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Technological and Biological Evaluation of Pan Bread Supplemented with Desert Date (*Balanites Aegyptiaca*)

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KEYWORDS
(Balanites aegyptiaca),
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$AlCl_3$,
Hepatotoxicity,
LDL-C,
HDL-C,
AST,
ALT.

ABSTRACT:

Introduction: Large concentrations of soluble tannins, polyphenols, and flavonoids found in *Balanites aegyptiaca* (BA) make it a great source of antioxidants and reactive oxygen species scavengers.

Objectives: The present study was carried out to prepare pan bread from desert date (*Balanites aegyptiaca*) powder (PBDDP) and its extracts (PBDDE) 3%, 5%, 7%, and 10% and study their protection effect against $AlCl_3$-induced hepatotoxicity.

Methods: Sensory evaluation, chemical composition, physical properties, staling tests, and antioxidant activity (DPPH %) of prepared pan bread were determined. A biological experiment was conducted on albino rats that fed on prepared pan bread (PBDDP and PBDDE) at 3%, 5%, and $AlCl_3$ (34 mg/kg bw in drinking water), then the levels of TC, LDL-C, HDL-C, ALT, and AST were measured in serum.

Results: The results of pan bread samples showed that PBDDP and PBDDE (3% and 5%) were well accepted by consumers. The highest protein content was found in PBDDP 5% and PBDDP 3% (11.77% and 11.69%, respectively). AWRC decreased slowly during storage time 24, 48, and 72 h in PBDDP 3% followed by PBDDP and PBDDE 5% compared to the other pan bread samples indicating preservation of bread freshness and slow staling of the bread during storage times. Antioxidant activity and total phenol increased significantly in PBDDP 5% followed by 3% PBDDP. The levels of TC and LDL-C were decreased significantly in all groups that administrated PBDDP and PBDDE (3% and 5%) + $AlCl_3$(34 mg/kg bw) compared with the positive group (PC), while HDL-C was increased significantly in groups (G4, G6, and G3). The results also indicated that G4 administrated $AlCl_3$ (34 mg/kg bw) + 5% PBDDP gave the best results, where it showed a significant decrease in serum TC and LDL-C levels, also significantly increased HDL-C level followed by G6 that administrated $AlCl_3$ (34 mg/kg bw) + PBDDE 5%. Also, G4 and G6 gave the best results of the levels of AST and ALT compared to all groups, where they decreased significantly AST and ALT activities, and their results were similar to the NC.

Conclusions: We can conclude that the PBDDP 5% showed a strong effect against toxicity induced by $AlCl_3$; therefore, desert dates (*Balanites aegyptiaca*) can be considered a suitable natural is ideal ingredient against $AlCl_3$-induced hepatotoxicity.

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1. Introduction

The most common metal on Earth, aluminium (Al), which comprises 8.13 percent of the crust, can enter the human body through food, beverages, and medications that contain Al [1]. Al can be found in drinking water 0.2 mg/L, food additives, cooking pots with an approximate 20% aluminium content, can bottles, antiperspirant cosmetic items, and aluminium foil paper [2]. It is also employed as a water-purifying agent. Due to aluminum's extensive use, biotoxicity has recently received increased attention [3], and reports of a well-established neurotoxic model in experimental animals have been made [4, 5]. Chronic exposure to aluminium can cause changes to the respiratory, haematological, neurological, and skeletal systems [6, 7]. Numerous biochemical alterations, such as the release of liver damage enzyme indicators and modification of oxidant status, are linked to aluminium buildup in the liver [8]. Furthermore, chronic aluminium exposure has been linked to renal toxicity, liver toxicity, and neurological diseases [8 - 10]. Despite having a low capacity for gastrointestinal absorption (less than 1%), it can build up over time in critical organs such as the brain, liver, and kidney, where it can manifest as cytotoxicity and neurotoxicity [2]. Mailloux *et al.* [11] and Exley [12], illustrated that the generation of reactive oxygen species (ROS) is thought to be a mediating factor in the toxic effects of aluminium. ROS can cause oxidative deterioration of cellular lipids, proteins, and DNA, as well as induce changes in tissue antioxidant enzyme activity, altered gene expression, and apoptosis. Nsimba *et al.* [13], said that antioxidants are crucial because they prevent free radical activity and fat oxidation. They also stop oxidative chain reactions in tissues and membranes. Phenolic compounds, which are present in cereals, fruits, and vegetables, have several health benefits, including anti-inflammatory, anti-cancer, anti-viral, and protection against cardiovascular diseases and Alzheimer's disease [14]. Due to its natural makeup, biodegradability, accessibility, low side effects, and cost, medicinal plants and herbs are currently preferred over conventional medications [15]. It has been demonstrated that medicinal plants and herbs can effectively treat a variety of liver problems by encouraging the regeneration and healing of the liver [16]. *Balanites aegyptiaca (BA), (L.)* Delile, family Zygophyllaceae, is a wild herbal used in Egyptian folk medicines to treat liver disorders, particularly jaundice, and epilepsy [17, 18]. Egypt's Eastern and Western Deserts, as well as the borders with Sudan, are home to BA growth. Al Ashaal *et al.* [19] describe the plant Hegleig as a versatile medicinal herb. In the near future, BA is anticipated to be a very promising medicinal plant. Usman *et al.* [20] mentioned that BA has been discovered to have antifungal, antioxidant, anti-inflammatory, and anticancer activities in a variety of plant parts, including leaves, fruit pulp, roots, and stem bark. These effects can be attributed to the presence of flavonoids, tannins, and anti-oxidative qualities (18, 21]. Usman *et al.* [20] stated that the aqueous BA fruit extracts have a hepatoprotective effect, which lowers the spike in liver function biomarker levels brought on by hepatotoxic chemicals. Serum bilirubin levels decreased in a dose-dependent manner after the prior extract was administered to the biliary duct [18].

