

## Nutritional Evaluation of Guddaim Fruits (*Grewia tenax*) and its Utilization in Ice Cream Production

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**ABSTRACT:** In the present study the nutritional evaluation of guddaim fruits, seeds and pulps was carried out, the contents of moisture, ash, fat, fiber, protein and carbohydrate were 7.20%, 3.50%, 0.13%, 14.0%, 8.20%, 66.97%, 7.30%, 3.0%, 0.92%, 14.85%, 7.5%, 66.43% and 7.60%, 3.30%, 0.10%, 13.60%, 8.80% and 66.6% for the fruits, seeds and pulps, respectively. Guddaim fruits were found to contain about 25.5% D-fructose, 15 mg/100g ascorbic acid, 25 mg/100g iron and 40 mg/100g calcium. The effect of soaking periods on juices quality was investigated. Juice extracted by steam distillain for two hours, had a pH 4.30 and T. S. S 10.5; while the cold extracted juice for the same period had a pH 4.80 and T.S.S 3.0. The juice acidity and T. S. S. increased with the increase of soaking periods. However it had a weak flavor and brown colour due to the fruits cooking during the extraction process. The longer the periods of cold juices extraction, the higher the pH but the T.S.S remained constant. The Guddaim –flavored ice cream was, subjected to organoleptic evaluation by sensory panels, was good as vanilla and strawberry – flavoured ice cream according to appearance, texture, colour, flavour and overall acceptability.

**KEYWORDS:** *Fruits, guddaim flavoured ice cream, nutritional evaluation.*

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### INTRODUCTION:

Guddaim (*Grewia tenax*) is one of the valuable plant species in Sudan. It is largely spread in arid area such as sand and near mountains, especially in Savanna plantation area at the Northern and Middle of Sudan. FAO (1988), reported about guddaim growth destinations and it has a discontinuous availability at arid area in India, Elgezira Southern area, and the Eastern of Africa. Guddaim is ashrub, its mature orange fruits are often 2-3-4 lobed (Andrews 1950). Guddaim plant requires 200 mm of seasonal rainfall and it is well resistant to soil salinity and its productivity is about 1500 grain per Kg. FAO (1988) proved that guddaim plant is used in traditional medication and treatment in Sudan; it is used to treat flesh irritation and skin inflammation for both human

beings and animals. Guddaim fruits may be eaten ripe or kept for later usage because it consists of great proportion of carbohydrates in liquidized form, and a great amount of iron and calcium. Some efforts were made to promote guddaim fruits and its industrial utilization (Elamin 1995). From guddaim fruit, people prepare drink for pregnant women, the fruits are highly recommended and one sack of 'guddaim' is equal in price to three sacks of wheat in Khartoum market (Gebauera et al., 2002). In Kordofan, a drink was prepared by soaking the fruits overnight, hand-pressing, sieving, and sweetening. A Nesha was also prepared from this drink, by the addition of custard and flour, the Nesha is given to mothers to improve their health and lactation (Abdelmuti et al., 1991; Gupta et al., 1968; Saxena 1979). Guddaim fruits, both

fresh and dry, are favored and extensively consumed by the Sudanese population (Magid 2003). Guddaim fruits contain 6.3% protein, 0.4% fat, 8.1% crude fiber, 4.5% ash, 15.1% starch, 1.6% sucrose, 21.0% D-glucose, and 24.3% D-fructose (Abdelmuti *et al.*, 1991; Gupta *et al.*, 1968 and Saxena 1979).

Ice-cream is a frozen dessert usually made from dairy products, such as milk and cream, combined with fruits or other ingredients and flavours. Most varieties contain sugar, although some are made with other sweeteners. In some cases, artificial flavourings and colourings are used in addition to (or in replacement of) the natural ingredients. This mixture is stirred slowly while cooling to prevent large ice crystals from forming; the result is a smoothly textured ice-cream according to the International Food service Distributors Association (2008).

The objectives of this study were to i) evaluate the nutritional constituents of guddaim fruits. ii) study the efficiency of the juice extracted by thermal means in comparison to cold extraction and iii) produce guddaim-flavoured ice cream and assess its quality through sensory evaluation.

## **MATERIALS and METHODS**

### **Preparation of raw materials:**

Guddaim fruits were collected from a valley located at Um-Gouna Village, Southern Darfur State, Sudan. The experiment was carried out during the year 2005. The guddaim fruits were cleaned and freed from foreign materials. The physical evaluation consisted of measurement of fruits and pulps weigh (using a sensitive balance). Water and filter apparatus were used for soaking to ease pulps separation from seeds.

