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Production and Quality Evaluation of Spiced Black Tea Blends

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ABSTRACT

Black tea is a widely consumed beverage appreciated for its distinctive flavour, aroma, and nutritional value. The incorporation of natural spices such as ginger, cloves, cinnamon, lemon, and doum palm into black tea can improve its overall quality by enhancing its nutritional composition and sensory characteristics. These ingredients contribute valuable nutrients, including carbohydrates, proteins, dietary fibre, minerals, and other bioactive constituents that may improve the quality of the beverage. In addition, the combination of these spices can enhance desirable sensory attributes such as colour, aroma, taste, flavour, and overall acceptability. Therefore, the production and quality evaluation of spiced black tea are important for developing a nutritious and consumer-acceptable beverage. This study investigated the production, proximate composition and sensory evaluation of spiced black tea blend.The black spiced tea blend were produced from doum palm(Hyhaene Thebaica),lemon grass(Cympogon Citratus),ginger(Zingiber Offinale),cloves(Syzygium aromaticun),Cinnamon (Cinnamomum Verum) that have unique properties that could potentially enhance the flavor and taste of black spiced tea.The resulting formulated samples (sample A (100% Black Tea), B (90% Black Tea, 10% Ginger), C (80% Black Tea, 13% Ginger ,7% Clovers), D (50% Black Tea, 20% lemon grass, 30% Doum palm), E (60% Black Tea, 15% Cinnamon, 25% Doum plam), F (70% Black Tea, 15% Ginger ,5% Cloves. 10% Cinnamon), G (60% Black Tea, 10% lemon grass, 10% Cinnamon, 15% Ginger, 5% Cloves), and H (60% Black Tea, 5% Cinnamon, 14% Doum plam, 5%, 10% Ginger, 6% Cloves,5% Lemon grass).) were analysed using standard method and result were subjected to statistical analysis Sensory evaluation was carried out using 10 semi-trained panelists in accordance to 9-point hedonic scale. the proximate composition values were: moisture content ranged from (8.50-6.54%), the protein content values ranged from (5.68-3.48%), crude fibre content values ranged from(17.16-4.55%) fat content (3.58-1.41%), ash content values ranged from (7.34-5.49%), carbohydrate content values ranged from (77.93-58.72%), The Energy values ranged from (340.55-288.98%),From the sensory scores sample H (60% Black Tea, 5% Cinnamon, 14% Doum plam, 5%, 10% Ginger, 6% Cloves,5% Lemon grass) was most preferred in terms of taste, flavour and overall acceptance and Sample B (90% Black Tea, 10% Ginger) was the most preferred in terms of appearance. The findings indicate that the blends significantly improved the taste and aroma of the tea blends.

Keywords: Proximate composition, Sensory evaluation, Black tea, Doum palm, Lemon grass, Cloves, Cinnamon

INTRODUCTION

Tea is the most popular and the most consumed drink after water (Otten, 2010; Walter & Wiederecht, 2006). It is not only the most popular and one of the oldest beverages in the world but also an anti-oxidative agent available in everyday life, which may help to prevent a wide variety of diseases such as cancer and heart diseases (Luczaj & Skrzydlewleska, 2005, Yang, 2002). Tea processing has had many incarnations over the 100 years from loose tea to blended, to packet teas, to tea bags and finally to instant teas, ready-to-drink teas and flavored teas (Boriah, 1997). The beverage is made from the infusion of the processed leaves in the boiling water. It is served hot, cold, or even iced, anywhere and for any occasion. Tea is known for its aroma, refreshing taste, and potential health benefits.

The ingredients mentioned tea leaves, doum palm, ginger, cloves, cinnamon, and lemon-grass all have unique properties that could potentially enhance the flavor and health benefits of tea. For example, ginger is known for its anti-inflammatory and digestive properties, while cloves have been shown to have antioxidant and antimicrobial properties. Lemongrass, on the other hand, is known for its citrus flavor and potential health benefits such as reducing inflammation and relieving anxiety (Kuroda et al., 2000). Cinnamon has been employed as a stomachic and carminative for gastrointestinal complaints as well as other ailments and is still used for these conditions in many countries (Teuscher, 2003).

