Thermal Effect on Physiochemical and Phytochemical Qualities of Pretreated Balanites Aeqyptiaca Seed Oil.

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Abstract

The oil of Balanites Aeqyptiaca seed were pretreated and extracted mechanically using centrifugal screw rotor at 100rpm.Oil Samples were analyzed for physiochemical and phytochemical properties using edible ground nut seed oil as a control. This is to ascertain edibility of balanites seed oil at these process approach using a control sample .Result analysis showed moisture content range between (0.23-1.34)%, Acid value (1.18-7.82)mg/kOH/g, saponification values (190-193.34)mgkOH/g ,Iodine values (71-80)wijis ,Peroxide value (4.50-34.80)mgkOH/g ,free fatty acid (1.51-4.50)mgkOH/g ,viscosity (45-50.0)pa/s and refractive index (1.47-1.8) at 36^{o}C. Saponification value, Iodine value and viscosity of the five minutes heated oil were observed to be low compare with roasted balanites oil sample as well as the control. Tannins and saponins were absent in the control and roasted balanites oil samples respectively, however present in heated oil sample. Flavonoid, Alkaloid and phenolase results on the five minutes thermal heated oil sample revealed the absence of these phytochemicals but flavonoids and alkaloids were present in control sample. Thermal heating orients more bounds and tends balanites crude oil towards edibility status.

Keyword; Balanites seed, oil, thermal heating, process- treatment, physio-chemicals, phytochemical, edibility

Introduction.

Oil seeds are energy dense foods containing protein and carbohydrate, the food energy they provide is mostly as fat (9 kcal or 37kJ/g). Some seed oils contain substantial amounts of alpha linoleic acid; an n-3 fatty acid, and linoleic acid; an n-6 fatty acid both of which are essential fatty acids, Emmanuel et al (2014). The levels of macronutrients, minerals and vitamins found in vegetable oils are not same as found in whole oil seeds Ong et al (1995). Unrefined oils are used as salad oil in warm salad dressing, and pasta sauces or light cooking oils (light sautés and low heat baking). However, they are not cooked at high temperatures. Unrefined oils could be processed by cold-pressed and expeller-pressed methods and they carry with them the true bouquet of olives, corn, sesame seeds, peanut, soybeans, sunflower, or whatever plant source of the oils. The strong flavors of unrefined oils can dominate whatever dish or backed good is made with them and in some cases they are used as flavoring agents Fawad,(1993). The major sources of edible oils in Nigeria are groundnut oil (*Arachis hypogoea*) and oil palm (*Elvesis guineensis*). These oils are utilized basically as cooking oils, for the manufacturing of soap, margarine and cosmetics Aremu et al (2015) .With increasing demand which has led to importation of cooking oils, there is need to source for local oil- bearing fruit apart from vegetables which can be exploited for production of oils, both for consumption and industrial applications. Balanites aegyptiaca is an important tree of dry region; it could contribute immensely to the nutrition and health care of people particularly in northern Nigeria. It can also help in microclimate amelioration as well as climate change mitigation as browse plant. However, the aim of this study was to assess the oil physiochemical and phytochemical characteristics of the seed oil at extraction, five minutes heat treatment as a refining approach, which may be useful for domestic application as local base alternative source of oil at various process operation for culinary.

MATERIALS AND METHODS

Survey and collection of sample

Fruits of Balanites aegyptia were collected from the villages around Gashua town and its suburbs ,such as Nguru , Gari alkali, karasuma , Jajimaji , and usufari in zone C senatorial district of Yobe states. The fruits collected from all these locations were cracked and the succulent mesocarp picked before process treatments.

Method

Method employed is described below. Thermal heating was done using heating mantle. Roasting was carried out using open pan in an open fire.

