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Research Article

THE EFFECTS OF DIFFERENT DOMESTIC PROCESSING ON THE TUNDUB SEEDS AND THEIR PRODUCT

Khalid[1] A, Abdelgadir and Hassan[2] A, Mudawi

[1]National Food Research Center
[2]University of Khartoum

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ABSTRACT

This study is aimed to determine the effect of conventional processing on the nutritional and industrial values of Tundub seeds and also, to identify the suitable portion of Tundub seeds flour (TSF) to prepare porridge by blending TSF and sorghum flour. The conventional processing were (soaking 3h + washing), (soaking 12h + washing), (boiling 1/2h + washing) and (boiling 1/2h + washing + fermenting). Sorghum flour mixed with four levels of (0 %, 10%, 20% and 30%) TSF. The nutritional value was evaluated by measuring chemical properties, minerals, amino acids and anti nutritional factors. The industrial value was evaluated by preparing porridge from Tundub seeds flour in addition to sensory evaluation. Characteristically Tundub seeds contained 28.95% protein, 8.42% fat, 27.03% fiber and 6.40% moisture (after extract the oil). The high values for crude protein 30.82 % and protein digestibility 86.69 % were obtained by (boiling 1/2h + washing +fermenting) treatment and also, the low values of anti nutritional factors were obtained by the same treatment. Moreover, the seed protein contained essential amino acids: 5.8% valine, 0.6% methionine, 4.1% isoluecine, 8.1% leucine, 5.2% phenylalanine, 2.9% histidine, 2.5% lysine and 17.9% arginine. The chemical composition of the porridge showed a significant ($p \leq 0.05$) increase in protein from 8.74% in the control to 15.76% and 16.62% in the porridge with20% and 30% Tundub seeds, respectably. The concentration of (20 % TSF) was found to be the best treatment for preparing porridge.

INTRODUCTION

Capparis decidua or Tundub was a plant of Sudan having widely distributed in North, South, East and West Sudan especially on sandy soils and low rainfall savanna on clays (El Amin 1990). It is also found in Blue Nile and Upper Nile (ELGazali *et al.*, 1987). The plant usually grows in dry climate, shows strong climatic adaptation, often on foot hills and in waste lands. It is found in the deserts. The species are used for making pickle and number of other uses including medicinal, fuel wood and fodder. It is tolerant to high temperature, salt and drought stress and help in arresting wind erosion and improving the soil fertility (Mahla, *et al.,* 2013). *Capparis decidua* was one of the important multipurpose woody species of desert and arid regions of the Indians sub continent, Africa and Saudi Arabia. It was an important constituent of desert ecosystems and plays a significant role in total economy of peoples of the arid regions.

Besides many socioeconomic and ecological benefits, all parts of this plant has a number of medicinal properties (Mahla 2010). The natives of this region (arid) recognized the importance of this shrub long ago (Singh and Ranjay. 2011). In India it is found in the deserts, especially of Rajputanam Punjab and Sind (Nadlkarni, 2009). Seeds are globs, 2.5-2mm in diameter dried seeds are reniform, 4-5mm length 3-4mm in width, 1.5-2mm in thickness, covered with grayish white fleshy arid, surface shows fine network of uniformly developed shallow depression throughout, test a very hard, black with pitted surface, helm situated in a small depression on the edge of the seeds to the pointed end (Gupta, 2008). *C. decidua* is one of the most important flours among 44% of all species of vascular plants which come under biodiversity hot spots. Being a desert plant, it possesses diverse chemical constituents, which are of great nutritional and medicinal value and can be used as a potential food supplement (Chauhan *et al.,* 1986). The compositional studies indicated that *C decidua* seeds are rich sources of all three major food components carbohydrates, 25.42%, lipids 29.11%, and proteins 27.71%, in addition to crude fiber 10.44%, ash 3.03% and moisture 4.29%. Similarly the amino acids profile indicated sufficient amounts of essential and non- essential amino acids isoleucine 4.03%, leucine 6.14%, lysine 6.02%, methionine 0.75, phenylalanine 5.51%,

*✉ *Corresponding author:* **Khalid A**
National Food Research Center

threonine 3.64%, tryptophan 0.88%, valine 6.89%, arginine 3.46%, histidine 4.05%, alanine 4.99%, aspartic acid 11.91%, cysteine 0.34%, glutamic acid 24.01%, glycine 4.86%, proline 4.71%, serine 4.40% and tyrosine 2.58 (Muhammad *et al*., 2011).

