



Assessing the Nutritional Composition and Acceptability of Indian Almond Drink

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This study was to find out the nutritional composition and acceptability of Indian Almond Nuts (IAN) drink among the students of the University of Cape Coast. Experimental and descriptive research designs were adopted for the study. Proximate analysis was done on the dry matter of IAN to determine the nutrient in the nuts, juice and drinks. Mean, standard deviation and One-way ANOVA were used to analyse the data. The result had shown that IAN had protein, Oil/Fat, fibre and carbohydrate, as well as mineral elements. The mineral elements found were Phosphorous, Potassium, Sodium, Iron, Copper, Zinc, Calcium, Magnesium, Protein and carbohydrate at varied degrees in Juice with un-spiced syrup (JUS), Juice with spiced syrup with vanilla flavour (JSV), Juice with spiced syrup and pineapple (JSP); Juice with spiced syrup and strawberry flavour (JSS). Also, the result showed JSS was the most accepted formulation (4.09). The study recommends that health personnel to encourage people to take the IAN drink for the health benefits and Agriculture extension officers should educate farmers to grow more of India Almond trees for the nuts.

Keywords: *Nutrient; acceptability; almond; juice; drink; minerals.*

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1. INTRODUCTION

The Indian almond nut tree is an economic tree that is found across the length and breadth of Ghana. The nuts contain essential food nutrients like protein, carbohydrate, unsaturated fats, vitamins and mineral elements, but most people are ignorant of this important information [1]. A lot of people need to have access to the nutritional benefits that is associated with the nuts.

The constituents of Indian almond nuts according to Barku, Nyarko and Dordunu [2] had a specific gravity (0.923), refractive index (1.465), moisture content (0.550%), insoluble impurities (0.133%), free fatty acid (0.38%). The peroxide, iodine, acid and saponification found were (4.073 meq/kg), (121.19 wijs), (0.78 mgKOH/g), (168.27 mg KOH/g) respectively. The mineral content in the three samples indicated that P, Na, Ca, Mg and K were abundant in five minerals examined [3].

According to Weerasekara et al. [4], proximate analysis IAN drink and the protein and fibre content found were 0.043% and 0.82% respectively. Similarly, a significant difference ($p < 0.05$) was found when sensory evaluation was carried out [5]. Sensory evaluation of the milk samples showed significant differences between samples. Almond milk (1.90) was comparable to soymilk (2.10) in mouth feel ($p > 0.05$). According to Alozie and Udofia [5] Almond milk was more preferred in terms of colour, flavour, taste and overall acceptability ($p < 0.05$). This study looked at preparing a non-alcoholic drink using Indian almond nuts and sensory testing to obtain acceptability of the drink for people to benefit from its nutritional value.

1.1 Research Questions

1. What kinds of nutrients are found in the Indian almond nuts?
2. What is the composition of Indian almond drink?
3. Would the Indian almond drink be accepted by consumers?

2. MATERIALS AND METHODS

This section discusses the research design, sample size and sampling procedure, instrumentation, Sample Selection and Preparation and data analysis.

2.1 Research Design

This study adopted experimental and descriptive research designs to investigate the nutrients available in Indian Almond Nuts in a non-alcoholic drink. There are disadvantages of this design, the advantages outweigh the disadvantages. The advantages of the completely randomised design are that there is complete flexibility in this design because any number of treatments and replications can be tried and also the whole experimental material can be utilised [6].

2.2 Sample Size and Sampling Procedure for Sensory Evaluation

A total of one hundred and twelve (112) students were purposively selected from four hundred and seventy-one (471) students from the Department of Vocational and Technical Education in University of Cape Coast. Purposive sampling was employed in the sense that these students study Foods and Clothing hence, they have knowledge on how to do sensory evaluation. The Level 400 students were out on off Campus teaching practice so only a few were accessed to take part in the study. The Level 100 students were not easily available since they were new on campus, most of them were not available due to lecture schedules and so getting them was difficult.

2.3 Instrumentation

The instruments for data collection were questionnaires and observation checklist. The sensory evaluation questionnaire was self-designed based on 5 point hedonic scale [7]. The measuring scale was 1-Poor, 2-Fair, 3-Good, 4-Very good and 5-Excellent. The observation checklist used was to help judge the respondents' facial expression as they taste the drinks.