Diagram on Thermal Heat Treatments of Balanites Seed

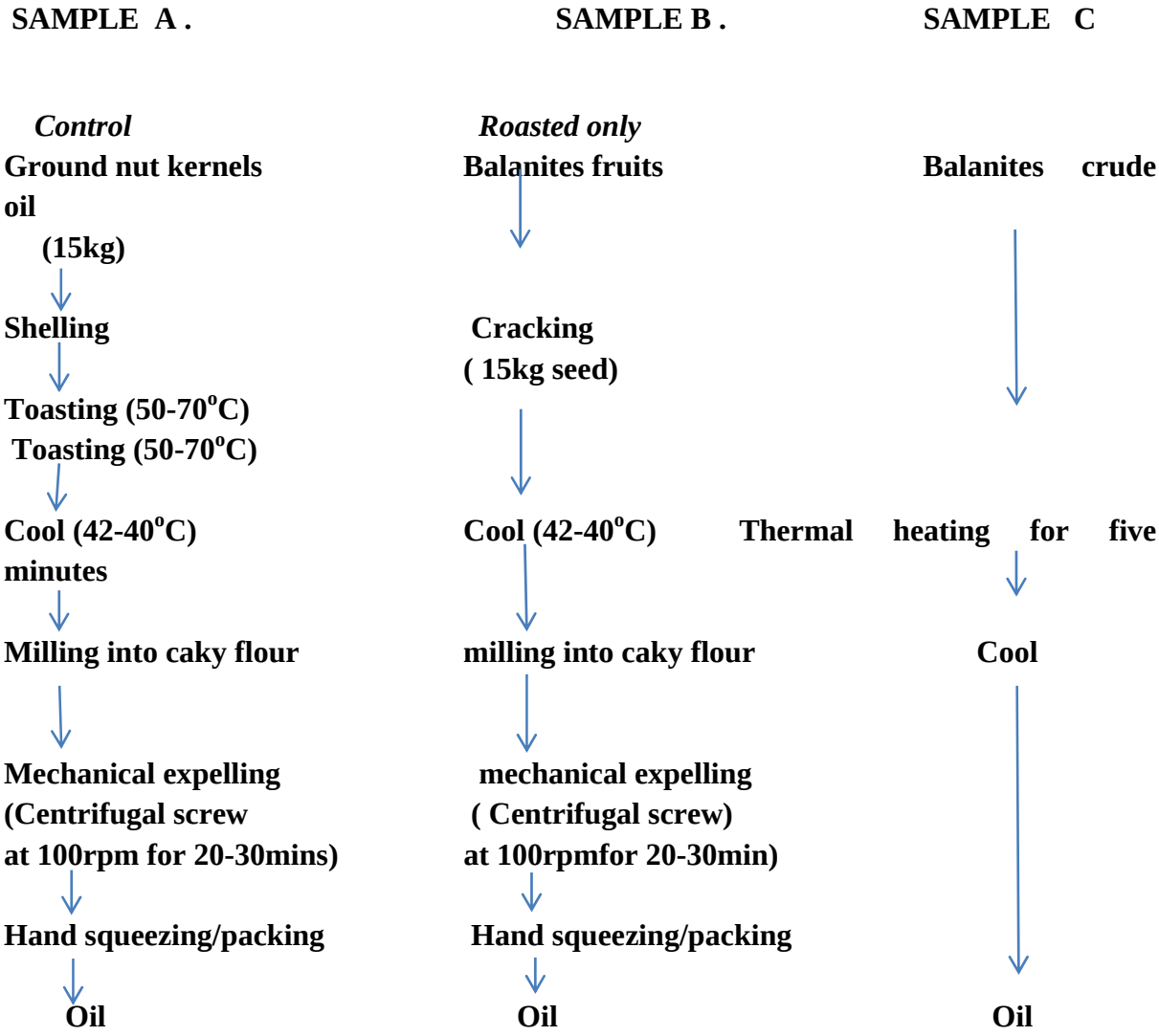

Fig 1 : Process treatment methods of Balanites Aeqyptiac seed kernel:

Physiochemical analysis of *Balanites* seed oil.

Physio-chemical analysis of balanites seed oil such as Moisture content ,Acid value ,Saponification value ,Iodine value ,Peroxide value , matter ,Free fatty acid ,Viscosity ,Refractive index@ 36.0°C was carried out using standard procedures as described by Sofowara (1993) ,Evans, Trease . (2002) ,Harborne (1998) ,Oloyed O.I.(2005) ,Chang (2002) and Ercisli, (2007)

Phytochemical analysis of *Balanites* seed oil.

Quantitative Phytochemical analysis such as Tannin, Saponin, Flavonoid, Alkaloid and Phenolase were analyzed by using the methods which have been reported by Abd EIslam, et al (2013) , Baba et al (2015) *and* Devanaboyina, et al (2013).

RESULTS AND DISCUSSION

Table 1: Physiochemical properties of *Balanites* seed oil

Parameters	**Sample A control** (Groundnut oil)	**Sample B** (Roasted)	**Sample C** (5 minutes heating)
Moiture content	1.54	0.23	0.60
Acid value mgKOH/g	1.18	7.854	4.99
Saponification value mgKOH/g	190.98	193.54	190.93
Iodine value (wij's)	80.62	80	71
Peroxide value meq/Kg	4.50	25.14	34.80
Free fatty acid mgKOH/g	0.51	3.927	4.495
Viscosity mPa/s	50.0	45.0	48.5
Refractive index@ 36.0^{o}C	1.47	1.8	1.723

The moisture content of the control sample had highest moisture content, iodine and viscosity values. Sample B , (roasted balanites oil) had the highest value of acid value , saponification value and refractive index while sample C the oil heat had highest value on peroxide values compare to the control, roasted and the heated oil samples. However, the moisture value in heated sample is low compare with the control. This tells that bound water may be low in this sample, hence good Storagebility.