Objectives

To evaluate the fruit seed for different food uses.
To study macro and micro- nutrients in Tundub fruit seeds to qualify them for different food preparations (e. g. traditional porridge.

Materials used in the study

After Collecting Tundub (*Capaaris decidua*) fruit from Elsururab area, these were kept in plastic containers and stored at freezing temperature (- 18°C) until analysis and preparation of Tundub seeds flour. The local variety of sorghum (Wad Akar) was brought from Agricultural Research Corporation.

for 30 minutes and washing with water until the bitter taste was removed) then, the mixture of sorghum and Tundub flour was milled by using a falling number mill, No 69444-Helsinki Sweden, and kept in sachet containers at 4°C.

Fermented dough was prepared in the traditional way by adding sterile water to the mixture of sorghum and Tundub flour in a 1:2 (wt/V ratio). Fermented dough was then added to the mixture to act as starter (about 10%). This mixture was incubated at 37°C for 24 hrs. After that the porridge was prepared by traditional method in the Lab of the Cereals Technology, Food Research Centre, and Shambat.

METHODS

The protein content of the samples was determined by the micro-kjeldahl method (AOAC, 2008). Fat content was determined according to the AOAC (2008) method. Crude fiber was determined according to the AOAC method (2008).

Table 1 The effect of different processing on the chemical composition of Tundub seeds.

(Sample	Moisture content%	Ash content%	Crude protein%	Crude fibre%	Oil content%	Available carbohydrates%
			%			
C	6.40^{a} ±0.09	2.27^{c} ±0.08	28.95^{c} ±0.75	27.03^{a} ±1.52	8.42^{a} ±0.52	26.92^{a} ±2.51
B	6.51^{a} ±0.19	2.44^{bc} ±0.11	29.72^{bc} ±0.09	28.60^{a} ±0.21	6.58^{b} ±0.47	26.19^{a} ±0.51
D	5.73^{c} ±0.33	2.77^{a} ±0.13	30.26^{ab} ±0.24	28.41^{a} ±0.18	6.52^{b} ±0.31	26.32^{a} ±0.20
E	6.30^{ab} ±0.11	2.59^{ab} ±0.25	29.74^{bc} ±0.92	28.86^{a} ±0.61	6.17^{bc} ±0.15	26.35^{a} ±1.60
A	5.99^{bc} ±0.13	2.86^{a} ±0.08	30.82^{a} ±0.11	28.52^{a} ±1.93	5.84^{c} ±0.08	25.97^{a} ±1.91
$Lsd_{0.05}$	0.3452*	0.2636*	0.9931*	2.069$^{n.s}$	0.638*	2.914$^{n.s}$
SE±	0.1095	0.08367	0.3152	0.6565	0.2025	0.9248

Values are mean ±SD.
Any two mean value(s) sharing different superscript(s) in a column are significantly different (P≤0.05) according to DMRT.
C ≡ Blank B ≡ Soaking for 3 h+ washing. D ≡ Soaking for 12 h+ washing.
E ≡ Boiling for ½ h+ washing. A ≡ Boiling for ½ h+, washing + fermenting.
h = Hour

Table 2 The effect of different processing on the In vitro protein digestibility and anti nutritional factors of Tundub seeds.

Sample	Phenolic mg/100g)	Tannins (%)	Phytate (mg/100g)	IVPD (%)
C	2.24a ±0.23	3.18a ±0.21	52.50a ±1.92	61.91d ±2.03
B	1.70b ±0.07	2.64b ±0.12	47.10b ±0.27	65.45c ±0.67
D	1.27c ±0.17	1.52c ±0.13	25.45c ±2.95	78.75b ±1.06
E	1.04c ±0.08	1.05d ±0.06	17.31d ±0.14	80.25b ±0.31
A	0.51d ±0.16	0.40e ±0.01	8.28e ±1.21	86.69a ±1.26
Lsd0.05	0.2518*	0.2301*	3.04*	2.209*
SE±	0.08944	0.07303	0.9647	0.7012

Values are mean ±SD.
Any two mean value(s) sharing different superscript(s) in a column are significantly different (P≤0.05) according to DMRT.
C ≡ Blank B ≡ Soaking for 3 h+ washing. D ≡ Soaking for 12 h+ washing.
E ≡ Boiling for ½ h+ washing. A ≡ Boiling for ½ h+, washing+ fermenting.

