Sensory Characteristics of No-Sugar Black-Rice Tea Drinks

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Abstract:

This research studied the sensory characteristics of no-sugar black rice tea drinks using various types of rice, including Luem-Pua glutinous rice, Mali-Nil rice and Sangyod rice with different rice bran:rice seed ratios. The sensory characteristics of no-sugar black rice tea drinks were tested on 50 people using the Hedonic 9-scale test. Statistical analysis of variance (ANOVA) followed by LSD multiple comparison post-hoc tests were employed to analyze the data obtained from the study ($p<0.05$) in appearance, color, odor, taste and overall acceptance. Rice-seed tea drink had a significantly lower score than rice-bran tea drink for all characteristics. Preferences of rice bran tea drink with various rice bran: rice seed ratios showed insignificant differences ($p>0.05$) for odor, taste and overall acceptance. The highest of appearance and color scores in Sangyod rice drinks were significant ($p<0.05$). Overall, the acceptance of Luem-Pua glutinous rice drink was the best. Therefore, Luem-Pua glutinous rice tea drink 1:2 formulation is the most suitable. This research demonstrates an application of rice bran to provide high nutritional ingredients for healthy drink products.

Keywords: Rice-tea drinks, Sensory characteristics, Black rice

Introduction

Recently, people have developed increased interest in health promotion. Consumption of grain products is popular in the form of tea drinks, especially in Thailand, where the hot weather results in the drinking of cold drink products. Nevertheless, grain tea drinks presently contain a large amount of sugar, providing energy to the body. When consumers have an unbalanced intake of sugar, the result may be health problems [1]. Thus the addition of sugar substitutes (sucralose) is necessary. Furthermore, the development of a no-sugar tea drink from rice (*Oryza sativa* Linn.) bran would provide a good choice for consumers. Rice bran is one of the valuable by-products of the rice milling process, with potential to supply beneficial health effects for the human body. In particular, rice bran is rich in dietary fiber and contains starch, protein, vitamins and dietary minerals [2]. Moreover, rice bran contains antioxidant phytochemicals such as α-tocopherol, tocotrienol and γ-oryzano [3]. Several studies have shown that α-tocopherol in rice bran can lower the risk of cancer formation, coronary heart diseases, Alzheimer's disease and allergies [4]. Tocotrienols also reportedly inhibit cholesterol synthesis, lower serum-cholesterol levels in various animal models, and suppress tumor-cell proliferation [5]. It is also reported to γ-oryzanol can be used to reduce blood cholesterol levels, treat nerve imbalance, treat inflammatory processes, increase HDL cholesterol levels and inhibit platelet aggregation [6]. Many studies have found that black rice contains higher levels of γ-oryzanol than white rice [7]. The few well-known black varieties such as Luem-Pua glutinous, Mali-Nil and Sangyod are popular for consumption, but studies to develop cold drinks using these promising rice types are still lacking. Therefore, this study aimed to develop cold no-sugar black-rice tea drinks.

Materials and methods

Sample preparation

Rice material of three varieties were collected from difference sources, Luem-Pua glutinous (Sisaket province), Mali-Nil (Surin province) and Sangyod (Phatthalung province). The paddy-rice samples were milled to obtain rice bran and milled grain. All rice brans were dried in a hot air oven at 60 □C for 12 hours and the remaining grain samples were heated for 5 min. These rice bran and grain samples were used in the development of no-sugar black rice tea drinks.

Development of no-sugar black rice tea drinks

In the first preliminary phase, six formulations were prepared in tea bags which were only rice bran or only grain (Table 1). All formulations were dipped in 200 ml of boiling water for 5 min. After cooling, to all drink products were added 0.0067 g of sucralose. Before the sensory test, the drink products were refrigerated at 5 □C for 12 h.

Table 1 Formulation of cold drink products in preliminary phase

Formulation	Rice bran(g)	Grain(g)
Luem-Pua glutinous	3	-
Luem-Pua glutinous	-	3
Mali-Nil	3	-
Mali-Nil	-	3
Sangyod	3	-
Sangyod	-	3

The secondary phase included nine formulations in tea bags (Table 2). All formulations were dipped in 200 ml of boiling water for 5 min. After cooling, to all drink products were added 0.0067 g of sucralose. Before the sensory test, the drink products were refrigerated at 5 □C for 12 h.

