GSJ: Volume 8, Issue 2, February 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

Effectsof Conditioning on the Proximate/Chemical Composition of Tiger Nut Milk.

[1]Ayuba,L.O., [2]Bolarin, F.M and [3]Chukwu, U.C
[1]Agro Industrial Development and Extension Department;
[2] Processing and Storage Engineering Department;
[3] Farm Power and Machinery Department;
National Centre for Agricultural Mechanization,PMB 1525, Ilorin, Kwara State, Nigeria.

Abstract

Tiger nuttubers (cyperusesculeatus L) were processed into tiger nut milk and analysed for its proximate and chemical composition. There were six samples labelled A, B, C, D and E. Samples were soaked for 6 hours, 12, 18, and 24 hours for A, B, D, and E respectively. Sample C was notsoakedand used as a control. Analysis were carried out for moisture content, fat, protein, crude fibre, total soluble solids, pH and titratable acidity.The result revealed a pH of between 5.95- 6.45% and total soluble solids of between 8.75- 10.30% for all the samples. The ash content decreased with soaking time, valued at 0.49%, 0.45%, 0.41% 0.38% for samples A, B, D, and E respectively. Furthermore, the result also revealed that protein, fat and crude fibre increased with soaking time valued at 4.2%, 4.3%, 4.5% and 4.6% protein for samples A, B, D and E respectively while fat was valued at 28.0%, 28.5%, 29.5% and 30.7% for samples A, B, D and E respectively. The result also showed that all the samples contained reasonable amount of Vitamin C with values of 16.8%, 10.3% 18.7%, 16.0% and 15.5% for samples A, B, C, D and E respectively. It was clearly shown that milk from non-soakedtiger nut has highest Vitamin C, ash and low protein, fat and crude fibre.

Key words: *Tiger nut milk, Conditioning, Milk, Proximate composition, Tiger nut tubers.*

1. INTRODUCTION

Tiger nut is of the biological kingdom-*plantae*, genus *–cyperus*, species- *C. esculentus*. Thebotanical name is *Cyperusesculentus* which also in various languages is called “chufa sedge, nut grass, yellow nut sedge, tiger nut sedge or earth almond”. The crop has a wide outreach as it is found in most parts of the planet earth. Historically the crops dates back 4,000 years, which ranks it amongst the oldest cultivated plant in the world. The dry tubers have been found in tombs from predynastic times about 6000 years ago.

According to Moshe,(1992), tiger nut tubers were consumed either boiled in beer, roasted or as sweets made of ground tubers, with honey in the days of old, while Defelice (2002)

reported that it is medicinal when taken orally, also that it is used as an ointment, an enema and in fumigants to sweeten the smell of homes or clothing.

It was reported that Spain is the world's leading producer of tiger nuts which is normally cultivated in loamy and sandy soils to produce edible tubers generally used for the preparation of the Spanish "*horchata de chufa*", a sweet, milk-like beverage. (Sandez et al, 2012).

Cyperusesulentus is an annual or perennial plant,planted between April and May,developingup to 90cm (3 feet) tall, with solitary stems growing from a tuber (see Fig 1). Propagation is by seeds, creeping rhizomes and tubersand must have to be irrigated every week until they are harvested usually in November and December. However, low temperatures, shadows, and light intensity can inhibit its flowering.(Pascual et al, 2012).

Fig 1. Tiger-nut plant

In Nigeria, Cyperusesculentus is well grown in the northern part of Nigeria and is available in semi-dried (see Fig 2) and fresh forms (see Fig 3)in markets where it is sold locally and consumed uncooked, roasted or dried.

Fig 2. Semi-dried tiger nut

Fig 3. Fresh tiger nut

Tiger nut tuber which is an under-utilized crop has been reported to be high in dietary fibreContent and could be effective in the treatment and prevention of many diseases, includingColon cancer, coronary heart disease, obesity diabetes and gastro-intestinal diseases. A lot of people in Nigeria eat tiger nut without knowing its health benefits; it has essential minerals like calcium, magnesium and iron necessary for bones, tissues repairs, muscles and the blood stream. Its regular consumption can prevent regular falling illness, especially by sickle cell patients who experience crisis or pain in the bone because their red blood cells

sickle excessively to block the blood vessels, thereby preventing blood flow into other organs of the body, (Iwalokun,2013).

