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PROCESSING OF SOME NEW INSTANT PRODUCTS FROM TARTUFI (JERUSALEM ARTICHOKE) (*Helianthus tuberosus,L*), POWDER MIXTURES

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ABSTRACT

Tartufi (Jerusalem artichoke) (J.A)is considered as a tuber crops ,rich in carbohydrates specially inulin which analyzed to fructose. Eight mixtures were prepared from tartufi powder and roasted flour from wheat, chickpeas, lentils and broad beans in addition to the powder of carrot, fenugreek, peas, sesame seeds , dried orange , sucrose beside some spices and herbs. Chemical composition, minerals, phenolic compounds, flavonoids compounds and the nutritional value were determined for different mixtures before and after storage at ambient temperature. Results , showed high increase in moisture in formula F6 (10.30%), protein in formula F5 (17.74%), inulin in formula F7 (9.33%), carbohydrates in formula F2 (65.45%) and free amino acids in formula F6 (3488 mg/100gm), the highest percentage in phosphorus and potassium exhibited in formula F1 and F2 which recorded 683.48 and 377.21 mg/100gm respectively, also results for phenolic and flavonoids compounds indicated that there were an observed increase and decrease at zero time and after 8 months . Three new products were processed from the previous mixtures namely bars, drinks and cream soup as follow: bars was processed from formula F1 to F8 and drinks was processed from formula F1 to formula F5 while cream soup prepared from formula F6,7 and F8 , these all mixtures were organoleptically evaluated and the results showed that the best acceptability being for formula F3 when compared with the others, while after storage for 8 months all mixtures have a moderate degrees of acceptability except mixture 5 and 7 .All drinks had a good degree of acceptability except mixture 5 after processing while after storage for 8 months both of mixture 2,3 and 4 had a high degree of acceptability, also cream soup had a high degree of acceptability. Obtained results showed that 100 gm of each formulated tartufi mixtures provides children about 32 to 36% of energy, from 49 to 93% of protein, 71 to 147.84% of phosphorus , 7.83 to 10.32% of potassium for children, 17 to 19.39% of calcium and 108.5 to 208.3% of iron. Also provides male about 16 to 19% and female about 18 to 21% of energy daily requirements, provides male and female with protein level ranged from 16 to 31% and 20 to 38% respectively of daily requirement, provides male and female with about 50 to 100% of phosphorus requirements, 18 and 23% of potassium for male and female, 16.74 to 20.24% of calcium for male and female , 135.62 to 260.37% of iron for male and female from 60.27 to 115.72% of daily requirements respectively .

INTRODUCTION

Tartufi Jerusalem artichoke (J.A) (*Helianthus tuberosus*,*L*), native to eastern North America, belongs to the sunflower family of plants. Also known as the earth apple, sun choke, sunroot and topinambour, the Jerusalem artichoke is a healthy root vegetable cultivated for its highly nutritious and

fleshy tuber. The skin of the root, varies in color from light brown and white to purple and red Anon,(2010).

It contain plenty of inulin, a type of prebiotic fibers that has been credited with a number of health benefits due to its medicinal properties. Many of these health effects can be attributed to the ability of inulin to stimulate the growth of bifidobacteria, naturally present in the large intestine, bifidobacteria fight harmful bacteria in the intestines, prevent constipation, and give the immune system a boost Anon(2010).

The tubers store fructans instead of starch. Fructans are non-digestible carbohydrates considered functional food ingredients because they affect body processes in ways that result in better health and in many diseases prevention. However, the Jerusalem artichoke deserves attention not only because of the content of fructans, but recent studies also indicate a high protein content, including essential amino acids Cieslik *et al*., (2011).

Jerusalem artichoke tubers (CVs.Local and Fuseau) were evaluated for their chemical composition,dietary fiber fractions as well as their minerals content and potential uses. They found that tubers of both cultivars contained 79.78 to 81.25 % moisture;76.85 to 77.81% nitrogen free extract ;1.19 to 1.36% ether free extract; 8.83 to 9.5% crude protein; 4.14 to 4.36%crude fiber and 7.29 to 8.60% ash, they also found that Jerusalem artichoke could be considered as a good source for dietary fiber ,K, Mg,Ca and inulin . Inulin (the most important fraction in tubers) was found to be ranged from 23.32 to 24.62% out of the nitrogen free extract of the tasted tubers . Also the panelists accepted the different products (blanched , cooked , puree, and reconstituted puree and jam) from tubers of the local cv . These products contained 16.17; 16.52; 12,67; 8,96% and from 7,15 to 10.75% of inulin , receptively Amin *et al*., (2005).

The chemical composition of J.A with or with out peel also the chemical composition of some products prepared with J.A powder, she found that moisture and ash content were (78.03, 4.1, 77.3 and 4.9%), protein and fat content were (6.4, 5.71 ,6.00 and 4.29%), crude fiber and carbohydrate content were (3.94, 79.85 and 4.34 and 80.47%), inulin content was 13.3 and 16.05% for J.A without peel or with peel respectively, also mineral contents for J.A without peel (22.8, 74.22, 3.5 and 2.82 mg/100g)for (K, Ca, Na and Fe) respectively, while for J.A with peel(217.6, 73.87, 2.5 and 3.87 mg/100g)respectively. Also the some researcher reported that fortified some bakery(pizza, cinnamon biscuits, batonsale, shami bread and high bran bread) with J.A peel may be suggested for commercial production as they mostly ranted good Rizk, (2006).

Instant foods is a dried foods that reconstitute rapidly when water is added, e.g. tea, coffee, milk, soups, precooked cereal products, potatoes, etc. The dried powders may be agglomerated to control particle size and improve solubility. ‘Instant puddings’ are formulated with pregelatinized starch and disperse rapidly in cold milk DAVID ,(2005).

The present study was carried out to prepare some new formulated instant food from Tartufi powder as a new source of carbohydrates and protein with roasted flour from wheat, chickpeas, lentils and broad beans in addition to powder of carrot, fenugreek, peas, sesame seeds , dried orange ,

sucrose beside some spices and herbs , also study the chemical characteristics, antioxidative properties, nutritional value and organoleptic evaluation.