2.4 Sample Selection and Preparation

The Indian Almond Nuts used for the juice were collected at the backyard of residents in Cape Coast Metropolis. The nuts were dried under the Sun during the day and collected when the Sun sets. Manual cracking of the nuts was done because there was no mechanical machine available to crush the IAN in Cape Coast. The seeds were washed with potable water at 37⁰ C and left to dry in an oven. A measured 100g of

Indian almond nuts was first milled with a blender in whole and dried in the oven at 60°C for 48 hours and later cooled in the desiccator. The rough powder was then milled to enlarge the surface area of the sample for easy breakdown of the food components for the various contents to be identified. The sample was then put in zip lock for the various analyses.

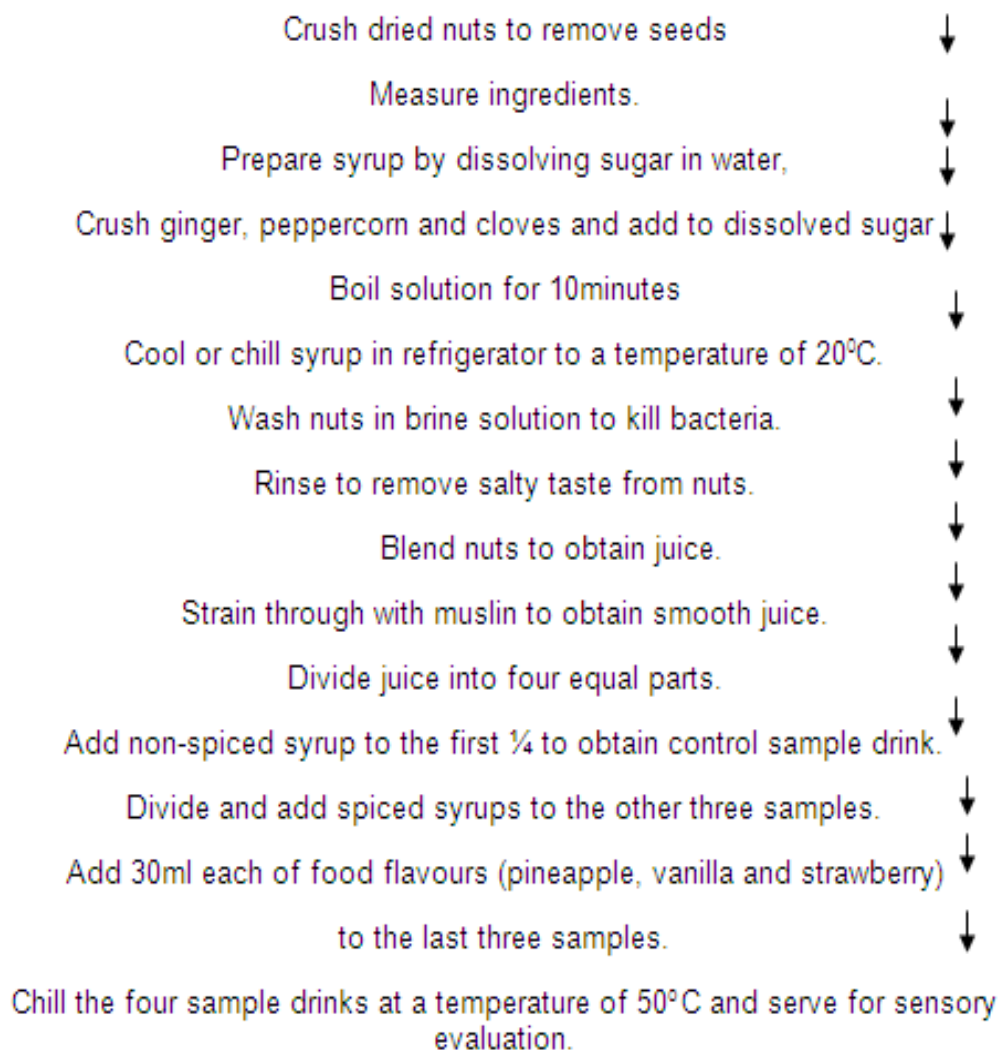
The cracked nuts were divided into two sets. One portion was used to get juice for drink preparation. The other portion was labelled A1 which was milled as a whole (the husk and the endosperm) while the other portion labelled A2 had its husks removed from the nuts leaving the