Doum palm, which is a fruit from the doum palm tree, is less well-known but has been traditionally used for medicinal purposes in some cultures. Doum is one of commonly consumed beverages in traditional places in Egypt and is rich in polyphenolic compounds. The current focus is toward natural antioxidant especially plant polyphenolics (Katalinic et al., 2006; Eldahshan et al., 2008, 2009) Physiologically, antioxidants play a major role in preventing the formation of free radicals, which are responsible for many oxidative processes, antioxidants may be synthetic, such as butylated hydroxyanisole (BHA), Propyle gallate (PC) and butylated

hydroxytoluene (BHT) or of natural origin such as tocopherol, phenolic compounds as well as polyphenolics (Abas et al., 2006). It has been reported to have potential health benefits such as reducing inflammation, improving heart health, and boosting the immune system. It was against the background that the above ingredients were combined to produce tea blend, to create a unique and potentially beneficial tea. The production and evaluation of this tea blend could involve testing different ratios of ingredients, different processing methods, and conducting sensory evaluation and chemical analyses to evaluate the flavor and potential health benefits of the tea.

MATERIALS AND METHODS

Materials

The materials that were used in this study are Black tea leaf, Doum palm fruit, Ginger, Lemon grass, Cinnamon, and Cloves and all were purchased from Monday market in Maiduguri Borno State. The analysis was carried out at National Agency Food and Drug, Administration and Control (NAFDAC), Maiduguri, Borno state. Nigeria.

Sample Preparation

After collecting all the samples, they were dried, ground, sieved to obtained a finely powdered sample which was stored in airtight containers for further analysis. Then the powdered tea was measured and thoroughly mixed with each of the other powdered ingredient in varying ratios, to obtain the desired mixtures and used for the subsequent analysis (Chatterjee et al. 2014).

Table 1: Sample Formulations of Black Tea

Samples	Black tea	Lemon grass	Ginger	Cloves	Cinnamon	Doum palm	%
A	100	0	0	0	0	0	100
B	90	0	10	0	0	0	100
C	80	0	13	7	0	0	100
D	50	20	0	0	0	30	100
E	60	0	0	0	15	25	100
F	70	0	15	5	10	0	100
G	60	10	15	5	10	0	100
H	60	5	10	6	5	14	100

RESULTS AND DISCUSSION

Proximate Composition

Table 2 present the proximate composition of spiced black tea blends from doum palm, lemon grass, ginger, cinnamon and cloves. The proximate composition of the spiced black tea powder blends varied significantly across the different samples. The results showed that the addition of various spices and ingredients affected the sensory attribute of the black tea powder. According to Kumar et al. (2017), the addition of spices and herbs can enhance the nutritional value of tea beverages. In this study, the addition of ginger, cinnamon, and cloves increased the ash, fiber and protein content of the spiced black tea powder blends.

The moisture content ranged from 8.5 % to 6.54 %, with sample F having the highest value of 8.5 % and sample A having the least value of 6.54 %. %, which is within the recommended range for tea powders (Kumar et al., 2017), Sample F had a higher moisture content, which could be attributed to the higher proportion of ginger and cinnamon. The values varied significantly among the samples.

The Ash content ranged from 7.34% to 5.49 % with sample H having the highest value of 7.34 % and sample A having the least value of 5.49 %. the ash content of the samples varied significantly ($p>0.05$), with Sample H having the highest ash content. This could be due to the presence of doum palm, which is rich in minerals such as potassium and magnesium (Omotayo et al., 2018). According to Lee et al. (2018), the ash content of tea powders can vary depending on the type and proportion of ingredients used.

The protein content of the samples differed significantly ($P<0.05$) from each other and ranged from 5.68% – 3.48%. Sample H recorded the highest value 5.68%, followed by samples D which recorded the value of 5.41%, followed by samples C which recorded the value 5.16%, followed by samples B which recorded the value 4.36%, followed by samples F which recorded the value 4.02%, followed by samples A which recorded the value 3.96%, followed by samples G which recorded the value 3.57 while sample E recorded the least in protein content with the value 3.48%, which is comparable to the protein content of other tea beverages (Lee et al., 2018). The addition of doum palm, a fruit known for its high protein content (Omotayo et al., 2018) and ginger increased the protein content of the Spiced Black Tea powder blends. According to Kumar et al. (2017), the protein content of tea powders can vary depending on the type and proportion of ingredients used.

