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# Nutritional Evaluation of Extrusion Snacks Supplemented by Date Fruits Powder

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## Abstract

This study was made on fruits of two dry dates, the first one called Seedling (unclassified - Manthor date) and the second Bartamouda which is one of the most famous dates in Egypt. The powder of these fruits was used (at 1, 3 and 5%) for preparation the date- snacks, as a new snack product from dates. snack food now a very wide range of products, including several types. Extruded snack- products which are easy to consume, tasty, crispy, with thousands of shapes, flavors, textures, and are consumed worldwide. They can be expanded directly or indirectly. Therefore, this study was divided into two parts, the first one related to studying the physical properties, proximate chemical composition and determination of minerals content of Seedling and Bartamuda date fruits at tamr stage, then evaluation the effect of date powder addition on the sensory properties of snacks made from corn grits and date powders at 1, 3 and 5 %. So, the second part of this research was including study the effect of date powder type and the addition level on sugars (reducing and non- reducing and total sugars), crude fat, crude protein, fiber, ash, phenols content and the titratable acidity. Moreover Phosphorus, potassium, calcium, magnesium, iron, zinc and manganese contents (mg/100 g) were also determined. The results showed that there were significant differences ($P \leq 0.05$) between the both date varieties under study as regard to chemical properties. The first one Seedling date., was higher in reducing sugar, crude fiber and crude fat, while the second (Bartamuda cv.) was higher in non-reducing sugars and total sugars and the both were equal in protein contents. As regard to mineral analysis there were significant differences ($P \leq 0.05$) between the both varieties and control and the second variety was the highest. As regard to the effect of adding date powders (D.P.1 and D.P.2) of Seedling and Bartamuda varieties on crude fat and protein content of snacks fortified with 1, 3 and 5% there were no significant differences between the snacks and control, while for crude protein there were significant differences ($P \leq 0.05$) and control was the lowest. As regard to the effect of adding on crude fiber and ash, there were marked increases between the level of substitution and the second variety was the best. As regard to the effect of adding on Phosphorus, potassium, calcium and magnesium, there were marked increases between the four elements for snacks fortified with all levels of both varieties and D.P.2 was the highest and potassium mineral was the dominant element. As regard to the effect of adding on iron, zinc, manganese and cupper, the results showed that there were significant differences between the substitution levels and 3 and 5% were the highest, while the control was the least. There were no significant differences between

treatments (1, 3 and 5%) and control for all sensory attributes and Seedling. was the best and significantly different.

***Keywords:*** *Extrusion snacks, date powder, Seedling (Manthor) dateBartomoda date cv.*

## Introduction

The date palm tree (*Phoenix dactylifera* L.) is an arborescent of the family Palmaceae (Arecaceae), inhabit tropical and sub-tropical habitats and the majority of palms are found in the old world, as claimed by El Hadrami and El Hadrami (2009). Date palm was known in ancient Egypt since 4000 years ago and this fact can be simply proven from date palm inscriptions appearing on the walls of ancient Egyptian temples (Al-Qarawi *et al.* (2003). The date palm - plays an important social, environmental, and economic role for many people living in arid and semi-arid regions of the world. Fruits of the date palm are very commonly consumed in many parts of the world and considered as a vital component of the diet and a staple food in most Arab countries (Al-Farsi and Lee, 2008). The world production of dates has increased from about 4.6 million tons in 1994 to 8,460,443 million tons in FAO (2016). Date fruits contain a high percentage of -total sugars (44-88%), -crude protein (2.3-5.6%), crude fat (0.2-0.5%), minerals and vitamins and a high percentage of dietary fibre (6.4-11.5%). The date flesh contains 0.2-0.5% oil, whereas the seed contains 7.7-9.7% oil-(Al-Showiman (1998), Al-Shahib and Marshall (2003), Al-Farsi *et al.* (2005) and Tang *et al*., 2013). In many ways, dates may be considered as an almost ideal food, providing a wide range of essential nutrients and potential health benefits as was reported by Al- Showiman (1998), Al-Shahib and Marshall (2003), Al-Farsi *et al.* (2005) and Tang *et al.* 2013). Extrusion cooking as a continuous cooking, mixing, and forming process, is a versatile, low cost, and very efficient technology in food processing (Ilo *et al*., 1999). Aswan governorate contributed with 2056929 fruitful female palms (According to Annual Statistical of the Ministry of Agriculture in 2015). Also, it may reveal new and essential information for better understanding of date fruit that helps to enhance industrialization and propagation of the best date varieties that satisfy producers as well as consumers demands (- El-Sharabasy *et al.,* 2003; Jaradate and Zaid, 2004; Ismail *et al*., 2006; Abdalla, 2002 and Gadalla, 2013).