endosperm. The portion labelled A2 was also milled to extract the juice for the drink preparation. The recipe used for preparing the drink were Indian almond nuts (1500 g), Sugar (400 g), Ginger (200 g), peppercorn (10 g), cloves (10 g), 30 ml each of food flavours [pineapple, vanilla & strawberry], Salt (20 g) and Water (3.2l).

2.5 Tools and Materials

The following tools and materials were used during the preparation of the Indian almond nuts drink: white muslin, blender, 2 mixing bowls, 4 small size margarine buckets, measuring cup, measuring scale, rubber bucket and wooden spoon.

Procedure for Sample Treatment:



2.6 Data collection Procedure for Sensory Evaluation

The correspondences are presented in Appendices D and E. The students were communicated to through their Course Representatives on what day, time and venue the Sensory Evaluation would be done. The students were educated on how to go about the evaluation process after which the sensory evaluation materials were provided to the students. The formulations were put in disposable cups which were labelled accordingly with the respective acronyms (JUS, JSV, JSP & JSS).

2.7 Data Analysis

The Statistical module in IBM-SPSS version 21.0 for Windows was used to do the various analyses. Standard deviations and means were also used to analyse research questions 1 and 2. In addition, bar chart was also used to present the nutrients present in the nuts for research question 1. Means and standard deviation was used to analyse research question 3.

3. RESULTS AND DISCUSSIONS

The result for the nutrients found in the Indian almond nuts is presented in Table 1.

3.1 Nutrients Found in the Indian Almond Nuts

The nutrients found in the Indian Almond Nuts have been presented in Table 1 for discussion. A cursory look at Table 1, indicated that the value

for %DM of the samples were almost the same. The %DM of the four samples (Unpeeled, Peeled, Roughage & Peels) had a range of 96.12% and 96.64%. Meanwhile, the value of Unpeeled Indian Almond nuts was more by 0.52% as compared to the peeled Indian Almond Nuts. The Roughage was also more in value by 0.5% with respect to the Peeled Indian Almond nuts. The %DM of Peels had 0.34% with respect to the Peeled Indian Almond Nuts. The difference in %DM of the highest and the lowest with respect to the four samples was 0.52%. It can be observed that the difference in value between the highest and the lowest %DM was the same value of difference between Unpeeled and Peeled Indian Almond Nuts.

It was clear that without the dry matter, determination of component in the IAN sample under investigation would have not been possible. Hence, it is therefore necessary to determine the dry matter. Dry matter makes it possible to ascertain the exact moisture, nutrients and others in a food sample under consideration (Welle, Greten, Rietmann, Alley, Sinnaeve, & Dardenne, 2003).

The range of value of %Moisture for the samples were 3.39 ± 0.03 and 3.91 ± 0.03 for Unpeeled and Peeled Indian Almond Nuts respectively. The maximum %Moisture value range difference of the samples stood at 0.52 while the minimum %Moisture value of the samples was 0.52. There was about 1.2 times the %Moisture value of Unpeeled Indian Almond Nuts to that of the Peeled Indian Almond Nuts. The %Moisture value between the first and second highest value with respect to Unpeeled Indian Almond Nuts was 0.20.

Table 1. Nutrients present in Indian Almond Nuts

Sample	% DM	% Moisture	% Ash	% Protein	% Oil/Fat	% Fibre	% CHO
Unpeeled - I. A. nuts	96.61±0.03	3.39±0.03	5.21±0.18	31.49±0.52	47.44±0.20	4.67±0.16	7.61±0.39
Peeled-I.A. nuts	96.09±0.03	3.91±0.03	4.57±0.38	32.59±0.18	43.21±0.74	5.45±0.15	9.07±0.52
Roughage	96.59±0.03	3.40±0.03	4.70±0.03	36.84±0.85	44.41±0.27	5.40±0.15	6.39±0.33
Peels	96.43±0.06	3.57±0.06	5.64±0.07	24.84±0.12	40.71±0.33	12.24±0.22	11.07±0.06

**Values are averages of triplicate determinations*

**Data is represented as mean ± standard deviation*

The result has been taken in triplicate at the laboratory and the average found for the study. The result has been presented using means and standard deviation.

