Egypt. J. Agric. Res., 79 (2) , 2001

STUDY ON THE PREPARATION OF DATE SEEDS FOR FEEDING

ABD EL-MOHSEN M.M. NEZAM EL-DIN
AND AZZA KAMAL EL-DIN ABD EL-HAMEED

Food Technology Research Institute, Agric. Res. centre, Giza, Egypt.

(Manuscript received July 1999)

Abstract

Egypt is one of the important countries in date production. Manufacturing and package processes accumulate high quantities of date seeds. So, the chemical constituent of date seeds, germinated date seeds and the methods of removing steroid contents were studied.

The germination was done on different lengths of radical till appearance of plumule, and to remove the steroids compounds, the date seeds were treated by hexane and diethyl ether (ether).

The results revealed that steroids content of date seeds was decreased by germination (at the end of seeds germination) and also after treating by hexane.

Progesterone hormone was disappeared by germination till length of radical reaches 8 centimeter and in the ungerminated seeds after treating by water.

Osteriol hormone was decreased gradually by germination to 0.028 mg/l00g, disappeared in the ungerminated seeds, decreased to 0.083 mg/100g of hexane treated seeds and decreased to 0.044 mg/ 100 g of ether treated seeds.

INTRODUCTION

Egypt is the second important country in date world production which produced 710000 tons as reported in FAO, (1997). The Egyptian dates represented about 17% of the total world production.

Date seeds represent 10-15% of date fruits. At present time there are 16 factories for date processing and others will be built in the future (GOI, 1999). All these factories have a mass production of date seeds being wastes during date processing. If these seeds were well exploited, they could play a good role in the national income.

Some works, have been carried out on date seeds, such as Sumianah *et al.*, (1984) who studied the effect of germination at 35-36°C for 22 and 52 days on three cultivars (Razaz, Khalas and Beshi); They found that crude protein, fats, total carbohydrates and starch decreased by germination but crude fiber, ash, total soluble carbohy-

drate and reducing sugars increased during germination. Also, the germination for 52 days was useful as a pretreatment of date seeds for animal feeding.

Buckaeve *et al.*, (1976) found that Zahdi date seeds contained estradiole (0.857 mg/kg) and estrone (1.030 mg/kg) as well as other hormones such as progesterone and testosterone.

Barreveld (1993) mentioned that a growth stimulating hormones were found in date seeds such as estrone (1.9 mg/kg), the synthetically produced sisters of this female sex hormone have been used in chemical caponizing of young cocks, but are more known for their growth promoting effect in animals. The use of these hormones in most countries is strictly regulated or totally forbidden for fear of continuing effects of the hormone on humans by the consumption of animal products.

The remaining steroids hormones in different parts of chicken were studied by Mohammad, (1987) who found that the concentration of these hormones more than double normal contents (feeding on diet free of hormones), the increase of these hormones have an important role in uterus and breast cancers.

So, this study aimed to lowering and removing the steroids hormones contents of date seeds.

MATERIALS AND METHODS

Materials:

Date seeds germination:

Date seeds of Siwi dates were collected, washed, dried by air oven then wetted by water and covered by a wet cloth and left at ambient temperature for 40 days with keeping the cloth in wet form. The germinated seeds were collected and fractionated to six fractions depending on level of radical lengths as follow: appearance of radical length 0.1-0.4, 0.5-1.9, 2-4, 5-8, >8 cm and appearance of plumule.

The germinated seeds with the same characteristics were washed, dried by fan oven, then crushed and ground to powder. Every sample fraction was placed in a jar and stored in deep freezer (-18°C) until chemical analysis.

Methods:

Moisture and crude protein were determined according to A.O.A.C., (1990).

Reducing sugars were extracted by ethanol 80% and determined by arsinomolybdates and Somogi Cupper reagent as described by Somogi, (1952) and Nelson, (1974).

Total free amino acids were determined by formal titration as recommended by Kirk and Sawyar, (1991)

Total free phenols were determined by using Folin-Denis reagent as described by Swain and Hillis, (1959)

Starch was measured as reported by Ranganna, (1977).

Lignin was determined according to the method published by Tanaka *et al.* (1985).