## Materials and Methods

### Materials:

Date fruits of Seedling (Manthor) and Bartamouda were purchased from -Aswan governorate, Egypt. Palm oil, corn grits and taste and aroma supplements were purchased from the local market from Giza, Egypt. Packaging materials: Laminated packaging (polyester/aluminum foil/polyethylene) was obtained from Pharmaceutical packing company, 6 October region, Giza, Egypt. Polyethylene bags were obtained from the local market. Whereas, Bioxial oriented polypropylene metalized (BOPPM) 20/20 micron was obtained from Food Engineering and Packaging Dept., Food Technology Research Institute, Egypt.

**Methods:**

**1. Preparation of date samples:** Date fruits at tamr stage were cleaned, pitted, and then packed into polyethylene bags for analysis. Another part of date fruits were dried in an oven at 70°C ± 3°C till constant weight obtained according to Borechani *et al.* (2010) date fruits were pitted, grinded then milling bymixer (K45SS, 250 W, Kitchen Aid, Inc., MI) Date powder was packaged in (15 × 20 cm) laminated polyester/ aluminum foil/polyethylene) bags.

**2. Production of snacks:** Snacks continued on corn grits; salt, oil food (17-18 %), water, flavor (0.8 %). snack was prepared by addling date powders at 1, 3 and 5% to the formula. The snacks recipes were carried out according to the method of García-Segovia *et al.* (2020). Apilot-scale single screw extruder (MX-300 Extruder, USA) with painted steel frame, a 275lb. barrel diameter of 50 mm was used for the preparation of extruded corn snacks**.** The operating conditions (screw speed, barrel temperature, and feed rate) were standardized based on preliminary trials and the extrusion system was configured to operate at feed rate of 30 kg/h, screw speed of 150 rpm and barrel temperature was maintained at 150-170°C. The extruded was forced through circular brass made concave die exits (3.5 mm) and cut by a knife rotating to form extruded snacks. The snacks were packed into Laminated packaging (polyester/aluminum foil/ polyethylene) after producing immediately (García-Segovia *et al.,* 2020).

**3-Chemical methods:** Moisture, sugars, crude fiber, crude protein, crude fat, ash content and total titratable acidity, were carried out according to A.O.A.C. (2010).

**Total phenols content:** Total phenols were extracted according to the procedure described by (Maier and Metzler 1965) as follows Twenty five fruits were pitted, chopped and 50g of flesh were put immediately into 150 ml. boiling 80% ethyl alcohol for 15 min. then the ethanol mixture was blended for 10 min. and filtered. The procedure was repeated 3 times using fresh 80% alcohol solution each time and extracts were collected and filtered. The ethanol extract was heated and alcohol was replaced with water and volume made up to 100 ml. The total phenols were determined in the extracts according to Swain and Hillis (1959) method as follows:

