Effect of brewing time and duration of listening to Mozart’s symphony on emotions and sensory perception of Wonosari green tea

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Abstract. Mind and body relaxation can be stimulated by consuming tea and enjoying music. While green tea contains L-theanin which stimulate relaxation, music in general may change moods and emotions. This current study aims to determine the effect of listening to Mozart’s symphony number 6, K. 43 at fundamental tone F music on emotion and sensory perception when consuming green tea. Three brewing durations (1, 3 and 5 minutes), 3 levels of listening time to the music (1, 3, and 5 minutes) with 4 different treatment techniques. There were 14 trained panellists involved in the study and they were asked to assess 15 sensory attributes including taste, flavour and mouth-feel of Wonosari green tea on Spectrum method. In general it can be concluded that the music mostly enhance the intensity of sensory attributes (p-value<0.05). It is also important to note that positive emotions improved when respondents listening to Mozart’s regardless the duration of listening.

1. Introduction
Tea is the most consumed drink, after water. Tea is a drink made from the Camellia sinensis plant [1]. Each type of tea has different quality characteristics including color, aroma, taste and appearance [2]. The aroma of tea is a fragrant and has a distinctive taste which is preferred by consumers [3]. As reported, tea commodities greatly affect the economy in Indonesia [4]. One of the tea plantations in Indonesia that producing green tea is Wonosari tea plantation, Lawang.

Green tea as one type of commercial tea which has a relaxing effect mainly due to its L-theanine content [5]. Currently, there are many people who enjoy tea at the café or tea house. Tea connoisseurs consume tea together with cake or just enjoy tea [6,7]. Culturally, during Chinese and Japanese tea ceremonies, they often listen to their traditional and it was believed improving the relaxing effect of enjoying tea. In a separate study, it was reported that Mozart symphony can reduce a person’s stress level and increase the relaxation effect [8]. Therefore, this study focused on the influence of Mozart’s symphony in improving the relaxation effect.

It was also reported in psychology literature states that consumer acceptance of a product is not only influenced by the quality of the product itself, but also influenced by the emotional state of the consumer [9]. Emotions can also play a major role when consumers taste products. Thus, emotions are often involved in sales strategies [10]. Music background is an environmental factor that affects people’s perception of food or drink [11].
The purpose of this study was to determine the effect of Mozart’s symphony to emotions and sensory perceptions when consuming tea. In this current study, the tea was brewed at 85°C for 3 different duration of brewing (1, 3 and 5 minutes). In conjunction to brewing conditions, 3 different listening duration to the music (1, 3 and 5 minutes) were also observed to investigate the influence of music both before and during tea consumption. The sensory attributes of green tea were profiled by sensory spectrum method. The spectrum method consists of a complete, detailed, and accurate descriptive characterization of product’s sensory attributes. This characterisation provides information on the intensities of perceived sensory attributes [12].

2. Materials and Method

2.1. Materials

The raw material used in this study was green tea. Green tea used was obtained from Agrowisata Kebun Teh Wonosari Lawang, East Java in the form of dried tea leaves. In addition, mineral water was used as a palate cleanser and a solvent.

2.2. Method

This research involved 14 trained panellists recruited among Universitas Brawijaya students. One of the main requirements to become a trained panellist candidate is having an interest in green tea and is willing to make time for sensory testing. The selected panellists were trained to identify 15 sensory attributes, including aroma, taste and mouth-feel. All tested sensory attributes are listed in Table 1.