Table 2 Formulation of cold drink products in secondary phase

Formulation	Rice bran(g)	Grain(g)
Luem-Pua glutinous	1.0	2.0
Luem-Pua glutinous	1.5	1.5
Luem-Pua glutinous	2.0	1.0
Mali-Nil	1.0	2.0
Mali-Nil	1.5	1.5
Mali-Nil	2.0	1.0
Sangyod	1.0	2.0
Sangyod	1.5	1.5
Sangyod	2.0	1.0

Sensory characteristic of no-sugar black rice tea drinks

Products of both the first preliminary phase and the second phase were labeled with a 3-digit random code number. Fifty subjects who were without rice allergy received the black rice tea drinks. Six sensory characteristics were evaluated by the sample's appearance, color, odor, taste, flavor and overall preference. The study on sensory characteristics was tested by the 9-point hedonic test, 9 being most preferred to 1 being least preferred. The study was approved by the Ethical Clearance Committee on Human Rights Related to Research Involving Human Subjects, Ministry of Public Health (Ref. no. 33/2561).

Results and discussion

Rice tea and rice bran tea drinks

Results from the 9-scale hedonic analysis of rice bran tea and rice seed tea are presented in Table 3. The Luem-Pua glutinous rice, Mali-Nil rice and Sangyod only rice seed tea had overall acceptability scores of 5.62, 5.82 and 5.62, respectively. Overall acceptability score of Luem-Pua glutinous rice, Mali-Nil rice and Sangyod rice bran formulations were 3.92, 4.44 and 4.08, respectively. Mean score of rice bran drink was 3.92-4.64 while rice tea was 4.92-6.12. Rice tea drink had the significantly lower score than rice bran tea drink for all characteristic. Due to rice bran did possess unique odor influencing sensory evaluation. This odor consequent effect on the volatile compound in black rice bran [8]. However, rice bran contains active ingredient for health benefits. This the reason, this study incorporate between rice bran and rice seed to accept in consumer.

Table 3 Sensory characteristics of rice bran and rice tea drinks

Characteristic	Rice tea drinks	
	Rice bran	Rice
1. Luem-Pua glutinous rice		
Appearance	4.08 ± 1.24^{b}	5.82 ± 1.48^{a}
Color	3.90 ± 1.23^{b}	5.70 ± 1.68^{a}
Odor	4.26 ± 1.19^{b}	4.92 ± 1.32^{a}
Taste	4.04 ± 1.29^{b}	5.56 ± 1.57^{a}
Overall acceptance	3.92 ± 1.37^{b}	5.62 ± 1.52^{a}
2. Mali-Nil rice		
Appearance	4.58 ± 1.42^{b}	6.12 ± 1.61^{a}
Color	4.22 ± 1.43^{b}	6.06 ± 1.65^{a}
Odor	4.64 ± 1.44^{b}	5.26 ± 1.66^{a}
Taste	4.44 ± 1.70^{b}	5.82 ± 1.70^{a}
Overall acceptance	4.44 ± 1.69^{b}	5.82 ± 1.59^{a}
3. Sangyod rice		
Appearance	4.42 ± 1.43^{b}	5.82 ± 1.73^{a}
Color	4.44 ± 1.53^{b}	6.10 ± 1.74^{a}
Odor	4.38 ± 1.77^{b}	5.40 ± 1.26^{a}
Taste	4.02 ± 1.78^{b}	5.60 ± 1.59^{a}
Overall acceptance	4.08 ± 1.69^{b}	5.62 ± 1.54^{a}

* Data are means of three replications ± standard deviation. Different letters within the columns indicate significant difference ($p<0.05$).

Ratio of rice bran and rice

In the development of drinks, sensory properties such as appearance, color, odor, taste and overall acceptance are important factors determining consumer acceptability. The mean sensory scores of the parameters of the rice tea drink formulations, as affected by the rice bran : rice ratio 1 : 2, 1 : 1 and 2 : 1, are presented in Table 4.

Preferences of rice bran tea drinks with various ratios of rice bran and rice seed showed insignificant differences ($P>0.05$) for odor, taste and overall acceptance (Table 4). The color of Sangyod rice drinks at 1 : 1 had preference scores significantly lower than Luem-Pua glutinous and Mali-nil rice tea drinks ($P<0.05$). Color preferences of Luem-Pua glutinous rice tea drink at 2:1 also were significantly lower than for other rice tea drinks. Sangyod rice tea drink had the higher scores for the appearance and color characteristics. Results demonstrated that the dark red purple of Sangyod rice tea drink was preferred. The color of Sangyod rice tea drink results from proanthocyanin which is a red purple pigment [9]. Nadjaree et al reported that the color of rice has high importance for product development [10]. Therefore, only color characteristic influenced the preferences of consumers. Rice tea drink ratios of 1 : 2 formulations had the highest means of sensory scores while the ratio 1 : 1 had the lowest score for overall acceptance ($P>0.05$).