Newly, society's awareness of healthy nutrition has increased, which contributes to reducing the incidence of dangerous diseases, and since bread is a staple food all over the world and is a good source of energy for the human body [22] and pan bread, or called slices bread is a product in which dough is baked in a loaf pan to give it its distinctive shape pan bread [23]. Whereas, bread and pan bread are both made from polished wheat flour which is a nutrient-poor food, so healthy bread rich in bioactive compounds such as phenolic antioxidants can be prepared.

2. Objectives

This study aims to increase the nutritional value of pan bread by adding desert date (*Balanites aegyptiaca*) powder and its aqueous extract, evaluating the Sensory and Physiochemical properties of prepared pan bread, total phenol contained and antioxidant activity (DPPH radical scavenging activity). Additionally, to study the protection effect of prepared pan bread on the liver against $AlCl_3$-induced toxicity in rats.

3. Methods

Materials

Wheat flour 72%, dry yeast, salt, sugar, and corn oil which are used to prepare pan bread were bought from the local market, and desert date fruits (*Balanites aegyptiaca*) from Siwa, Egypt. All chemicals used in this study were purchased from Sigma Company.

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Methods

Preparation of desert date extract

Desert date fruit powder *(Balanites aegyptiaca*) was ground to a fine powder by using the coffee mill, and then 3, 5, 7, and 10g powder was extracted using 100 ml distilled boiling water in a conical flask, it was stirred for 24h and then filtered through Whatman filter paper No 1. Extracts are kept in the refrigerator at -4 °C until used.

Preparing pan bread

Desert date (*Balanites aegyptiaca*) powder (DDP) and its extracts (DDE) were added to wheat flour for preparing pan bread. The level of replacement of DDP and DDE was 3, 5, 7, and 10 % (as a preliminary study), while control pan bread was produced from wheat flour (100%). The pan bread blends shown in Table 1, mix all ingredients with water or DDE to form dough. The dough was placed at 37 °C and 80–85% relative humidity in a fermentation cabinet, for 20 min, and then the dough was divided into 125g portions. The dough was left for 30 min in a fermentation cabinet at a controlled temperature and relative humidity and then baked at 220 °C for 20 min in an electric oven [25]., then the baked pan bread was cooled at room temperature for 20 min before packaged in polyethylene bags.

Sensory evaluation of pan bread

According to Stone and Sidel [26], the sensory evaluation of pan bread included appearance, crust color, crust texture, taste, odor, and overall acceptability evaluated by 10 panelists from the Food Technology Research Institute at the Agricultural Research Centre in Egypt using a 9-point hedonic scale test.

Analytical methods

Moisture, ash, crude fibre, crude protein, and crude fat, were analyzed in the pan bread product according to the procedures described in AOAC [27]. By using the difference, total carbohydrates were computed. James [28] used the following equation to compute the energy:

Energy (Kcal/100g) = [(Fat x 9) + (Protein x 4) + (Total carbohydrate x4)]

Physical properties of pan bread

After cooling, the baked pan bread was weighed in grams, the average weight of the pan bread was noted, and the volume of the bread loaf (cm^3) was calculated using the displacement of rapeseeds; according to AACC [(29], this value was regarded as the loaf volume. The loaf's specific volume (cm^3/g) was computed by dividing its volume by its weight.

Staling tests:

1- **Alkaline Water Retention Capacity (AWRC):** It was determined according to method 56-10 AACC [30]. Weight the centrifuge tube with a rubber stopper, then Weigh 0.9500–1.0000 g flour known of moisture content into the centrifuge tube, add 5 ml (0.1N) sodium bicarbonate solution, Stopper the tube, and shake vigorously. Set a timer for 20 min to permit to hydrate, and then shake at 5, 10, 15, and 20 min, then Centrifugation at exactly 1,000 gravity for 15 min. Then, decant the supernatant liquid drain the tube at a 45° angle for 5 min, and dry the lip of the tube with tissue paper. Place the tube upside down (90°) on tissue paper in a test tube rack and drain for an additional 5 min, then weigh the tube, stopper, and gel.

$$AWRC\% = \left[\frac{tube\ ,stopper\&gelwt - tube\&stopperwt}{flourwt} - 1\right] \times \left[\frac{86}{100 - moisture}\right]$$

2- **Swelling Power:** It was determined according to Schoch and French [31].

3- **Volume of Sediment:** Weighting of 6 grams of crumb in a cylinder size 50 ml and adding 25 ml distilled water, then mixing the contents for 15 minutes and leaving them for an hour until noting the sedimentation of all contents of the crumb and the supernatant was clear, the volume of the sedimentation (cm^3) was recorded according to Bice and Geddes [32].

