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Proximate Analysis and Sensory Evaluation of Milk Drink Produced from Cashew Nut (*Anacardium occidentale*) and African Black Plum (*Vitex doniana*)

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Abstract

The main objective of the study was to evaluate proximate attributes and sensory properties of milk drink produced from cashew nut (*Anacardium occidentale*) and African black plum (*Vitex doniana*).Specifically, the study determined proximate attributes, vitamins, mineral, flavonoid content and sensory properties of the milk drink. Cashew nuts were bought from Oba market in Nsukka, Enugu State. The cashew nuts were washed thoroughly and soaked for eight hours and stored in the refrigerator. The cashew nuts were washed thoroughly the second time ground with a food blender to obtain the milk. The vitex doniana was washed thoroughly in salted water rinsed thoroughly, skinned and deseeded. Water was added to the pulp, the pulp was pasteurized. The cashew nut milk and vitex doniana pulp were mixed with honey and blended. The instrument used for data collection was the use of standard scientific method of chemical analysis of AOAC, 2010 and an organoleptic test template of 9-point hedonic scale was used. Findings reveal that the drink (drink made with cashew nut and African black plum and honey (DRMC)is high in energy (289.58 kcal), crude protein(5.85%), fat (10.15%) ash (2.43%) carbohydrate(8.85%) crude fibre(4.01%) moisture(84.77%)zinc (198.33 µg/100g). iron (3821.04µg/100g); potassium (17.58mg/100g), vitamin A, B,C,E, flavonoid(0.65mg/100g) and low level phytate (1.18mg/100g). The produced drink is therefore rich in nutrients and was highly accepted ($\overline{X}$ = 8.6), texture rated ($\overline{X}$ = 8.4), appearance ($\overline{X}$ = 7.8), taste ($\overline{X}$ = 8.8). Base on the findings three recommendation were made.

Keywords: Cashew, Nut, Plum, Milk, Drink, Proximate, Analysis, Sensory Evaluation, Honey,

Introduction

Drinks are liquids that are orally consumed for nourishment. According to Rashford (2023) drinks are liquids specifically prepared for human consumption to provide both fluid and nutrients. They can be sugary or tangy, plain like water or flavoured, light, or

heavy such as yoghurt or smoothie. They can also be coloured or plain. Burnett (2012) observed that drinks can be in any form, sweet or sour. Drinks can be made at home or manufactured in factories with fruits, roots, seeds, leaves nuts and barks of plants. According to Mason et al (2020) beverage crops are verse and drinks can be produced from any part of the plant. Drinks are also referred as beverages. Beverages produced from plants can also be classified into alcoholic and non-alcoholic drinks. Feroze, et al (2021) acknowledge that drinks can be classified into two major groups, alcoholic and non-alcoholic.

The non-alcoholic drinks are further grouped under refreshing, stimulating and nourishing drinks. Refreshing drinks include water, fruit, juices, sweetened and unsweetened soft drinks. Nourishing drinks provide protein and other nutrients to the body. According to Hattersley, et al (2023) nourishing drinks have high protein, energy, vitamins and mineral. Nourishing drinks include drinks prepared from fruits and vegetables, milk shakes and milk based products.

Milk based drinks are beverages that are made from milk products. Milk can be obtained from both animal and plant sources. Milk from plant sources are obtained from cereals, legumes, seeds, roots and nuts. Tyagi and Anurag (2016) noted that plant based milks are non-dairy beverages made from water based plant extracts. Some of these plant extracts include coconut, almond, walnuts, hazelnuts,pistachio, tiger nuts, soya beans and cashew nut.

Cashew nut is obtained from a tropical plant, the cashew tree. The oval ,round or oblong leaves are yellow lemon green and dark green in colour and abundant on the tree. The tree is a canopy growing up to 20metres in maturity (Nkumbula, 2023). According to Nkumbula(2023)the cashew (*Anarcadium occidantale*) is a perennial plant that may be found growing in various tropical regions it is a hardy tree that can thrive in a many environments. Cashew tree originated from Brasil. Gnagne et al (2023) noted that cashew originated from Brasil, then the European merchants introduced the plant into tropical African soil. *Anacardium occidentale* is cultivated through vegetative propagation. Elouaflin et al (2023) stated that vegetative propagation remains the only effective way of cultivating *Anacardium occidentale*. The plant grows rapidly in tropical soil whether muddy or sandy. When the tree is vegetatively propagated flowering starts in one year(Nkumbula et al, 2023).The cashew fruits have two distint parts, the fleshy juicy cashew apple from the stalk(false fruit) and the hard kidney shaped nut which is the real fruit. Akyereko (2023) stated that fleshy part of the fruit which is also rich in nutrients is the pseudo fruit while the nut is the proper fruit and that the nut is of more economic value than the cashew apple. Nigeria has high ranking in cashew nut production. According to Pelemo et al(2023) Nigeria is the fifth largest producer of cashew in the world. The cashew apples are eaten whole or used to make juice. In Nigeria the nuts are mainly

