J. Agric. Sci. Mansoura Univ., 27(8): 5411- 5420, 2002

QUALITY AND STABILITY OF SOME NEW PUMPKIN (*Cucurbita moschata*) EDIBLE PRODUCTS

Naser, M.A.[1]; Wafaa A.Amin[1] and M.A.Siam[2]

1- Horticul. Crop. Res. Processing Dept., Food Technol. Inst., (ARC) Sabahia, Alex., Egypt.

2- Food Scie. And Technol. Dept., Fac. Of Agric.Alex.Univ. Alex., Egypt

ABSTRACT

Pumpkin plant (*Cucurbita moschata*) is one of the tropical and subtropical crops. It is only used by some Egyptians to prepare some sweet products. Therefore current research aimed to extend the utilization of such crop in preparing some industrial food products such as juice, compote, sheet and jam. It was found that fruits of this plant were large in size and consisted of 4.75% rind or peel, 81.3% pulp, 3.9% seeds and 10.05% funicular. The pulp of this fruit had 89.53% moisture, 0.27% crude ether extract, 1.2% crude protein, 1.3% crude fiber, 0.8% ash and 6.9% nitrogen free extract on wet basis in addition to a considerable concentration of β-carotene (19.60 mg/100g), low content of both ascorbic acid (9.30 mg/100g) and pectin (0.26%). Physicochemical characteristics of pumpkin pulp products differed according to their recipes and preparation methods. The sensory properties of these products (juice, compote, sheet and jam) were moderately acceptable by panelists. Addition of either an orange or mango essences increased the acceptability of such products. Also, the pumpkin juices prepared by blending either 20% natural mango or an orange juice was highly acceptable. During storage for six months at room temperature (20±2°C), only marked successive reduction in the ascorbic acid of such products was recorded while the other studied quality parameters were slightly affected.

INTRODUCTION

The origin of pumpkin (*Cucurbita moschata*) plant is Central America. It is primarily grown as a leafy vegetable. This crop likes melon and watermelon in its cultivation requirements. It is suitable for cultivation under tropical and subtropical condition in light good drainage soils (Bermejo and Leon, 1992). It ranges from medium to large in size, round to spherical with flattened ends in shape, yellow to orange rind colour, and tough to soft texture. It consists of an outer thin rind, soft spongy flashy pulp and white seed; with little water quantity in its hollow center. During ripping and storage, high percentage of fruit pulp starch converts to sugars. This causes changes in the consistency of the fruits pulp from tough to soft. The main sugars of the ripe fruit pulp are sucrose, glucose and fructose (Peckham, 1969). The pulp of this fruit considers a good source of both carotenes and dietary fibers. It is rich in beta and alpha carotenes in addition to lutlin (Rodriguez, 1999). Beta carotene is one of an important natural antioxidant. It is also had role in reducing the risk of developing certain types of cancer and protection against other diseases as well as some degenerative aspects of aging (University of Illinois Extension, 2000). Pulps of the pumpkin fruits use in Latin and Central America as well as in some an eastern European countries in food preparation (North Willamette Research and Extension, 2002). The seeds of these fruits contain high levels of both oil and protein (Aboul Nasr,*et al*, 1997 and Abd El-Fattah,1997). It may roast to use as a snacks or grind to flour to use in preparation some food products and medicine (University of Illinois Extension, 2000).

The cultivation of such crop in Egypt is limited. Only few of the common Egyptian peoples used it's fruit in preparing some sweet products. Therefore the objective of this study was to extend the utilization of the pulp of such crop in preparing several industrial edible products like juice, compote, sheet and jam. The successful of this trend may encourage the cultivation of such crop in large area particularly in the new arable lands in Egypt. Quality and storage stability of the prepared pumpkin products were also evaluated.

MATERIALS AND METHODS

1.Materials:- Full ripe fifteen pumpkin fruits (*Cucurbita moschata* C.V. *Balady*) were obtained from Sabahia Horticultural Research Station, (ARC) in summer 2000, Alexandria, Egypt. Mango and orange fruits, sucrose, pectin, citric acid, sodium meta bisulphate, mango and orange essence, 450 g. tin cans, glass and saran sheets were obtained from the commercial Alexandria market, Egypt.