| Attributes                  | Definitions                                                                 | Reference    |
|-----------------------------|-----------------------------------------------------------------------------|--------------|
| Bitter taste                | The basic taste on the tongue is affected by caffeine solution. The bitter taste in the caffeine solution is 0.05% [13]. | Caffeine solution |
| Sweet taste                 | Basic taste associated with sugar solution. Sweet taste in 0.1% sugar solution [13]. | Sucrose solution |
| Sour taste                  | The basic taste is associated with acid. Sour taste with 0.035% citric acid [13]. | Citric acid solution |
| Astringency                 | The dry and wrinkled sensation in the mouth affects the whole tongue more or less evenly. The taste of astringents in cranberries [13]. | Cranberry |
| Toothetch                   | Dryness / tightness is felt when the tongue is rubbed on the back of the tooth surface [13]. | Cranberry |
| Jasmine like aroma          | An intense, slightly stinging, sweet aroma like jasmine, placed 1 drop on a cotton ball [14]. | Jasmine extract |
| Rose like aroma             | The sweet and soft flower scent associated with fresh or dried roses, placed 2 drops on a cotton ball [14]. | Rose water |
| Green herb-like aroma       | The common aroma is associated with herbs, slightly stinging and slightly bitter. Each taken 0.5 g / 100 mL which has been destroyed, then taken 5 mL / 200 mL [14]. | Bay leaves, thyme and basil |
| Smoky aroma                 | Sharp aroma that can be produced and burning wood and leaves. Place 5 almonds in a cup [14]. | Almond |
| Fresh aroma                 | Scent associated with freshly cut grass and stinging leafy plants. Aroma with 5 pieces of grass [13]. | Grass |
| Floral aroma                | A sweet, light, slightly fragrant aroma associated with fresh flowers. Mix 10 g of | Jasmine and green tea |
Attributes | Definitions | Reference
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jasmine tea (into 200 mL of warm water for 2 minutes) and mix with 60 g of green tea (into 200 mL of warm water for 2 minutes) [13]. | Tobacco aroma | Tobacco
The aroma of chocolate, slightly sweet, slightly stinging and related to tobacco. Tobacco is taken 0.2 g which is placed in a closed container [15]. | Brown aroma | Caramel
The aroma smells sharp, caramel, and smells like burning. Given 4 caramel drops on a cotton ball placed in a container and closed [15]. | Spinach aroma | Spinach
The aroma is like the smell of spinach. 35 g of spinach were washed, cut and added 300 ml of water and cooked 3 minutes [13]. | Dried straw aroma | Dry straw
Aroma like dry straw/husk. Dried straw as much as 10 g [13].

For the first experiment, 3 different cups with different brewing times; 1 minute, 3 minutes and 5 minutes at 80°C were presented in front of the panellists. The drinks were prepared by weighing 5 grams of green tea leaves. The music treatments were conducted following the procedure listed in Table 2 without time limitation of listening to the music. For the second experiment, the panellists were served 3 cups of 3 minutes brewed-tea but the panellists were listening to the music at 3 different duration times. Both experiments were assessing exactly the same 15 attributes of green tea compiled from literatures.

Panellists listened to the music through a headset available at the Multimedia Laboratory where the sound intensity can be set up homogenously; 100 for the headset volume and 35 for the computer volume. Tests were carried out by panellists being played by classical music by Mozart with the basic tone F for symphony no. 6 k.43. To move from one technique to the next, a time lag of 5-7 minutes was given, to provide breaks to the panellists. The panellists made an assessment by giving a check mark about their emotions state before and after treatments.

![Table 2. Music giving techniques](image)

| Mozart Music Giving Technique | Pre-Treatment (Before Consuming Tea) | Treatment (At The Consuming of Tea) |
|---|---|---|
| 1st Technique | Without music | Without music |
| 2nd Technique | Without music | Basic tone music F |
| 3rd Technique | Basic tone music F | Without music |
| 4th Technique | Musics basic tone F | Basic tone music F |

Reference: Modified [16].