MATERIALS AND METHODS

1-Materials:

Tartufi Jerusalem artichoke (J.A) tubers (*Helianthus tuberosus.L*) fuzia type, harvested in December 2012-2013 were provided from Agriculture Research Center Giza Egypt. Other ingredients wheat grains , chickpea, broad bean without peel, fenugreek, lentil, wheat flour, dried orange powder, sucrose powder , milk powder, carrot, pea, sesame, salt, spices, rosemary, thyme, anise , fennouil and olive oil were obtained from local market (EL-Wekalaa Market, Mansoura Governarte .EL-Dakhlehia-Egypt).

2-Methods:

Technological Methods:

preparation of Jerusalem artichoke tubers flour.

Tubers of Jerusalem artichoke (30 kilo garm) were cleaned with tap water to remove dust and undesirable materials,the cleaned tubers were boiling by steam for 30 minutes , then cut into small pecies, then dried in an air oven (Fisher Scientific) at 60-70° C for 72 hours. Dried particles were milled in cereal mechanical mill to pass through fine mesh screen sieve (Mesh enwhite w=0.125mm, d=0.09mm). Final powder were kept in polyethylene pouches and stored at -18° C until used.

preparation of roasted grains and legumes :

Wheat grains, chick pea, broad beans without peel, yellow lentil and fenugreek cleaned with tap water to remove both of dust and undesirable materials while legumes were soaked for 6 hours.Clean materials were dried in an air oven at 60° C for 1 hour. Dried grains and legumes except fenugreek were roasted at 250° C for 10 minutes in air oven drier then milled to obtain fine particle which pass through screen sieve. The powder of previous roasted grains and legume were kept in polyethylene bags and stored at -18° C until used.

preparation of some new formulae :

Jerusalem artichoke powder with peel were added to the roasted grains and legumes for making some new instant formulated food mixtures(it is new methods and no body used this methods before).

Preparation of final new formulae from Tarufi powder .

Eight food formulae were prepared using the ingredients as shown in Table (1).

Table (1) Ingredients used in the preparation of different new formulated instant food from Tartufi powder .

Formulae / Ingredients	F1	F2	F3	F4	F5	F6	F7	F8
Roasted wheat flour	150	150	150	150	150	150	75	150
Dried J.A powder	—	150	150	150	150	150	150	75
Roasted chickpea flour	150	150	150	150	150	25	25	25
Roasted lentil flour	—	—	150	—	—	—	—	—
Roasted broad been without peel flour	—	—	—	150	—	—	—	—
Fenugreek flour	—	—	—	—	75	—	—	—
Dried carrot powder	—	—	—	—	—	40	40	40
Dried pea powder	—	—	—	—	—	40	40	40
Sesame powder	37.5	37.5	37.5	37.5	37.5	—	—	—
Dried orange peel powder	2	2	—	—	2	—	—	—
Sucrose	—	100	—	—	100	—	—	—
Fenouil	4	4	4	4	4	—	—	—
Anise	4	4	4	4	4	—	—	—
Thyme	—	—	—	—	—	1	1	1
Rose marry	—	—	—	—	—	0.5	0.5	0.5
Spices	—	—	10	10	—	1	1	1

All the ingredients of all mixtures were homogenized by mixer, then packing in sterilized glass jars cited from Anon., (2011).

Bars :

Each formula (F1,F2,F3,F4,F5,F6,F7 and F8)were prepared by adding olive oil (40gm), sucrose powder (20gm) and milk powder (50ml) to 100g of one of the previous mixture then formed in a short bars Anon., (2011)..

Drink:

Each 15 gm from formula (F1,F2,F3,F4 and F5)were added to 50 ml hot milk sweated with sugar 15 gm(sucrose) Anon., (2011).

Cream soup :

Cream soup was prepared by adding 15 gm from each mixture (F6,F7 and F8) to 50ml hot meat soup Anon., (2011).

Chemical Analysis

Jerusalem artichoke powder and different new products namely (bars, drinks and cream soup) were chemically analyzed as following nutrients: Moisture, ash, protein, fat, fiber ,total acidity , total carbohydrates and minerals according to the methods of A.O.A.C,(2007).

pH values was measured by using Beckman pH meter with glass electrode at 25°C.Total sugars determined as the methods of Somogi, (1952) and Nelson, (1974).

Total phenols content was determined according to the method described by Danial and George, (1979) and total flavonoids were determined at 440nm according to the described by(Zhisen,1999).

Total free amino acids were determined as described by Fahd ,(1972) in the department of Horticultural Crops, Agric. Res- Giza- Egypt. Center. Also, fractionation of polyphenolic compounds were determined by HPLC according to the method of Goupy *et al*., (1999) and fractionation of flavonoids were determined by HPLC according to method of Mattila *et al*., (2000) in Food Technology Research Inst., Agric. Res. Center.

The inulin content was determined according to Strepkon (1936) and calculated using the following equation :

1.82 ml of 0.01 N potassium permanganate solution = 1 mg inulin.

Organoleptic evaluations were carried out in department of Horticultural Crops, Agric. Res- Giza- Egypt according to Larmond, (1970) and statistical analysis were carried out according to Steel and Torie, (1980) .

RESULTS AND DISCUSSIONS

Chemical properties of Fresh and dried Jerusalem artichoke:

Table (2) showed that some physicochemical properties of fresh and dried Jerusalem artichoke during storage up to 8 months at ambient temperature.

Data showed that fresh tubers of Jerusalem artichoke contained (71.31, 6.99, 0.74%, 3.40, 3.37, 7.15, 3.65, 51.35, 80.79 and 16.58)%, for moisture, pH value, total acidity, ash, crude fiber, protein, fats, total sugars, total carbohydrate and inulin, while total phenols ,total flavonoids and free amino acid recorded 850,410 and 4348 mg/100gm on D.W respectively . Results were in agreement with those obtained by Amin *et al*.,(2005) and Rizk, (2006) who studied the chemical composition of J.A with or without peel also the chemical composition of some products prepared with J.A powder .Also she found that moisture and ash content were (78.03, 4.1, 77.3 and 4.9%), protein and fat content were (6.4, 5.71 ,6.00 and 4.29%), crude fiber and carbohydrate content were (3.94, 79.85 and 4.34 and 80.47%)respectively, on the other hand inulin content was 13.3 and 16.05% for J.A without peel or with peel respectively. Drying of Jerusalem artichoke tubers led to decrease the moisture contents from 71.31% of fresh J.A to 7.26% at zero time, meanwhile increase was noticed prolonged for 8 months to 9.13%, this increase may be related to the effect of fructose content on the absorption of relative humidity (Abd El-Hameed., 2006).