Milk is an excellent source of all nutrients except iron and ascorbate(Ukwu et al., 2011). Milk has been recognised as an important food for infants and growing children (Obizoba et al,1995). In developing countries, the cost of dairy milk and their products are exorbitant which decreases the intake of cow milk. This dramatic decrease in consumption of milk and milk products motivated the processing of milk from different seeds, tubers and nuts (Belewu et al, 2007),

Though undervalued in the past, milk from plant sources are key ingredients in the diet of African countries (Udezor, 2012). In recent times, researchers have shown strong interest in these milk sources from plant due to their high nutritive values and economic potentials.

Tiger nut (cyperusesculents. L), a non-conventional and under-utilizedtubers belong to the family of cyperaceae and is native to Mediterranean and tropical regions (Oladele, et al., 2009). Its tubers can be eaten raw, roasted with sugar, soaked in water, processed into starch (Umerie, et al., 1997) and flour (Oladele et al, 2007). It can also be processed into milky beverage called Horchata de chufain Spain (Cortes et al., 2005) or Atadire milk in Ghana. Djondi and Ndjouenken, (2006) reported that Tiger nut milk can be used in conjunction with other foods to fight cardiovascular diseases.

In Nigeria, Cyperusesculentus is well grown and available in semi-dried form in Nigerian market where it is sold locally and consumed uncooked, roasted or dried.

The cost of dairy milk and their products in developing countries such as Nigeria is very high. In most cases dairy milk is consumed by adding some amount of breakfast cereals, cocoa beverage, tea or coffee, due to its high cost. This high cost of milk in developing countries is what has led to the development of alternative source of milk from plant materials (Singhet al,1988).This inexpensive substitute of milk made from locally available plantfoods, high in protein with a satisfactory quality could play an important role to reduce protein malnutrition. Unlike soybeans which have been extensively studied, tiger nut and some other oilseeds has not been comprehensively investigated. Direct milk consumption as a beverage prior to the development of such phyto milk like tiger nut milk wasn't common inNigeria (Onweluzo et al, 2005).Development of such milk extracted from plant sources could serve as an alternative source of an acceptable source of anutritious milk drink.

Tiger nut tuber can be processed into varieties of milk products, such as, natural tiger nut milk, pasteurised tiger nut milk, sterilized tiger nut milk, ultra-high temperature tiger nut milk and concentrated and condensed tiger nut milk. Tiger nut milk could be used by special people having milk allergies such as galactosemia and lactose intolerance (Ukwuru et al, 2011).Bacillussubtilis, Staphylococcus aereus, Aspergilluflavus, A.niger, usariumsolani,Saccharomyces cerevisiae,biligeraand Candidapseudotropicalishavebeen associated with tiger-nut milk (Onovo et.al. 2007). Hence processing conditions are fundamental to the storage stability and overall quality of tiger-nut milk. The need for a defined processing treatment to take care of its wholesomeness is necessary.

Optimizing the processing techniques requires that the effect of processing on variousproducts be studied. This gives an insight into process control as it affects tiger nut milk. Although milk has been successfully processed from fresh tiger nut tubers, not much effort have been made in trying to standardize the processing treatment to maximize the nutritive value of the milk. Such standardization on processing and milk quality is of commercial and health significance.

Two common processing techniques are pasteurization and ultra-high temperature sterilization and their effects on the nutritive qualities on milk can be manipulated to suit the desired tiger nut milk quality. This study was therefore aimed at using variousprocessing treatments on fresh tiger nut to obtain milk and to evaluate the effects of processing treatment on the chemical characteristics of the resulting milk.

2. MATERIALS AND METHOD

Tigernut (cyperusesculeatus L) obtained from a local market in Sango, Ilorin, Kwara state was sorted to remove stones, pebbles, dirt materials rotten stems and broken tubers before cleaning in water to remove adhesive soil. The cleaned tubers were divided into five parts labelled A, B, C, D, and E. All the samples were soaked at room temperature for 6 hours, 12, 18 and 24 hours for samples A, B, D and E respectively and sample C was used as control.

Furthermore, all the samples were wet milled, milk was extracted using cheese cloth and sweetened with sugar. Proximate and chemical analysis was carried out in all the samples using AOAC method (2016).

