

PHYSICO-CHEMICAL AND MICROBIAL ANALYSIS OF "ADUWA" DRINK

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ABSTRACT

"Aduwa" drink was produced from "Aduwa" fruit *balanites aegyptiaca* Linn. The sun-dried fruit obtained from local market were peeled, washed and juice extracted by infusion into hot water at a temperature of 80°C for 30 minutes. Nine sample drinks were produced with varying extract, sugar concentration and tiger nut juice. The drinks were subjected to chemical, physical, microbiological and organoleptic evaluations. Panelists result on sensory evaluation showed that sample drinks coded A B and C, were generally of acceptable quality as determined. Drinks, stored under refrigeration, ambient and under ambient exposed to sunlight for three weeks indicates that pH ranged from 4.10 - 3.85, 4.20-3.77 and 4.00 -3.60 respectively. Specific gravity from 1.073-1.003, 1.073-1.000 and 1.073-1.080 respectively, ascorbic acid content from 30.10-28.75mg/100ml, 29.00-2.300mg/100ml and 27.05-18.00/100ml. Total titratable acidity from 0.665-0.669, 0.668-0.684 and 0.661-0.661 respectively. Yeast and mould count range from 4×10^3 - 3.7×10^4 cfu/ml, 2×10^2 - 2.5×10^4 cfu/ml and 2.0×10^2 - 1.9×10^4 cfu/ml, respectively and bacteria total count from 2×10^2 - 4.3×10^4 cfu/ml, 4×10^2 - 5.6×10^4 cfu/ml and 5×10^2 - 7.8×10^4 cfu/ml.

Key words: "Aduwa" drink, Chemical and Microbial Analysis.

INTRODUCTION

Fruits contribute greatly to man's source of food. A ripened fruit contains various chemical constituents which are useful to man and other animals. These nutrients composition are carbohydrate, fat protein, vitamins, minerals and organic acid. This composition varies from fruits to fruits.

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The level of food consumed in the world shows that fruits provide over 90% of world wide ascorbic acid. About 60% of other vitamins, 25% of iron, about 20% of carbohydrate and 7% of protein (Crues, 1958). Generally, fruits are seasonal and highly perishable. It was estimated that about 60% of the total annual fruits harvested in many developing countries are lost primarily due to microbial activities (Banwart, 1981). There is therefore the need to devise a means of storage in order to preserve these useful parts of man's diet. However, preservation of fruits among which is fruit drinks.

Fruit drink is a regular or synthetic fruit juice or a combination of the two. It contains natural or synthetic flavour, sugar, colour, ascorbic acid and preservatives. They are convenient and refreshing beverages but they contain relatively small quantities of nutrients (Eva 1986). In Nigeria fruits drinks are increasingly becoming popular with the largest market share going for fruit flavored drinks because of the low horticultural activities in the country and the consequent high prices of the fruits. Domestically, however, varieties of fruit drinks are produced locally in Nigerian homes using some locally available fruits. Drinks from pawpaw, orange, lemon, mango, guava, pineapple and lime are common in some parts of the country.

Balanites aegyptiaca Linn is a plant species which belongs to the family of balanitaceae. The common name include: soap berry, thorn tree, desert date and Egyptian myrobalan. The plant is considered very useful to the desert race and quickly propagated by stalk. The tree is about 12 metre high and 2.5-7.5 centimeter long, green when young and yellow when ripe (Dalziel, 1937) the bark is grey, coarse longitudinal fissures, the branches are greenish in colour. The fruits are succulent and the nuts are long, broadly, oblong-ellipsoid ends rounded, smooth or wrinkled, yellow, a single hard stone seed. The fruits and the nuts have freshly sweet juice pulp covering. "Aduwa" is a perennial shrub that produce abundant seeds. It starts bearing fruits between the month of December and January and the fruits mature later in March or early April. The aim of this work is to produce the 'Aduwa' drink and subject it to chemical and microbial analysis. It is hoped that, the data obtained may serve as a basis for technical improvement on the production method and nutritional significance.