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Total phenol content and antioxidant activity (DPPH

radical scavenging activity)

The total phenolic content was determined using the Folin–Ciocalteu technique, as explained by Vázquez *et al.* [33]. According to Nickavar *et al.* [34], the radical scavenging activity was measured using 2, 20-diphenylpicrylhydrazyl (DPPH) as a free radical.

Biological Methods

Male albino adult rats (48 animals weighing 180g ± 2g) were obtained from the Vaccination Center, Helwan, Giza, Egypt, and then transported to the Animal House of Ophthalmology Research Institute, Giza, Egypt. For ten days, the rats were kept in separate cages with screen bottoms and fed a basic meal consisting of 10% casein, 70% corn starch, 5% cellulose, 10% corn seed oil, 1% vitamin mixture and 4% salt mixture. Rats were weighed and split into sex groups (eight animals per group) once they had equilibrated. G1: Normal Control (NC) group that received distilled water (d.w) + basal diet, G2: positive control (PC): received $AlCl_3$ (34 mg/kg bw) in drinking water + basal diet, G3: treated group that received $AlCl_3$(34 mg/kg bw) in drinking water plus pan bread made from 3 % desert date powder (PBDDP 3%), G4: treated group that received $AlCl_3$ (34 mg/kg bw) in drinking water plus pan bread made from 5 % desert date powder (PBDDP 5%). G5: treated group that received $AlCl_3$ (34 mg/kg bw) in drinking water plus pan bread made from 3 % desert date extract (PBDDE 3 %). G6: treated group that received $AlCl_3$ (34 mg/kg bw) in drinking water plus pan bread made from 5 % desert date extract (PBDDE 5%) for seventy days. Fresh feed was given daily, the animal's total body weight was recorded at the start of the experiment and throughout, and the amount of feed they consumed overall was weighed.

Table1. Formulation of pan bread

Ingredient	Control	3% DDP	5% DDP	7% DDP	3% DDE	5% DDE	7% DDE	10% DDE
wheat flour (g)	100	97	95	93	100	100	100	100
DDP (g)	-	3	5	7	-	-	-	-
Salt (g)	1	1	1	1	1	1	1	1
Yeast (g)	4	4	4	4	4	4	4	4
Sugar (g)	4	4	4	4	4	4	4	4
Corn oil (ml)	5	5	5	5	5	5	5	5
Water (ml)	50	50	50	50	-	-	-	-
DDE (ml)	-	-	-		50	50	50	50

DDP = desert date powder, DDE = desert date extract

Blood Collection

Glass capillary tubes were used to draw blood samples from the orbital plexus, then left in clean tubes at room temperature to clot for 30 min, then serum was separated by centrifugation for 30 min at 1500xg at 4°C to obtain serum. The serum was collected in labeled Eppendorf tubes and stored in the refrigerator until used.

Chemistry of Serum

Total Cholesterol (TC) and high-density Lipoprotein Cholesterol (HDL-C) were measured according to Allain *et al*. [35] and Lopez-virella *et al.* [36], and the

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levels of Low-Density Lipoprotein Cholesterol (LDL-C) were calculated by using the formula of Friedewald *et al.* [37]. Aspartate transferase and Alanine transferase (sAST and sALT) were measured colorimetrically using the Reitaman and Frankel [38] method.

Statistical Analysis

Analysis of variance was applied to the data gathered from the physical, chemical, and sensory evaluations (ANOVA). To compare means, Duncan's multiple range tests were employed at the ($P < 0.05$) level.

4. Results

Sensory evaluation

Table 2. Shown the sensory evaluation of different formulations of pan bread. From the results, it was observed that the control sample obtained the highest scores for all properties evaluated, followed by 3% PBDDP, which slightly decreased in appearance, crust color, and taste, and there were no significant differences in crust texture, odor, and overall acceptability compared to the control sample. Concerning 5% PBDDP decreased slightly than the control sample in crust texture, taste, odor, and overall acceptability. From the data, slight decreases were observed in crust color, taste, odor, and overall acceptability between 3% PBDDE and the control sample. There are slightly significant differences between 5% PBDDE and the control sample in odor. It is noteworthy that 3% PBDDP had the best score followed by 5% PBDDP and 3%, 5% PBDDE. The rejected pan bread samples by consumers were made from 7% PBDDP and 10% PBDDE which received lower scores in appearance, crust color, taste, odor, and overall acceptability, as well as the sample 7% PBDDE which got low scores in appearance, taste, and overall acceptability. Therefore, were selected 3%, 5% PBDDP, and 3%, 5% PBDDE to complete the remainder of the study as the best pan bread