In processing tiger nut into a milky beverage, soaking and milling are major unit operations. Soaking is a method of food processing which involves inserting food materials in liquid for a time until it becomes completely wet (Kumar et al., 1979). It can be used to reduce soluble anti-nutrient (e.g. Tannins and polyphenols) which can be eliminated with discarding soaking solution (Oladele et al., 2009). Soaking of tiger nut can be achieved at different temperatures and time ranging from ambient (25-30^{0}C) to 100^{0}C for 5 to 12 hours depending on the processor while milling is amethod used in food processing to reduce food particle size.

2.1.Soaking time

2.1.1. 6 hours soaking.

Five hundred milliliters (500 ml) of water was added to 200 g of soakedtiger nut and blended using aburr mill. The blended material was sieved using cheese cloth. The filtrate was boiled (80^{o}C, 30 min). This was cooled to 30^{o}C and filled into bottles and was pasteurized at 75^{o}C for 5 mins.

2.1.2. 12 hours soaking.

SoakedTiger nut (200 g) was blended into slurry with water (400ml). The slurry was pressed using cheese cloth to extract the milk. Theextract was pasteurized at 75^{o}C for 15 min. It was homogenized, bottled when hot and rapidly cooled.

2.1.3. 18 hours soaking.

Tiger nut (200 g) was soaked in warm water (40^{o}C, 3 h) and blended to a smooth paste. The paste was mixed with 500 ml of water and sieved using cheese cloth. The filtrate was clarified by settling for 30 min, preheatedat 50^{o}C for 30 min and filled into sterilized bottles. Thiswas sterilized at 130^{o}C for 10 sec and cooled.

2.1.4. 24 hours soaking.

Soaked Tiger nut (200 g) was milled with 500 ml water. The slurry was filtered using a cheese cloth. The filtrate was boiled at 80^{o}C for 30 min after which the extract was pasteurized at75^{o}C for 5 min (Fig. 1).Non Soaked Tiger nut- Tiger nut (200g) was milled with 500 ml water. The slurry was filtered using a cheese cloth. The filtrate was boiled at 80^{o}C for 30 min after which the extract was pasteurized at 75^{o}C for 5 min.

2.2.Analysis of Proximate/ Chemical analysis:

Moisture, ash, fat, protein,carbohydrate by difference, titratable acidity, pH and totalsolids were determined according to standard methods (AOAC, 2016).

3. RESULTS AND DISCUSSION

3.1.Physical and chemical properties

Table 1 shows the summary of the results of the physical and chemical properties of tiger-nut.

Proximate Composition	Treatment (%) hours (A) 6	(B) 12	(C)Non soaked	(D)18	(E)24
Crude Fibre	0.02	0.02	0.01	0.02	0.02
Crude Fat	8.0	8.5	7.8	9.5	9.7
Moisture	80.5	81.7	77.7	82.9	83.3
Ash	0.47	0.45	0.60	0.41	0.38
Vitamin C	16.8	16.5	18.7	16.0	15.5
Total Soluble Solids	8.3	8.8	8.0	9.1	9.7
Titrable Acids	0.02	0.03	0.02	0.03	0.02
pH	6.0	6.0	6.3	6.4	6.5
Crude Protein	4.2	4.3	4.1	4.5	4.6
Carbohydrate	6.8	5.2	9.8	2.7	2.4

3.2.Effect of processing treatment on the chemical characteristics of tigernut milk products:

The effect of processing treatment on the chemical properties is presented on Table 1. Crude protein content of the various treatments ranged from 4.6-4.2% and werehigher than Treculiaafricanaseed milk (3.85%) and soy milk (3.20%) (Onweluzo and Nwakalor, 2009). Previous work suggested that tigernut milk could have 8.07% protein (Belewu and Belewu, 2007). There were no significant differences in non- soaked sample with other treatment samples in protein contents. Apparently this non differences in protein values reflected that soaking does not have effect on the milk protein. The various treatment methods had no significant effect ($p>0.05$) on the moisture, carbohydrate, fat and titratable acidity (Table 1). The pH range from 6.3 in non- soaked tiger nut to 6.4 in 24 hours soaked sample showed that the least pH is that of tiger nut soaked at 6 hours. This low pH is advantageous because it will discourage the growth of pathogens that may cause gastrointestinal problems. These were comparable to the pH of melon seed milk (6.25), cowpea milk (6.79) and soymilk (6.6) reported by Akubor (1998); Nnam (2003) and Onweluzo and Owo (2005) respectively. The non-soaked had lower total solids 7.95% and were significantly different ($p<0.05$) from other samples. These values were below the minimum standard for sweetened dairy milk (28%) (FAO/WHO, 2011). The crude fat extract of the milk samples were within the same range (27.8%-0.7%)and were below minimum of 8% standard for dairy milk (Codex 2011). Tiger nut itself was reported to be rich in fat (25.50%) (Belewu and Abdunrin, 2006). The shows no significant difference between fat in tiger nut tubers and its milk extract.