PH values of fresh J.A being 6.99 which decreased by drying to 6.64 at zero time and after storage period for 8 months to 6.11, while the values of total acidity at zero time and after storage for 8 months were logic when compared to the pH value, the increase peroid in total acidity may be releated to the liberation of free phenolic acids of soluble tannins (Markakis., 1982).

Also in the same Table(2), ash content and crude fiber increased after drying to 5.52 and 4.26% and decreased gradually after storage for 8 months

to (4.46 and 3.85%) respectively , this decrease may be releated to the effect of drying process on the degradation of some components such as pectin and hemicellulose (EL-Feky.,2002).

Concerning to data in the same Table(2) , the crude protein content of dried J.A was decreasing during storage from 8.61% to 7.60%, this decrease may be related to the increase of total carbohydrates content.

Also in Table (2) showed also that total lipids content of dried J.A were 3.64%, 3.60% at zero time and after storage foe 8 months, also a clear decrease from 39.24 to 21.73% was observed in total sugars after drying and storage for 8 months,this may be due to the non-enzymatic browning reaction.

While total carbohydrate after drying process ranged from 76.51 to 80.12 % at zero time and storage period for 8 months respectively. A clear decrease in inulin was observed after drying J.A which recorded 12.95% at zero time and decrease to 7.37 after 8 months storage. Concerning total free amino acids of dried J.A , results recorded a clear decrease ranged from 4348 for fresh J.A to 4120 and 1770 mg/100g on dry weight bassis after drying at zero time and storage for 8 months storage respectively. Total free phenolic compounds of fresh J.A (850 mg/100g) were decreased by drying and storage at ambient temperature for zero time and after 8 months storage to 620 and 230 mg/100g respectively, these decrease may be related to the non enzymatic browning of sugars and phenolic amino acids (Nezam EL-Din, 1978). Total flavonoids were also affected by drying and storage and decreasing as shown in Table (2). This decrease after drying related to the effect of the thermal operation through drying process and the effect of browning reaction after storage.

Table (2) Effect of processing and storage period on chemical composition of Fresh and dried Jerusalem artichoke (gm/100gm dry weight) .

Samples / constitutes	Fresh J.A	Dried J.A at different storage months		
		Zero time	After 4 months	After 8 months
Moisture%	71.31	7.26	8.49	9.13
pH%	6.99	6.64	6.49	6.11
Acidity (as citric acid)	0.74	0.75	0.77	0.95
Ash%	3.40	5.52	4.99	4.46
Fiber%	3.37	4.26	4.05	3.85
Protein%	7.15	8.61	8.11	7.60
Total lipids%	3.65	3.64	3.63	3.60
Total sugars%	51.35	39.24	32.96	21.73
Total carbohydrate%	80.43	76.51	77.95	80.12
Inulin%	16.58	12.95	8.44	7.37
*Free amino acid	4348	4120	1920	1770
**Total phenolic compounds	850	620	410	230
***Total flavonoid compounds	410	87	84	41

***mg/100gm as Isolucine. **mg/100gm as Galic acid. ***mg/100gm as Quercetin.**

Minerals contents of fresh and dried Jeursalem artichoke:

Table (3) showed the minerals contents of fresh and dried Jerusalem artichoke tubers , it was found that ,following minerals namely : phosophours(P) , potassium(K) , sodium(Na) , calcium(Ca) , nitrogen(N) and magnesium(Mg) were the major minerals in J.A while manganese(Mn) , iron(Fe) and zinc(Zn) were the trace minerals in it. Values shown in Table (3) were relatively higher than that mentioned by Amin *etal*., (2005), and EL-Sharkawy, (1998). These variation may be due to the difference in cultivation conditions and practices. Concerning dried J.A tubers , the results in Table (3) showed that a clear decrease was recorded up to 8 months storage at ambient temperature may be personal error during calibration.

Table (3) Effect of processing and storage periods on minerals content of fresh and dried Jeursalem artichoke tubers(mg/100 gm dry weight basis).

Samples / Minerals	Fresh J.A	Storage period of dried J.A powder	
		Zero time	After 8 months
P mg/100 gm	2167.35	712.04	711.98
K mg/100 gm	450.56	467.31	466.89
Na mg/100 gm	340.33	380.26	379.56
Ca mg/100 gm	257.65	261.55	260.97
N mg/100 gm	123.49	119.70	119.05
Mg mg/100gm	229.31	230.99	230.82
Mn mg/100gm	1.79	3.80	2.90
Fe mg/100 gm	24.46	46.98	19.77
Zn mg/100 gm	5.27	5.64	3.07

Phenolic compounds of fresh and dried powder of Jeursalem artichoke at zero time and storage period for 8 months (mg/100g dry weight basis):

Phenolic compounds of fresh and dried J.A were fractionated using HPLC and forteen phenolic compounds were detected.

Results in Table (4) showed that the total phenolic compounds in fresh and J.A dried J.A powders at zero time and after storage period for 8 months being 25.57, 13.53 and 3.17 respectively.Major and maximum phenolic compounds of fresh and dried J.A were Benzoic acid 6.69 , Gallic acid 4.53 ,Salicylic acid 3.76 and Caffein 2.20 mg/100g respectively, this results are in coincide with those reported by Tchone *et al.*,(2006) and Mattila and Hellstrom (2007).

Benzoic acid was the major phenolic compounds in fresh and dried J.A powder at zero time and storage for 8 months, while Coumarin exhibited the lowest value which recorded 0.14, 0.085 and 0.046 mg/100gmfor fresh and dried powder of J.A.Storage for 8 months has a clear decreases in all

phenolic compounds fraction, this decreases may be related to the effect of polyphenol oxidized (Zimmer., 1999).

Table (4) Effect of drying process and storage period on fresh and dried J.A at zero time and up to 8 months (mg/100gm dry weight basis).

