Slightly; 3 – Dislike Moderately; 2 – Dislike Very Much; 1 – Dislike Extremely.

[2]All mean scores bearing different superscripts in columns are significantly different on application of LSD at 5% level of significance.

In terms of aroma, there were no significant difference in the mean scores of the four different brews. In general, roasted sweet sorghum brew is less aromatic than coffee; thus, it had a mean rating equivalent to "like slightly" for aroma.

Mouthfeel for brews extracted from drip, steep, and percolator method were comparable which had mean scores equivalent to "like moderately". Mouthfeel is a tactile sensation which literally refer to how food feels in the mouth. For coffee, mouthfeel can be directly affected by roast level and brew strength [8]. In this study, roast level is the same for all the methods, hence it is not a factor for the difference in the mouthfeel characteristic of the brews. Therefore, brew strength for drip, steep, and percolator methods might be the same for the case of brewed sweet sorghum.

On the other hand, brew produced from drip method was the least acceptable in terms of bitterness. As compared to other brews, brew produced from drip method had the least bitterness. This can also be explained by the intensity of brew strength. In drip method, the roasted sweet sorghum grounds might be less efficiently extracted producing a flat and less flavorful brew. Aftertaste or finish describes the sensations that linger after the brew has been swallowed. In this study, aftertaste appeared to be similar for all the sweet sorghum brews. The panelist liked all the samples, "slightly" to "moderately".

General acceptability reflects the panel's overall subjective assessment of the brews' characteristics. Among the four methods used, brewing using the percolator and steep method had the highest acceptability. The percolator and steep method, enriches the liquid extracts more with all the extractable substances by drawing less soluble coffee components into the beverage [9], thus having the highest mean score for general acceptability. This study shows that using percolator or steep method can produce an acceptable sweet sorghum coffee substitute brew.

Correlation of general acceptability to the sensory characteristics

In order to determine the effect of the individual characteristics to the general acceptability of the sample, correlation analysis using Pearson rank of coefficient was done. Table 2 showed that sensory characteristics (color, aroma, mouthfeel, bitterness, and aftertaste) have direct relationship with the general acceptability. Aroma has strong positive relationship with the general acceptability as well as color and mouthfeel. The bitterness and aftertaste characteristics were observed to have a very strong positive relationship with the general acceptability among all the sensory characteristics. Therefore, bitterness and aftertaste characteristics of the brew strongly contribute to the respondents' preference of the SSCS.

General Acceptability	Color	Aroma	Mouthfeel	Bitterness	Aftertaste
Correlation Coefficient	0.588	0.431	0.652	0.791	0.719
Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
N	140	140	140	140	140

Table 2: *Correlation of general acceptability to the sensory attributes of the four differently brewed sweet sorghum coffee substitute[1].*

[1]Correlation is significant at 1% level of significance (2-tailed).

Antioxidant activity

In this study, DPPH was used to evaluate antioxidant activity. When DPPH encounters a proton-donating substance such as an antioxidant, the radical is scavenged and the absorbance is reduced. Thus, the antioxidant capacity of the sweet sorghum brew can be expressed as its ability in scavenging the DPPH free radical. Table 3 shows that brews from drip, press, and percolator method had comparable high

antioxidant activity. On the contrary, brew made from steep method also had high antioxidant activity (81%), but lower than the other methods. The period of contact between the sweet sorghum grounds and the water could be the reason for this. Longer contact time with water can extract more of the antioxidative components of the sweet sorghum grounds. Steep method had the lowest contact time (3 minutes) compared to drip (6 minutes), press (4 minutes), and percolator (8 minutes) method.

Methods	Antioxidant Activity
Drip	90.07 ± 0.28^{a}
Steep	81.10 ± 0.99^{b}
Press	88.91 ± 0.60^{a}
Percolator	89.35 ± 0.27^{a}

Table 3: *Mean scores of the functional components and antioxidant activity of four differently brewed sweet sorghum coffee subsitute[1,2].*

[1]Values are expressed as mean ± standard deviation (3 replicates)

[2]All mean scores bearing different superscripts in columns are significantly different on application of Tukey's Test at 5% level of significance.

Conclusion

Bitterness and aftertaste are the two main characteristics which contributed to the acceptability of the sweet sorghum coffee substitute in this study. Panelist preferred those samples with strong bitter characteristic and aftertaste. Findings of this study suggest that, percolator and steep methods are appropriate to produce an acceptable sweet sorghum coffee substitute. These methods can yield brew with better color, mouthfeel, and bitterness as compared to the others. On the other hand, antioxidant activity was found to be higher in the brew made from percolator than steep method. Taking into account the health contribution of sweet sorghum coffee substitute in the diet, this study recommends the percolator method for brewing sorghum.

Conflict of Interest

The authors declare no conflict of interest.

Bibliography

1. Dendy D. "Sorghum and Millets: Chemistry and Technology". USA: American Association of Cereal Chemists, Inc., (1995).
2. Awika JM and Rooney LW. "Sorghum phytochemicals and their potential impact on human health". *Phytochemistry* 65.9 (2004): 1199-1221.
3. Department of Agriculture. "Coffee" (2013).
4. Belitz HD., *et al*. "Food Chemistry. 4th ed". *Berlin Heidelberg: Springer-Verlig* (2009).
5. Abacan SF., *et al*. "Acceptability, nutritional, and potential health values of sweet sorghum [Sorghum bicolor (L.) Moench] coffee substitute". *Philippine Science and Technology* 8.2 (2015): 68-72.
6. Claudio V., *et al*. "Basic Foods for Filipinos*". Manila: Merriam and Webster Bookstore, Inc.* (1999).

7. Shimada K., *et al*. "Antioxidative properties of xanthan on the autooxidation of soybean oil in cyclodextrin emulsion". *Journal of Agricultural and Food Chemistry* 40.6 (1992):945-948.

8. "Mouthfeel". Coffee Shrub.

9. Clarke RJ and Vitzthum OG. "Coffee: Recent Developments". *Australia: Blackwell Science Ltd.* (2011).

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