**Folin-Denis reagent:** One hundred grams of sodium tungestate was dissolved in 750 ml. distilled water, then 20g of phosphomolbdic acid were added, followed by 50 ml. of 85% phosphoric acid. The mixture was boiled for 2 hours, cooled down to room temperature, then completed to one liter by distilled water and kept refrigerated till use. Twenty five grams of anhydrous sodium carbonate were added to 100 ml. distilled water, warmed to dissolve and left to cool overnight, then a crystal of sodium carbonate was added to super saturated solution. After crystallization, the clear liquid solution (saturated) was filtered. One tenth ml. of the obtained extract was diluted with distilled water to about 7 ml. in a 10 ml. graduated test tube. The content were well mixed, 0.5 ml. of the Folin-Denis reagent was added and the tube was shaken for 3 min., then 1.0 ml. of

the saturated sodium carbonate solution was added and the mixture was made up to 10 ml. with distilled water. After 1 hr., the absorbance was determined at 725 nm using Shamadzu Spectrophotometer against a blank. The concentration of total phenols was calculated from a standard curve prepared by using known concentrations (0.05 to 1 mg/ml) of pyrogallol.

**Mineral Content:**

Potassium, magnesium, iron, copper, zinc, phosphorous, calcium were determined in the studied samples according to A.O.A.C. (2010).

**Sensory evaluation:**

Ten semi trained panelists evaluated the samples using the numerical hedonic scale method for their taste, color, texture, odor and overall acceptability according to the methods of Sumainah and El-Nahal (1984) and Yousif *et al*. (1990).

**Statistical analysis:**

The products were statistically analyzed by analysis of variance (ANOVA) according to the method of SAS program (2009) and Duncan's Multiple Range Test was applied to assess significant differences between means at 5% level of probability (Duncan, 1952).

**Fig (1)**: Control without dates powder.

**Fig (2):** Snacks product with date powder 1 %. From Seedling Dates powder


**Fig (3):** Snacks product with date powder 3%. From Bartamuda Dates powder

## 3. Results and Discussion:

The data in Table (1) showed that moisture, reducing-, non-reducing-and total sugars, crude fiber, crude protein, crude fat, ash, acidity, phenolwere13.58, 8.89, 43.41, 52.30, 10.13, 1.88, 0.40, 3.46, 0.63 and 0.38 % for Seedling fruits , respectively. In other hand it were 12.77, 8.65, 58.15, 66.79, 9.24, 1.74, 0.31, 2.74, 0.46 and 0.56% for Bartamuda fruits, respectively. The data in Table (2) showed that the levels of P, K, Ca, Mg, Fe, Zn, Mn and Cu were 110.71, 545.42, 162.71, 27.44, 2.43, 0.245, 0.184 and 0.735 mg/100g of Seedling fruits, respectively. However, they were 114.90, 556.20, 179.38, 36.09, 2.97, 0.276, 0.217 and 0.793 mg/100 g of Bartamuda fruits, respectively. These results show that dates are nutritious and can play a major role in human nutrition and health (Assirey, 2015). Also potassium was the dominant element in the both date varities.

**Table 1. Chemical composition of Seedling and Bartamouda date fruits at tamr stage (% on dry weight basis).**

| Date fruit types / *Compounds (%) | Seedling (Manthor) | Bartamuda cv. |
|---|---|---|
| Moisture | 13.58±0.215a | 12.77±0.266a |
| Reducing sugars | 8.89±0.129a | 8.65±0.858b |
| Non-Reducing sugars | 43.41±1.163b | 58.15±2.515a |
| Total sugars | 52.30 ±1.224b | 66.79±1.675a |
| Crude fiber | 10.13±0.085a | 9.24±0.207b |
| Crude protein | 1.88±0.077a | 1.74±0.084a |
| Crude fat | 0.40±0.014a | 0.31±0.005b |
| Ash | 3.46±0.277a | 2.74±0.171b |
| Acidity | 0.63±0.062a | 0.46±0.086b |
| Phenol | 0.38±0.046b | 0.56±0.014a |

* Means (±S.D. n=3) in the same row sharing the same letters(s) are not significantly different at $P < 0.05$.