The percentage moisture of the sample presents the IAN at its natural state without any alteration of the content in any chemical form. It did present the IAN to be analysed to see what it contains which can be studied into details. A moisture content of 4.13% was found in the Indian Almond Nuts [8]. However, this level of moisture was more than what was found in the samples as presented in Table 3. The moisture content found in IAN by Akpakpan and Akpbio [9] was 25.23% which is far more than what was found in the present study which ranged from 3.36 – 3.94.

The highest %Ash value compared to the closet sample was 0.32 and it can be observed that the Unpeeled Indian Almond Nuts and the Peels were in the same %Ash range value while the Peeled Indian Almond Nuts and the Roughage were as well in a similar value range. The range value for the more and the less ash content of the samples was 0.76 and this shows the magnitude of difference that existed in the range of the samples under investigation. According to Akpakpan and Akpbio [9], the ash content found in their proximate analysis was 32.73% which is far more than what was found in the current study as presented in Table 4. The high difference in the ash content in the case of the two studies might be attributed to the geographical and soil profile from where the nuts were grown.

The %Protein in the samples with high value was below 38% and least value was also below 25%. The range difference in value of the percentage ash of the samples however, was 12.73. The other nutrient determined in the IAN was %Oil/Fat with range value of 41.04 and 47.64. It was observed that the value of peeled IAN and the roughage were almost close in terms of value. However, there was a little difference of 0.73 with respect to the peeled and the roughage samples.

Protein as existing literature noted is to repair worn-out tissues, promote growth hence, when it is contained in a drink, the body would derive such nutrients from the drink prepared from IAN [10]. Since protein provides energy in the absence of carbohydrate, its content in the IAN is good for the body when used for drink. Fats and Oils being the source of heat and energy to the body present the IAN as good sample that when used to prepare food supplement in the form of drink serve as refreshing and nourishing to the human body.

Protein, being the body's regulatory nutrients in terms of the functioning of the tissues is essential to the human system [11]. The presence of protein in the IAN drink could help in augmenting the required nutrients that the body needs. In the study of Adigbo and Madah [10] it had been found that there was Fat/Oil in the IAN and the same minerals have been found in the current study.

The quantity of Fat presence in IAN was 16.02% in a study to determine the kind of mineral elements and their quantities present in IAN [8] and Oduro et al [12] had 1.07% of Fat in their proximate analysis. However the Fat/Oil quantity in this study was in the range of 40% - 47% in this present study. Anuforo et al [13] found that crude Fat in Indian Almond Nuts was 8.53 ± 0.18 g/100 g).

Percentage fibre was also found in the nuts during the analysis of the sample. The result showed that the %Fibre of peels was almost three times as compared to Unpeeled IAN. This result thus showed that there was more fibre presence in the Peels as compared to the other three samples. Though the roughage was expected to be rich in %Fibre, the proximate analysis showed otherwise. The percentage fibre content was even more in the Peeled IAN apart from the Peels.

The carbohydrate seems to be increasing in value when compared to the corresponding %Fibre of each sample. For instance, the least %Fibre value for Unpeeled IAN had the least value of %CHO and this runs through to the highest %Fibre value of Peels and this pattern was the same for the %CHO. Although, there was an increase in %Fibre which corresponds to that of %CHO of the samples, it was not proportionate. The fact remains that there is a link between %Fibre and the %CHO.

The result indicating the presence of fibre in the IAN would be good for digestion. Some of the particles presence in the drink would be good for the body. Dietary fibre is the edible part of plants or analogous carbohydrate that assists to get digestion after eating other food products [14]. Fibre presence in food could not be under stated in the digestion process. The fibre in the IAN drink makes it good to be consumed after eating other foods. Digestion of food in the small intestine whether complete or partial state in the large intestine would be aided by the presence of fibre in the food [15].