MATERIALS AND METHODS

Processing and Production of Fruit Drink: The general flow chart for fruit drink production was compiled by (wood roof, 1975) and reported in figure 1. Fully ripe fruits are harvested and allowed to mellow for some days. The fruits are then sorted, graded and washed. These pre-processing operations are followed by the processing operation that includes peeling, coring, deseeding, slicing, dicing or pureeing and branching. Each of these processing operations varies with types of fruits. The juice is extracted from the size reduced and blanched fruits, by pressing, using pressers such as crack

press and expeller press. The juice is then clarified using pectinase enzyme followed by sedimentation and filtration. Filter aids such as glutin and bentonite are sometimes used to facilitate the clarification process instead of pectinase enzyme (Caradroit, 1977). Some fruits are required in un-clarified condition and they are generally sold in fresh state or preserve with 0.1% sodium benzoate. The extracted and clarified juice is then concentrated to the total solids of 19° Brix and above using an open or a vacuum evaporators. The choice of evaporator system varies with the nature of the juice sugar added to further increase the total solids, sweetness and helps preserve the juice. The concentrated juice described above can be made into fruit drink by diluting the concentrate with water in ratio 2:3, the fruit drink is packed, pasteurized and chilled pasteurization temperature for fruit drink varies with the pH level of the drink, level of preservation and the predominant microorganism to be destroyed. Sometimes higher temperature 85-90°C is employed to avoid cloudiness (Kew, 1957).

Production Technique of "Aduwa" Drink: Sun-dried "Aduwa" fruit (*Balanite aegyptiaca* Linn) was purchased locally from an open market in Bauchi town. It was peeled using hand peeling, the fruits were then soaked in clean water, and the peeled fruits were then soaked in water bath for 30 minutes at about 30°C with continuous agitation. In all the batches produced one portion of the fruits to 5 parts of water. This was filtered through a muslin cloth and then through a standard sieve of 0.075mm diameter to obtain a clear filtrate. The resulting filtrate (extract) was diluted to obtain 2%, 5.5% and 10% extract drink. The diluted extract was sweetened with invert - sugar and tiger nut juice to varying total soluble solids of 12° Brix, 11 Brix and 10° Brix. Each batch of the three batches produced was give the same dilution ratio, but different brix and all batches were code as in table 1. The drink were bottled and immediately pasteurized at 72°C for 15 seconds, rapidly cooled to room temperature and then store a sample in refrigerator, a sample under Ambient temperature and the last under Ambient temperature and expose to sunlight for subsequent analysis and sensory evaluation. The production flow chat is as shown in figure 2.

Methods of Chemical Analysis: The methods of analysis used in this work are those of Association of Official Analytical Chemist (AOAC, 1980), International Union for Pure and Applied Chemist (IUPAC) and International Standard Organization as described by (Pearson, 1976).