2.Methods:-

2.1.Technological methods:-

2.1.1.Pumpkin products:- The fruits were manual cut into smali pieces and peeled using stainless steel knives after removing the funicular part, spongy portion containing the seed. Table (1) shows the recipes used for preparing juice, compote, sheet and jam products of pumpkin fruits pulp. Meanwhile, Fig (1) illustrates the flow sheet of processing such products.

Table (1): Recipes of some pumpkin products.

Ingredient%	Pumpkin products				
	Juice		Compote	Jam	Sheet
	Pure pumpkin	Blended			
Pumpkin cubes	-	-	60.60	-	-
Pumpkin pulp	23.16	18.50	-	49.65	84.20
Water	66.64	66.64	25.30	-	-
Sugars	10.00	10.00	14.00	49.65	15.00
Pectin	-	-	-	0.40	0.80
Citric acid	0.20	0.20	0.10	0.30	-
Sodium metabisulphate (ppm)	-	-	-	-	350*
Mango or orange essence	Trace	-	Trace	Trace	trace
Mango or Orange juice	-	4.66	-	-	-

2.1.2.Preparation of mango juice:- The fruits were peeled, sliced using stainless steel knives, and the slices were quickly pulped using fruit pulper. The obtained pulp was filtered through nylon cloth to remove fine particles.

2.1.3.Preparation of orange juice:- The Balady orange fruits were halved with stainless steel knives, then squeezed by a manual squeezer. The resulted juice was then filtered through nylon cloth to remove seeds and fine parts.

2.1.4.Blended juice:- It was prepared by mixing 80% pumpkin juice free from fruit essences with 20% of either natural mango or orange juice. These juices were filled and pasteurized as illustrated in fig (1) with 100% pumpkin juice.

2.2.Fruit characteristics:- An average weight (kg) of 15 pumpkin fruits was determined. The rind, pulp and funicular, the spongy portion including seeds, were manually separated using stainless steel knives, then weighted and calculated as % of an average fruit weight.

2.3.Chemical methods:- Fresh pulp of pumpkin fruit and the processed products were prepared for analysis as stated by Rangana (1977). The following methods were determined according to A.O.A.C. (1990), pH with Cole-Pamer digital pH meter, total soluble solids (T.S.S) at 20°C by Abbè refractometer (Model 2WAI, China), total