Amino acids were fractionated by high performance amino acid analyzer Model Beckman System 7300 and Data system 7000, column No/A/B/D 25 /cm column.

Steroids:

Oil fraction of date seeds was extracted by hexane (three times), Sodium hydroxide (20%) was added for saponifaction. The unsaponifible matters were extracted by benzen (three time) and Sodium sulfite unhydrous was used to remove any traces of moisture in benzen, then filtrated benzen put in small bottle and had been removed the solvent by air dryer, then remaining compounds kept after titly closing in deep freezer until fractionation of steroids by HPLC (Harborne, 1973).

Fractionation of steroids by HPLC.

High pressure liquid chromatography was used (Hewelt Packard 1050). LC. Equipped with a reversed phase column (C18)12.25 X 4.6 n ID 5MM and U.V detector adjusted at 254 nm. The solvent mixture used was methanol/water (63-27) with a flow rate of 1ml/min. for the separation of different steroids.

RESULTS AND DISCUSSION

By evaluation of date seeds for feeding usage, it was found that the chemical composition of dried and germinated date seeds were as follows:

The moisture content of date seeds after air drying ranged from 9.00 to 10.155% .

Reducing sugars:

Table 1 shows that reducing sugars of germinated seeds increased gradually till appearance of plumule. This increase might be resulted from the effect of specific enzymes of special substances (such as amylase on starch and invertase enzyme on sucrose), these results agree with the finding of Sumianah *et al.* (1984). The increase in reducing sugars was pronounced in ungerminated seeds by respiration and there was no activation of polysaccharides hydrolysis, this might be related to the enzymatic growth inactivation of the ungerminated seeds .

Starch:

Dried date seeds contained high amount of starch, this component decreased gradually by germination till appearance of plumule. The decrease of starch might be related to the activity of starch enzyme (amylase) which led to increase in the reducing sugars (Table, 1). Previous results are similar to the results of Sumianah *et al.*, (1984).

Free amino acids:

From Table 2, it could be noticed that free amino acids were increased by germination of date seeds till appearance of plumule, this increase might be resulted from the hydrolysis of protein, the same results were found by Sumianah *et al.*, (1984).

Protein:

The crude protein of dried Siwi date seeds was 7.37% (Table, 2), this results similar to the results on Ruzeiz date seed(Sawaya *et al.*, 1984).

A decrease in protein content during first stage of seeds germination (0.1-0.4 cm radical length) till the radical reached 4 cm in length, then the protein content increased till appearance of plumule.

Total free phenols:

Total free phenols (Table, 2) were decreased clearly after appearance of radical (0.1-0.4 cm length) which might be related to consumption of simple phenols through the formation of other complicated compounds and high molecular weight compounds, having a good role in the new parts of seed growth during germination (radical and plumule).

Total free phenols showed a slight increase during growth of A radical from 0.1 to >8 cm in length and slight decrease was observed after appearance of plumule.

Lignin:

The data in Table 2 show a gradually decrease in lignin content by germination till radical length reaches 2-4 cm, then lignin increased from radical length 5 to 8 cm till appearance of plumule.

The first decrease might be attributed to the hydrolysis of lignin at the beginning of germination, on the other hand lignin was increased till appearance of plumule, resulted from the formation of new parts (radical and plumule) containing lignin. The lignin in ungerminated date seeds was higher than dried date seeds, this increase might be related to a decrease of total solids such as sugars, starch, protein and total free phenols, which led to increase percentage of lignin.

Anthocyanidin:

By measuring anthocyanidin compounds related to flavonoids, tannins and anthocyanin pigments (Barreveld, 1993), it was observed (Table, 2) that dried date seeds content of anthocyanidin was dropped from 1.19 to 0.57% by germination of radical length 0.1-0.4 cm, then this component increased gradually till radical length reaches >8 cm. The appearance of plumule led to exhausting more than half of anthocyanidin content.

Fractionation of amino acids:

By measuring the fractionated amino acids (Table, 3), it was found that threonine of date seeds was more than human requirement, this amino acid decreased by germination to 3.08g/100g protein of radical length 5-8 cm. and after appearance of plumule decreased to 1.47 g/l00g protein.