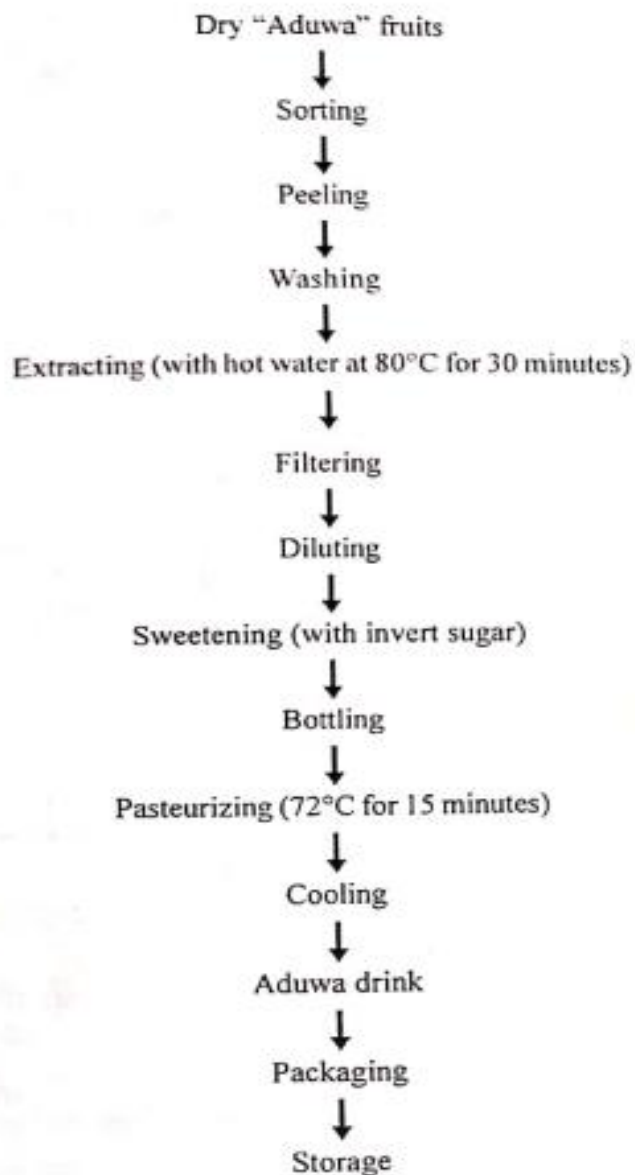
Proximate Analysis: The moisture content, total ash, Ascorbic acid, titratable acidity, pH value of the drinks were determined using AOAC (1980) method. Soluble solids and specific gravity of the drink were determined using Abbey Refractometer and Pyknometer bottles at 20°C respectively as described by Pearson (1976).

Microbial Analysis: Microbiological examination of the drink is necessary to ascertain the fitness of the drink for consumption. Total aerobic plate count for yeast and mould

and presence of coliform bacteria were determined using Collins and Lyne, Method (1970).

Sensory Evaluation: The formulated “Aduwa” drinks were subjected to sensory evaluation by first ranking the three samples for preference test based on taste using fifteen panelists. The format for this test and calculation in consumer panel rating was used for the acceptance test of the drink. Table 1: List of drink samples produced.

Fig. 1: Flow chart for “Aduwa” drinks Production



Batch	Sample	code	%	extract	obrix
A ₁	8		12		
A ₂	8		11		
A ₃	8		10		
B ₁	55		12		
B ₂	55		11		
B ₃	55		10		
C ₁	10		12		
C ₂	10		11		
C ₃	10		10		

RESULTS AND DISCUSSION

Table 1: Specific gravity

<i>Length of Time in Weeks</i>	<i>Storage under refrigeration temperature (A₁)</i>	<i>Storage under ambient temperature (B₁)</i>	<i>Storage under ambient temperature exposed to sunlight (C₁)</i>
Week 1	1.073	1.073	1.073
Week 2	1.073	1.094	1.079
Week 3	1.003	1.000	1.080

Table 3: Total soluble solid measured in degree brit (obrix)

<i>Length of Time in Weeks</i>	<i>storage under refrigeration temperature (A₁)</i>	<i>storage under ambient temperature (B₁)</i>	<i>storage under ambient temperature exposed to the sun (C₁)</i>
Week 1	12.00	11.00	12.00
Week 2	11.90	10.50	11.40
Week 3	11.40	9.50	9.35

Table 4: Total titration acidity

<i>Length of Time in Weeks</i>	<i>storage under refrigeration temperature (A₁)</i>	<i>storage under ambient temperature (B₁)</i>	<i>storage under ambient temperature exposed to the sun (C₁)</i>
Week 1	0.665	0.668	0.661
Week 2	0.667	0.679	0.671
Week 3	0.669	0.684	0.678

Table 5: pH Length of Time in Weeks

Length of Time in Weeks	storage under refrigeration temperature (A ₁)	storage under ambient temperature (B ₁)	storage under ambient temperature exposed to the sun (C ₁)
Week 1	4.10	4.20	4.00
Week 2	4.00	3.90	3.81
Week 3	3.85	3.77	3.60