Samples / Phenolic compounds	Fresh J.A	Dried J.A powder	
		Zero time	After 8 months
Gallic acid	4.53	0.52	0.27
Protocatechuic acid	0.45	0.47	0.52
Catachein	0.87	0.54	0.26
Catechol	1.48	1.14	0.34
Chlorogenic	1.25	0.70	0.44
Caffic acid	0.35	0.98	0.067
Vanillic acid	1.43	0.56	0.13
Ferulic acid	0.73	0.31	0.10
Salicylic acid	3.76	1.61	0.12
Benzoic acid	6.69	5.80	0.22
Coumarin	0.14	0.085	0.046
Caffein	2.20	0.23	0.43
Ellagic acid	1.69	0.58	0.23
Syringic acid	-	-	-
Total phenolic compounds	25.57	13.53	3.17

Flavonoids compound of Fresh and dried powder of J.A (mg/100gm dry weight basis):

Results in Table (5) showed that thirteen flavonoids compound were identified in methanol extract of fresh and dried powder of J.A. Data showed that the contents of Hisperdin and Naringin were the highest of all flavonoids compounds for fresh J.A which accounted (41.47and 3.01 mg/100g) respectively, other compounds were identified in small quantities. Some changes was observed after dried of J.A tubers which showed increase , decrease and also disappear for flavonoids compounds at zero time of storage such as Quercetin, Hisperdin, Narenginin, Hispertin and Apigen were decreased while a slight increase was noticed in the other flavonoids as shown in Table (5). Results also showed that some percentage of loss were found which depending on the ability and sensitivity of every phenolic and flavonoids content to heat and oxidation during drying process and storage period (Dalmadi *et al.*,2005).

Table (5) Effect of drying process and storage period on Flavonoids compound of Fresh and dried powder of J.A (mg/100gm dry weight).

Samples / Flavonoids compounds	Fresh J.A	Dried J.A powder	
		Zero time	After 8 months
Rosmarinic	-	0.98	0.038
Naringin	3.01	3.11	3.69
Quercetin	0.25	0.092	0.21
Hisperdin	41.47	-	6.53
Rutin	-	-	0.28
Hypersoide	0.80	2.43	-
Narenginin	0.045	0.036	-
Quercetrin	0.084	0.28	0.31
Hispertin	0.19	0.089	0.097
Kampferol	0.080	0.087	-
Apigen	0.42	0.15	-
Luteolin	-	-	-
7-oHflavone	-	-	0.020
Total Flavonoids compounds	46.35	7.25	11.18

New food formulae from Tartufi J. powder

Chemical composition of New food formulae from Tartufi powder

Eight formulae (F1,F2,F3,F4,F5,F6,F7and F8) were chemically analyzed and results were tabulated in Table(6). It could be noticed that moisture content ranged from 7.18 and 10.30 at zero time and 5.21 to 7.61 at 8 months of storage. Low moisture content is a great importance for keep quality and reasonable for extend shelf life in final products. While acidity was increased gradually in all formulae prolonged storage period. A slight increase also was observed in ash content after 8 months of storage,but pH values slightly decreases. Concerning to data at the same table indicated that protein content were ranged from 9.37 and 17.74 and 9.25 to 14.60 at zero time and 8 months of storage in all prepared formulae. while carbohydrates being (50.03 to 65.45%) at zero time and (56.29 to 68.80%) at 8 months. The same results showed that there were an observed decrease in both of total Phenolic and total Flavonoids compounds, these decrease may be related to non-enzymatic browning reaction between phenolic amino acids (i.e phenyl alanine, tyrosine) and reducing sugars (Krifi *et al*., 2000).

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Effect of drying process and storage periods on mineral contents of foods formulae from Tartufi powder (mg/100gm dry weight basis):

Data presented in Table (7) showed that phosphorus contents ranged between 359.89 and 739.21 mg/100gm for formulae F6 and F8,while potassium values ranged between 360.90 and 330.67 mg/100gm at zero time respectively , also formulae F7 had the highest value of sodium being 283.13 followed by F1 (281.31), F6 (280.77), F3 (263.66), F5 (260.66) and F2 (231.73 mg/100gm) respectively. Results also showed that F3 had the highest amounts of calcium (202.41 mg/100gm) followed by F1, F7, F6 and F5.

While nitrogen content ranged between 67.25 to 135.08 mg/100gm for F4 and F6 respectively, meanwhile magnesium ranged between 175.41 and 333.21 mg/100gm for F6 and F1. Results also showed that food formulae contained higher values in all determined trace elements namely (manganese, iron and zinc), Iron ranged between 10.85 and 20.83 mg/100g m for F5 and F7, and zinc ranged between 2.66 and 20.61 mg/100gm for formulae F3 and F7 respectively. In this concern, obtained results revealed that there were a clear decreases observed in all major and trace elements of different formulated food except zinc elements in formulae F3, F4 and F6 at 8 months as show in Table (7).

Phenolic compounds of new foods formulae from Tartufi J.A powder (mg/100gm dry weight basis):

Phenolic compounds of different foods formulae were determined and the data were illustrated in Table (8), F1had the maximum amount of total phenolic compounds while the other formulae could be arranged descendingly as follows by F4, F6, F7, F8, F2, F5 and F3 after storage period. Results also showed that Benzoic acid was the major phenolic compounds in all formulae. Data also showed that formulae F7 had the maximum concentration of Salcylic acid being16.95 mg/100gm followed by F1, F6, F4, F8, F3 and F2 but F8 had the maximum concentration of Chlorogenic acid (4.68mg/100gm) followed by formulae F2 , F6 , F4 , F1 and F5 respectively. Results in the same Table (8) indicated that formulae F4 had the maximum concentration of Benzoic acid (18.81 mg/100gm),while Catechol and Salcylic acid (4.78 and 16.95 mg/100gm)respectively were high in formulae F7. Storage for 8 months indicated noticeable loss in some phenolic compounds like Catachin, Catechol, Chlorogenic, Caffic, Salcylic, Benzoic acid, Coumarin and Caffein and raises in other phenolic compounds (Protocatechuic, Vanillic, Ellagic acid) in formulae F1while in F2 it was observed a loss in Gallic acid, Catechol, Chlorogenic, Caffic acid, Ferulic, Salcylic, Benzoic acid, caffein and Ellagic acid) . Storage F5 for 8 months led to decreases , increases in some phenolic compounds and appearance in others (Salcylic and Coumarin), while an increase in Protocatechuic acid was observed in formulae all formulae ,Vanillic acid was appeared in F3, F6 and F7 and decreased in F8.The decrease and loss of phenolic compounds may be related to the oxidation to quinoune (Khames,2004), also the increases of phenolic compounds may be related to the degradation of carbohydrates through the non-enzymatic browning reaction (Vranova and Ciesanova, 2007)