Table2. Sensory evaluation of pan bread

	Appearance	Crust color	Crust texture	Taste	odor	Overall Acceptability
Control	$8.90^{a} \pm 0.11$	$8.80^{a} \pm 0.34$	$8.90^{a} \pm 0.31$	$8.70^{a} \pm 0.67$	$8.55^{a} \pm 0.68$	$8.75^{a} \pm 0.35$
3%PBDDP	$8.65^{ab} \pm 0.41$	$8.45^{ab} \pm 0.49$	$8.70^{a} \pm 0.53$	$8.40^{ab} \pm 0.39$	$8.65^{a} \pm 0.47$	$8.65^{a} \pm 0.33$
5%PBDDP	$8.55^{b} \pm 0.49$	$8.15^{b} \pm 0.24$	$8.50^{ab} \pm 0.52$	$8.32^{ab} \pm 0.49$	$8.45^{ab} \pm 0.59$	$8.40^{ab} \pm 0.45$
7%PBDDP	$7.52^{c} \pm 0.55$	$7.10^{d} \pm 0.51$	$8.55^{ab} \pm 0.55$	$4.05^{d} \pm 0.28$	$5.80^{c} \pm 0.59$	$4.20^{d} \pm 0.48$
3% PBDDE	$8.60^{b} \pm 0.39$	$8.50^{ab} \pm 0.23$	$8.70^{a} \pm 0.42$	$8.55^{ab} \pm 0.36$	$8.40^{ab} \pm 0.39$	$8.40^{ab} \pm 0.45$
5%PBDDE	$7.85^{c} \pm 0.41$	$8.25^{b} \pm 0.42$	$8.15^{b} \pm 0.24$	$8.25^{b} \pm 0.35$	$8.10^{ab} \pm 0.56$	$8.00^{b} \pm 0.52$
7%PBDDE	$7.80^{c} \pm 0.34$	$8.15^{b} \pm 0.41$	$8.55^{ab} \pm 0.43$	$7.90^{c} \pm 0.45$	$7.85^{b} \pm 0.62$	$7.50^{c} \pm 0.42$
10%PBDDE	$7.70^{c} \pm 0.53$	$7.55^{c} \pm 0.49$	$8.15^{ab} \pm 0.24$	$4.35^{d} \pm 0.33$	$4.95^{d} \pm 0.69$	$4.40^{d} \pm 0.45$

PBDDP= pan bread made from desert date powder, PBDDE = pan bread made from desert date extract

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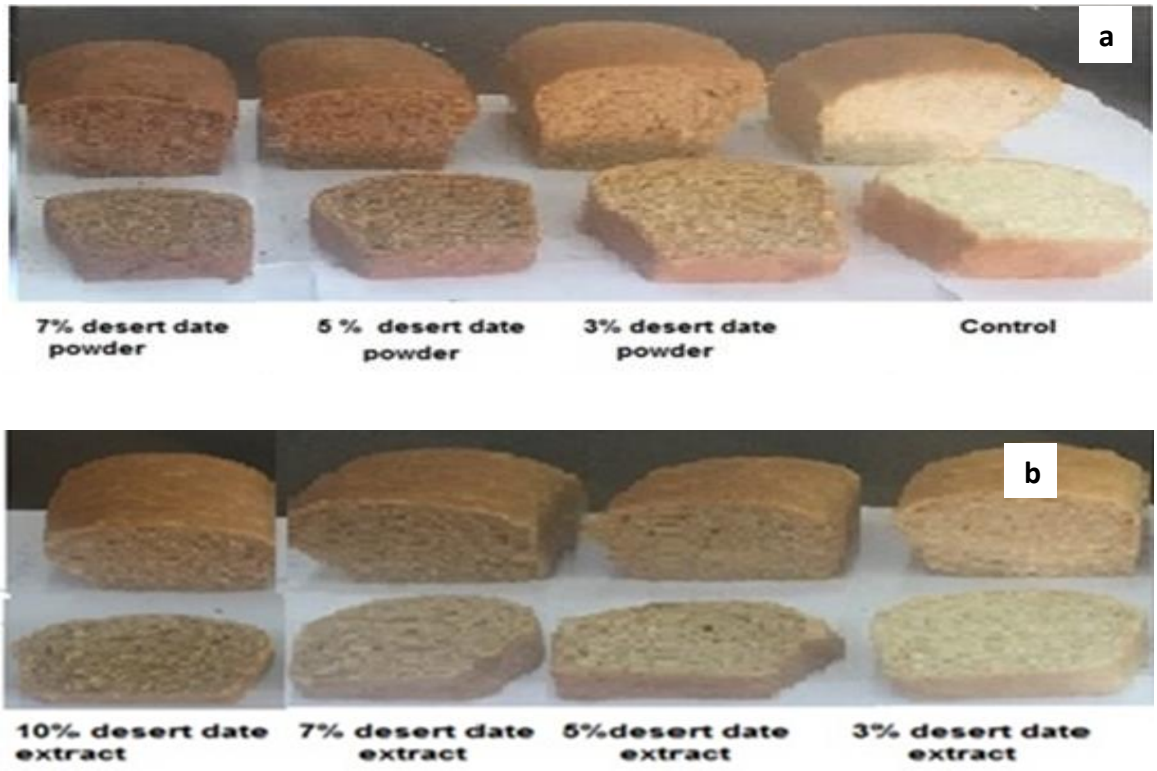

Fig 1. Picture of pan bread made from a) desert date powder and control, b) desert date extracts.

Chemical composition of ban bread

Crude fiber, ash, Protein, fat, and total carbohydrate of pan bread are presented in Table 3. The obtained data indicated that the crude fiber significantly increased in the 5% PBDDP (0.31%) followed by 3% PBDDP (0.28%) compared with the other samples. Ash and protein content significantly increased in the 5%, and 3% PBDDP compared to the control and other samples. The highest fat content was found in 5% PBDDP (5.41%), while the fat content decreased significantly in 3%, and 5% PBDDE (5.12%, and 5.15%). The data observed that the total carbohydrate content increased significantly in 3% and 5% PBDDE and no significant between them and the control.