The data in Table (1) showed that moisture, reducing-, non-reducing-and total sugars, crude fiber, crude protein, crude fat, ash, acidity, phenolwere13.58, 8.89, 43.41, 52.30, 10.13, 1.88, 0.40, 3.46, 0.63 and 0.38% for Seedling fruits, respectively. In other hand it were 12.77, 8.65, 58.15, 66.79, 9.24, 1.74, 0.31, 2.74, 0.46 and 0.56% for Bartamuda fruits, respectively. The data in Table (2) showed that the levels of P, K, Ca,

Mg, Fe, Zn, Mn and Cu were 110.71, 545.42, 162.71, 27.44, 2.43, 0.245, 0.184 and 0.735 mg/100g of Seedling fruits, respectively. However, they were 114.90, 556.20, 179.38, 36.09, 2.97, 0.276, 0.217 and 0.793 mg/100 g of Bartamuda fruits, respectively. These results show that dates are nutritious and can play a major role in human nutrition and health (Assirey, 2015). Also potassium was the dominant element in the both date varities.

**Table 2. Minerals content of Seedling and Bartamouda date fruits at Tamr stage (mg/100 g dry weight basis).**

| Date types / Element | Seedling fruits. | Bartamuda fruits |
|---|---|---|
| P | 110.71±0.058b | 114.90±0.0249a |
| K | 545.42±0.509b | 556.20±0.905a |
| Ca | 162.71±0.603b | 179.38±0.168a |
| Mg | 27.44±0.619b | 36.09±0.324b |
| Fe | 2.43±0.151a | 2.97±0.338a |
| Zn | 0.245±0.219a | 0.276±0.232a |
| Mn | 0.184±0.110b | 0.217±0.121a |
| Cu | 0.735±0.205b | 0.793±0215a |

Means (±S.D., n=3) in the same row sharing the same letters(s) are not significantly different at P < 0.05.

The data presented in Table (3) referred to the crude fat and protein (%) of the studied snacks with different levels of date powders. With regard to crude fat data, obviously that those snacks at 1, 3 and 5% of D.P.1 and D.P.2 were not significantly different (P≤0.05) from the control in all specific effect and interaction effect. Concerning to the crude protein content of snacks containing 3 and 5 % of D.P.1 and D.P.2, they were significantly (P≤0.05) different and the highest compared with the control.

**Table 3. Effect of date powder addition on crude fat and protein contents of snacks (% on dry weight basis).**

| Parameters (%) | Date powder. | Control | snack (1%) | snack (3%) | snack (5%) | Mean |
|---|---|---|---|---|---|---|
| Crude fat | D.P. (1) | 3.850±0.128a | 3.854±0.125a | 3.862±0.0130a | 3.870±0.134a | 3.859±0.128A |
| | D.P. (2) | 3.850±0.128a | 3.853±0.124a | 3.859±0.128a | 3.865±0.130a | 3.857±0.126A |
| Mean | | 3.850±0.128A | 3.854±0.125A | 3.861±0.132A | 3.868±0.129A | |
| Crude protein | D.P. (1) | 8.650±0.395c | 8.660±0.381c | 8.706±0.403b | 8.744±0.424a | 8.690±0.422A |
| | D.P. (2) | 8.650±0.395c | 8.667±0.388c | 8.702±0.399b | 8.737±0.414a | 8.689±0.415A |
| Mean | | 8.650±0.395D | 8.664±0.417C | 8.704±0.439B | 8.741±0.427A | |

D.P.1 = Seedling date powder D.P.2 = Bartamuda date powder
Control = without date powder.