2.3. Data analysis
For emotional responses, data was collected by completely randomized block design with 2 factors; duration of listening to music and treatment techniques as listed in Table 2. Data results from the assessment of sensory attributes without music and with music were analysed using analysis of variance (ANOVA) and using general linear model (GLM). Then, the results of the analysis were correlated using the Pearson correlation. Emotional questionnaires were presented in the form of words and the panellists provided a checkmark to the word box, which then were classified into 3 categories; positive emotions, neutral emotions, and negative emotions. The emotion was given a code to simplify the analysis process using the one proportion test in which 0 was classified as neutral, 1 was classified as positive and -1 was classified as negative emotion.
3. Results and Discussion
Based on the average value of green tea attribute ratings with different lengths of brewing time, sweetness showed an increase trend when panellists consumed green tea while listening to the music. Unlike the sweetness, the attributes of sour taste, bitter taste, astringent and tooth-etch tended to decreases when music was played. Bitter sensations tended to decrease if the duration of listening to music was longer. It was reported that music affects sweet, sour and bitter taste [17]. It was also reported that Mozart's music improved wine flavor and tended to be sweeter [18, 19].

From the results of testing the effect of listening to music by consuming tea with 3 different brewing times, it showed that the longer the brewing time of the tea, the feeling of tightness, astringency and the perceived tooth-etch were stronger. These attributes are categorized as the mouth-feel sensations. It has been reported that the longer the tea is immersed in water, the stronger mouth-feel sensation of tea [20]. In addition, Mozart's classical music stimulation with different time intensities can also influence the assessment of sensory attributes of green tea. The longer duration of listening to the Mozart's classical music, then the taste of steeping green tea was sweeter. Listening to the music is believed to be able to change a person's sensory and emotional perceptions. Listening to music can affect moods or certain emotional states both positively and negatively [21].

![Figure 1](image1.png)

**Figure 1.** Emotional Response for the duration of listening to music 1 minute(a), 3 minutes(b) and 5 minutes(c)

Based on Figure 1, the technique as listed in Table 2 significantly affected (p-value<0.05) the emotions of panellists, while the duration of listening to the music did not significantly affect the emotions. It was reported that students who listened to Mozart showed better results of standardized tests than students who did not listen to Mozart [22]. Listening to music is considered to be the main
spatial ability because it is similar to nerve activation between passive spatial reasoning and hearing. Other studies also show that Mozart can increase comfort, arousal and positive mood quickly [23].

Recent epidemiological evidence shows that negative emotions can play an important role in the development of various diseases, such as diabetes and hypertension [24]. Classical music is able to activate stored memory and can affect the autonomic nervous system through neurotransmitters that will affect the hypothalamus and then to the pituitary. Music that enters the pituitary gland can provide a negative emotional feedback response into the adrenal gland to suppress the release of stress hormones, so someone who listens to classical music will feel more calm [25]. Giving a combination of treatments between consuming green tea and listening to Mozart's classical music, is thought to reduce stress due to stress so the panellists feel more relaxed.

![Figure 2. Hedonic values for green tea consumption before and after music treatments](image-url)

As shows in Figure 2, the hedonic values tended to increase after musical stimulus. However, the music stimulus duration did not show a significant difference. This is supported by the ANOVA results which show a p-value of 0.241 (p-value <0.05) which means the duration of listening to music does not provide a significant difference to the level of preference of panellists when consuming green tea. Emotions have been shown to affect olfactory perceptions [26]. Music has been shown to influence the perception of sour taste, sweetness, fruitiness, astringency, and length of wine. Listening to music can affect the mood of someone both positive and negative. Drinking wine along with listening to the right music, will get a wine that is more delicious and can create a feeling of comfort [27]. Mood and emotion influence the results of the description of taste, this is because one's feelings can influence their ability to detect both olfactory and gustatory stimuli [27].

4. Conclusions

Even though music stimulus significantly improved panellist hedonic preference, the duration of listening music between 1 and 5 minutes did not change the hedonic score. It was suspected that the duration is not sufficient. However, it has been confirmed that combination of drinking green tea and listening to the Mozart’s tends to improve positive emotions of the panellist. The Mozart’s also tends to improve perception of sweetness the green tea while supress sour taste, bitter taste, astringent and tooth-etch.
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