In the same table (table 3) the energy value of pan bread results was shown. The highest energy value was found in the control (419.06 kcal/100g) followed by 3%, 5% PBDDE (416.92 kcal/100g, 416.83 kcal/100g). Concerning the nutritional quality, the Dietary Reference Intake (DRI) for each 100g of pan bread for males and females aged 9-13 years, data showed that the 5% PBDDP for males and females will provide the highest protein content (34.61 %) compared to the other pan bread. Also, DRI for each 100g of pan bread for males and females aged 9-13, it was found that the control sample gave the highest energy (18.38% and 20.23%) for males and females respectively, compared to the other pan bread.

Table 3. Chemical composition of ban bread

Chemical composition (%)	Control	3% PBDDP	5% PBDDP	3% PBDDE	5% PBDDE
Crude fiber	0.14^{c}±0.005	0.28^{b}±0.01	0.31^{a}±0.005	0.14^{c}±0.01	0.15^{c}±0.011
Ash	1.72^{c}±0.	2.42^{a}±0.	2.43^{a}±0.	2.03^{b}±0	2.08^{b}±0.

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	01	02	015	.02	04
Protein	11.31^{b}± 0.05	11.69^{a}± 0.01	11.77^{a}± 0.03	11.29^{b}± 0.20	11.30^{b}±0 .20
Fat	5.30^{b}±0. 07	5.34^{b}±0 .04	5.41^{a}±0. 02	5.12^{c}±0. 04	5.15^{c}±0. 03
Total carbohydrate	81.53^{a} ±0.07	80.27^{b}± 0.24	80.08^{b}± 0.01	81.42^{a}± 0.15	81.32^{a}±0 .01
Energy Kcal/100g	419.06^{a} ±0.015	415.90^{c} ±0.02	416.09^{c} ±0.04	416.92^{b} ±0.02	416.83^{b} ±0.05
Nutritional Quality of pan bread					
DRI of protein / 100g Based on 34g/day for male and female	33.26	33.38	34.61	33.20	33.23
DRI of energy/ 100g Based on 2279 Kcal / day for male	18.38	18.24	18.25	18.29	18.29
DRI of energy/ 100g Based on 2071 Kcal/ day for female	20.23	20.08	20.09	20.13	20.12

PBDDP= pan bread made from desert date powder, PBDDE = pan bread made from desert date extract

Physical properties of pan bread

Effect of replacement of PBDDP and PBDDE on weight, volume, and specific volume of pan bread. The results of weight, volume, and specific volume of pan bread were illustrated in Table 4. Data indicated that the weight ranged from 147.51 to 152.86 g/100g, however, the volume ranged from 442.1 to 462.5 cm^3, and the specific volume ranged from 2.919 to 3.037 (cm^3 /g). The PBDDP 5% significantly increased in weight as well as the control sample followed by the PBDDP 3%, while the control sample had the highest volume compared to the other samples. On the other hand, the PBDDP (3% and 5%) decreased significantly in specific volume may be due to the replacement of flour with date powder. Moreover, PBDDE 3% significantly increased in a specific volume similar to the control sample.

Table 4. Effect of replacement of PBDDP and PBDDE on weight, volume and specific volume of pan bread

Treatments	Weight (g)	Volume Cm^3	Specific volume (cm^3 /g)
Control	152.28^{a}± 0.38	462.50^{a} ± 2.5	3.037^{a} ± 0.01
3% PBDDP	151.17^{b}± 0.41	444.00^{c}±1.0	2.937^{c}±0.01
5% PBDDP	152.86^{a}± 0.30	446.30^{b}±1.04	2.919 ^{c}± 0.01
3% PBDDE	148.05^{c}± 0.31	447.00^{b}±2.60	3.019^{a}± 0.02
5% PBDDE	147.51^{c}±0.44	442.10^{c}± 1.15	2.997^{b} ± 0.02

PBDDP = pan bread made from desert date powder, PBDDE = pan bread made from desert date extract

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Staling tests

1- Alkaline Water Retention Capacity (AWRC) of pan bread

Alkaline water retention capacity (AWRC) is a quick test to follow the staling or retrogradation and freshness of pan bread. Samples of different pan bread after baking and after storage periods (0, 24, 48, and 72 h.) were estimated as shown in Fig 2. The data revealed that AWRC decreases with increasing storage periods in all pan bread samples. Moreover, AWRC decreased slowly during storage times in PBDDP 3% compared to the other pan bread samples, and since there is a positive relationship between AWRC and freshness and an inverse relationship with staling of bread, therefore, this sample is considered the best compared to the other samples in terms of preserving the freshness and slow staling of the bread, followed by PBDDE 5%.