A cursory look at Table 2 revealed that %DM was very high compared to the other nutrients. The value of the dry matter was about three times of the %Moisture to as low as 3.36% and this value started the Carbohydrate quantity in IAN increased across Table 4 to as high as 47.64. However, the values reduced drastically to %Fibre column of as low as 4.51 and had increased sharply to 12.46. Another pattern worth noting is that high percentage values were associated with the dry matter, protein and Oil/Fat. Meanwhile, less percentage values were also connected to the moisture, ash, fibre and carbohydrates contents. The analysis of the result showed that the IAN has seven different nutrients at varying percentages. All the nutrients are very essential to the growth and replenishing worn-out tissues of human beings.

Fat/oil and carbohydrate present in the intended formulated drink from IAN would have a lot of positive effect on the persons that might consume the drink. Protein is the only nutrient that promotes growth and repair worn-out tissues. They form the genes that carry the characteristics from parents to their offspring and build antibodies that fight against diseases and infections as well as enhancing the immune system of the body among others [10]. The Oil/Fat is very necessary for maintaining cell structure, enhancing vision and aiding digestion.

Carbohydrate provides energy which can be converted to fat and stored. Primarily, carbohydrates function to supply heat and energy especially to the brain and red blood cells. It provides dietary fibre which helps in enhancing stool formation and excretion, and also in the synthesis of fat in the body. Human beings need a lot of energy to work with hence drinks from IAN could be a good supplement to the energy needs [11].

Looking at the content of essential nutrients in the IAN, it can therefore be concluded that a drink that is formulated from it would be of great help to an individual. There is no trace of toxin in the analysis of the IAN hence, it is envisaged that Ghana Food and Drugs Authority and its sister agencies may not object to a drink being formulated from the IAN for human consumption.

3.2 Composition of Mineral Elements in the Indian Almond Nuts Drink

The constituents present in IAN drink has been presented in Table 2 for discussion. The IAN constituents found were ten mineral elements in the four samples as presented in Table 2 for discussion.

The amount of Phosphate in $\mu\text{g/ml}$ in the four samples was in the range of 504.02 ± 3.46 and 580.34 ± 4.53 . The sample with the least amount of Phosphate is JSP and difference in the amount of Phosphate in the preceding sample (JSV) has a difference of $14.36 \mu\text{g/ml}$.

The mean difference between JSP and JSV is significant and the same effect existed between JSP and JSS. Potassium (K) content of the formulated drink was lower in JSP as compared to the other three samples. JSV according to the analysis had more Potassium content and difference in $\mu\text{g/ml}$ value to the next low value stood at 37.88 . Potassium is micronutrient that helps regulate human functions (Roach, 2009; Tull, 1996). The human body needs this to function hence, the consumption of JSS drink could help provide the body needs of individual persons.

Literature has shown that Sodium (Na) content in the four samples showed that JSV was the sample with the highest content while the least was for JSS [9], Sathe, 1993; Grieve, 1981. According to the study, the difference in the Sodium content between JSV and JSS is $66.07 \mu\text{g/ml}$. Five times of the difference ($66.07 \mu\text{g/ml}$) equals the content of Sodium value in JSS. In the current study, the iron content of IAN ranges between 36.47 and 86.13 . The sample with the most iron content is JUS and the least iron content is also JSS.

A closer look at the figures indicated that JUS's iron content was 2.32 times the iron content in JSS. It implies that iron demand of a person probably on medical grounds would be an ideal thing to recommend. Copper (Cu) was one of the elements that have been identified in the sample analysis at the laboratory. The Copper presence was intense in the JUS formulation sample while JSP registered the least Copper presence. According to British Nutrition Foundation [16], copper is needed in small quantity to be useful for the body.