Preparation of dough and porridge

After the oil was extracted (till 8.42%) from the Tundub seed and sweating (by boiling the defatted seeds in distilled water

Total Carbohydrate was calculated by difference according to Pearson, (1981) using the following formula: Total carbohydrate% = 100– (moisture%+ crude fat %+ crude protein %+ ash %). The amino acid composition of all samples were

determined according to the standard using Sykam HPLC (model S 7130) system which is equipped with programmable auto injector. Minerals of raw and processed samples were extracted according to Pearson's method (1981). Calcium content was carried out according to Chapman and Pratt (1968). Potassium and sodium contents of each extracted sample were determined according to AOAC (1984)). Analysis of phosphorous was carried out according to the method of Chapman and Pratt (1968). Cellulose, hemi-cellulose, lignin, phenols and saponin were Determined according to methods described by (Abdulrazak and Fujihara, 1999). Tannin content was carried out using modified vanillin-HCI in methanol method as described by Price and Butler (1978). Phytic acid was determined according to the method described by Wheeler and Ferrel (1971). In vitro protein digestibility (IVPD) was measured according to the method of Saunders et al. (1973).

Statistical analysis

Data generated was subjected to Statistical Analysis System (SAS) Software. Means –SD were tested using One Factor Analysis of Variance (ANOVA) according to Steel and Torrie (1980), and the means separated using Duncans Multiple Test (DMRT) according to Duncan (1955).

RESULTS AND DISCUSSION

Tables (1) and (2) show the r results of different domestic processing (soaking 3h + washing), (soaking 12h + washing), (boiling 1/2h + washing) and (boiling 1/2h + washing + fermenting) on Tundub seeds flour.

Table (1) shows the chemical composition of Tundub seeds. The results showed the difference between raw seeds and sweating one, which were progressed and improved the quality of seeds by increasing the nutritional component and decreasing the anti-nutritional factors. From the above Tundub seeds were found very rich in, protein, fat and carbohydrate 28.11 %, 25.72 % and 22.74 %, respectively. This confirmed by (Muhammad *et al*. 2011). The chemical composition is therefore an index of total energy content in Tundub seeds and its analysis usually is the first step when evaluating its nutritional potent. The high values for crude protein 30.82 % and protein digestibility 86.69 % were obtained by (boiling 1/2h + washing +fermenting) treatment and also, the low values for anti nutritional factors were obtained by the same treatment which is the best among the other treatments or domestic processing. The results also

Table 3 Chemical composition of porridge prepared from sorghum and Tundub seeds.

Sample	Crude protein (%)	Moisture content (%)	Crude fibre (%)	Ash content (%)	Fat content (%)	Carbohydrate (%)
Control	8.73±0.02d	6.70±0.01a	3.56±0.01d	2.15±0.02b	4.18±0.03a	74.65±0.08a
10% Tundub	10.52±0.03c	6.51±0.02b	5.47±0.01c	1.63±0.02d	3.27±0.29c	72.76±0.11b
20% Tundub	15.76±0.02b	6.37±0.02c	9.62±0.01b	2.46±0.01a	3.71±0.03b	62.07±0.00d
30% Tundub	16.61±0.02a	6.00±0.01d	11.15±0.01a	1.64±0.02c	1.01±0.02d	63.58±0.03c
Lsd0.05	0.0878*	0.000878*	0.000878*	0.0005954*	0.2729*	0.1963*
SE±	0.02236	0.0002236	0.0002236	0.0001826	0.08367	0.05

Mean ±SD values having same superscript within a column are not differ significantly (P≤0.05) according to DMRT.

Table 4 Minerals content of porridge prepared from sorghum and Tundub seeds.

Sample	P (%)	K (%)	Na (%)	Ca (ppm)	Zn (ppm)	Fe (ppm)	Mg (ppm)	Mn (ppm)
Control	1.24±0.00b	2.32±0.00a	0.66±0.00a	0.08±0.00d	8.31±0.00a	7.37±0.00a	202.27±0.00a	1.21±0.00a
10% Tundub	0.21±0.00c	0.67±0.00b	0.27±0.00b	9.76±0.00c	0.36±0.00c	1.16±0.00c	9.60±0.00c	0.10±0.00b
20% Tundub	0.29±0.00c	1.70±0.00ab	0.45±0.00ab	29.99±0.00a	1.34±0.00b	2.00±0.00b	22.47±0.00b	0.21±0.00b
30% Tundub	2.10±0.00a	1.50±0.00ab	0.66±0.00a	16.62±0.00b	0.47±0.00c	1.22±0.00c	9.63±0.00c	0.11±0.00b
Lsd0.05	0.6813*	1.0263*	0.1938*	5.4712**	0.7859*	0.5927*	10.2791**	0.0765*
SE±	0.01826	0.6541	0.0063	0.8369	0.1058	0.0836	2.5153	0.0027

Mean ±SD values having same superscript within a column are not differ significantly (P≤0.05) according to DMRT.