eaten as snacks or used as part of puddings and sweet dishes. Akyereko (2023) stated that most people eat the cashew apple whole but few use the fruit as puree or use the juice for alcoholic drink.

Cashew nut milk is a plant based milk obtained from cashew nuts. Apart from soy and rice milk, other plant based milk are now introduced to the market. Slade (2023) opined that the alternative milk market that was once dominated by soy and rice milk now has many varieties of nut-based milks, each of which provides a unique flavour and different nutritional benefits. Cashew nut milk may be an excellent alternative to dairy milk . This is because of the protein ,healthy fat and other nutrients it provides while still maintaining a creamier viscosity than other nut milk. According to Reyes-Jurado et al (2023) Cashew nut milk is a supreme alternative to dairy milk. Aydar (2023) further noted that yoghurt made from cashew nut milk has similar texture, colour and taste as the yoghurt made from dairy milk. Also It contains high levels of proteins, carbohydrates, polyunsaturated and monounsaturated fatty acids (PUFAs and MUFAs), ascorbic acid, reducing sugars and minerals (Ca, Fe, P, Mn, Cu, and Se), which act as cofactors that regulate the physiological mechanisms and metabolic functions(Aydar 2023). In the area of plant-based alternatives to dairy milk. As the world is searching for nutritious and environmentally sustainable alternatives to feeding, this nut based milk may become the favourite. Offering a lactose-free and dairy-free solution that appeals to the taste and health of many. It may boost immunity and improve heart, eye, and skin health (Reyes-Jurdo et al 2023)

Cashew nut milk has a creamy dull colour, in order to make attractive like a chocolate drink, the cashew nut milk was coloured with (*Vitex donianablack*) Africa black plum. *Vitex doniana* is not only a natural fruit with colour, it is also rich in food nutrients .Therefore *Vitex doniana* will also enrich the milk with nutrients. The colour of beverages and drinks play major roles in demand and choice of consumers. Echegaray, et al (2023) stated that the use of colourant in food industries is an essential ingredient in drinks and other products since color is one of the most essential attributes of food.

Vitex doniana (black plum) is a tree that grows widely in West Africa. This is abundant in all parts of Enugu state.The fruit is dark brown when ripe and succulent. According to Adoukonou-Sagbadjaet al (2023)*Vitex doniana* is a deciduous, nitrogen-fixing forest fruit tree found from coastal woodlands and savannah and dry forests to wetter areas at lower elevations in tropical Africa. Also Irinmwinuwa et al (2023) Stated that this medium-sized, deciduous tree is 8–18 m tall with a heavy, rounded crown, has oblong fruit that is about 3 cm long. The fruit is green when young and turns purplish black when ripe. It is sweet and eaten fresh or can be used for making jam or wine. Odoom et al (2023) states that the fruit can be used for making jam and wine. The plant has many names in Nigeria some call "*mbebe*", some call

"*mkwamkwa*", others call "*uchakiri*". The plant is also commonly referred to by other various local names in different regions, such as "*Kei apple*" in South Africa and black plum or "*mkani*" in various African languages. The fruit has high nutritional content of fat, carbohydrate, protein, vitamins and mineral. According to Audu et al (2023) African black plum (*Vitex doniana*) is rich in protein. fat, carbohydrate, iron, potassium, sodium, calcium, copper and also Vitamins A, B 1 , B 2 , B 6 Therefore African black plum (*Vitex doniana*) will fortify and supplement the nourishing drink with additional food nutrients. The fruits are picked and eaten raw, made into a preserve as jam or syrup.