Valine was increased by germination to be near the requirements, on the other hand, systeine and methionine together were more than the requirements during germination till radical length reaches to 8 cm, but after appearance of plumule these two amino acids decreased to 1.58 g/100g protein. Isoleucine content was more than half of the requirements in dried date seeds and during germination until appearance of plumule.

Leucine was increased by germination and slight decrease was observed after appearance of plumule. The leucine, (tyrosine and phenylalanine) and lysine contents in dried and germinated date seeds represented more than 70, 66 and 70% of requirements (FAO/WHO, 1973).

Generally, glutamic, aspartic and arginine represent the maximal percentage of total protein content in all samples of seeds (Table, 3).

Steroids:

Steroids, specially the hormones, representing one of the most problem for beneficial uses of the date seeds in nutrition purposes (Mohammad, 1987).

In this study fractionation of steroids content of dried and germinated date seeds samples was carried out by HPLC and the results are shown in Table 4.

By measuring the steroids (as progestrone) of every germinated phase, it was found that steroids of dried seeds were decreased gradually by germination till appearance of plumule, treating ground and dried date seeds by hexane and ether led to decrease the steroids, also steroids were decreased in ungerminated date seeds.

The known steroids hormones were decreased as follows:

Ostriol hormone was decreased from 0.045 mg/100g of dried date seeds to 0.149, 0.09, 0.07, 0.059, 0.055 and 0.028 mg/100g of germinated date seeds at radical length of 0.1-0.4, 0.5-1.9, 2-4, 5-8 and >8 centimeter and appearance of plumule; respectively. On the other hand, it was decreased to 0.083 and 0.044 mg/100g of treated seeds by hexane and ether respectively, but disappeared from ungerminated date seeds.

Progesterone hormone was decreased by germination from 0.505 mg/100g to 0.182, 0.132, 0.054 and 00 mg/100g of germinated date seeds at radical length of 0.1-0.4, 0.5-1.9, 2-4, 5-8 cm and the other germinated stages; respectively.

Estrone 3-methyl ether hormone decreased from 0.814 mg/100g of dried date seeds to 0.70, 0.63, 0.018, 00, 00 and 0.063 mg/100g of germinated date seeds with radical length of 0.1-0.4, 0.5-1.9, 2-4, 5-8, >8 cm and appearance of plumule; respectively. Moreover, this hormone was disappeared in ungerminated date seeds (Table, 4), but increased from 0.814 mg/100g of dried date seeds to 0.906 and 1.25 mg/100gm of treated date seeds by hexane and ether. No, estrone found in Siwi date seed.

So, it is very clear that reducing sugars and free amino acids increased by germination till appearance of plumule, but starch, total free phenols and anthocyanidin were decreased at first stage of germination then showed an increase.

The total steroids were decreased by germination and by solvent. (hexane and ether) treatments. Ostriol was decreased by germination and by solvent treatments. Progesterone was reduced to zero by germination, but decreased to 0.00 and 0.047 mg/100g after treating by hexane and ether; respectively. Estrone 3-methyl ethyl was decreased from 0.814 mg/100g of dried date seeds until 0.00 of radical length 5-8 and >8 cm, but after appearance of plumule, hormone reached to 0.63, but treating by solvents led to increase this hormone.

Table 1. Total solids, reducing sugars, starch and lignin of different germinated stages of date seeds*.

	Total Solids %	Reducing sugars %	Starch %	Lignin %
Dried date seeds	90.62	5.46	17.98	7.20
Appearance of radical length 0.1-0.4 cm	91.00	5.60	17.84	6.45
Radical length 0.5-1.9 cm	89.85	5.75	17.05	5.20
Radical length 2-4 cm	90.60	6.05	16.61	4.80
Radical length 5-8 cm	90.15	6.32	15.08	4.80
Radical length >8 cm	90.18	6.32	14.35	5.60
Appearance of plumule	90.65	6.99	10.98	8.20
Ungerminated seeds	90.00	4.28	14.56	7.40

* All percentages measured on dry weight basis.

Table. 2. Total free phenols, free amino acids, protein and anthocyandin of different germinated stages of date seeds*.