**Table 4. Effect of date powder addition on crude fiber and ash content of snacks (% on dry weight basis)**

| Parameters | Date powder level | Control 0%. | snack (1%) | snack (3%) | snack (5%) | Mean |
|---|---|---|---|---|---|---|
| Crude fiber (%) | D.P.(1) | 1.870±0.210e | 1.970±0.199d | 2.174±0.208c | 2.377±0.251a | 2.098±0.237A |
| | D.P.(2) | 1.870±0.210e | 1.962±0.187d | 2.147±0.166c | 2.332±0.176b | 2.078±0.219B |
| Mean | | 1.870±0.210D | 1.966±0.206C | 2.161±0.221B | 2.355±0.243A | |
| Ash (%) | D.P.(1) | 1.580±0.117e | 1.615±0.113d | 1.684±0.140c | 1.753±0.155a | 1.658±0.131A |
| | D.P.(2) | 1.580±0.117e | 1.607±0.148d | 1.662±0.110c | 1.717±0.104b | 1.642±0.124A |
| Mean | | 1.580±0.117D | 1.611±0.105C | 1.673±0.112B | 1.735±0.145A | |

D.P.1 = Seedling date Powder D.P.2 = Bartamuda date Powder Control = Mixture without date powder.

The interaction between date powders and the addition concentration were shown in Table (4), it could recognized that the snacks with 1, 3 and 5% of D.P.1 and D.P.2 were having the highest crude fiber and ash values compared with the control and the Bartamuda fruits was the highest. On the contrary, the control sample of D.P.1 and D.P.2 had the lowest values (1.580 and 1.580%), respectively. The data represented in Table (5) cleared the snacks fortified with the date powders D.P.1 and D.P.2 and their effects on the four macronutrients (phosphorus, potassium, calcium and magnesium contents) of the two studied date powder samples. The data recorded that there were marked increases in the four elements Phosphorus, Potassium, Calcium and magnesium for snacks fortified with 1, 3 and 5% of date powders D.P.1 and D.P.2 which was the highest and they were significant differences (P≤0.05) compared with the control which was the lowest (1.580 and 1.580%), respectively.

**Table 5. Effect of date powder addition on phosphorus, potassium, calcium and magnesium content of snacks (mg/100 g on dry weight basis).**

| Element | . | Control 0% | 1% | 3% | 5% | Mean |
|---|---|---|---|---|---|---|
| Phosphorus | D.P.(1) | 101.70±0.200H | 105.00±0.338G | 106.80±0.681f | 111.80±0.365D | 106.30±0.501B |
| | D.P.(2) | 109.20±0.325E | 112.50±0.298C | 114.30±0.595B | 119.30±0.755A | 113.83±0.448A |
| Mean | | 105.45±0.650D | 108.75±0.559C | 110.55±0.751B | 115.55±0.960A | |
| Potassium | D.P.(1) | 515.90±0.475G | 524.00±0.450F | 541.10±0.390C | 553.50±0.725B | 533.65±1.050B |
| | D.P.(2) | 527.10±0.250E | 535.20±0.310D | 552.30±0.480B | 564.70±0.825A | 544.8±1.100A |
| Mean | | 521.50±0.500D | 529.60±0.650C | 546.70±0.640B | 559.10±0.625A | |
| Calcium | D.P.(1) | 141.60±0.335H | 152.90±0.290 F | 160.80±0.270D | 177.30±0.300B | 158.15±0.620B |
| | D.P.(2) | 148.1±0.315G | 159.40±0.240E | 167.20±0.510C | 183.70±0.430A | 164.60±0.710A |
| Mean | | 144.85±0.315D | 156.15±0.290C | 164.00±0.335B | 180.50±0.515A | |
| Magnesium | D.P.(1) | 21.85±0.100F | 24.45±0.125E | 27.35±0.085D | 30.55±0.125B | 26.05±0.133B |
| | D.P.(2) | 24.20±0.115E | 26.80±0.140D | 29.70±0.105C | 32.90±0.165A | 28.40±0.145A |
| Mean | | 23.03±0.095B | 25.63±0.155C | 28.53±0.110B | 31.73±0.180A | |

D.P.1 = Seedling date Powder D.P.2 = Bartamuda Date Powder Control = Mixture without date powder.