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Flavonoids compound of new foods formulae from Tartufi J.A powder (mg/100gm dry weight basis):

From data presented in Table(9) it can be seen that the effect of storage period on flavonoids compounds of different foods formulate, there were some quantitative difference in Flavonoids compounds among eight food formulae.From obtained data, it was observed that Rosmarinic, Naringen, Quercetin, Hisperdin, Rutin, Hypersoide, Hispertin, Quercetrin, Kampferol, Apignen, Luteolin and 7-oH flavone were the major flavonoids compounds indentified, Hisperdin have the maximum concentration in formulae F1(559.56 mg/100gm) followed by F3(169.77 mg/100gm) at zero time,and disappeared in the rest of formulae, while Naringin was observed in all food formulae at different ratios being 32.77mg/100gm in F1 followed by 16.44, 13.73, 6.57, 6.28, 4.79, 3.66 and 3.16 mg/100gm for F5, F7, F2, F8, F6, F4 and F3 respectively, also it was showed a variability on the amount of the yield and a difference of the flavonoids compounds in the eight foods formulae after storage period for 8 months, observed a clear decrease and increase, appeared and disappeared of most of flavonoids compounds in Table (9). These changes attributed to the mixing of different ingredient in the final products .

Nutritional evaluation of different new foods formulae prepared from Tartufi (J.A) powder:

From data in Table (10) it could be noticed that 100 gm from each tested formulae provides children aged(3-8 years) about 32 to 36% of energy daily requirement. Also the same amount of each formulae provides adult male (aged 19-35 years) with 16 to 19% and female with 18 to 21% of energy daily requirement as reported by (RNI ,2005). Also results in the same table showed that 100 gram of all new formulae offered a good concentration of protein and provides children(aged3-8 years) more than 49 to 93% of daily requirement, also gave male and female (aged19-35years) with level ranged from 16 to 31% and from 20 to 38% respectively. The same Table also revealed that 100 gram of all new foods formulae provides childern more than 71.97 to 147.84% of phosphours daily requirements, also gave male and female about 51.41to 105.6% nearly phosphours requirements, and from 18.03 and 23.77% of potassium daily requirement, 16.74 to 20.24% of calcium for male and female, 135.62 to 260.37% of iron for male and from 60.27 to 115.72% of iron for female daily requirements . Also 53.2 to 412.2 of zinc for children and 24.18 to 187.36 of Zinc for male , 33.25 to 257.6% of Zinc for female daily requirements (RDAs 1997), (DRIs 1997, 2001, 2005).

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Table (10) Nutritive values in 100gm of new foods formulae prepared from Tartufi (J.A) powder compared with daily Recommended Requirements .

Elements	Daily Recommended Requirements			F1	F2	F3	F4	F5	F6	F7	F8
	Children (3-8years)	Males (19-35years)	Females (19-35years)								
Energy k.cal	1290-1340	2460	2180	425.34	437.40	424.48	419.67	401.71	459.63	452.02	474.07
Protein g	19	56	46	10.83	17.05	17.31	17.74	13.98	13.98	15.60	17.02
P mg	500	700	700	683.48	410.33	491.19	520.22	619.36	359.88	637.95	739.20
K mg	3800	1650	1650	392.21	347.44	318.78	297.56	377.12	360.90	362.05	330.67
Na mg	1200	1600	1600	281.31	231.73	263.66	206.09	260.66	280.77	283.13	230.37
Ca mg	1000	1000	1000	199.98	167.45	202.41	177.50	192.15	193.97	197.63	177.28
Mg mg	130	400	310	333.21	212.73	209.12	242.34	187.29	175.41	205.32	214.01
Mn mg	1.5	400	366	3.32	1.98	1.91	1.36	1.45	1.38	1.69	1.77
Fe mg	10	8	18	11.71	13.09	13.32	18.71	10.85	11.42	20.83	12.94
Zn mg	5	11	8	5.66	3.24	2.66	3.58	3.33	10.26	20.61	16.33

Organoleptic evaluation of different new Tartufi (J.A) powder formulae :

Results in Table (11,12 and 13) showed that different sensory properties for new Tartufi powder formulae namely (bars, drinks and cream soup).

Mean values of organoleptic evaluation namely color, taste, odor, texture and acceptability of bars produced from final forms of formulated food mixture are shown in Table (11) at zero time. Analysis of variance showed that significant differences were observed between bars produced from F1, F2, F4 and F7 for color while non significant differences was noticed between bars of F5, F6 and F7 for color at zero time. The results indicated that bars (F5) recorded lower mean value of all parameters of sensory evaluation except texture when compared with bars of F7 and F8, also the obtained results indicated that the best preferable mixture with respect to acceptability was F3 followed by F2, F4, F8, F6,F7 and F5 . After storage for 8 months, data in Table (11) showed that bars produced from F5 recorded the lower mean value of all properties of organoleptic evaluation when compared with the others formulates, also the results in the same table indicated that the differences between all bars produced from the different mixtures (F1, F2, F4, F6 and F8) were showed no significant difference in color and odor, non significant difference showed between F2,F3,F4,F7 and F8 while a significant difference were observed in texture for F4,F5 and F6 but in taste, data showed non significant difference between all formulae.In general, it could be concluded that, all the tested food mixture have mean score of acceptability except mixture F5 and F7 which made them palatable according to Larmond, (1970).