	Total free phenols %	Free amino acids %	Protein %	Anthoc-yandin %
Dried date seeds	3.66	0.79	7.37	1.19
Appearance of radical length (0.1-0.4 cm)	2.55	1.01	7.14	0.57
Radical length 0.5-1.9 cm	2.28	1.04	7.00	0.60
Radical length 2-4 cm	2.42	0.05	6.65	0.46
Radical length 5-8 cm	2.70	1.06	6.95	0.79
Radical length >8 cm	2.99	1.09	7.90	1.06
Appearance of plumule	2.91	1.49	7.30	0.50
Ungerminated seeds	3.37	1.03	7.03	1.13

* All percentages measured on dry weight basis.

Table 3. Amino acid composition (g/100 g) of dried and germinated date seed protein.

Amino acid	Fresh dried seeds	Radical length 0.5-1.9 cm	Radical length 5-8 cm	Appear-ance of plumule	FAO/WHO 1973
Essential amino acids					
Lysine	4.55	4.87	5.09	4.87	5.5
Threonine	5.16	2.99	3.09	1.47	4.0
Valine	3.64	4.65	4.73	4.08	5.0
Methionine	2.57	1.77	1.77	0.56	3.5
Systeine	3.03	2.54	2.13	1.02	3.5
Isoleucine	2.73	2.77	2.96	2.94	4.0
Leucine	5.61	5.87	6.16	6.12	7.0
Phenylalanine	3.64	5.76	3.90	3.85	6.0
Tyrosine	0.60	0.55	0.59	0.56	6.0
Tryptophan	--	--	--	--	--
Non essential amino acids					
Asparatic acid	10.78	12.19	13.50	8.27	--
Serine	5.61	3.54	3.31	1.81	--
Glutamic acid	25.79	26.49	32.70	29.25	--
Proline	--	--	--	--	--
Glysine	5.16	4.76	5.09	4.98	--
Alanine	4.24	4.54	4.97	5.10	--
Histidine	1.94	1.99	2.13	2.04	--
Arginine	10.77	16.60	7.81	23.01	--

Table 4. Steroids and other unknown compounds (mg/100g) of different germinated stages of date seeds.

STEROIDS RETENTION TIME	1.4 *	1.826 *	2.13 *	2.444 ostriol	2.601 progest erone	2.732 *	3.19 *	3.514 estron-3-methyl ether	3.95 *	4.780 *	4.91 *	5.280 *	5.43 *	5.90 *	6.46 *	6.891 *	7.149 *	7.49 *
Dried date seeds	0.000	0.307	0.000	0.240	0.505	0.000	0.104	0.814	0.354	0.066	0.044	0.045	0.062	0.000	0.114	0.444	0.178	0.240
Appearance of radical length 0.1-0.4 cm	0.000	0.175	0.031	0.149	0.182	0.000	0.000	0.700	0.000	0.000	0.050	0.000	0.000	0.000	0.070	0.200	0.000	0.000
Radical length 0.5-1.9 cm	0.000	0.161	0.031	0.090	0.132	0.000	0.000	0.630	0.000	0.000	0.055	0.000	0.000	0.000	0.064	0.140	0.000	0.000
Radical length 2-4 cm	0.036	0.000	0.000	0.070	0.054	0.039	0.000	0.180	0.000	0.094	0.062	0.000	0.000	0.000	0.059	0.000	0.000	0.000
Radical length 5-8 cm	0.031	0.045	0.000	0.059	0.000	0.052	0.000	0.000	0.000	0.000	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Radical length >8 cm	0.028	0.000	0.000	0.055	0.000	0.036	0.000	0.000	0.000	0.000	0.067	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Appearance of plumule	0.022	0.000	0.000	0.028	0.000	0.000	0.000	0.063	0.000	0.000	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ungerminated seeds	0.028	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.040	0.074	0.000	0.000	0.324	0.000	0.420	0.000	0.000
Seeds treated by hexane	0.024	0.000	0.000	0.083	0.000	0.025	0.062	0.906	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Seeds treated by ether	0.000	0.045	0.000	0.044	0.047	0.000	0.000	1.250	0.000	0.000	0.000	0.000	0.000	0.047	0.000	0.000	0.000	0.000

*** Unknown compounds**

All compounds measured as progesterone.