The combination between date powder and concentrations data in the same Table showed that the D.P.2 with snacks (5%) was having the highest value in this respect (119.30 mg/100 g). Meanwhile, the lowest value was for the control (untreated) with D.P.1 (101.70 mg/100 g), re-

spectively. Concerning to potassium content, the (D.P.2) Bartamuda date palm was the highest and significantly (P≤0.05) different (544.8 mg/100 g) followed by the date powder seeded date which ranked the second (533.65 mg/100 g). Furthermore, snacks at 5% was the highest and significantly (P≤0.05) different (559.10 mg/100 g). On the contrary the control "mixed without powder date palm" was the lowest and significantly (P≤0.05) different (521.50 mg/100 g) in this study. On the other side, the interaction between the date powder and the addition concentration, the snacks at 5% with D.P.2 Bartamuda date palm was the highest in this concern (564.70 mg/100 g) and significantly (P≤0.05) different. On the contrary, the lowest value was for the control with D.P.1 (515.90 mg/100 g). The data represented in Table (6) showed the effect of date powders addition (D.P.1 and D.P.2) on iron, zinc, manganese and cupper (microelements) of fortified snacks. The results showed that there were significant differences (P≤0.05) between 1, 3 and 5% and control which was the lowest and 3 and 5% were the highest. In this concern, the interaction between date powder and concentrations data in the same Table showed that the D.P.2 with snacks at 3 and 5% were having the highest values in this respect (2.250 and 3.110 mg/100 g) for iron. However, the lowest value was by the control (untreated) with D.P.1 (1.640 mg/100 g), respectively. Concerning to Zn content, the date powders of D.P.2 was the highest and significantly different (P≤0.05) for 3 and 5% (0.237 and 0.288 mg/100 g) followed by the seeded date powder (D.P.1) (0.201 and 0.252 mg/100 g). Furthermore, the same manner was observed for Manganese and cupper. Moreover, the combination between date powder and concentration addition, the snacks at 3 and 5% with D.P.2 were having the highest values in this concern. On reverse to that, the lowest values were for the control with D.P.1 and D.P.2 respectively. Meanwhile, other combinations treatments were intermediate the abovementioned discussed combinations treatments.

**Table 6. Effect of date powder addition on iron, zinc, manganese and cupper content of snacks (mg/100 gon dry weight basis).**

| Parameters | Concentrations | Control | snacks (1%) | snacks (3%) | snacks (5%) | Mean |
|---|---|---|---|---|---|---|
| Iron (Fe) | D.P.(1) | 1.640±0.035f | 1.780±0.061ef | 1.980±0.064d | 2.840±0.072b | 2.060±0.038B |
| | D.P.(2) | 1.910±0.047de | 2.050±0.066d | 2.250±0.056c | 3.110±0.070a | 2.330±0.049A |
| Mean | | 1.775±0.038D | 1.915±0.029C | 2.115±0.043B | 2.975±0.054A | |
| Zinc (Zn) | D.P.(1) | 0.162±0.050e | 0.179±0.055de | 0.201±0.051c-e | 0.252±0.048ab | 0.199±0.028B |
| | D.P.(2) | 0.198±0.029c-e | 0.215±0.044b-d | 0.237±0.037bc | 0.288±0.060a | 0.235±0.034A |
| Mean | | 0.180±0.017C | 0.197±0.019BC | 0.219±0.022B | 0.270±0.030A | |
| Manganese (Mn) | D.P.(1) | 0.104±0.004g | 0.114±0.006fg | 0.124±0.007ef | 0.192±0.010b | 0.134±0.011B |
| | D.P.(2) | 0.135±0.009de | 0.145±0.008d | 0.165±0.003c | 0.223±0.014a | 0.167±0.017A |
| Mean | | 0.120±0.012C | 0.130±0.014C | 0.145±0.018B | 0.208±0.026A | |
| Cupper (Cu) | D.P.(1) | 0.582±0.021f | 0.599±0.041ef | 0.620±0.059d-f | 0.759±0.074b | 0.640±0.134B |
| | D.P.(2) | 0.637±0.107c-e | 0.654±0.105cd | 0.675±0.117c | 0.814±0.124a | 0.695±0.126A |
| Mean | | 0.610±0.052C | 0.627±0.082BC | 0.648±0.077B | 0.787±0.093A | |