Table 6: Ascorbic acid detrmination (mg/100ml)

Length of Time in Weeks	storage under refrigeration temperature (A ₁)	storage under ambient temperature (B ₁)	storage under ambient temperature exposed to the sun (C ₁)
Week 1	30.10	29.00	27.05
Week 2	29.20	23.75	20.10
Week 3	28.75	23.00	18.00

Table 7: General acceptability test of the product length of time in week

Sample	A1	B2	C1
Week (1)			
Mean score	4.4	4.1	3.7
Percent score	44	41	37
Week (2)			
Mean score	4.1	3.9	3.4
Percent score	41	39	34
Week (3)			
Mean score	3.7	3.2	3.0
Percent score	37	32	30

KEY

- A Aduwa drink stored under refrigeration temperature
- B¹ Aduwa drink stored under Ambient temperature
- C² Aduwa drink stored under ambient, exposed to sunlight

It was found during the chemical analysis, that, there were changes in all the: samples, but those stored under the refrigeration temperature condition showed some consistency to changes, the values obtained from all the samples stored under different environmental condition has shown that the values has relation to the rate of chemical changes which take place between different storage temperature condition for different components.

Titrateable Acidity: There was a general increase in the values of titrateable acidity from the samples. It was confirmed during the three weeks of storage that the samples contain lactic acid bacteria and yeast which is believed is responsible for fermenting and breaking down of the sugars giving organic acid, which results in decreasing the pH and increases the acidity of the product including lactic acid.

pH Value: There was decrease in the pH values of all the samples under the different storage condition: It ranges from 4.10-3.85 in the sample stored under refrigeration temperature. The change was, pronounced with the samples stored under ambient and ambient exposed to sunlight. The samples values are 4.20-3.77 and 4.00-3.60 respectively.

Total Soluble Solid (TSS): The samples stored under refrigeration temperature showed a gradual decrease but those under ambient and ambient exposed to sunlight showed a large decrease in all the samples. The decrease for ambient was from 11° brix -9.500 brix and ambient exposed to sunlight was from 12° brix-9.35° bnx. But that of under refrigeration temperature was from 12° brix- 11:400 brix in three weeks. These results showed that the rate of fermentation is less in the sample stored under refrigeration temperature than those stored under ambient temperature and ambient exposed to sunlight.

Ascorbic Acid (AA): There was decrease in ascorbic acid (vitamin C) content of all the samples during the storage time. Ranging from 30.10mg/100ml - 28.75mg/100ml for the sample stored under refrigeration temperature which showed a gradual decrease. But the sample under ambient showed rapid decrease from 29mg/100ml-23mg/100ml but the sample under ambient exposed to sunlight showed more rapid decrease from 27.05mg/100ml -18mg/100ml. This could be due to high volatile nature of ascorbic acid when exposed to sunlight. There is tendency of loss of some quantity of ascorbic acid in the drink during sun drying of "Aduwa" fruit (Addo 1983) some vitamin C losses may also be during pasteurization. As samples stored under sunlight and ambient seen to loss their pigment more faster than the ones stored under refrigeration. Pigments are also adversely affected by light of appropriate wavelength Awan and Okaka (1985).

Microbial Analysis: Micro-organisms are not expected to survive in the drinks because is a low acid drink and the heat treatment pasteurization given to the drink. The microbial count contain (2×10^4 - 4.3×10^4 , 4×10^5 - 5.6×10^5 and 5×10^6 - 7.8×10^6 (cfu/ml) mold count rages from 4×10^3 - 7×10^3 , 2×10^4 - 2.5×10^4 and 2×10^5 - 1.9×10^5 (for samples & B2 and C) indicate that the surviving organisms are adopted to the environment. (Ban wart, 1981). After the one week plate count, yeast, mold and bacteria were present in the juice which may be due to contamination from equipment used and filtration cloth. It may also be due to yeast and mold growth, as well as from the bottle.