REFERENCES

1. AOAC, (1990). Official Methods of Analysis of the Association of Official Analytical Chemists, Arlington, Virginia.

2. Barreveld, W.H. (1993). Date palm product. (FAO) Agricultural Services Bulletin 101.

3. Buckaeve, V.; Sobih, Kh.; Fadil, W. and Ali, N.M. (1976). Gas chromatographic identification of steroids in one variety (Zahdi) of Iraq date seeds. Tech. Bull., No. 4/76, (1976). Palm and Date Research Centre, Baghdad, Iraq.

4. FAO, (1997). Production Yearbook. FAO Production Yearbook, Vol. 51 (1997)

5. FAO/WHO. (1973). Energy and protein requirements. FAO Nutritional meeting Report Services. No. 52, WHO Technical Report Series., No. 522, Food and Agriculture Organization, Rome.

6. GOI, (1999). General Organization for Industrialization, Cairo, Egypt.

7. Harborne, J.B. (1973). Phytochemical Methods. Chapman and Hall Limited. John Wiley and Sons, New York.

8. Kirk, R.S. and Sawyar, R. (1991). Person's composition and analysis of Foods. Ninth Edition, Longman Scientific and Technical.

9. Mohammad, M.A. (1987).On the analysis of sone contraceptive compounds. M. Sc. Thesis in Pharmaceutical Science (Analytical Chemistry), Faculty of Pharmacy, Cairo University.

10. Nelson, N. (1974). A photometric adaptation of the somogi methods for determination of glucose. J. Biol. Chemistry, 153-375, 380.

11. Ranganna, S. (1979). Manual of analysis of fruit and vegetable products. Tota Mc. Graw-Hill. Publishing Company Limited, New Delhi.

12. Sawaya, W. N.; Khalil, T.K. and Safi, W.J. (1984). Chemical composition and nutritional quality of date seeds. J. Food Sci., 49(1984), pp. 617-620.

13. Somogi, M. (1952). Notes on sugar determination. J. Biol. Chem., 195,19.

14. Sumianah, G.H.M.; Makki, Y.M. and Rumne, T.G. (1984). Changes in the chemical composition of three cultivars of date palm seed during germination. Date Palm J., 3(2): 395-407.

15. Swain, T. and Hillis, A.E. (1959). The quantitative analysis of phenolic constituents. J. Sci. Food Agriculture, 10, 65.

16. Tanaka, M.; Robsion, C.W. and Moo-Young M(1985). Chemical and enzymatic Pre-treatment fermentation substrates . Biotechnol. And Bioeng., 27,362-368.

دراسة على إعداد نوى التمر للاستخدامات الغذائية

عبد المحسن محمود محمود نظام الدين ، عزة كمال الدين عبد الحميد

معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - ٩ ش جامعة القاهرة - جيزة - مصر

نظرا لما تتميز به مصر من الإنتاج المرتفع من التمور وكذلك تكدس مصانع تعبئة وتصنيع التمور بالنوى الناتج منها لذلك تم دراسة التركيب الكيماوى لنوى التمر وكيفية التخلص من الهرمونات والمواد الاستيرويدية حتى يمكن استخدامها بصورة غذائية أفضل.

ولقد حدث إنخفاض فى محتوى النوى من المواد الإستيرويدية بالإنبات واستمر هذا الإنخفاض حتى الوصول إلى مرحلة ما قبل ظهور الريشة مباشرة أيضاً عند المعاملة بالهكسان حدث انخفاض فى هذه المواد، كذلك وجد أن هرمون البروجستيرون قد تم التخلص منه كلية عند الإنبات ووصول الجذير إلى طول ٨ سم وكذلك العينات المعرضة للماء ولم تنبت، أما هرمون الاستريول فقد انخفض تدريجياً فى العينات المنبتة حتى مرحلة ظهور الريشة حيث وصل إلى ٠,٠٢٨ ملجم /١٠٠ جم بينما انخفض تركيزه إلى الصفر فى العينات التى لم تنبت كذلك انخفض إلى ٠,٠٨٣ ملجم /١٠٠ جم فى العينات المعاملة بالهكسان و٠,٠٤٤ ملجم /١٠٠ جم عند المعاملة بالأثير.