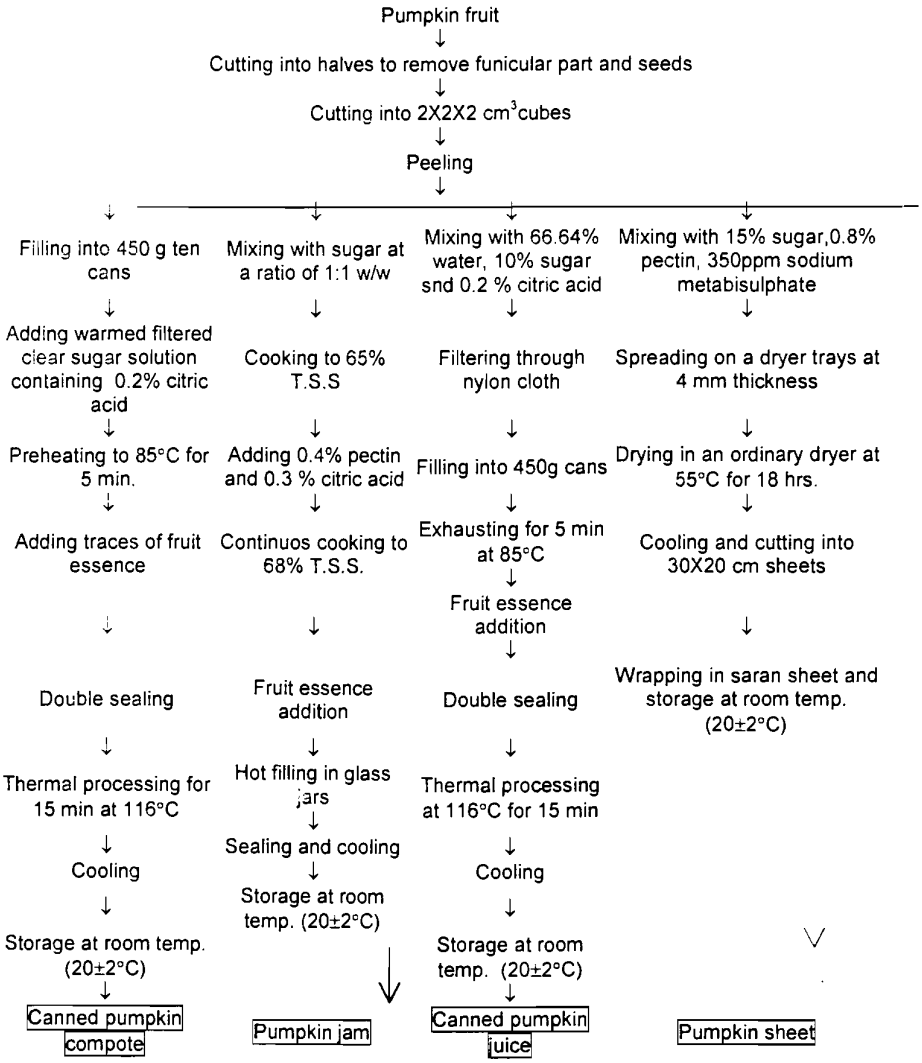

Fig (1): Flow sheet of production of some pumpkin products

titrable acidity as malic acid, moisture content using vacuum oven at 70°C, ether extract, crude protein, crude fiber, ash and total sugars as reducing sugars after acid hydrolyzing using Lane and Eynon method. Nitrogen free extract were calculated by difference. Ascorbic acid by 2,6-dichlorophenole indophenole dye, β-carotene and pectin were estimated as stated by Rangana (1977). The results obtained were reported as the mean value of 3 determinations.

2.4.Sensory evaluation:- Sensory properties of pumpkin products were subjectively assessed by ten panelists of Food Science and Technology Department, Faculty of Agriculture, Alexandria University, Egypt using hedonic scale as mentioned by Rangana (1977).

RESULTS AND DISCUSSION

3.1.Weight composition of pumpkin fruit: As shown from Table (2) pumpkin fruit had large size, 3.2 kg on average weight. The yield of fruit pulp was relatively high (81.3%) due to its low content of other fruit parts especially peel and seed. Park *et al* (1997) mentioned that the ratio of both funicular and seeds of pumpkin fruit were up 10%. According to Baskaran *et al* (2001) pulp represented 82.85% of pumpkin fruit.

Table (2): Weight composition of pumpkin fruit.

Property		Value
Average fruit weight (kg)		3.20
Fruit weight composition:-		
	Peel or rind (%)	4.75
	Pulp (%)	81.30
	Seeds (%)	3.90
	Funicular (%)	10.05

3.2.Proximate composition of pumpkin fruit pulp: Table (3) shown the proximate composition of pumpkin pulp. Moisture (89.53%) was the major component of this pulp. Same observation mentioned by Whitaker and Davis (1962), Mineu and Boboia (1975), Gusina *et al.* (1978) and Baskaran *et al* (2001). They found that moisture content of pumpkin pulp varied from 86.65 to 94.93%. According to Moskvina *et al.* (1998), Danilcenko and Genyte (1999) and Paris (2000) dry mater of pulp of 23 pumpkin cultivers ranged from 5.1 to 24.1%. As illustrated in Table (3) the main component of this dry mater was the nitrogen free extract. Total sugar represented more than 50% of this component. Value of nitrogen free extract in the present study was relatively lower than that reported by Saied (2000). She found that pumpkin pulp contained 77.71% total carbohydrate on dry basis. Generally, the contents of the ether extract, crude protein and crude fiber of pulp of Balady pumpkin cultiver (Table 3) were higher when compared with those mentioned by Mineu and Boboia (1975). They found that the average contents of ether extract, protein and crude fiber of different pumpkin varieties were 1.96, 10.18 and 11.4% on dry basis, respectively.