Mean scores of rice tea drinks with various rice types were significantly different ($P<0.05$) for appearance. Sangyod rice tea drink (4.92) had the highest preference followed by Luem-Pua glutinous rice (4.76) and Mali-nil rice tea drink (4.36). For the odor and taste evaluation, Luem-Pua glutinous rice drink had higher scores than Mali-nil rice and Sangyod rice formulations ($P>0.05$). Luem-Pua glutinous rice is highly pigmented with strongly flavored rice.

For the 1 : 2 rice tea drinks, the Luem-Pua glutinous rice, Mali-nil rice and Sangyod rice tea formulations had significantly overall acceptability scores of 5.10, 4.44 and 4.58, respectively ($P<0.05$). Results showed that Luem-Pua glutinous rice with 1 : 2 formulation was the most acceptable one because of color and appearance. Luem-Pua glutinous rice 1 : 2 formulation tea drink had the highest score (5.10), which was evaluated as "average". The consumers rated all the sensory attributes for all sample between 4 and 5, which were evaluated as ''slightly unlike" to ''average", respectively. Although scores in preference of rice bran tea drinks were slightly low,this result demonstrated the possibility of rice bran tea drink development.

Conclusions

This research evaluated sensory characteristics of no-sugar black rice tea drinks with various combinations of rice bran and rice seed. The Luem-Pua glutinous rice exhibited the highest overall acceptability score for 1:2 ratio. Other rice tea drinks including rice bran and rice seed were evaluated as slightly unlike. Therefore, there are essential for pursuing further study of rice tea product development. However, our research demonstrated that rice bran tea possessing high nutritional ingredients could be employed for producing difference healthy drink products.

Table 4 Sensory characteristics of rice bran tea drink with difference ratio of rice bran and rice seed

	Ratio of rice bran:rice seed		
	1:2	**1:1**	**2:1**
1. Luem-Pua glutinous rice			
Appearance	4.76 ± 1.48^{aAB}	4.26 ± 1.77^{aB}	4.24 ± 2.08^{aA}
Color	4.82 ± 1.60^{aA}	4.16 ± 1.61^{abB}	4.08 ± 2.09^{bB}
Odor	4.86 ± 1.74^{aA}	4.78 ± 1.65^{aA}	4.96 ± 1.98^{aA}
Taste	4.84 ± 1.65^{aA}	4.92 ± 1.97^{aA}	4.86 ± 2.04^{aA}
Overall acceptance	5.10 ± 1.59^{aA}	4.72 ± 1.92^{aA}	4.92 ± 1.93^{aA}
2. Mali-Nil rice			
Appearance	4.36 ± 1.38^{aB}	4.36 ± 1.38^{aAB}	4.22 ± 1.72^{aA}
Color	4.74 ± 1.29^{aA}	4.12 ± 1.57^{bBC}	4.22 ± 1.72^{abAB}
Odor	4.70 ± 1.13^{aA}	4.40 ± 1.54^{aA}	4.12 ± 1.72^{aA}
Taste	4.16 ± 1.53^{aA}	4.24 ± 1.79^{aA}	4.50 ± 1.74^{a}
Overall acceptance	4.44 ± 1.47^{aAB}	4.24 ± 1.83^{aA}	4.38 ± 1.64^{aA}
3. Sangyod rice			
Appearance	4.92 ± 1.37^{aA}	4.92 ± 1.37^{aA}	4.84 ± 1.52^{aA}
Color	4.98 ± 1.45^{aA}	4.98 ± 1.45^{aA}	4.80 ± 1.57^{aA}
Odor	4.64 ± 1.55^{aA}	4.64 ± 1.55^{aA}	4.58 ± 1.26^{aA}
Taste	4.38 ± 2.00^{aA}	4.38 ± 2.00^{aA}	4.16 ± 1.68^{aA}
Overall acceptance	4.58 ± 1.79^{aB}	4.58 ± 1.79^{aA}	4.46 ± 1.81^{aA}

* Data are mean of three replications ± standard deviation. Different letters within the columns indicate significant difference ($P < 0.05$).

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