The fat content of the samples ranged from 0.99% to 3.58%. Sample G had the highest fat content, followed by samples H (3.47%) while sample C (0.99%) recorded the least in fat content. Which could be attributed to the presence of ginger, a spice known for its high fat content (Kumar et al., 2017). According to Lee et al. (2018), the fat content of tea powders can vary depending on the type and proportion of ingredients used. The crude fiber content of the samples varied significantly, ranging from 4.55% to 17.16%. Sample H had the highest crude fiber content, Sample H recorded the highest value of 17.16% followed by samples G, F, E, D, C, B, and A having the value of 15.93%, 14.16%, 12.46%, 9.16%, 7.76%, 6.18%, 4.55% respectively. The addition of doum palm, lemon grass, and cinnamon increased the fiber content of the Spiced Black Tea powder blends. According to Kumar et al. (2017), the crude fiber content of tea powders can vary depending on the type and proportion of ingredients used. The carbohydrate content of the Spiced Black Tea powder blends varied significantly across the different samples ($P<0.05$). Carbohydrate content of the samples ranged from 77.93 – 58.72% and sample A (77.93%) recorded the highest value, while sample H (58.72%) recorded the least in carbohydrate content. Sample A, which contained 100% Black Tea powder, had the highest carbohydrate content (77.93%) which could be attributed to the absence of any additional ingredients. This is consistent with the findings of Kumar et al. (2017), who reported that black tea contains a high amount of carbohydrates, mainly in the form of sugars and starches.

The addition of spices and ingredients such as ginger, cinnamon, and cloves decreased the carbohydrate content of the Spiced Black Tea powder blends. For example, Sample H, which contained 60% Black Tea powder, 10% ginger, 6% Cloves, 5% Cinnamon, 5% Lemon grass, and 14% doum palm had a carbohydrate content of 58.72%. This decrease in carbohydrate content could be attributed to the higher fiber and protein content of the spices and ingredients added (Lee, et al., 2018).

The energy content of the Spiced Black Tea powder blends also varied significantly across the different samples. Sample A had the highest energy content (340.55 kcal/100g), which is consistent with the findings of Lee et al. (2018), who reported that black tea contains a high amount of energy due to its high carbohydrate content. The addition of spices and ingredients decreased the energy content of the Spiced Black Tea powder blends. For example, Sample H, which contained 60% Black Tea powder and a blend of spices and ingredients, had an energy content of 288.98 kcal/100g. This decrease in energy content could be attributed to the higher fiber and protein content of the spices and ingredients added, which can help to reduce the energy density of the beverage (Omotayo et al., 2018).

The proximate composition of the Black tea blends showed significant variations in sensory attributes content. The addition of various spices and ingredients can significantly affect the nutritional content of Black tea blends. These findings are consistent with previous studies on the nutritional content of tea powders (Kumar et al., 2017; Lee et al., 2018). Overall, the results suggest that the addition of spices and ingredients can affect the carbohydrate and energy content of Spiced Black Tea powder blends. The study highlights the potential of Spiced Black Tea powder blends as a nutritious and flavorful beverage option.

Table 2: Proximate Composition of Spiced Black tea from the Blends of Doum Palm, Lemon Grass, Ginger, Cinnamon and Cloves

SAMPLE	Proximate Composition %						ENERGY(Kcal/g)
	Moisture	Ash	Protein	Fat	Fiber	Carbohydrate	
A	$6.54^{g}\pm0.01$	$5.49^{f}\pm0.01$	$3.96^{f}\pm0.02$	$1.41^{de}\pm0.02$	$4.55^{h}\pm0.16$	$77.93^{a}\pm0.06$	$340.55^{a}\pm0.08$
B	$7.13^{e}\pm0.01$	$6.89^{c}\pm0.01$	$4.36^{d}\pm0.02$	$2.32^{c}\pm0.02$	$6.18^{g}\pm0.01$	$73.05^{b}\pm0.02$	$330.71^{b}\pm0.01$
C	$6.58^{g}\pm0.01$	$6.91^{c}\pm0.02$	$5.16^{c}\pm0.01$	$0.99^{f}\pm0.01$	$7.76^{f}\pm0.01$	$72.52^{c}\pm0.02$	$319.82^{c}\pm0.02$
D	$6.66^{f}\pm0.02$	$6.35^{e}\pm0.02$	$5.41^{d}\pm0.01$	$1.44^{d}\pm0.03$	$9.16^{e}\pm0.02$	$70.93^{d}\pm0.01$	$318.09^{d}\pm0.02$
E	$7.96^{b}\pm0.01$	$6.55^{d}\pm0.02$	$3.48^{h}\pm0.02$	$1.39^{e}\pm0.01$	$12.46^{d}\pm0.02$	$68.09^{e}\pm0.01$	$298.72^{e}\pm0.02$
F	$8.5^{a}\pm0.01$	$6.96^{b}\pm0.01$	$4.02^{e}\pm0.02$	$2.32^{c}\pm0.02$	$14.16^{c}\pm0.02$	$63.96^{f}\pm0.02$	$293.01^{f}\pm0.01$
G	$7.42^{d}\pm0.05$	$6.99^{b}\pm0.01$	$3.57^{g}\pm0.01$	$3.58^{a}\pm0.02$	$15.93^{b}\pm0.01$	$62.46^{g}\pm0.02$	$296.66^{g}\pm0.01$
H	$7.57^{c}\pm0.02$	$7.34^{a}\pm0.01$	$5.68^{a}\pm0.01$	$3.47^{b}\pm0.01$	$17.16^{a}\pm0.01$	$58.72^{h}\pm0.02$	$288.98^{h}\pm0.01$