Table (3): Proximate composition and physicochemical properties of pumpkin fruit pulp.

Component	value	
	On fresh weight	On dry weight
1-Proximate composition %:-		
Moisture	89.53	-
Ether extract	0.27	2.58
Crude protein	1.20	11.46
Crude fiber	1.30	12.42
Ash	0.80	7.64
Nitrogen free extract	6.90	65.90
2-Physicochemical properties:-		
T.S.S (%)	5.00	
Total sugars (%)	3.80	
Total acidity (as malic acid) (%)	0.38	
Ascorbic acid (mg/100g)	9.30	
β-carotene (mg/100g)	19.60	
Pectin (%)	0.26	

3.3.Physicochemical properties of pumpkin fruit pulp: As shown in Table (3) total soluble solids (5.00%) was higher than total sugars (3.8%) of pumpkin pulp. This may be due to the presence of some of its minerals in soluble form. According to Baskaran *et al* (2001) the average of total soluble solids in pumpkin pulp of different cultivers, was 7.96%. Park *et al* (1997) reported that fructose and glucose composed 87% of total free sugars of pumpkin pulp. Due to the high pH (6.00) of pumpkin pulp it can consider low acid foods. This is because of its low content of total acidity (0.38% as malic acid). Park *et al* (1997) showed that the main organic acids of pumpkin pulp were malic, succinic and fumaric acids. Among these acids, malic acid was the major one.

As seen in Table (3), the pulp of this fruit had a considerable concentration of β-carotene, low ascorbic acid and pectin. Generally, the value of β-carotene of pumpkin pulp reported in literatures by many investigations such as ZengRu *et al* (1998), Danilcenko and Genyte (1999) and Paris (2000) varied from 1.6 to 45.6 mg/100g according to cultivar. Park *et al* (1997) mentioned that 87% of the total carotenoids of pumpkin fruit concentrated in it's funicular portion. According to the above results the preparation of different products from pumpkin pulp needs to reduce its moisture content by drying or sugar addition to bind water as well as addition of citric acid to lower pH and pectin to improve the texture.

3.4.Some physicochemical and sensory evaluation of pumpkin pulp products during storage: Table (4) shown some physicochemical properties and storage stability of some pumpkin pulp products. Sensory properties of pumpkin products were reported in Table (5).

Table (4): Some physicochemical properties of pumpkin products during storage at room temp.(20 ± 2 ^{0}C).

Product	Storage period (month)	Property				
		PH	Total acidity (%)	Total sugars (%)	Ascorbic acid (mg/100g)	β-carotene (mg/100g)
Juice	0	4.00	0.30	10.96	2.12	5.10
	2	4.00	0.30	10.96	1.80	5.00
	4	4.10	0.29	10.96	1.50	4.95
	6	4.10	0.29	10.96	0.89	4.86
Compote cubes	0	5.20	0.26	22.90	3.30	12.00
	2	5.10	0.26	22.96	3.00	11.93
	4	5.10	0.25	23.10	2.90	11.86
	6	5.09	0.26	23.10	2.30	11.80
Sheet	0	4.00	0.68	70.30	2.69	18.60
	2	4.08	0.67	70.28	2.00	18.30
	4	4.10	0.65	70.26	N.D*	18.00
	6	4.11	0.66	70.24	N.D*	17.70
Jam	0	3.90	0.54	65.40	3.20	11.70
	2	3.90	0.56	65.31	3.00	11.60
	4	3.80	0.55	65.30	2.00	11.30
	6	3.80	0.54	65.21	N.D*	11.00

*Not Detected.