D.P.1 = Date Powder seeded date palm D.P.2 = Date Powder Bartamuda date palm Control = Mixture without powder date palm.

**Table 7. Sensory evaluation of snacks from the two cultivars.**

| Addition percentage | | Taste | Color | Texture | Odor | Overall acceptability |
|---|---|---|---|---|---|---|
| Control | | 9.00a | 9.00a | 9.00a | 9.00a | 36.00a |
| D.P.1* Seedling | 1 | 9.00a | 9.00a | 9.00a | 9.00a | 36.00a |
| | 3 | 9.00a | 8.50b | 8.9Ab | 9.00a | 35.4Ab |
| | 5 | 7.00d | 8.00c | 7.00d | 8.50b | 30.50e |
| D.P.2** Bartamuda cv. | 1 | 8.50b | 9.00a | 8.50b | 9.00a | 35.00b |
| | 3 | 8.9Ab | 8.50b | 8.9Ab | 8.8Ab | 35.1Ab |
| | 5 | 8.00c | 7.00d | 8.00c | 8.00c | 31.00d |
| **LSD at 0.5 %** | | **0.253** | **0.162** | **0.179** | **0.194** | **0.269** |

Means (±S.D. n=3) in the same column sharing the same letters(s) are not significantly different at P < 0.05. DP1*: Date powder of Seedling. DP2**: Date powder of Bartamuda cv.

The sensory evaluation for taste, color, texture, odor and overall acceptability of the powders from Seeded dry date and Bartamuda date palm were shown in Table (7). The data showed that sensory attributes were influenced by the different concentrations of powders from the two varieties. Date powder concentrations (DP.1 for Seedling., and DP.2 for Bartamuda cv.) at different rations ranged between 1, 3 and 5% were used to produce the best quality of snacks product in the final. The data in Table (7) cleared also that there were no significant differences (P≤0.05) between treatments (1, 3 and 5%) and control in all sensory attributes for Seedling date., which was the best and significantly different (P≤0.05) and this results agreed with the fact that substitution at 1and 3% can be used in production of snacks from seeded cultivar followed by Bartamuda cv. Also, it could be seen that from the values that addition of date powder concentration (5; odor and overall%) for Seeded and Bartamuda date palm were the lowest in all sensory evaluations (Taste, color, texture acceptability), respectively.

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# التقييم الغذائي للوجبات الخفيفة المبثوقة المدعمة بإضافة مسحوق ثمار التمر