Objectives of the Study

The main objective of the study was to investigate the proximate composition and sensory attributes of milk drink produced from cashew nut (*Anacardium occidentale*) and black plum (*Vtex doniana).*

Specifically, the study determined the following compositions of the milk drink produced from cashew Nut (*Anacardium occidentale*) and African black plum(*Vitex doniana*):

1. Nutrient and energy
2. vitamins
3. minerals
4. flavonoid
5. phytate
6. sensory properties

Materials and Methods

***Design of the study*:** Experimental research design was employed in the study.

***Materials*:** Cashew nut(*Anarcadium occidentale*),) was purchased from Oba market in Nsukka, Enugu State Nigeria. The Black plum *(Vitex doniana*) was picked from the trees in Federal Government College Enugu, Enugu State. Honey was bought from Nkwo Ibagwa Nsukka in Enugu state. Chemicals used in the study were of analytical grade and obtained from Energy Center University of Nigeria Nsukka. Vanilla flavour was bought from Ogbette main market in Enugu

Preparation of Materials: Materials were prepared as following:

Cashew nut milk: One cup of cashew nuts was washed with salt using clean boiled water. The nuts were soaked in sterilised container with water that had been boiled and cooled in the refrigerator for eight hours. The nuts were thoroughly rinsed three times until the water became clear. The cashew nuts were milled using Binatone blender with method described by Talor (2017). Ratio was one cup cashew nuts to two cups water. A creamy homogenous mixture. The milk obtained was not strained.

Black plum(*Vitex Doniana*) extract: 300grams of black plum was thoroughly washed with salt water and rinsed four times to remove any trace of salt. The fruits were skinned to remove the thin leathery peel. The pulp was washed out with one cup of water, the extracted brown liquid was pasteurized by heating in a double

boiler while stirring frequently for 1 minute.

Honey: The honey was also pasteurized by heating in a double boiler with low temperature for 5minutes.Bodor et al(2023) stated that heating honey under low temperature has no effect on the physicochemical parameters.

Formulation of cashew nut milk, black plum extract and honey milk drink:

Recipes**:**

1. 2 cups of cashew nut milk
2. 7 tablespoons of extract from black plum
3. 3 tablespoons of honey
4. ¼ teaspoon of vanilla essence flavour

The above were mixed with agitation in Binatone blender for 30 seconds to obtain the milk drink.

Nutrient Analysis**:** Analysis of the drink was carried out in triplicates using standard methods as follows:

Fat, protein, moisture, carbohydrate, and energy of nourishing drink were determined according to the AOAC(2016) method. Moisture content was determined via thermogravimetric in muffle furnace (Sanyo Gallenkamp, Weiss Technik, West Midlands,UK) at 500C for 24 h. Fat was determined by exhaustive extraction of 0.5g of sample with petroleum ether in a microsoxhlet extraction unit (Gerhardt, Bonn, Germany). Determination of protein was by Kjeldahl method. After distillation and titration, nitrogen was corrected using a factor of 5.25. Carbohydrate was obtained by the difference of moisture, protein fat and ash fom 100 percent.

Mineral Analysis: The mineral content of the nourishing drink was evaluated using the method of AOAC (2016). Calcium, Potassium, Zinc, iron and sodium were determined using the atomic absorption spectrophotometer (Buck Scientific 210 CGP, USA) after preparation of mineral solution.

Vitamin Analysis: The vitamins A, B2, B6, B12, C, and E of nourishing drink were determined according to the AOAC(2016)

Sensory Evaluation:

Selection of Panellist: A twenty-member panellist consisting of students of Home Economics and Hospitality Management Education University of Nigeria Nsukka were used for the sensory evaluation. The criterion for the selection of panellist was based on their knowledge of the products to be evaluated. The panellists were asked to sit on the laboratory stools with spaces apart with coded paper given to each of them to evaluate the drink. The panellists were instructed to rinse their mouth with water before and after tasting the drink.

Instrument of data collection**:** The instrument used for data collection was a sensory evaluation questionnaire. The drink sample was evaluated for appearance, taste, texture, flavour and overall acceptability. Each attribute was rated on a 9-point hedonic scale with 1= dislike extremely while 9=like extremely (Iwe, 2010)

Data collection**:** The instrument was administered to the students in the

sensory evaluation laboratory. Two (2) research assistants were also recruited and instructed on the method of administration of the questionnaire.
Data analysis technique: Results were analyzed statistically by mean rating of the sensory attributes.

RESULTS

Table 1: Energy, Protein, Fat, Ash, Crude Fibre, Moisture and Carbohydrate Contents of Milk Drink

Variables	DRMC (% nutrient composition 100g)
Energy content(Kcal)	289.58Kcal
Crude Protein (%)	5.85
Fat%	10.25
Ash	2.43
Crude Fibre	4.01
Moisture	84. 77
Carbohydrate	8.85

DRMC = drink made from cashew nut milk, black plum and honey.