Table(11) Oraganoleptic evaluations of Tartufi bars after storage period(8 months).

constitute / Formulae	Color		Taste		Odor		Texture		Acceptability	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
F1	9.00^{a}	8.85^{a}	8.71^{a}	8.71^{a}	8.92^{a}	8.71^{a}	8.50^{a}	8.35^{a}	8.64^{a}	8.42^{a}
F2	8.28^{abc}	8.00^{ab}	8.50^{a}	8.71^{a}	8.85^{a}	8.07^{ab}	8.35^{a}	7.85^{ab}	8.57^{a}	8.14^{ab}
F3	8.92^{a}	8.57^{a}	8.35^{a}	8.57^{a}	8.50^{a}	7.71^{ab}	8.57^{a}	7.85^{ab}	8.71^{a}	8.00^{ab}
F4	8.57^{ab}	8.35^{ab}	8.28^{a}	8.71^{a}	8.21^{a}	8.14^{ab}	8.28^{a}	7.78^{ab}	8.42^{a}	8.14^{ab}
F5	6.92^{c}	6.42^{c}	6.35^{b}	4.57^{b}	6.71^{b}	5.57^{c}	7.85^{a}	7.00^{b}	6.71^{b}	6.14^{c}
F6	7.92^{abc}	8.07^{ab}	7.28^{ab}	7.50^{a}	8.00^{ab}	7.35^{b}	8.14^{a}	8.00^{a}	7.64^{ab}	7.71^{ab}
F7	7.00^{bc}	7.50^{b}	7.42^{ab}	7.92^{a}	7.64^{ab}	8.14^{ab}	7.35^{a}	7.00^{b}	7.57^{ab}	7.57^{b}
F8	7.85^{abc}	7.92^{ab}	7.78^{ab}	8.28^{a}	8.07^{ab}	8.35^{ab}	7.85^{a}	7.64^{ab}	8.14^{ab}	7.78^{ab}

X values in the same column with the same latter are not significantly different at P≤ 0.05

The panel tests were measured at zero time and after storage period for 8 months of every formulate. The drinks of formulated foods mixtures except F5 have a good color, taste, odor, texture and acceptability. The obtained results showed that F5 recorded lower value of all organoleptic properties when compared with the other mixtures as shown in Table(12).

After storage for 8 months, data in the same Table appeared that a clear change was observed in the organoleptic properties such as: color, taste and texture which a significant difference was observed between drink F3, F4 , F5 and F1. No significant difference was observed between drink F2 and the (F1) in all organoleptic properties except odor and texture, also drink F5 recorded lower value in all properties of organoleptic evaluation. Finally the mean value of acceptability of F2, F3 and F4 made them palatable according to Larmond, (1970).

Table(12) Oraganoleptic evaluations of Tartufi drinks after storage period(8 months).

Constitutes / Formulae	Color		Taste		Odor		Texture		Acceptability	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
F1	8.07^{ab}	9.71^{a}	7.85^{a}	9.57^{a}	7.92^{a}	9.71^{a}	8.35^{a}	9.71^{a}	8.00^{a}	9.71^{a}
F2	8.21^{a}	8.71^{ab}	8.42^{a}	9.14^{ab}	8.00^{a}	9.07^{a}	8.35^{a}	9.50^{a}	8.35^{a}	9.00^{ab}
F3	8.07^{ab}	8.00^{bc}	8.14^{a}	8.42^{bc}	7.71^{a}	8.00^{b}	7.64^{a}	8.85^{ab}	8.00^{a}	8.14^{bc}
F4	8.14^{ab}	7.42^{cd}	7.85^{a}	7.71^{c}	8.00^{a}	7.57^{b}	7.85^{a}	8.42^{b}	8.14^{a}	7.71^{c}
F5	7.14^{b}	6.42^{d}	6.00^{b}	5.28^{d}	5.42^{b}	4.85^{c}	6.35^{b}	6.14^{c}	6.14^{b}	6.00^{d}

X values in the same column with the same latter are not significantly different at P≤ 0.05

One of limiting factor for consumer acceptability is the organoleptic properties. Table (13) illustrated the mean values of the sensory characteristic scores of new formulated cream soup. The obtained results indicated that the best perferable formulated with respect to acceptability was F8 followed by F7 and the last blend F6 at zero time. After storage period for 8 months, non significant difference was observed in the means values of F6

and F7 for color and odor, while F7 had the lower mean of taste compared to the other mixtures. It could be stated that F6 and F8 had the highest acceptability compared to F7. Finally the mean score of acceptability of F6, F7 and F8 made them palatable according to Larmond (1970) as shown in Table (13).

Table(13) Oraganoleptic evaluations of (cream soup) at zero time and after 8 months storage.

Constitutes / Formulae	Color		Taste		Odor		Acceptability	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
F6	6.28^{c}	7.21^{a}	7.00^{b}	7.85^{a}	6.85^{b}	8.14^{a}	6.50^{c}	8.14^{a}
F7	7.21^{b}	7.28^{a}	8.28^{a}	7.14^{b}	8.07^{a}	7.78^{a}	7.85^{b}	7.50^{b}
F8	8.64^{a}	7.57^{a}	8.00^{a}	8.00^{a}	8.78^{a}	8.00^{a}	8.57^{a}	7.71^{ab}

X values in the same column with the same latter are not significantly different at P≤ 0.05

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تصنيع منتجات جديدة سريعة التحضير باستخدام خلطات من مسحوق الطرطوفة