**Proximate analysis :** Guddaim fruits, seeds and pulps were analyzed for the contents of moisture and crude protein according to the AOAC (2000) method, ash, and crude fiber were determined according to the AOAC (1990) method, fat was determined according to A.O.C.S

(1981) method, the carbohydrates content was calculated by subtracting the previous components from 100.

**The iron, ascorbic acid, D-fructose sugar and calcium determination:** The iron content was determined according to Chapman (1978) with some modifications. Ascorbic acid was determined according to Ruck (1963). The D-fructose sugar was determined by the general volumetric method of Laine and Eynon as described in AOAC (2000) method. The calcium (Ca<sup>++</sup>) content was determined according to AOAC (2000) method in which flame-photometer (coring 400) was used for analysis.

### **The guddaim fruits juices extraction :**

The cleaned guddaim fruits were weighed and soaked for three hours in tap water at a ratio of 1: 2 (w/v); the mixture was blended by a Laboratory Mixer Emulsifier Machine (No. 18510, England) for half an hour and then sieved by a juice extraction machine to remove the cell wall, fiber and seeds. The juice obtained was filtered by a centrifugal filter; the clear juice was used as drinking juice or as ice cream flavour.

### **Hot juices extraction:**

The cleaned guddaim fruits were used for hot juice extraction by steam distillation-using distilled water for two hours, also the guddaim fruits were saturated prior to steam distillation was applied for the same periods. The guddaim fruit juice was evaluated immediately for pH value using a digital pH meter (Philips PW 9418) and for total soluble solids, using a hand refractometer (Atago N 1, Brix 0~32%, Japan).

### **Ice cream Supplemented with Guddaim:**

For ice cream flavouring with guddaim, three hundred and fifty grams jelly, two hundred grams milk powder, 1kg sugar, 60 g crema, one egg as stabilizer and 500 ml guddaim juice were added to 3 litre fresh milk in a stainless steel container and continuously shaken. The mixture was well mixed for 30 minutes; then left to be cooled in refrigerator, after cooling, the mixture was transferred to a Toshiba soft creamer (IF-161SY, Tokyo,

Japan) for ice cream manufacturing. The ice cream was packed in plastic cups (50 g each) and kept in a refrigerator (-15°C).

**Sensory evaluation analysis:** Ice cream samples were subjected to taste panel, (Appearance, texture, colour, flavour and overall acceptability) using hedonic scale. The results obtained by the panelists were converted to scores ranging from like extremely (9) to dislike extremely (1) William (1970) and Larmond (1982). The sensory data were subjected to analysis of variance. Mean separation was done according to the Duncan's Multiple Test at 5% level.

## RESULTS and DISCUSSION

### Guddaim fruits Physical characteristics:

The average weight of one thousand of guddaim fruits in this study was 212.5±0.7g. Percentage values of seeds and pulps were 66.75±0.05% and 33.25±0.04%, respectively. The percentage of guddaim residues, seeds and water soluble substances were 10.6±0.04%, 63.3±0.03% and 26.1±0.02%, respectively.

### Nutritional evaluation of guddaim fruits, seeds and pulps:

The proximate nutritional composition of guddaim fruits, seeds and pulps are shown in table 1. The moisture content of guddaim fruits was 7.45±0.03%. The result is similar to that of Boutros (1986) who reported 7.4%. The moisture contents of guddaim seeds and pulps in this study were 7.30±0.04% and 7.60±0.02%, respectively. The ash contents of guddaim fruits was 3.15±0.01%. This result is lower than those reported by Abdelmuti (1991) and Boutros (1986) who reported values of

4.50% and 5.1%, respectively. The ash content of guddaim seeds and pulps in the present study was 3.0±0.01% and 3.3±0.03%, respectively.

The guddaim fruits fat content was 0.46±0.03%. The value is similar to that determined by Abdelmuti (1991) and is higher than that of Boutros (1986) who reported values of 0.4 % and 0.10%. The guddaim seeds and pulps fat contents in the present study were 0.81±0.02% and 0.10±0.04%, respectively.

The crude fiber content of guddaim fruits was 14.22±0.04%. The value is higher than that reported by Boutros (1986) which was 13.8% and lower than that determined by Abdelmuti (1991) who reported a value of 8.1%. In this study, the guddaim seeds and pulps crude fiber contents were 14.85±0.03% and 13.60±0.03%, respectively.

The guddaim fruits crude protein content was 8.15±0.05%. The value is higher than those reported by Abdelmuti (1991) and Boutros (1986) which were 6.3% and 7.7%, respectively. The protein contents of guddaim seeds and pulps in this study were 7.5±0.04% and 8.8±0.04%, respectively.