Table 1 shows the energy and proximate composition of DRMC per 100g. The energy content was (289.58Kal) per 100g , crude protein content (5.85%),fat content (10.25%), ash content 2.43%, crude fibre 4.01%, moisture 84.77%, carbohydrate 8.85%.

Table 2: Vitamins contents of the milk drink

Variables	DRMC (vitamins in mg)
Vitamin A (mg/100g)	0.12
Vitamin C (mg/100g)	8.35
Vitamin E (mg/100g)	0.35
Vitamin B12 (ug/100g)	0.59
Vitamin B2 (mg/100g)	1.05
Vitamin B6 (mg/100g)	0.08

DRMC = drink made from cashew nut milk, black plum and honey.

Table:2 Shows that DRMC has vitamin A (0.12 mg/100 g), vitamin C (8. 35 mg/100 g), vitamin E (0.35 mg/100 g), vitamin B12 (0.59 ug /100 g), and vitamin B2 (1.05 mg/100 g) vitamin B6 is 0.08 mg/100 g as shown in table. Unlike the other vitamins, vitamin B12 was measured in micrograms because it is required in minute quantity to satisfy body need.

Table 3: Mineral contents of the milk drink

Variables	DRMC mineral content(mg/100g)
Zinc (µg/100g)	198.33
Iron (µg/100g)	3821.04
Potassium (mg/100g)	75.58
Sodium (mg/100g)	17.85
Calcium (mg/100g)	22.22

DRMC = drink made from cashew nut milk, black plum and honey.

Table 3 shows the mineral content of DRMC, zinc (198.33 µg/100 g), Iron (3821.04 µg/100 g), potassium content (75.58 mg/100 g), sodium content (17.85 mg/100 g) and Calcium content (22.22 mg/100 g). The zinc and iron were measured in micrograms because

they are required in minute quantities meet up with body needs.

Table 4: Phytochemical contents of the milk drink

Variables	DRMC (mg/100g)
Flavonoids (mg/100g)	0.65
Phytate (mg/100g)	0.18

DRMC = drink made from cashew nut milk, black plum and honey .

Table 4 show that DRMC has flavonoids 0.65mg/100g and phytate 0.18mg/100g

Table 5: Sensory properties of the milk drink.

Variables	**Mean values**	**Decision**
Appearance	7.8	Good
Taste	8.8	Good
Texture	8.4	Good
Aroma	8.2	Good
Flavour	8.6	Good
Overall acceptability	8.6	Good

DRMC = drink made from cashew nut milk, black plum and honey
Good=mean score within the limit of 9.00 -6.00

Table 5 shows that the taste of DRMC is the highest attribute. Even though the flavor and texture were also rated (8.4) higher than the appearance (7.8), the appearance also has good rating. The Table which has overall acceptability at 8.6 displayed optimum organoleptic acceptance.

Discussion

The higher energy value observed in DRMC could be attributed to sum of the fat, protein and carbohydrate composition of the ingredients such cashew nuts used in the production of the drink (Audu et al (2023) . The protein content of the drink sample is similar to the 6.0 g protein in dairy yoghurt, this collaborates the report by Aydar(2023) that cashew nut milk have closer nutrient quality to dairy milk than other nut milks. Higher protein content of the drinks suggests valuable contribution in combating protein energy malnutrition. The presence of fat in the drink samples could be attributed to the fat content of cashew nuts used in the production of the drink sample. The fat in the drink samples could suggest possible presence of fat-soluble vitamins and contributes to high rank in the flavoured score. The fats are also healthy plant fats as reported by Reyes-Jurdo et al (2023) that the fat from cashew nuts are polyunsaturated and monounsaturated fatty acids (PUFAs and MUFAs. The value of vitamin A and E observed in this study were low. The reason could be that all the sources of the ingredients used in the production of the drink samples are not good sources of vitamin A and E. Vitamins A and E are antioxidant that plays a significant role in fighting free radicals, vitamin A helps in the sight and boost immunity. Vitamin C is an antioxidant that mitigate oxidative stress, (Jodh et al 2023). Vitamin C is also enhancer of nonheme iron absorption, and help in wound healing. Riboflavin found in the sample drink could be traced to the food sources of the drinks used in its production such as cashew nut and *Vitex donaina*, approximately 108 ml and 91.7 ml of this drink per day will