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تعتبر الطرطوفة من محاصيل الخضر الدرنية و الغنية بالكربوهيدرات خاصة مادة الانيولين و الذى يتم تحليلة الى سكرالفركتوز. تم اعداد ٨ خلطات من مسحوق دقيق الطرطوفة و تم اضافتة الي الدقيق المحمص لكلا من القمح و الحمص و العدس و الفول المدشوش و مسحوق كلا من الجزر , الحلبة , البسلة , السمسم , قشور البرتقال المجففة بالاضافة الى السكروز و بعض التوابل و الاعشاب , و تم تقدير التركيب الكيماوى و نسبة المعادن و المركبات الفينولية و الفلافونيدية و القيمة التغذوية للخلطات السابقة المخزنة على درجة حرارة الغرفة . و قد اظهرت النتائج ارتفاع كلا من الرطوبة فى الخلطة ٦ (١٠.٣٠ %) و البروتين فى الخلطة ٥ (١٧.٧٤ %) و الانيولين فى الخلطة ٧ (٩.٣٣ %) و الكربوهيدرات فى الخلطة ٢ (٦٥.٤٥ %) و الاحماض الامنية الحرة فى الخلطة ٦ (٣٤٨٨ ملجم/١٠٠ جم) , وكانت اعلى نسبة فسفور والبوتاسيوم فى الخلطة ١ والخلطة ٢وكانت(٦٨٣.٤٨و ٣٧٧.١٢ ملجم/١٠٠ جم) واعطت ايضا اعطت نتائج المركبات الفينولية و الفلافونيدية قبل و بعد التخزين علي ٨ اشهر انخفضت بعضها و ارتفاع البعض الاخر .وتم تصنيع ثلاث منتجات هي (اصابعbars, مشروبdrinks , شوربةcream soup) من الخلطات السابقة كالتالى من خلطة١ الي خلطة٨ تم تصنيع اصابع الطرطوفة و الخلطات من (خلطة ١ الى خلطة ٥)تم تصنيع المشروب و الخلطات (٦, ٧ ,٨) تم تصنيع منها الشوربة و تم تقيم الخلطات السابقة حسيا و اعطت النتائج التالية بالنسبة للاصابع bars: لوحظ ان افضل خلطة حققت افضل درجة قبول كانت الخلطة ٣ مقارنة بالخلطات الاخري و ذلك بعد التصنيع , بينما بعد التخزين لمدة ٨ شهور حصلت كل الخلطات على درجة قبول متوسطة فيما عدا الخلطة ٥ والخلطة ٧ .بالنسبة للمشروب (drinks) فقد حصلت كل الخلطات على درجة قبول جيدة فيما عدا الخلطة ٥ و ذلك بعد التصنيع, بينما بعد التخزين لمدة ٨ شهور حصل كلا من الخلطات ٢, ٣, ٤ على اعلى درجة من حيث درجة القبول , اما التقيم الحسى للشوربة (cream soup) فقد سجلت الخلطات الثلاثة للشوربة اعلى درجة من حيث القبول. اوضحت النتائج ايضاان ١٠٠ جرام من الخلطات الجديدة لمسحوق الطرطوفة تمد الاطفال بحوالى٣٢ :٣٦% من الطاقة و من ٤٩ الى ٩٣% من البروتين , ٧١% الى ١٤٧.٨٤% من الفسفور, ٧.٨٣ :١٠.٣٢% من البوتاسيوم , ١٧ :١٩.٣٩% من الكالسيوم , ١٠٨.٥: ٢٠٨.٣% من الحديد . كذلك تمد الذكور ١٦: ١٩% من احتياجاتهم من الطاقة و تمد الاناث ١٨: ٢١% من احتياجاتهم من الطاقة ,كذلك تمد كلا من الذكور و الاناث بنسب من البروتين يتراوح من ١٦ :٣١% و ٢٠ : ٣٨% من احتياجات البروتين اليومية لهم على التوالى و كذلك تمدهم بكلا من ٥٠ : ١٠٠% من احتياجاتهم من الفسفور , و من ١٨: ٢٣% من البوتاسيوم , ١٦.٧٤: ٢٠.٢٤% من الكالسيوم ,و تمد الذكور ١٣٥.٦٢: ٢٦٠.٣٧% من الحديد , و الاناث ٦٠.٢٧: ١١٥.٧٢% من الحديد من الاحتياجات اليومية من المعادن .

التوصية:

التوسع فى زراعة محصول الطرطوفة لما له من قيمة غذائية عالية , كذلك استخدام الطرطوفة طازجة و مجففة و ادخالها فى منتجات متنوعة للاستفادة منها.

Table (6) Chemical composition of new food formulae from Tartufi powder during storage period(gm/100gm dry weight basis).

Formulae / Constitutes	F1		F2		F3		F4		F5		F6		F7		F8	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
Moisture	7.18	5.98	6.70	5.21	8.65	6.32	7.42	5.67	6.37	4.34	10.30	6.97	10.02	6.33	10.28	7.61
pH	6.47	6.23	6.53	6.30	6.74	6.36	6.69	6.42	6.71	6.36	6.31	6.15	6.21	5.82	6.37	6.14
Acidity (as citric acid)	0.64	0.70	0.41	0.57	0.63	0.73	0.68	0.77	0.59	0.64	0.62	0.69	1.17	1.92	0.77	0.89
Ash	2.59	2.39	2.63	2.10	2.99	2.77	2.88	2.57	2.67	2.32	3.45	2.93	4.02	3.21	2.93	2.82
Fiber	6.71	3.28	3.69	2.79	3.54	3.16	5.21	3.07	4.75	3.41	4.74	3.98	4.72	4.67	4.03	4.02
Protein	9.37	9.25	10.83	9.15	17.05	13.79	17.31	13.90	17.74	14.60	13.98	11.54	15.60	10.16	17.02	10.83
Total Lipids	10.93	10.81	10.46	10.38	8.24	8.12	8.72	8.61	3.99	3.87	17.26	17.15	16.57	16.47	19.15	19.01
Total sugars	18.98	6.19	24.94	21.00	16.84	13.58	15.03	14.09	23.07	22.00	24.74	23.05	25.22	24.00	28.15	27.01
Total carbohydrate	63.29	67.34	65.45	68.71	60.81	65.07	58.51	64.66	63.55	68.80	53.64	57.56	51.71	57.75	50.03	56.29
Inulin	0.44	0.36	6.8	4.7	5.4	4.6	5.5	5.0	7.0	5.2	6.5	5.8	9.3	7.9	9.5	6.5
*Free amino acid	467	361	1184	556.4	3102	418.7	1519	399	1847	293	3488	1634	1956	466	1244	689
**Total phenolic compounds	1750	570	3420	2770	2190	1100	3610	1820	3830	1670	3450	2240	1870	980	2600	1970
***Total flavonoid compounds	450	120	110	21	160	33	120	36	240	91	130	44	200	78	18	14

***mg/100gm as Isolucine. **mg/100gm as Galic acid. ***mg/100gm as Quercetin.**

Table (7) Effect of drying process and storage periods on mineral contents of foods formulae from Tartufi powder (mg/100gm dry weight basis).