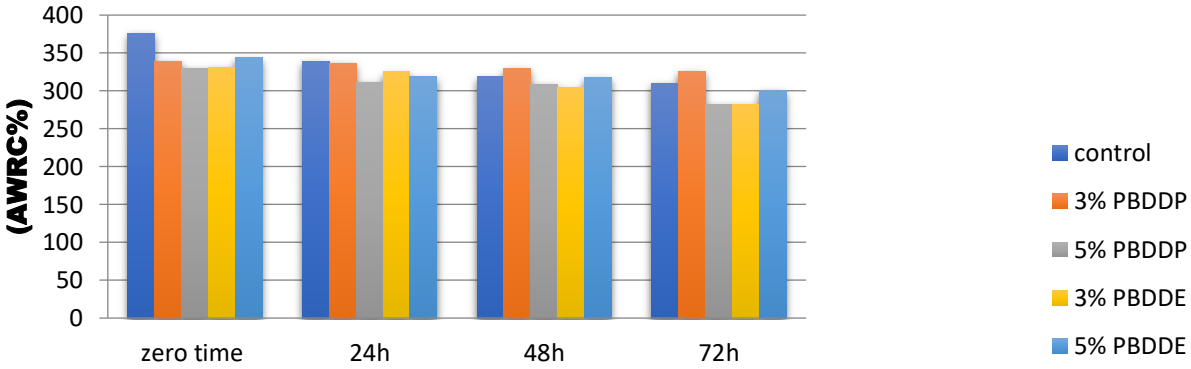

Fig 2. Alkaline Water retention Capacity (AWRC%) of pan bread

2- Swelling Power of pan bread

Figure 3. Shows the swelling power of pan bread samples during storage times. Data explained that the swelling power at zero time for all pan bread samples was high and gradually decreased with increasing storage times at 24, 48, and 72 h, Moreover, it was observed that there was no affected of the swelling power during 24, 48, and 72 h in PBDDP 3% compared to the other samples. Also, the swelling power was not affected during storage for 48 and 72h in PBDDE 3%, 5%. While it was observed that the swelling power decreased significantly during all storage times for PBDDP 5%, which indicates a decreased freshness of pan bread, due to migration water from the crumb to the crust and starch crystallization, this may be due to the increase in the addition ratio of the desert dates.

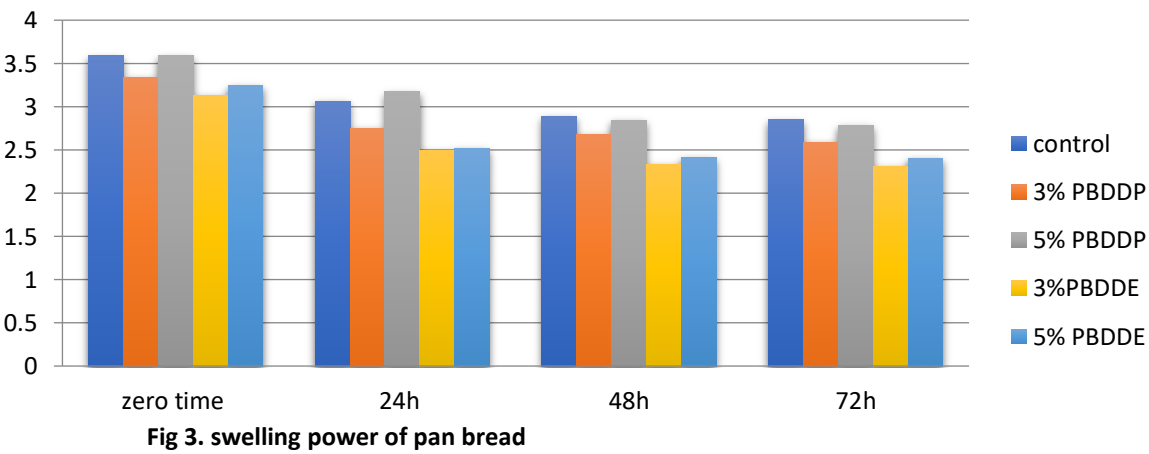

Fig 3. swelling power of pan bread

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3- **Volume of Sediment**

Fig.4 Shows the volume of the sediment for various samples of pan bread. It was observed that the volume of the sediment was not significantly affected at zero time and after 24 h, and then decreased significantly after 48h in PBDDE (3% and 5%) compared to the other samples, while the volume of the sediment gradually decreased with increasing storage after 24, 48, 72h in PBDDP (3% and 5%) compared to all samples.

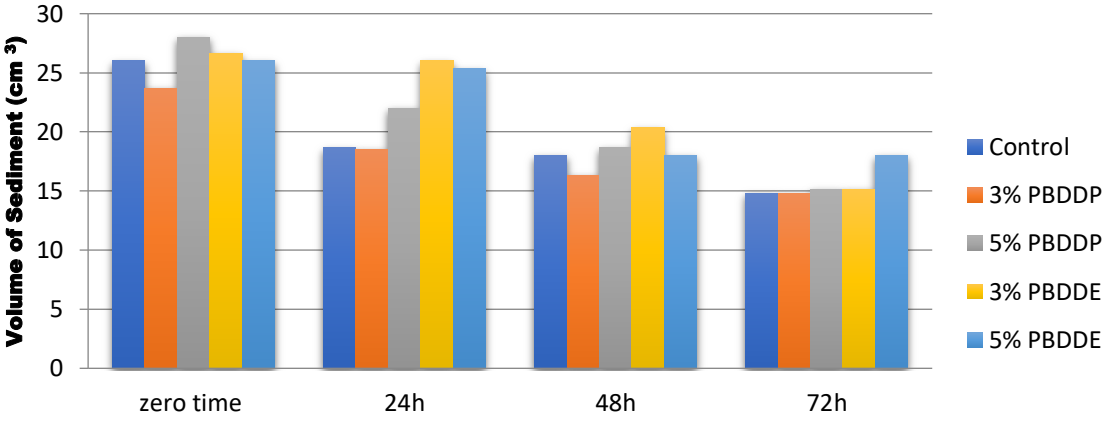

Fig. 4 Volume of Sediment (cm ³) of pan bread

Antioxidant activity and total phenolic content of pan bread

Antioxidant activity and total phenol are presented in Table (4). The control sample had the lowest antioxidant activity and total phenol. Moreover, the antioxidant activity and total phenol increased significantly in PBDDP 5% followed by 3% PBDDP, while antioxidant activity and total phenol decreased with decreasing add desert date extract in PBDDE (3%, 5%).