During storage, changes in taste, odour, turbidity, sediments were seen which

indicate the presence of yeast in the drink. There was gradual increase in the microbial load of the sample stored under refrigeration temperature for the period of storage, but the sample stored under ambient exposed to sunlight showed the highest count in term of microbial load. Yellow and light yellow creamy colonies were found in the plates that contains plate count agar with cotton shaped and black shaped colonies form acidified malt extract agar. Yeast cells were in single and some in budding form. Also mold was confirmed by straining with methylene blue. The organisms present are likely to be spore formers, heat resistant and acid loving.

Sensory Evaluation: The sensory evaluation results indicated that panelist ranked samples B2 and C, as the best out of the nine samples provided and also A, was rated highest out of the three best samples, which is the sample stored under refrigeration temperature from the calculation it show that all the three samples are significantly different from each other but sample A, was more accepted and still maintain its quality parameter after three weeks of storage. This may be due to its reduced bitterness, brighter colour and high sugar content.

CONCLUDING REMARKS

Flavour is blend to taste, aroma and mouth feel and it is critical that the flavour is acceptable to the intended consumers. The mild flavour of 'Aduwa' drink is appealing. Also because of its natural pigment, 'Aduwa' drink is capable of establishing its own market within fruit drinks especially those with artificial colour which may have toxicological effect on the consumers. From the analysis carried out, it can be concluded that storage has a very great influence on the drink and that the fruit drink is best when stored under refrigeration temperature. Apart from serving as a refreshing drink, 'Aduwa' drink is believed to have medicinal values as reported by various authors.

REFERENCES

- Addo, A. A.** (1987). Ascorbic Acid Contents of Food Commonly Consumed in Northern States of Nigeria. *Nigeria Food Journal* 1(1): 130.
- ADAC** (1980). Official Methods of Analysis of the Association Official Analytical Chemists (13 Ed.) Arlington VA 22209.
- Awan J A and Okaka, J. C.** (1985) Element of Food Spoilage and Preservation (2nd Edition) Enugu: Panco Nig. Ltd.
- Azzini E. et al** (1990). Utilization of Local Food Production in Sub-Sahara Africa. *Practical Theoretical Indicated* 5:29.
- Banwart, G. J.** (1981). *Basic Food Microbiology* (1st Edition). West Point Publishing Company Inc.

- Chantengel, P. and Lanzam, B. F.** (1963). Contribution a Letude Chimiguade Puips et de Lamande De Balamites Aegytienea Annales De la Nutrition. *Alimentaire* 17:128.
- Collins, C. H. and Lyne, P. M.** (1970). *Microbiological Methods*. Butter: Worth and Co. Publishers Limited.
- Crues W. V.** (1958). *Commercial Fruit and Vegetable Product*. New York: Mc Graw Hill Book Co.
- Dalziel J. M.** (1937). The useful plant of West. *Tropical African Volume 1- H: 247*.
- Eva, M.** (1986). *Food Preparattions and Theory*. New Jersey: Prentice Hill. Inc. Eagle Wood-Cliffs.
- Ihekoronye, A. I. and Ngoddy, P. O.** (1985). *Integrated Food Science and Technology for the Tropics*. London: Macmillan Publishers Ltd.
- Keay R. W. T.; Onoriche C. F. A. and Stanfield D. P.** (1964). *Nigcjitn Trees*. Volume 2. Apapa: Nigerian National Press Limited and Department of Forest Research Ibadan 50pp.
- Kew, T. S.** (1957). Five Years Storage of Frozen Concentrate Orange Juice at 40-50°C. *Florida State Horticultural Society* 30, 120-122.
- Pearson, D.** (1976). *The Chemical Analysis of Foods* (7th Edition). New York: Churchill Livigstone 6-7pp.
- Wood Roof J. G. and Luh, B.** (1975). *Commercial Fruit Processing*. Westport Connecticut: Avi Publishing Company Inc.