Mean in the same column with different superscript are significantly different from each other at ($p<0.05$).Sample A; Black Tea powder 100%, Sample B; Black Tea 90%, Ginger 10%, Sample C; Black Tea 80%, Ginger 13%, Cloves7 %, Sample D; Black Tea 50%, Lemon grass 20%, Doum palm 30%, Sample E; Black Tea 60%, Cinnamon 15%, Doum palm 10%, Sample F; Black Tea 70%, Ginger 15%, Cloves 5%, Cinnamon 10%, Sample G; Black Tea 60 %, Lemon grass 10%, Ginger 15%, Cloves 5%, Cinnamon 10%, Sample H; Black Tea 60%, Lemon grass 5%, Ginger10%, Cloves 6%, Cinnamon 5%, Doum palm 14%

Sensory Attribute Test

The sensory evaluation of the spiced black tea samples revealed significant differences in the perception of color, taste, aroma, and overall acceptability. These findings highlight the complex and subjective nature of human perception, which is influenced by various factors such as cultural background, personal experiences, and emotional state (Katz, 2013). The parameters assessed were color, aroma, taste and overall acceptability which is presented in the table below. The highest score in Colour was in sample H (8.20), followed by sample E (7.20), sample G (7.10), sample A (7.00), sample C (7.00), sample B (6.80), sample D (6.70), and the lowest was sample F (5.50). Taste showed that the highest score was sample E (7.40), followed by sample D (7.40), sample A (7.40), sample G (7.40), sample H (7.20), sample C (6.90), sample F (6.30), and lowest score was sample B (5.80). Aroma showed that the highest score was sample H (8.30), followed by sample E (7.10), Sample C (7.00), Sample A (6.80), Sample D (6.70), Sample B (6.50), Sample G (6.50) and the lowest score was Sample F (5.20).

The Overall acceptability indicated that highest score was recorded in Sample H (8.40) followed by Sample E (7.40), Sample D (7.40), Sample A (7.40), Sample G (7.30), Sample F (7.20), Sample C (6.90) while Sample B (6.60) had the lowest score.

Sample A (Black Tea 100%) had the highest score for taste which can be attributed to the natural sweetness and astringency of black tea (Kuhnert, 2010). The moderate score for aroma is consistent with the typical tea aroma profile (Spence, 2015). Sample B (Black Tea 90%, Ginger 10%)

The addition of ginger in Sample B resulted in a slightly spicy and sweet taste profile, which is consistent with the typical flavor profile of ginger (Grzanna, 2005). The moderate score for aroma is consistent with the typical aroma profile of ginger (Naik, 2010). Sample C (Black Tea 80%, Ginger 13%, Cloves 7%). The combination of ginger and cloves in Sample C resulted in a complex flavor profile, with a balance of sweet, spicy, and aromatic notes (Kikunaga, 2010). The strong tea and spice aroma is consistent with the typical aroma profile of black tea and spices (Spence, 2015).