Table 5 Acceptability of sorghum porridge fortified with Tundub seed flour.

Sample	Color	Taste	Texture	Flavor	General performance
A	7^{a}_{14b}	7^{a}_{14b}	7^{a}_{14b}	7^{a}_{14b}	7^{a}_{14b}
B					
C	21^{b}	21^{b}	21^{b}	21^{b}	21^{b}
D	28^{c}	28^{c}	28^{c}	28^{c}	28^{c}

Any two sum of ranks having different superscript letter in the same column different significantly (P<0.05)
A = Control sorghum flour B = 10 % Tundub seed flour
C = 20% Tundub seed flour D = 30% Tundub seed flour
a < 11 b = 11-24 c > 24.

Sensory evaluation analysis

Porridge was organoleptically evaluated by the ranking procedure described by Ihekoroney and Ngoddy (1985). Semi trained staff from National Food Research Center (NFRC), Sudan, Shambat, were asked to examine and evaluate samples by giving ranks to attribute stated to them on evaluation forms in which rank 1 was taken to represent the best sample in the respective attribute, while the highest of rank was taken as the least rank in quality. Sum of ranks were then statistically interpreted. For potato chips Hedonic scale was used.

showed significant different ($P \leq 0.05$) through the blank and the best treatment for moisture, ash, fat, crude protein, protein digestibility, and anti nutritional factors.

The amino acids profile of Tundub seeds enumerated the sufficient amount of essential and nonessential amino acids such as aspartic acid, threonine, serine, glotamic acid, glycine, alanine, cystine, valine, methionine, isoleucine, leucine, tyrocine, phenylalanine, histidine, lysine, ammonia and arginine as 6.1, 2.1, 1.1, 25.1, 3.7, 6.4, 1.1, 5.8, .6, 4.1, 8.1, 1.1, 5.2, 2.9, 2.5, 5.9 and 17.9 %, respectively. A balanced amino acids profile is an indicator of quality of protein and foods. Also, these results indicated that glutamic (25.1 %) was present in a highest concentration, while methionine (0.6 %) was in lowest concentration. This agrees with (Muhammad *et al.*, 2011).

Tables (3) and (4) contained the chemical composition and minerals contents of porridge prepared from sorghum and Tundub seed flour with different concentrations (0, 10, 20 and 30 %). The results obtained showed that, the protein was increased from 8.74 % in control to 16.62 % in the sample fortified with 30 % Tundub seeds, also fibre were increased from 3.57 in control to11.11 in the sample fortified with 30 % Tundub seeds, respectively. While fat was decreased from 4.18 % in control to1.01 in the sample fortified with 30 % Tundub seeds. Carbohydrates were decreased from74.65 in control % to 64.85 % in the sample fortified with 30 % Tundub seeds, respectively. Moreover, the results of chemical composition were agreed with that obtained by (Yagoub *et al*., 2009).

The minerals content (Table 4) showed that calcium was increased from 0.08 ppm in control to 16.62 ppm in the sample fortified with 30 % Tundub seeds and phosphorus was increased from 1.24 ppm in control to 2.10 ppm in the sample fortified with 30 % Tundub seeds. While iron was decreased from 7.37 ppm in control to 1.22 ppm in the sample fortified with 30 % Tundub seeds and magnesium was decreased from 202.27 ppm in control to 9.63 ppm in the sample fortified with 30 % Tundub seeds, respectively.

Although, in Table (5) the panelists were preferred the porridge processed from sorghum, but we can progress the porridge processed from Tundub seeds by enough milling, suitable fermenting and adapting the sorghum varieties.

From this study the treatment of Tundub seeds by (boiling 1/2h + washing +fermenting) and concentration of (20 % Tundub seed flour) for preparing porridge were found to be the best treatments depending on the crude protein, protein digestibility, anti nutritional factors and calcium content. Table 2.The effect of different processing on the chemical composition of Tundub seeds.

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