Table 2. Mineral elements present in Indian Almond Nuts Drink

Sample	P (µg/ml)	K (µg/ml)	Na(µg/ml)	Fe (µg/ml)	Cu (µg/ml)	Zn (µg/ml)	Ca (mg/l)	Mg (mg/l)
JUS	580.34 ±4.53	765.15 ±13.12	284.85 ±20.99	85.80 ±0.33	192.42 ±0.29	12.38 ±0.29	835.00 ±57.85	184.35 ±3.50
JSV	518.38 ±3.46	803.03 ±13.12	363.64 ±0.00	51.42 ±1.01	186.95 ±0.58	9.47 ±0.24	527.72 ±20.86	273.49 ±36.97
JSP	504.02 ±3.46	621.21 ±13.12	284.85 ±20.99	44.27 ±0.21	56.817 ±0.29	8.40 ±0.22	611.22 ±10.02	245.13 ±15.29
JSS	576.56 ±3.46	693.18 ±11.36	281.82 ±15.75	36.80 ±0.33	62.77 ±0.29	6.80 ±0.26	724.78 ±32.21	124.59 ±8.04

*Values are averages of triplicate *Data is represented as Mean ± Standard deviation*JUS- Juice + unspiced syrup, JSV- Juice + spiced syrup + Vanilla flavour, JSP- Juice + spiced syrup +Pineapple flavour and JSS-Juice + spiced syrup + Strawberry flavour

Table 3. Descriptive analysis of overall acceptability of IAN drink

Drink Type	N	Mean	Std. Deviation	Std. Error
JUS (Control)	112	3.3571	.87875	.08303
JSV	112	3.9107	1.04454	.09870
JSP	112	3.8482	.96057	.09077
JSS	112	4.0893	.89597	.08466

The proximate analysis had indicated the copper content in JSP was the lowest of 56.817±0.29 mean and standard deviation. It implies that among the four formulations, the JSP was the right formulation per British Nutrition Foundation [16] recommendation. This recommendation was arrived at in view that other formulations had high mean and standard deviation in Table 2. The µg/ml range of values for Zinc (Z) was between 6.54 and 12.67. The Zinc presence in JSV and JSP were a bit close in terms of the quantities. However, the quantity difference was significant in the sense that the quantum was high (1.09 µg/ml).

Calcium (Ca) is one of the essential elements that help in bone development and according to the analysis, the quantity presence in the IAN ranged between 506.86 and 892.85 for the four samples. Calcium according to Wardlaw and Insel (1996) is needed in conjunction with vitamin D and vitamin K to develop and maintain bone and teeth. The current study had the presence of Calcium in the drinks under investigation which would be beneficial to the human body. The average quantity of the four samples was around 675ug/ml this figure is more than the amount of Ca presence in each of JSV and JSP. It implies that the quantity presence of Ca in JUS and JSS were so much compared to the other two samples under investigation. Magnesium (Mg) presence in the samples had a range of 116.55 and 310.46 and the presence of Mg was high in JSV and followed by JSP, JUS and JSS in that order of magnitude. Magnesium is an essential

mineral present in all human tissues, especially in bone British Nutrition Foundation, [16]; Andrews, 2014. The consumption of IAN drink can help the human body and the bones since these minerals are present in the drink per the proximate analysis.

The mineral elements that had been identified in the four samples vary in quantity with respect to all the minerals. The minerals are essential for growth, maintenance or energy needs of the human body (Adigbo & Madah, 2011; British Nutrition Foundation, 2017; Andrews, 2014). Depending on the body type, work and the requirement of the individual, the four samples seem good. For instance, when the individual needs more energy for labour intensive work, JUS and JSV could be the best in the sense that their carbohydrate contents were higher as compared to the other two samples. Babies need a lot of energy for the development of teeth as well as other bone development, so JUS and JSS could be the best. In relation to which sample is suitable, may depend on the situation at hand.

3.3 Acceptability of Indian Almond Nuts (IAN) Drink

To determine the acceptability of the formulated drinks from the IAN, four different samples were disguised and labelled JUS, JSV, JSP and JSS to be assessed by the participants. The JUS however, was the control sample for the sensory evaluation as presented in Table 3. Two tables

(Tables 4 & 5) were presented to support the discussion in determining the overall acceptability of what formulation was the most preferred one. The descriptive result from the One-way ANOVA is presented in Table 3 for discussion.

The result in Table 3 indicates the mean score, standard deviation and Std. Error. Formulation JSS had a higher mean score and it was followed by JSV, JSP and JUS in that order. The mean and standard deviation score indicate that majority of the participants preferred formulation JSS followed by JSV because of the high scores associated with those formulations.