Sample D (Black Tea 50%, Lemon Grass 20%, Doum Palm 30%). The addition of lemon grass and doum palm in Sample D resulted in a refreshing and citrusy flavor profile, which is consistent with the typical flavor profile of lemon grass (Naik, 2010). The moderate score for aroma is consistent with the typical aroma profile of citrus fruits (Kikunaga, 2010). Sample E (Black Tea 60%, Cinnamon 15%, Doum Palm 10%). The addition of cinnamon in Sample E resulted in a warm and spicy flavor profile, which is consistent with the typical flavor profile of cinnamon (Khan, 2003). The strong cinnamon aroma is consistent with the typical aroma profile of cinnamon (Spence, 2015).

Sample F (Black Tea 70%, Ginger 15%, Cloves 5%, Cinnamon 10%)

The high score for taste in Sample F can be attributed to the natural sweetness and spiciness of ginger (Grzanna, 2005).

However, the weak ginger aroma resulted in a lower score for aroma (Naik, 2010). Sample G (Black Tea 60%, Lemon Grass 10%, Ginger 15%, Cloves 5%, Cinnamon 10%). Sample H (Black Tea 60%, Lemon Grass 5%, Ginger 10%, Cloves 6%, Cinnamon 5%, Doum Palm 14%). The combination of ingredients in Sample H resulted in a complex and balanced flavor profile, with a strong and complex aroma. The high score for overall acceptability indicates that this sample was highly liked by the panelists (Katz, 2013). The results of this study emphasize the importance of considering the subjective and emotional aspects of human experience in the development and evaluation of food and beverage products. By taking into account the complex interplay between sensory perception, emotions, and cultural background, manufacturers and marketers can create products that resonate with consumers on a deeper level and provide a more satisfying and enjoyable experience (Loken, 2017).

Table 3: Sensory Properties of Spiced Black Tea from the Blends of Doum Palm, Lemon Grass, Ginger, Cinnamon and Cloves

SAMPLE	COLOUR	TASTE	AROMA	GENERAL ACCEPTABILITY
A	$7.00^{a}\pm1.34$	$7.40^{a}\pm1.27$	$6.80^{ab}\pm1.48$	$7.40^{ab}\pm1.18$
B	$6.80^{a}\pm2.15$	$5.80^{a}\pm2.79$	$6.50^{ab}\pm2.06$	$6.60^{ab}\pm2.28$
C	$7.00^{a}\pm2.06$	$6.90^{a}\pm2.14$	$7.00^{ab}\pm1.89$	$6.90^{ab}\pm1.45$
D	$6.70^{a}\pm1.95$	$7.40^{a}\pm1.89$	$6.70^{ab}\pm2.27$	7.50ab±1.44
E	$7.20^{a}\pm2.05$	$7.40^{a}\pm2.46$	$7.10^{ab}\pm2.14$	$7.50^{ab}\pm1.50$
F	$5.90^{a}\pm2.89$	$6.30^{a}\pm2.50$	$5.20^{b}\pm2.39$	$7.20^{b}\pm1.99$
G	$7.10^{a}\pm2.17$	$7.40^{a}\pm1.18$	6.50^{a}b±1.19	7.30^{a}b±1.16
H	$8.20^{a}\pm1.14$	$7.20^{a}\pm1.23$	$8.30^{a}\pm1.06$	$8.40^{a}\pm1.75$

Mean in the same column with different superscript are significantly different from each other at ($p<0.05$). Sample A; Black Tea powder 100%, Sample B; Black Tea 90%, Ginger 10%, Sample C; Black Tea 80%, Ginger 13%, Cloves7 %, Sample D; Black Tea 50%, Lemon grass 20%, Doum palm 30%, Sample E; Black Tea 60%, Cinnamon 15%, Doum palm 10%, Sample F; Black Tea 70%, Ginger 15%, Cloves 5%, Cinnamon 10%, Sample G; Black Tea 60 %, Lemon grass 10%, Ginger 15%, Cloves 5%, Cinnamon 10%, Sample H; Black Tea 60%, Lemon grass 5%, Ginger10%, Cloves 6%, Cinnamon 5%, Doum palm 14.

CONCLUSION

An acceptable Spiced Black tea formula was produced fromthe blends of doum palm, lemon grass, ginger, cinnamon and clovesat different proportion. Eight (8) products produced from different formulation were subjected to sensory evaluation. the sensory panel rated the products highly for all parameters investigated. Product H was produced from Black Tea 60%, Lemon grass 5%, Ginger10%, Cloves 6%, Cinnamon 5%, Doum palm 14% was most acceptable to panelist while Sample B having black tea 90%, ginger 10% had the lowest acceptability.

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