Table 5. Antioxidant activity and Total phenols of pan bred prepared from desert date

Samples	Anti-oxidant activity %	T. phenols (mgGAE/g)
Control	13.63^{e}±0.30	104.75^{e}±0.17
3% PBDDP	21.14^{b}±0.21	139.13^{b}± 0.21
5% PBDDP	22.21^{a}±0.22	141.52^{a}± 0.19
3%PBDDE	16.33^{d}±0.23	132.32^{d}±0.11
5%PBDDE	17.42^{c}±0.20	134.90^{c}± 0.24

PBDDP = pan bread made from desert date powder, PBDDE = pan bread made from desert date extract

Biological analysis:

1- Serum lipid profile

Serum lipid profile levels are summarized in Table 6. From the present data, we found that TC and LDL-C in positive control group (PC) treated with $AlCl_3$ (34 mg/kg bw) were increased significantly ($p \leq 0.05$) to (254.8 and 204.1 mg/dl, respectively) compared with normal control (NC) group (161.7, and 61.7mg/dl, respectively), while HDL-C level was decreased significantly ($p \leq 0.05$) to 51.0 mg/dl in PC compared with NC (103.1 mg/dl). On other hand, the levels of TC

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and LDL-C were decreased significantly ($p \leq 0.05$) in all groups that administrated PBDDP (3 or 5%) +$AlCl_3$ (34 mg/kg bw) and PBDDE (3 or 5%) + $AlCl_3$ (34 mg/kg bw) compared with PC that treated with $AlCl_3$ (34 mg/kg bw), while HDL-C was increased significantly ($p \leq 0.05$) in groups (G4, G6 and G3). The level of HDL-C in G5 that administrated $AlCl_3$ (34 mg/kg bw) + PBDDE 3%, was similar to PC and no differences between them but it had a good result (significantly increased) if compared to the level of TC in G5 with PC.

Table 6. Serum lipid profile of male rats treated with $AlCl_3$ (34 mg/kg bw) and fed on(PBDDP) and (PBDDE)

Treatments	Total cholesterol mg/dl	LDL-C mg/dl	HDL-C mg/dl
G1: (NC)	161.7^{e}±7.41	61.7^{e} ±1.43	103.1^{a} ± 3.37
G2:(PC)	254.8^{a} ±11.97	204.1^{a} ±10.91	51.0^{d} ±1.99
G3: $AlCl_3$(34 mg/kg bw) + PBDDP 3%	197.1^{cb}±12.37	126.95^{c} ±5.18	70.45^{c} ±3.18
G4: $AlCl_3$(34 mg/kg bw) + PBDDP5%	174.3^{de} ±19.57	62.1^{e} ±3.17	101.9^{a} ±2.11
G5: $AlCl_3$(34 mg/kg bw) + PBDDE 3%	202.4^{b} ±22.72	152.4^{b} ±12.02	50.6^{d} ±2.77
G6: $AlCl_3$(34 mg/kg bw) + PBDDE 5%	191.7^{cb}±21.52	101.5^{d} ±11.72	90.3^{b} ±3.32

PBDDP = pan bread made from desert date powder, PBDDE = pan bread made from desert date extract. Each value is mean ± SD for eight rats in each group. Significantly different from controls ($p < 0.05$) by ANOVA multiple rage test.(*) There is no significant differences between values with the same letter, for each column.

In the same Table (6) it is clear that group (G4) that administrated $AlCl_3$ + PBDDP 5% gave the best results of the levels of TC, LDL-C, and HDL-C compared to all groups where it showed a significantly decreased ($p \leq 0.05$) in serum TC and LDL-C levels (174.3 and 62.1 mg/dl, respectively), also significantly ($p \leq 0.05$) increased of HDL-C level (101.9 mg/dl), followed by group (G6) that administrated $AlCl_3$ (34 mg/kg bw) + PBDDE 5%.

2- Serum AST and ALT

The present data in Table 7 found that serum AST and ALT activities were significantly ($p \leq 0.05$) increased in PC (30.4 and 29.8 U/l, respectively) compared to NC (22.1 and 24.7 U/l, respectively). The treatments G4 and G6 give the best results of AST and ALT levels compared to all groups, where they decreased significantly AST level (22.5 and 23.1U/l, respectively) and reduction in ALT level (24.9 and 25.1 1U/l, respectively) and their results similar to the NC (24.71U/l). While the treatments G3 and G5 decreased AST level (24.8 and 25.5 U/l, respectively) and reduced ALT level (25.9 and 26.1 U/l, respectively) but there were no significant differences between them.

Table 7. Serum AST and ALT of male rats treated with $AlCl_3$ (34 mg/kgbw)and fed on PBDDP and PBDDE.