Formulae / Minerals	F1		F2		F3		F4		F5		F6		F7		F8	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
P	683.48	681.21	410.33	410.12	491.19	490.91	520.22	520.00	619.36	619.12	359.88	359.12	637.95	637.45	739.20	738.02
K	392.21	390.01	347.44	345.91	318.78	318.03	297.56	296.91	377.12	376.87	360.90	360.02	362.05	361.95	330.67	330.17
Na	281.31	280.21	231.73	230.80	263.66	262.96	206.09	205.99	260.66	260.12	280.77	280.27	283.13	282.21	230.37	229.72
Ca	199.98	197.89	167.45	166.45	202.41	202.14	177.50	176.79	192.15	191.75	193.97	192.72	197.63	196.33	177.28	176.81
N	124.79	123.89	97.23	95.03	82.33	80.93	67.25	62.13	69.07	68.21	135.08	132.48	110.52	108.23	99.14	95.91
Mg	333.21	330.12	212.73	210.75	209.12	206.14	242.34	240.45	187.29	186.35	175.41	172.38	205.32	201.55	314.01	213.91
Mn	3.32	3.22	1.98	1.59	1.91	1.77	1.36	1.21	1.45	1.39	1.38	1.30	1.69	1.59	1.77	1.69
Fe	11.71	10.91	13.09	12.13	13.32	12.60	18.71	11.74	10.85	7.32	11.42	7.48	20.83	13.66	12.94	7.87
Zn	5.66	5.19	3.24	3.33	2.66	4.50	3.58	4.75	3.33	2.27	10.26	11.98	20.61	16.81	16.33	7.58

Table (8) Effect of drying process and storage period on phenolic compounds of new formulated food from Tartufi powder (mg/100gm dry weight basis).

Formulae / Phenolic compounds	F1		F2		F3		F4		F5		F6		F7		F8	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
Gallic acid	0.25	0.22	0.44	0.33	0.79	0.26	0.68	0.33	0.51	0.48	2.02	0.16	0.99	1.45	0.61	0.86
Protocatechuic acid	0.26	2.25	0.35	0.64	0.21	1.14	0.37	3.27	0.22	1.32	0.45	2.64	0.19	2.09	0.41	1.11
Catachein	3.14	1.36	0.14	0.59	0.20	0.52	1.78	0.71	1.42	0.47	1.45	0.33	2.21	1.09	2.49	0.71
Catechol	3.14	0.81	2.27	0.90	0.84	0.28	2.89	0.94	2.13	2.67	0.72	0.32	4.78	0.36	1.76	0.65
Chlorogenic	2.60	1.43	3.90	0.39	2.09	0.66	2.67	0.71	2.32	4.46	3.13	0.33	1.68	0.23	4.68	0.77
Caffic acid	0.24	0.20	0.22	0.14	0.99	0.13	0.73	0.33	1.14	0.86	0.54	0.17	1.04	0.15	0.32	0.25
Vanillic acid	0.24	1.73	0.38	0.86	N.D	0.16	0.63	1.03	0.91	3.83	N.D	0.54	N.D	0.28	0.51	0.41
Ferulic acid	N.D	0.12	0.89	0.35	0.53	0.15	0.54	0.13	1.55	0.44	0.65	0.055	0.26	0.14	0.25	0.14
Salcylic acid	11.61	1.17	4.25	0.52	4.56	0.77	7.10	0.54	N.D	0.86	9.35	1.30	16.95	0.61	6.62	0.97
Benzoic acid	17.25	8.79	13.59	1.54	9.99	0.98	18.81	3.78	13.81	4.91	14.34	3.35	9.67	2.53	7.89	4.17
Coumarin	0.41	0.23	N.D	0.16	0.26	0.066	0.27	0.34	N.D	0.46	0.27	0.18	0.16	0.12	0.19	0.18
Caffein	0.64	0.041	0.12	0.39	N.D	0.059	0.29	0.24	1.54	1.01	0.85	0.63	0.96	0.34	0.76	0.17
Ellagic acid	1.33	2.22	1.89	0.66	1.38	0.49	1.69	0.82	1.48	N.D	N.D	0.43	2.19	0.38	2.20	1.06
Syringic acid	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
Total phenolic compounds	41.11	20.57	28.44	7.47	21.84	5.67	38.45	13.17	27.02	21.77	33.77	10.44	31.41	9.77	28.69	11.45

N.D= Not Detected

Table (9) Effect of storage period on Flavonoids compounds of new foods formulae from Tartufi (J.A) powder (mg/100gm dry weight basis).

Formulae / Flavonoid compounds	F1		F2		F3		F4		F5		F6		F7		F8	
	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months	Zero time	After 8 months
Rosmarinic	22.39	0.46	1.97	0.13	N.D	0.18	0.78	0.48	3.01	0.0048	1.62	0.11	3.75	0.99	2.35	0.19
Naringin	32.77	N.D	6.57	12.62	3.16	0.38	3.66	7.24	16.44	13.25	4.79	17.65	13.73	8.12	6.28	3.94
Quercetin	1.79	0.080	0.21	0.25	0.43	0.46	N.D	0.36	0.97	0.39	N.D	0.82	0.68	0.86	0.20	0.29
Hisperdin	559.56	23.41	N.D	2.25	169.77	2.99	N.D	8.34	N.D	8.24	N.D	16.95	N.D	12.79	N.D	19.47
Rutin	5.85	1.82	N.D	0.91	N.D	0.81	N.D	0.36	N.D	0.88	N.D	N.D	N.D	1.21	N.D	2.62
Hypersoide	8.11	N.D	2.23	N.D	N.D	N.D	4.88	N.D	6.84	N.D	N.D	N.D	4.73	N.D	3.20	N.D
Narenginin	0.82	0.33	N.D	0.052	N.D	0.12	N.D	0.26	0.11	0.072	0.46	0.058	0.38	0.070	0.21	0.18
Quercetrin	3.22	2.52	0.52	0.88	0.72	1.76	0.60	0.91	0.73	3.00	0.61	0.44	1.19	1.23	0.86	1.72
Hispertin	5.59	0.38	N.D	0.47	0.27	0.20	0.59	0.60	0.41	0.17	0.41	0.28	N.D	0.13	N.D	0.45
Kampferol	3.10	N.D	0.28	0.48	0.27	1.90	0.40	1.71	0.25	0.85	0.11	0.35	0.47	0.31	0.091	0.87
Apigen	9.68	N.D	0.84	N.D	0.83	N.D	1.50	N.D	0.68	N.D	0.81	N.D	0.51	N.D	1.64	N.D
Luteolin	N.D	1.11	N.D	0.44	N.D	0.65	N.D	0.16	N.D	0.52	N.D	0.28	N.D	0.21	N.D	0.52
7-oH flavone	N.D	0.086	N.D	0.038	N.D	0.14	N.D	0.10	N.D	0.43	N.D	0.31	N.D	0.078	N.D	0.061
Total Flavonoids compounds	652.87	30.19	12.62	18.52	175.45	9.59	12.41	20.52	29.44	27.80	8.81	37.24	25.44	25.99	14.83	30.31

N.D= Not Detected