The result showed that increase in soaking time slightly increased protein, Fat and Crude fibre ranged at 4.2 - 4.6 for protein, 8.0 – 9.7 for fat and 0.01 – 0.02 for crude fibre. The

increase could be attributed to leaching of some constituents of the tuber into soaking water as reported by Oladele et al., (2009). Constituents such as simple sugars and some anti-nutrients such as tannins and phytic acid are leached into soaking water especially at above ambient temperature through swollen and raptured cell walls which permeate water and soluble constituents.

3.2 Ash content

The result revealed that increase in soaking time decreases the ash content valued at 0.49, 0.45, 0.41 and 0.38 for samples A, B, D and E respectively. This decrease in ash could be attributed to the leaching of some mineral elements into soaking water. Obizoba and Afii(1991) made a similar observation for Sorghum soaked in water. Sample C showed the highest ash content because it was not soaked.

3.3 Moisture content

The moisture content from the result was high for all the samples; this could be because of the amount of water use during milling and extraction of milk from the tigernut.

3.4Carbohydrate content

The carbohydrate content decreased with longer soaking time with the non- soaked sample presenting a higher carbohydrate content of 9.8. This goes to show milk from non- soaked tiger nut is carbohydrate because some the dissolvable sugars have leached into the soaked water of soaked samples.

3.5 pH value

The pH values ranged between 6.0 – 6.5,Udezor, (2012) reported pH of 6.7 for tigernut milk which showed that tigernut is less acidic and implies that milk prepared from tigernut will be acceptable to patients with Ulcer and other related problems. This confirms the assertion of David, (1986) that tigernut is regarded as stimulant and tonic and can be used in the treatment of indigestion, colic diarrhoea and dysentery.

3.5 Total soluble solids

The total soluble solid ranges between 8.0– 9.7, non-soaked sample C recorded lowest for total soluble solids and sample E soaked for 24 hours recorded highest for total soluble solids. This shows that milk extraction is highest at the longest soaking time and therefore increases yield.

3.6 Vitamin C content

The vitamin C for sample C is highest, valued at 18.7%, Samples A, B, D, and E recorded decrease in Vitamin C valued at 16.8%, 16.5%, 16% and 15% respectively as soaking time increases. This could be that soaking affects the Vitamin C content.

4. CONCLUSION

This study shows that soaking as conditioning significantly affects the yield, proximate and chemical composition oftigernut. Fat, protein, crude fibre and total soluble solids increased with increased soaking time while pH, ash content and vitamin C decreased with increased soaking time. The pH values ranging between 6.0 – 6.45 implies that milk prepared from conditioned tigernut will be acceptable to patients with Ulcer and other related problems.The study also revealed that milk extraction is highest at the longest soaking time (24 hours) and therefore increases yield.

REFERENCES

AOAC Methods, 2016. Official Methods of Analysis, 20th edition,Association of Analytical Chemists. Washington DC.

Akubor P.I (1998) Physico-chemical and sensory characteristics of melon seed milk,\. Journal of Food Science and Technology Vol 35 Pp 93-95Belewu, M. A. and Belewu, K. Y. (2007): Comparative Physco-Evaluation of Tiger-nut, Soybean and Coconut milk sources. International Journal of Agricultural Biology; 9: 785 –79

Belewu M.A and Abdunrin D.A (2006) Preparation of Kunu from unexploited rich food source:Tiger nut (cyperusesculentus). World J. Dairy Food Science. 1. Pp 19-21

Cortes, C., Esteve, M. J., Frigola, A. and Torregrosa, F. (2005): Quality Characteristics of Chufa horchata (a Spanish Vegetable Beverage treated with pulse electric fields during Shelf life). Food Chemistry; 91; 319-357.