The Post Hoc test result had confirmed the descriptive result as presented in Table 4 that formulations JSS, JSV and JSP were the preferred formulations. However, the most preferred formulation was JSS. The mean score for the formulation in the line graph illustrated the pictorial view of the overall acceptability of the four formulations. The JSS plotted point was shown to be the highest as in the graph.

Table 4 presents the Post Hoc test analysis of the overall sample formulation acceptability of drinks from IAN. JUS was the least preferred drink by the respondents. The result was not surprising because the control might have better taste to the Panellists since it was the standard used in the experiment. The controlled (JUS) sample was the juice prepared from the IAN and a syrup added to it so the taste was not all that appreciated. JSP was evaluated by the respondents as the second least product. The JSP was an enhanced product of the JUS in the sense that the pineapple flavour was added to the juice and syrup.

The argument can be made that JSS drink was most appreciated because the respondents were not used to strawberry flavour in drinks. Most of the drinks on University of Cape Coast Campus were made from other flavours other than the strawberry so this might have contributed to the most acceptability of the JSS. Another case can be that mixing the juice, syrup and the strawberry gave the drink a peculiar taste which the respondents appreciated much. The acceptability of the samples by the respondents was also attributed to the colour, taste, aroma, sugar content, consistency, ginger quantity, nice/appreciation and after mouth feel of the drink [17].

Colour of drinks attracts attention of all age group and race in the world. Colour change in drink has its influence on the choice of users Santos, Lorenzo & Lannes, [17]; Ahrens, Venkatachalam, Mistry, Lapsley & Sathe, [18]. Eight of the respondents out of the total participants indicated that the colour or appearance of the drinks made them to accept a particular sample. One female respondent had indicated that she did not like the colour of JSS and JSP drinks on the ground that their colours were not appealing to her.

The attributes of the formulated drinks as assessed by the respondents have been presented in Table 5 for discussion. The result on the various attribute of the drink as presented in Table 5 has indicated that in general, the attributes have assessment of the various formulations were scored to be good on the average. According to Alozie and Udofia [5] colour, flavour and taste had accounted for the overall acceptability of an almond based drink. These attributes of drinks (Colour, flavour, taste, etc) may have influenced the respondents in this study. This thus suggests that in sensory evaluation, attribute of colour, taste among others should not be ignored.

The proximate analysis of Indian Almond drink in this present study did confirm what were identified in earlier studies [5,4,3]. The nutrients identified include Potassium, Sodium, Magnesium, Phosphorous, fibre, carbohydrate, Protein among others found in the current Indian Almond nuts drink in this study. The taste of the drinks was another factor that had accounted for the choice of JSS drink. Two of the respondents noted that some of the formulations tasted sour while one person said some of the samples had a strong taste and ten of the respondents also said they liked the taste of each sample. Twenty other respondents said the taste of the samples should be improved upon [5].

On the issue of aroma, six of the respondents had noted that there was no aroma or flavour present in JUS. Aroma or flavour of IAN drink was also one of the attributing factors the respondents may have used to arrive at the decision of accepting or rejecting a drink [5]. JUS sample was the control (only mixed with syrup) and this information was not available to the respondents. Probably, this could have contributed the observation made by the respondents. The aroma of the formulations were complained about by two respondents as being too much or too strong for them. However, one of

the respondents had indicated that there was no presence of aroma in the formulations. During the sensory evaluation, it was observed that the respondents talked among themselves about the aroma of the various formulations. One of the samples, JSS was commended to have a nice aroma by one of the respondents.

According to He and Hekmat (2015), consistency, flavour and texture had accounted for the overall acceptability of IAN drinks and these same attributes were used in this current study in judging JSS as the best drink (Henry, 1996). The Panelists (respondents) were therefore right in using such attributes in the sensory evaluation. The sensory evaluation done by He and Hekmat (2015) showed that there was a significant difference ($p < 0.03$). The overall acceptability for JSS was massive of 4.09 of Tukey B Post Hoc test compared to JSP, JSV and JUS drinks. Biego et al., (2012) found in their study that appetizers in IAN drink have influenced choice of drinks and same did happen in this current study. The control formulation (JUS) had only a syrup made from sugar and did not attract the respondents (Panelists) in making

them accept it as the overall best drink. Flavours of different kinds were added to the other three drinks. Aside the syrup which was added, Vanilla flavour, Pineapple flavour and Strawberry flavour were also added to JSV, JSP and JSS respectively. These flavours had accounted for the choice of the formulations as $JUS < JSP < JSV < JSS$.