provide an adult male and female, respectively with, respectively with 100% (1.3 mg for male and 1.1 mg for female) of their Recommended Dietary Allowance (RDAs) for their riboflavin requirement per day (McGuire &Beerman, 2011). Riboflavin is responsible for the production of flavin mononucleotide (FMN) and flavinadenin adenine dinucleotide (FAD), two important coenzymes for energy metabolism. This drink should be recommended for people who are suffering from riboflavine deficiency, alcoholics, people on poor diets and people suffering from thyroid disease for cost effective prevention and treatment of their conditions. Vitamin B12 also called cobalamin, was found in the drink sample. vitamin B12 in the sample DRMC in the study could furnish some percentage of the RDA for adults based on the 100 ml per day. Its role in the for ATP production and amino acid metabolism cannot be overemphasized, the low content of the vitamin B12 in the drink could be attributed to its uniqueness and for the facts that vitamin B12 cannot be made by plants or higher animals but only by microorganisms (such as bacteria and fungi).

Study observed high zinc and Iron content in drink sample DRMC made from Cashew nut milk coloured with vitex doniana extract and honey. This could be due to the high zinc and iron contribution of the individual ingredients for the production of the drink sample from cashew nut, vitex doniana and honey. High zinc and iron content of the drink have been reported to produce an essential micronutrient human body function. The presence of zinc, iron and vitamin C in the drink is essential role in haemoglobin formation, macronutrient oxidation, and central nervous system functioning it also helps in cell mediated immunity, control of infection and haemopoiesis and bioavailability of other nutrients (Totten et al 2023). Zinc is essential for human growth and immune functions. Higher consumption of drinks rich in zinc and iron will significantly help in combating malnutrition, iron deficiency anaemia, improve immune function and optimal growth and development. Potassium content in drink is of great value, Consumption of food rich in potassium is essential in the normal functioning of the skeletal muscles, heart and enzyme reactions (Etiola et al., 2018). The study observed that sodium content of the drink sample is lower compared to food product that contain 140 mg/100g of sodium or less that are considered as low sodium foods or drinks. The low sodium foods or drinks are suitable for individuals with conditions that require low sodium intake (Ezenwa and Iheme, 2021). The study observed Calcium content in DRMC, Calcium content in the sample drink would help in healthy bones and teeth.

The drink has flavonoids even though the flavonoid content of the drink sample was lower than the range (5 to 15%) reported for different brands of tea by (Ifemeje et al., 2020) and 92.86 to 115.35% of tisane produced from Aidan fruits (*Tetrapleura teraptera*) and *Uziza* seeds *(Piper guineense*) reported by Ezeocha and Urenwoke, (2023)

Flavonoids are strong anti-oxidants, with anti-inflammatory and antimicrobial properties (Okafor and Ogbobe, 2015). Even though there is phytate in the drink which is supposed to inhibits iron absorption, the vitamin C counteracts the inhibition effect of phytates,phytic acid also acts as antioxidant(Saleh et al 2023)

Organoleptic analysis of the drink indicated that the drink has high sensory attributes with optimum overall acceptability. The overall acceptability could be attributed to among other factors the attractive chocolate colour from *Vitex doniana* Echegaray, et al (2023) reported that the use of colourant in food industries is an essential ingredient in drinks and other products since color is one of the most essential attributes of food, that enhances acceptability.

Conclusion

The study concluded that the milk drink produced from cashew nut (*Anarcadium occidentale*) , Black plum *(Vitex doniana*) and honey showed that it is rich in fats, energy, protein and minerals such as iron, zinc, potassium, calcium and an appreciable amount of vitamins A, C E, B2, B6, and B12. The drink has high sensory score rate for all the attributes. Therefore, the drink should be promoted as a healthy and nutritious drink. Can be used for both prevention and management of malnutrition especially protein energy malnutrition (PEM), iron deficiency anaemia. The vitamins A, C,E, and minerals magnesium and zinc are essential in boosting immunity in adult and children. The drink can be a healthy alternative to people that are allergic to dairy milk and soy milk.

Recommendations

From this study, it is recommended that

1. The milk drink be promoted as a nutrient dense drink for quality health promotion.
2. The milk drink be consumed as better alternative to energy and carbonated drinks that predisposes people to nutritional problems especially among children in Nigeria.
3. The drink should be produced for individuals with dairy allergy problems.

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