Acid value for tells level of oxidative deterioration of oil by enzyme and degree of unsaturation of oil and corresponds to the amount of potassium hydroxide required to neutralize free fatty acids Wiliams (1975). The lower the acid value, the fewer free fatty acids it contains which could makes it less exposed to rancid spoilage. The acid values obtained for the oils in this study are higher than those reported for bean seed oil (2.77 mg KOH/g and 2.74 mg KOH/g Isman (2006), but lower than beniseed oil (47.6 mg KOH/g) [32]. Similarly Omujal (2008) reported acid value of 3.18-6.92 mg KOH kg for shea butter in Uganda .The treated samples however had higher acid values compare with the control. Saponification value determines the quantity of potassium hydroxide (in mg) needed to saponify the esters contained in 1 g of the lipid Williams (1975)

The saponification value of the heated oil is lower than the control, with sample B higher than both samples A and C respectively. These value however are within the range value of 187-250mgKOH/g obtained for peanut oil Robert ,(1971). The Iodine value for this study is within 237 ranges reported by Abu-Al-Futu (1983) and Chapagain et al. (2009) in Balanites oil extracted by expelling method. The higher the saponification value of oil, the higher the lauric acid content of that oil hence the treated samples B and C are suitable oil in soap making. The saponification value obtained in sample A, B and C reveals that oil could be good for soap making.

Iodine value tells of degree of unsaturation in fat or vegetable oil, determining the stability of oils to oxidation, Williams, (1975). The oil analyzed in this study has a lower iodine value when compared with that of control Arachis oil(86.50 mgI2/g) Thus, the oils in this study may not be suitable as alky resins for paint formulation but can act as plasticizers.

Peroxide Value indicates lipid peroxidation and generally crude oil have high peroxide values. Sample B and C oil (25.140), (34.8) meq/kgrespectively have higher values compare with the control sample A (4.50)meq/kg . The value observed from all the samples have higher value compared to what was reported by Sara Mohamed(2015) as (1.18) and (6.0) on balaintes oil extracted by expelling method This high values in sample B and C balanites oil indicates contamination and maybe due to lubricating or fuel presence in the crude oil Ihekoronye and Ngoddy(1989).

Free fatty acid confers specificity of free fatty acid in oil. The control sample A (0.50) mgKOH have lower valuecompare with sample B and C (3.93) mgKOH, (4.50)mgKOH respectively but higher compared with the roasted sample B (3.93)mgKOH, Boiled (4.22)mgKOH sample D. these values in sample B and C were higher than (2.8)mgKOH , 1.84 (mgKOH) reported by Babagana et al (2001), Manji (2013) respectively on balaintes oil extracted by expelling method

Viscosity of sample B (45cp) and sample C (48.5cp) were higher than the control of arachis oil (50.0cp) .Viscosities of 49 cp, have been reported by Chapagain et al (2009) for methanol balanites extracted oil . According to Chapagain et al. (2009), viscosity is one of the quality parameters making it suitable and potential resource for biodiesel production

Refractive index of sample B (1.8) and sample C (1.7) were higher than the control sample A (1.4).Refractive index range of (1.7-1.8) is close to (1.5) reported by Chapagain et al. (2009) From the table two above refractivity tells that these sample B and C oils could foul, Impure and cannot be easily hydrogenated or isomerized until refined.

Table 2: Qualitative Phytochemical properties of Balanites oil

SAMPLE	Tannin	Saponin	Flavonoid	Alkaloid	Phenols
A	-ve	-ve	+ve	+ve	-ve
B	-ve	-ve	-ve	-ve	-ve
C	+ve	+ve	-ve	-ve	-ve

A=Control (ground nut oil or Arachis oil sample)

B= Roasted Balanites oil sample

C= Five minutes thermal heating of Balanites oil sample

Phytochemicals such as Tannin , saponin , flavonoid , alkaloid and phenols are bio actives found in the balanites oil . Taninin and saponin were absent in sample B , roasted sample but present in sample C heated oil sample . The heated sample have the presence of tannin and saponin even at five minutes thermal heating .Tannin is recognized as anti – nutritional factor to inhibiting digestive enzymes. This implies that heating balanites oil after expelling from it seed mesocarp disrupt more bound to complex protein and releases its saponin bitterness Ercisli (2007).Roasted and heated balanites oil reveals the absence of flavonoid and alkaloid. This was prominent in Arachis oil sample A. Flavonoid are anti – oxidants bio actives and are against inflammations Abd EIslam,(2013).Alkaloids are good pharmaceuticals bio actives and anti – bacteria agents Chang (2002) This shows that heating discourages the activity of bio actives in balanites oil

Conclusion

Acid value. Saponification and iodine values reported in this study are generally within narrow range of most edible oils that are suitable for food and cosmetics. The bio-actives such as flavonoid alkaloid and phenols are absent from the treated samples. It was discovered that thermal heating allows complexation of bond and eruption of more anti-nutritional inhibitors.

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