3.4.1.Pumpkin juice: As noticed in Table (4) pumpkin juice had 4.0 pH, 0.30% total acidity as malic acid, 10.96% total sugars, 2.12% ascorbic acid and 5.10 mg/100g β-carotene. Addition of sugar solution containing citric acid was behind the decrease of ascorbic acid, β-carotene and an increase of acidity of this juice comparing with fresh pulp. During storage for six months at room temp. (20±2°C) a pronounced loss in ascorbic acid, and slight changes in pH and β-carotene were observed. According to the data in Table (5), the total acceptability of 100% pumpkin juice by panelists was moderately accepted. Oh and Park (1997) stated that stewed pumpkin juice has become popular as a health drink in Korea. Addition of traces of either mango or orange essence increased this acceptability to acceptable grade. Generally, juice had an acceptable yellow colour, slightly acceptable flat flavour and accepted thin cleared homogenized consistency. Blending 80% of pumpkin juice with 20% of natural mango or orange juice led to improve the organoleptic properties of 100% pumpkin juice. It converted its colour from yellow to golden yellow. It increased the acceptability of colour, flavour, and total acceptability from acceptable to very, extremely and very acceptable, respectively.

3.4.2.Pumpkin compote: The pumpkin cubes of this product had 5.2 pH, 0.26% total acidity as malic acid, 22.90% total sugars, 3.30 mg/100g ascorbic acid and 12 mg/100g β-carotene. Only ascorbic acid content of this product lowered successively during storage. The rate of this lower was relatively less than that occurred in pumpkin juice. This may be attributed to high viscosity of the syrup of compote, which influences the oxygen penetration rate in addition to its higher content of β-carotene than juice. As illustrated in Table

(5), the total acceptability was increased from moderately acceptable to acceptable after orange and mango essence addition to compote syrups. The cubes of the fruit had an acceptable pale yellow colour, acceptable soft texture, and slightly acceptable flavour before adding mango or orange essence. The syrup of this product had a light yellow colour, viscous consistency, strong sweet taste and odourless before fruit essence addition.

Table (5): Description and acceptability of sensory evaluation of pumpkin products.

Pumpkin products		Organoleptic properties						Total acceptability
		Colour		Flavour		Texture		
		Description	Acceptability	Description	Acceptability	Description	Acceptability	
Juice	A	Yellow	Acceptable	Flat	Slightly acceptable	Thin homogenized liquid	Acceptable	Moderately acceptable
	B	Yellow	Acceptable	Like orange	Acceptable	Thin homogenized liquid	Acceptable	Acceptable
	C	Yellow	Acceptable	Like mango	Acceptable	Thin homogenized liquid	Acceptable	Acceptable
	D	Golden yellow	Very acceptable	Like orange	Extremely acceptable	Thin homogenized liquid	Acceptable	Very acceptable
	E	Golden yellow	Very acceptable	Like mango	Extremely acceptable	Thin homogenized liquid	Acceptable	Very acceptable
Compote	A	Cubes Pale yellow	Acceptable	Flat	Slight acceptable	Soft texture	Acceptable	Moderately acceptable
		Syrup Light yellow	Acceptable	Strong sweet taste & flat odour	Slight acceptable	Viscous	Acceptable	Moderately acceptable
	B	Cubes Pale yellow	Acceptable	Like orange	Acceptable	Soft texture	Acceptable	Acceptable
		Syrup Light yellow	Acceptable	Like mango	Acceptable	Viscous	Acceptable	Acceptable
	C	Cubes Pale yellow	Acceptable	Like orange	Acceptable	Soft texture	Acceptable	Acceptable
		Syrup Light yellow	Acceptable	Like mango	Acceptable	Viscous	Acceptable	Acceptable
Sheet	A	Dark yellow	Acceptable	Flat	Slight acceptable	Chewy	Acceptable	Moderately acceptable
	B	Dark yellow	Acceptable	Like orange	Acceptable	Chewy	Acceptable	Acceptable
	C	Dark yellow	Acceptable	Like mango	Acceptable	Chewy	Acceptable	Acceptable
Jam	A	Yellow	Acceptable	Strong sweet taste & flat odour	Slight acceptable	Semisolid sticky	Acceptable	Moderately acceptable
	B	Yellow	Acceptable	Strong sweet taste & like orange	Acceptable	Semisolid sticky	Acceptable	Acceptable
	C	Yellow	Acceptable	Strong sweet taste & like mango	Acceptable	Semisolid sticky	Acceptable	Acceptable

A = 100% pumpkin **B = 100% pumpkin + mango essence**
C = 100% pumpkin + orange essence **D = 80% pumpkin juice + 20% mango juice**
E = 80% pumpkin juice + 20% orange juice.