The sugary nature of JUS was noted by one of the respondents and recommended reduction of the sugar level in the sample. However, two respondents had opposing views. While one of the respondents complained of low sugar in JSS formulation, the other proposed that it should be increased in the same formulation. The consistency or the 'lightness' of the samples were complained about. Ten of such respondents want the four samples to be a bit thicker compared to the current formulation that was being assessed (He & Hekmat, 2015). Drinks are not solid foods so consistency of a drink was always the norm and it has been accepted if not by all persons. He and Hekmat (2015) were of the view that it had accounted for the overall acceptability of the drinks they had

Table 4. Post hoc tests (Tukey B^a) of overall acceptability

Formulation	N	Subset for alpha =0.05	
		1	2
JUS	112	3.3571	
JSP	112		3.8482
JSV	112		3.9107
JSS	112		4.0893

Table 5. Attributes of formulated drinks

	Attribute	JSV	JSP	JSS	JUS
Colour	Poor	4	1	1	1
	Fair	10	7	12	21
	Good	39	36	37	40
	Very Good	41	38	28	34
	Excellent	18	30	34	16
Taste	Poor	-	2	2	2
	Fair	-	16	12	25
	Good	-	29	29	48
	Very Good	-	37	39	25
	Excellent	-	28	30	12
Aroma/ Flavour	Poor	4	4	-	16
	Fair	13	15	8	37
	Good	31	27	29	37
	Very Good	40	42	33	15
	Excellent	24	24	42	7
Mouth	Poor	5	1	2	4
	Fair	12	17	12	28
	Good	34	34	25	40
	Very Good	31	37	36	30
	Excellent	30	23	37	10

formulated. In the case of this study, consistency was commented on by some of the Panellists about JUS and JSV in particular of their inconsistencies.

Panel members who tasted the samples complained about low ginger content in the JSP sample. However, the ginger level in the other three samples was acceptable to them. Thirty-nine of the respondents noted that the formulations were nice and they liked them much while two other respondents said they disliked all the four samples. JUS was indicated by one of the respondents that, it had an after mouth feel, after taste of the drink had been tasted. The colour of the four formulations may have also contributed in choosing a formulation. Colour being an influenced factor was also found in other studies (Hunterlab, 1996; Pontes, 2004; Ramos & Gomide, 2007).

4. CONCLUSIONS

Indian Almond Nuts has a lot of nutritional value that could be of enormous benefit to the human body. The nuts could provide protein, vitamins, fats/Oils, carbohydrate among others, to build the body. The nuts could enhance the immune system and provide energy to the individual for the day to day activities. The medicinal value of Indian Almond Nuts is not doubted in view of the presence of phenolic compounds that were found in other studies. The drink from the nuts especially the juice is highly nutritious because of the chemical composition such as protein, calcium, iron and sodium.

The acceptability of the Indian Almond Nuts drinks, especially the JSS, which indicated that when produced for commercial use could attract a lot of customers. The colour and consistency of the drink did have a lot of commendation from the Panellists. The strawberry flavour in the JSS drink was not usually common in other drinks. This has therefore made the Panellists to see it as special product that was formulated from the Indian Almond Nuts.

Protein is very essential for the re-building of worn-out tissues of the human body. The protein presence in the juice as found in the various formulations (JUS, JSV, JSP & JSS) could be good for the human system. The proximate analysis using the dry matter of Indian Almond Nuts had indicated that there was high protein content in the peeled nuts.

The protein in the juice from the peeled nuts was high as compared to that of the protein content in the un-peeled nuts juice in the current study. However, the protein level in the spiced syrup added to the juice was higher than the protein content found in the un-spiced syrup for the juice. Carbohydrate being an energy giving food is one of the nutrients that could help human beings to do manual work. The carbohydrate content in the drinks and the juice were very high than the un-peeled nuts drink.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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