The carbohydrate content of guddaim fruits was 66.57±0.03%. The value is higher than that found by Boutros (1986) and lower than that reported by Abdelmuti (1991) which were 65.9% and 80.7%, respectively. In the present study the guddaim seeds and pulps carbohydrate contents were 66.45±0.04% and 66.60±0.03%, respectively.

Table 1: Proximate nutritional value (%) of whole guddaim fruits, seeds and pulps.

Parameter	Moisture	Ash	Fat	Crude fiber	Protein	Carbohydrate
Guddaim fruits	7.45±0.03	3.15±0.01	0.46±0.03	14.22±0.04	8.15±0.05	66.57±0.03
Guddaim seeds	7.30±0.04	3.00±0.01	0.81±0.02	14.85±0.03	7.50±0.04	66.54±0.04
Guddaim pulps	7.60±0.02	3.30±0.03	0.10±0.04	13.60±0.03	8.80±0.04	66.60±0.03

The guddaim extracted juice as presented in table 2 showed an increase in acidity with long periods of soaking, and there

was no change in total soluble solids; this is probably due to the browning reaction.

Table 2: pH and total soluble solids of guddaim fruits extracted juice soaked for different periods.

Soaking period	pH	T.S.S (%)
Two hours	4.80±0.01	3.00±0.02
Four hours	4.50±0.03	3.10±0.01
Six hours	4.30±0.02	3.00±0.02

Guddaim extracted juices by flash evaporator (No. 60200002, Rikakikai Co., LTD, Japan) led to increase in total soluble solids with long periods of soaking; while there was no change in

acidity (Table 3). The observed increase in the total soluble solids is probably due to water evaporation during the concentration process.

Table 3: pH and total soluble solids of guddaim fruits concentrated juices soaked for different periods.

Soaking period	pH	T.S.S (%)
Two hours	4.78±0.02	5.10±0.03
Four hours	4.46±0.01	5.00±0.02
Six hours	4.30±0.01	5.00±0.02

The guddaim fruits juices, which were extracted by steam distillation, had a brown colour and weak flavour, because guddaim fruits were cooked during the steam distillation extraction process. When guddaim fruits were saturated with water prior to steam distillation the extracted juices were yellow coloured and also had a weak flavour.

Generally, the present study indicated that, guddaim fruits possess good nutritional value, as they contain reasonable amount of iron (25 mg/100 gram). This result is higher than that reported by Mohammed and Yagi (2010) which was 20.8±0.08 mg/100g. The ascorbic acid was 15 mg/100. The D-fructose was 25.5%, this result is slightly

higher than 24.3% which was determined by Abdelmuti (1991). The calcium content was 40 mg/100gram.

**Sensory evaluation of Guddaim- flavoured ice cream compared with other commercial- ones:** The mean score for sensory attributes of guddaim- flavoured ice cream, vanilla-flavoured ice cream and ice cream flavoured with a strawberry indicated that there were no significant difference between the various ice cream products according to appearance, texture, flavour and overall acceptability and there were slight differences in colour ( $P \leq 0.05$ ). However, panelist gave higher score to guddaim and strawberry flavoured ice cream in case of overall acceptability (Table 4).

Table 4: Mean scores for sensory attributes\* of guddaim- flavoured ice cream, vanilla-flavored ice cream and strawberry-flavored ice cream.

Products	Appearance	Texture	Colour	Flavour	Overall acceptability
GFI	7.5 <sup>a**</sup>	7.5 <sup>a**</sup>	8.0 <sup>a**</sup>	8.0 <sup>a**</sup>	7.7 <sup>a**</sup>
VFI	6.5 <sup>a**</sup>	6.5 <sup>a**</sup>	6.7 <sup>ab</sup>	7.8 <sup>a**</sup>	7.4 <sup>a**</sup>
SFI	7.6 <sup>a**</sup>	8.0 <sup>a**</sup>	8.1 <sup>a**</sup>	7.5 <sup>a**</sup>	7.7 <sup>a**</sup>

\*Means based on 9 points scale (9=excellent, 1=extremely bad).

\*\*Means within columns with the same superscript letters in are not significantly different ( $P \leq 0.05$ ). GFI: Means guddaim-flavored ice cream. VFI: Means vanilla-flavored ice cream. SFI: Means strawberry-flavored ice cream.

## CONCLUSIONS

The approximate chemical composition indicated that guddaim fruits contained high amounts of crude protein, crude fiber and carbohydrates. Its nutritional values lies in its good content of iron, ascorbic acid, D-fructose sugar and calcium. The sensory evaluation revealed that the guddaim-flavoured ice cream was good as vanilla-flavoured ice cream and ice cream flavoured with strawberry.

Guddaim fruits can be used as a natural flavour in ice cream production .

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