3.4.3.Pumpkin sheet: The physicochemical properties of pumpkin sheet were 4.0 pH, 2.69 mg/100g ascorbic acid, 18.6 mg/100g β-carotene and 0.68% total acidity as malic acid and 70.3% total sugars. During storage at

room temperature (20±2°C), only ascorbic acid was completely disappeared after 2 months of storage while the other properties were slightly affected. As seen from Table (5) the total acceptability of this product by panelists was moderately acceptable and improved to acceptable by adding orange and mango essence. Pumpkin sheet had an acceptable dark yellow colour, acceptable chewy texture, and slightly acceptable flat flavour before adding either orange or mango essence.

3.4.4.Pumpkin jam: Generally pH, total sugars and total acidity of this product agree well with the known specifications of commercial jam. This product considered poor in ascorbic acid and contained considerable level of β-carotene. During storage of this product at room temperature, the content of ascorbic acid was intensively lost. According to data in Table (5), pumpkin jam had an acceptable yellow colour, acceptable semisolid sticky texture, strong sweet taste and slightly accepted flat odour. Such other products, addition of orange or mango essence improved the flavour of this product to very acceptable.

CONCLUSION

The above results showed the suitability and successful utilization of pulp of pumpkin fruits in preparing juice, jam, sheet and compote. Adding fruit essence and/or blending with other fruits increase the acceptability of such products especially flavour.

REFERENCES

Abd El-Fattah ,M.M.A.(1997).Chemical and Technological Studies on Some Oil Seeds and Their Products."Chemical and Technological Studies on Oils of some Cucrbitaceae Seeds" M.Sc.Thesis, Faculty of Agriculture, Kafr El-Shieh,Tanta University,A.R.E.

Aboul Nasr,M.H.; B.R. Ramadan and R.A. El-Dengawy (1997). Chemical composition of pumpkin seeds. Assiut J. of Agricultural Sci., 28:163-172.

A.O.A.C. (1990). Official Methods of Analysis of the Association of Official Analytical Chemists. Arlingnton, Virginia, 22201 U.S.A.

Baskaran,H.R; R. Rasad and K.M.Shivaiah (2001).Storage behavior of minimally processed pumpkin (Cucubita maxima) under modified atmosphere packaging conditions.European Food Research and Technology.212:165-169.

Bermejo,J.E.H. and J.Lean (1992). Neglected Crops from a Different Perspective. Pub. in collaboration with the botanical garden of Cordoba (Spain) as part of the etnobolanica 92.

http://www.fao.org/docrops/t06462/T064E09.htm#Cucurbita moschata

Danilcenko,H. and J.Genyte (1999). Biochemical research on pumpkin varieties. Sodininhyste-ir. Darzininkyste. 18:62-69.

Gusina,G.B.; Z.P.Kamneva and E.W.Belova (1978). Manufacture of preserved products from pumpkins. Konservnaya iovoshchesushil. "nayapromy shlennost." (9), 13-15, C.F.FSTA, 11, 8, 1979.

North Willamette Research and Extension (2002). Pumpkin and Winter Squash. North Willamette Research and Extension. Oregon State University.
http://www.Oregonstate.edu/dept/NWREC/Squash.html

Mineu,I. and D.Boboia (1975). Alimentatia rationala a omuluis anatos siboluav. Editura Medicala, Bucursti.C.F. Saied,Naglaa.M. (2000). Chemical and Technological Studies on Some Infant of Food Formulas". M.Sc. Thesis, Faculty of Agriculture, Kafr El-Shieh, Tanta University, A.R.E.

Moskvina,O.A.; MN.Plekhanova. E.I.Kolbasina and T.Paal. (1998). A promising crop for new food technologies. International conference on "Wild berry culture". An exchange of western and eastern experiences, Tartu, Estonia, 10-13 August. Metsanduslikud. Unrimused. 30:113-115.

Oh,B.Y.and B.H.Park (1998). Changes in physicochemical components of stewed pumpkin juice with ingredients (ginger, orange, jujbe, boxthrn) during storage. Journal of the Korean Society of Food Science and Nutrition.,27:1027-1033.