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**الملخص**

تم إجراء هذه الدراسة على ثمار نوعين من البلح في مرحلة التمر، الأول بذري D.P.1 (مجهل- منثور) والثاني برتمودا D.P.2 والذى يعتبر واحد من أشهر التمور فى مصر، ولقد تم استخدام الثمار لتجهيز بودر التمر، والذي أستخدم لإعداد اغذية التسالي بتركيزات ١، ٣ و٥% كأغذية تسالي جديدة من التمور، نظراً للانتشار الواسع لأغذية التسالي هذه الأيام والتي توجد في صور وأشكال متعددة. وتعتبر أغذية التسالي المنتجة بالبثق الحرارى منتجات من السهل استهلاكها، طعمها جيد ومقرمش، ذو نكهة جيدة، قوامها وتركيبها جيد وتستهلك على نطاق واسع، والتي يمكن أن تنتقش أو تتمدد بطريقة مباشرة أو غير مباشرة. لهذا قسمت هذه الدراسة الى جزئيين، الأول يتعلق بدراسة الخصائص الكيمائية، تقدير محتوى المعادن لثمار التمر تحت الدراسة فى مرحلة التمر، ثم تقييم تأثير إضافة بودرة التمر الناتجة منهما والمستخدمة في إعداد أنواع جديدة من أغذية التسالي بنسبة ١، ٣ و٥% على الخصائص الحسية لهذه المنتجات المصنعة من مجروش الذرة وبودرة التمور. وشمل الجزء الثانى من هذه الدراسة دراسة تأثير مسحوق التمور، التركيزات المضافة منها على المحتوي من السكريات (مختزلة وغير مختزله، والسكريات الكلية)، الدهون، البروتينات، الألياف، الرماد، والفينولات، الحموضة المقدرة بالمعايرة، وعلى المعادن الكبري (الفوسفور، البوتاسيوم، الكالسيوم والماغنسيوم، ملجم/ ١٠٠ جرام) وعلى المعادن الصغري أو معادن الأثار (الحديد، الزنك، المنجنيز والنحاس، ملجم/ ١٠٠ جرام). أظهرت الدراسات انه يوجد فروق معنوية عند مستوى معنوية ٥% بين نوعى البودر تحت الدراسة بالنسبة للخصائص الكيمائية ولقد اظهرت الدراسة ان نوعي التمور احتوى على نسبة عالية من السكر مقارنة بالكنترول والنوع الأول (مسحوق ثمار البلح البذري كان اعلى فى محتوى السكريات المختزلة، الألياف الخام ومحتوى الدهن، بينما الصنف الثانى (بودر التمر للصنف الثانىD.P.2) كان اعلى بالنسبة للسكريات الغير مختزلة والسكريات الكلية وتساوى الصنفان فى محتوى البروتين. ايضا كانت توجد فروق معنوية بين النوعين فيما يخص بتحليل المعادن وكانت السناكس من الصنف الثانى (DP.2) الأعلى. بالنسبة لتأثير اضافة مسحوق التمر(D.P.1 and D.P.2) على الدهن الخام ومحتوى البروتين للسناكس، فبالنسبة للدهن كان لا يوجد فروق معنوية بين السناكس المدعمة بالثلاث نسب وبين الكونترول، اما بالنسبة للبروتين الخام كانت توجد فروق معنوية وكانت هى الأعلى بالنسبة للكونترول. وبالنسبة لتأثير اضافة بودرى التمر على الألياف الخام والرماد، فلقد كانت السناكس المدعمة بالنسب الثلاث هى الأعلى وكانت توجد فروق معنوية بينها وبين الكونترول وكان النوع الثانى هو الأعلى. وبالنسبة لتأثير الإضافة على الفوسفور، البوتاسيوم، الكالسيوم والماغنسيوم، فقد وجد انه توجد زيادة ملحوظه في هذه المعادن الأربعة للسناكس المدعمة بكل النسب بالنسبة للنوعين الأول والثانى وكان الأخير هو الأعلى وكان عنصر البوتاسيوم هو العنصر السائد. بالنسبة لتأثير الأضافة على الحديد، الزنك، المنجنيز والنحاس (المعادن الصغرى) للسناكس المدعمة بالنسب الثلاث من بودرى التمر فقد وجد انه يوجد فروق معنوية بينها وبين الكونترول الذى كان الأقل، بينما نسبتى ٣ و٥ % كانوا الأعلى. وبالنسبة للتقييم الحسى كان لا يوجد فروق معنوية بين المعاملات ( ١، ٣ و٥%) وبين الكونترول لكل الخصائص الحسية وكان المنتج من مسحوق البلح البذري الأفضل وكان مختلف معنويا.