Treatments	AST U/l	ALT U/l
G1: (NC)	22.1^{d} ±1.04	24.7^{c} ±1.62

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G2: (PC)	30.4^{a} ±1.68	29.8^{a} ±1.95
G3: $AlCl_3$(34 mg/kg bw) + PBDDP 3%	24.8^{bc} ±1.15	25.9^{b} ±0.81
G4: $AlCl_3$(34 mg/kg bw) PBDDP5%	22.5^{cd} ±1.40	24.9^{c} ±0.94
G5: $AlCl_3$(34 mg/kg bw) + PBDDE 3%	25.5^{b} ±1.09	26.1^{b} ±0.88
G6: $AlCl_3$(34 mg/kg bw) + PBDDE 5%	23.1^{c} ±1.16	25.1^{c} ±0.91

PBDDP = pan bread made from desert date powder, PBDDE = pan bread made from desert date extract. Each value is mean ± SD for eight rats in each group. Significantly different from controls ($p < 0.05$) by ANOVA multiple rage test.(*) There is no significant differences between values with the same letter, for each column.

5. Discussion

Our data observed that the highest fat content was found in 5% PBDDP, while the fat content decreased significantly in 3%, and 5% PBDDE. Ash, crude protein, crude oil, crude fiber, and hydrolysable carbohydrate in *Balanites aegyptiaca* amounted to 2.59, 4.30, 11.92, 3.55 and 72.64%, respectively [39].
The data observed that the Dietary Reference Intake for each 100g of pan bread for males and females aged 9-13 years that the 5% PBDDP for males and females will provide the highest protein content (34.61 %) compared to the other pan bread. Also, the Dietary Reference Intake for each 100g of pan bread for males and females aged 9-13, it was found that the control sample gave the highest energy (18.38% and 20.23%) for males and females respectively, compared to the other pan bread [40].

Data showed that PBDDP (3% and 5%) decreased significantly in specific volume may be due to the replacement of flour with date powder. These results agree with Houben et al.,[41] who reported that a lower specific volume may be due to the decreased forming of gluten proteins which are responsible for gas retention in the dough through the fermentation process.

AWRC reduced slowly during storage times in PBDDP 3% compared to the other pan bread samples, followed by PBDDE 5%, and this slow decrease indicates a slow retrogradation of starch and slow staling of pan bread, as there is an inverse relationship between AWRC and the staling of bread and a Positive relationship with freshness A higher AWRC value indicates a high freshness of the bread [42]. AWRC indicates indirectly the degree of starch crystallization where, lower AWRC values indicate crystallized starch, staling, and loss in freshness, while a higher AWRC is positively correlated with a gelatinized starch and freshness [43].

The swelling power decreased significantly during all storage times for PBDDP 5%, this may be due to the increase in the addition ratio of the desert dates. A decreased freshness and increased staling of pan bread, due to the migration of water from the crumb to the crust and starch crystallization. A staling increases, as decrease the swelling power [44].

The volume of the sediment decreased significantly after 48h in PBDDE (3% and 5%) compared to the other samples, while the volume of the sediment gradually decreased with increasing storage after 24, 48, and 72h in PBDDP (3% and 5%) compared to all samples. The decrease in the volume of the sediment may be due to staling and the retrogradation of starch [45]

The antioxidant activity and total phenol were high in PBDDP 5% followed by 3% PBDDP, while antioxidant activity and total phenol decreased with decreasing add desert date extract in PBDDE (3%, 5%). These results may be due to the desert date (*Balanites aegyptiaca*) fruits, which contained high levels of antioxidants and phenolic compounds [46]].
Our findings align with the results presented by Abdel Aziz and Zabut[11] they indicated that $AlCl_3$ increased cholesterol levels (20%). The increase in total cholesterol levels is due to the response to aluminium [47]. When treated with aluminium chloride ($AlCl_3$), there was a considerable increase in TC and LDL-c, but a drop in HDL-c levels [48]. The lipid profile in the serum was significantly improved by extracts from the fruit and seeds of *Balanites aegyptiaca*[49].

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Balanites aegyptiaca powder and water extract for fruit have strongly shown protective effects in preserving plasma membrane for integrity hepatocytes to accelerate parenchymal cell regeneration, restoring the liver enzymes to normal levels [20]. All of the increased biochemical indicators as a result of hepatotoxin could be reduced by the aqueous extract of *Balanites aegyptiaca*, showing an improvement in the liver's functional state. Significant alterations only imply hepatic impairment; e.g., elevated levels of the liver toxicity markers AST and ALT are reliable indicators [50]. When compared to the positive control group, treatment with *Balanites aegyptiaca* water extract (100 and 200 mg/kg) significantly reduced AST and ALT and had a substantial hepatoprotective effect ($P < 0.05$) [51]. BA has high amounts of protein, soluble tannins, polyphenols, flavonoids, and other nutrients provide, also, has anti-inflammatory, hepatoprotective, and antioxidant properties [52].

Conclusion

Adding desert date (*Balanites aegyptiaca*) to wheat flour at 3% powder to produce the pan bread led to preserving the freshness and slow staling of the bread during storage times, swelling power no affected during 24, 48, and 72 h. Antioxidant activity and total phenol increased significantly in PBDDP at 5%. The levels of TC and LDL-C were decreased significantly in all groups that fed on PBDDP and PBDDE at 3%, 5%. PBDDP and PBDDE at 5% gave the best results of the levels of AST and ALT activities compared to all groups, where they decreased significantly AST and ALT levels and their results similar to the NC.

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