Paris,H.S. (2000). Biochemical composition and processability of pumpkin cultivars. Acta Horticulture. 510, 493-497.

Peckham, G.C. (1969). Foundations of Food Preparation. The Macmillan Co. Collier – Macmillan Ltd., London.

Park,Y.K.; S.C.Hwan.; W.P.Mee.; H.K.Yoon and M.S.Ho (1997). Chemical components in different parts of pumpkin. Journal of the Korean Society of Food Science and Nutrition., 26:639-646.

Rangana,S. (1977). Manual of Analysis of Fruit and Vegetable Products. McGrow-Hill Pub. Co. Lts., New Delhi.

Rodriguez,A.D.B. (1999). Latin-American food sources of carotenoids. Archivos – Latinoamericanas – de – Nutricion. 49:745-845.

Saied,Naglaa.M. (2000). Chemical and Technological Studies on Some Infant of Food Formulas". M.Sc. Thesis, Faculty of Agriculture, Kafr El-Shieh, Tanta University, A.R.E.

University of Illinois Extension (2000). Annual Report of University of Illinois at Urbana Champaign. Pumbkin & More. Pumbkin nutrition facts. http://www.urbanext.uvic.edu/pumpkins/

Whitaker.T.W. and G.N.Davis (1962). "Cucurbita Botany, Cultivation and Utilization: Inter Science Publishers, New York.

ZengRu,W.; J.TongMing; W.ZN and J.TM (1998). Determination of beta-carotene in different pumpkin varieties by HPLC. Acta Agriculture Boreali Sinica. 13:141-144.

جودة وثبات بعض المنتجات الغذائية الجديدة المصنعة من القرع العسلى

مدحت أحمد نصر[١] , وفاء على أمين [١] , محمد على صيام[٢]

١-قسم بحوث تصنيع الحاصلات البستانية, معهد تكنولوجيا الأغذية, مركز البحوث الزراعية, الصبحية, إسكندرية, مصر.

٢-قسم علوم وتكنولوجيا الأغذية, كلية الزراعة, الشاطبى, جامعه الإسكندرية, مصر.

يعتبر نبات القرع العسلى (*Cucurbita moschata*) واحد من المحاصيل الاستوائية وتحت الاستوائية. وتستخدم في مصر في إعداد منتجات محدودة حلوة الطعم. وهذا البحث يهدف إلى إنتاج منتجات جديدة منه مثل العصير, المربى, الكمبوت واللفائف. وتتميز ثماره بأنها كبيرة الحجم وتتكون من ٤,٧٥% قشرة, ٨١,٣٢% لب, ٣,٩% بذور, ١٠,٠٥% أجزاء ليفية محيطة بالبذور. ويحتوى لب هذه الثمار على ٨٩,٥٣% رطوبة ,٠,٢٧% مستخلص أثيرى خام, ١,٢% بروتين خام, ١,٣% ألياف خام, ٠,٨% رماد, ٦,٩% المستخلص الخالي من النيتروجين على أساس وزن رطب. بالإضافة إلى تركيز معتدل من البيتاكاروتين (١٩,٦٠ مج/١٠٠جم) ومنخفض من حامض الاسكوربيك (٩,٣٠ مج/١٠٠جم) والبكتين (٠,٢٦%). وتختلف الصفات الكيموطبيعية لمنتجات لب القرع العسلى تبعا لمكوناتها وطرق إعدادها. وكانت المنتجات المصنعة منه (عصير, كمبوت, لفائف, مربى) مقبولة حسيا وذات مواصفات جيدة. وأدى إضافة مكسبات طعم ورائحة من المانجو والبرتقال إلى زيادة درجة تقبلها. وعند إضافة ٢٠% عصير مانجو أو برتقال إلى عصير القرع العسلى حدث زيادة في درجة تقبله. وكان التغير بسيطا في مكونات هذه المنتجات خلال تخزينها لمدة ستة شهور على درجة حرارة الغرفة فيما عدا حامض الاسكوربيك حيث حدث له انخفاضا ملحوظا خلال تلك الفترة.