Codex Alimentarius (2011) Milk and Milk Products. Joint FAO/WHO Food Standards Program 2 Ed. Pp 43

David, F. (1986): Human Nutritional Dietary Food Encyclopaedia. Pp 35 – 36.

Defelice, M.S., 2002. Yellow Nutsedge (C. Esculentus L.). Snack Food of the Gods 1. Weed Technology 16; 901-7.

Djondi, R. A. E. and Ndjouenken, R. (2006): Characteristics of Tigernut (cyperusesculentus) Tubers and their Performance in the Production of a Milky Drink. Journal of Food preservation; 30: 145 – 163.

Moshe, N. 1992. A Sweetmeat Plant, A Perfume Plant and their Weedy Relatives. History of C. Esculentus L. & C. Rotundus L. Economic Botany 46; 64-71.

Iwalokun, B., (2013). Harnessing the Economic Potentials of Tiger Nut, Walnut. Published in Nigerian Observer of 27/09/13.

Kumar, N. R., Reddy, N. & Rao, K. N. (1979): levels of Phenolic Substances in the Leachates in Cicer seeds. Indian Journal Expt. Biol; 17: 114 – 116.

Nam N.M 2003.Nutrient composition and acceptability of vegetable milk made from oil seeds. Journal of Home Economics research. 5. Pp 57-61

Obizoba, I. C. and Anyika, J. U. (1995): Nutritive value of Baobob Milk (adansoniadigitata L), Hungry rice or Acha (digitanaerullis) flour. Plant Foods for Human Nutrition; 46: 156 – 165.

Oladele, A. K., Dahunsi, O. F., Oluwatoyin, A. and Yemisi, A. (2009): Influence of processing Techniques on the Nutrients and Anti-nutrients of Tigernut. (cyperusesculeatus L.). World Journal of Dairy and Food Science; 4(2): 88 – 93.

Onweluzo J.C and Owo O.S 2005. Stabilization potential of water soluble polysaccharide from two legumes (deterrummissocarpum and Mukuraflagellipes) in vegetable milk. Effects on selected quality characteristics \. Journal of Home Economics research, 6, Pp 39-44

Onweluzo J.C and Nwakalor 2009. Development and evaluation of vegetable milk from Treculia Africana (decne) seed. Pakistan Journal of Nutrion. 8, Pp 233-238

Onovo J.C and Ogarako A.A 2007. Studies on some microorganisms associated with exposed tigernut (cyperusesculentus L) milk. Journal of Biological Sciences. 7, Pp 1548-1550

Pascual-Seva, N., San Bautista, A., Lopez Galarza, S., Maroto, J.V., and Pascual, B.(2012). Yield & Irrigation Water Use Efficiency for Ridge & Bed Cultivated Chufa (C. EsculentusL.VarSativusBoeck).

Sandez-Zapata E., Fernandez-Lopez J., Angee-Perez, Alvarez, J., (2012). Tiger Nut (C. Esculentus). Commercialization Health Aspect Composition, Properties & Food Applications. Comprehensive Reviews in Food Science & Food Safety 11, 366-77.

Singh T and G.S Bains (1988). Grain extract milk beverage, processing and Physico-chemical characteristics. Journal of Food science.53, Pp 1387-1390

Udeozor, Linda .O. (2012): Tigernut-Soymilk Drink: Preparation, Proximate Composition and Sensory Qualities. International Journal of Food and Nutritional Science; 1(4), Pp 18-26:

Ukwuru, M. U., Ibeneme, C. I. and G.I (2011): New Product Development from Tiger-nut (cyperusesculeatus) and their sensory, proximate and Biological Evaluation. Pakistan Journal of Nutrition; 10(2): 101 – 105.

Umerle, S.C., Okafor, E. O. and Uka, A. S. (1997): Evaluation of the Tubers and oil of cyperusesculentus.Bioresource Technology; 61: 171 – 176.

Acknowledgements

We appreciate the Executive Director and the members of the management of the National Centre for Agricultural Mechanization for making funds available for the research work. Also all staff of the NCAM food laboratory for their assistance and professional inputs.