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Enrichment Patton SaleeProductUsing SweetLupine Peels to Enhance Sensory Properties and Nutritional Value as One of The Needs of Diabetes Patients

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Abstract

Body health is an indicator on a good nutrition, and free from chronic diseases as diabetes, heart diseases and blood pressure. Healthy foods asLeguminosae is a good source of nutrient, so legumesmay - beresponsible for preventing chronic diseases. The aim of this research is to study the effect of addition sweet lupine peels with different amounts on sensory properties and nutritional value of Patton Salee product as one of the needs of diabetes patients. Patton Salee was supplemented with different amounts of lupine peels (10%, 20%, 30%). The results of sensory evaluation showed that supplemented Patton Salee was acceptable, but the best results observed in supplemented sample with (10%), the values of taste improved from (4.55± 0.35 to 4.9± 0.31), Aroma improved from (4.7± 0.34 to 4.9± 0.31) and texture improved from (4.9 ± 0.20 to 4.9± 0.31). Chemical analysis showed increasing in protein, fat, fiber, ash, minerals, total antioxidants and total phenolic with increasing lupine peels amount, which that, increasing protein or fiber reducesblood glucose level and insulin metabolism. **Conclusion**: the results showed that addition lupine peels improvedthe sensory evaluation and nutritional value of Patton Salle; this illustrated the important of legumes peels especially lupine peels for diabetes patients' foods.

Keyword: Legumes,lupine, lupine peels, diabetesdisease, blood glucose level.

Introduction:

A healthy body is a good indicator of health and good nutrition, sowe should be care of our health to be free of diseasesespecially chronic diseases such as diabetic, heart disease and blood pressure. There are foods knownas healthy foods or functional foods, by increasinghealthy foods the awareness of individual's consumers increased**(Stoon, 2002)**, Like dietary fiber foods are consideredas functional foods **(Trumbo et al, 2002 and Berghofer, 2000)**. The recommendationsofdietaryfibersintakerangedbetween(25-30g) day**(Asp, 2004 and USDA, 2002**). So enriched bread with high fibers content increases the intake of fibers**(Goesaert et al, 2005, SangnarkandNoomhorm, 2004& Wang et al, 2002)**. The use of fibers from various sources in food production increasethe benefits of body health **(ElAdly and Asma ELGendy, 2009)**.There are studies suggested a relationship between decreasing in the consumption of dietary fiber and increasingsome illnesses such as colorectal cancer **(Cassidy et al, 1994 and Peters et al, 2003)**. Dietary fiber and protein also has a positive effect on the immune functionand reduce postprandial glycaemia and the addition of fiber and protein to highcarbohydrate foods may assist in acute glycaemic control in type 2 diabetes.**(Karamanlis et al, 2007&Tungland and Meyer, 2002)**.SoLeguminosae is a good source of fiber. The legumes used by humans are called food legumes or grain legumes. Itis divided into two groups, the pulses and the oilseeds.Pulses group consists of dried seeds of cultivated legumes. **(Asian Productivity Organization, 2003)**.Cereals and legumes consumed significantly by human. It is known that animal proteins characterized by high cost compared toplant proteins which contributes to about 33 % of the dietary protein nitrogen needs of humans. Moreover, plant proteins are considered a good source of minerals **(Kirmizi and Guleryuz, 2007)**.Among the legumes, lupine is rich in proteins,fiber, vitamins, minerals and antioxidants**(Sebastiá et al, 2001).**

Lupine is a plant grow in the Mediterranean area and South America, It isfound in Europe,and follows the family Leguminosae. Lupine is characterized by higher content of protein (30–40%), (6-10%) fat and dietary fiber (up to 50%) compared to other cereals andthe contain oflysine a higher in lupine**(Nalle et al, 2010,Písaříková and**

Zralý, 2010 &Suchy et al,2006). It is a good source of several nutrientssuch as dietary fiber, carbohydrates,vitamins and minerals**(Lee et al, 2006, Martinez Villaluenga et al,2009,MartínezVilla luenga et al, 2006 & Torres et al, 2005).**In addition tolupine contains phytochemicals with antioxidant capacity such as polyphenols, mainly tannins and flavonoids **(Oomah et al, 2006)**. Lupine seeds are consumed after soaking in the water for 3 days to remove alkaloids**.(Rahma and NarasingaRao, 2002 &Wäsche et al, 2001)**.Also it isconsumed as a snack in the Middle East andused as an alternative to protein such as protein soy because it is a source of protein and oil. **(Kurzbaum et al, 2008 &Sujak et al,2006)**.

Lupine is a food withhigh contentsin carbohydrate,protein and fiber**(Lee et al, 2006)**.Lupineflour (LF)is considered an excellent raw material for fortified foods because of high protein content **(Sironi et al, 2005)**and it is used as eggs substitute in cakes, pancakes, biscuits, or brioche **(Tronc, 1999)**.Lupine seeds are used for supplementation and technological improvement of foods **(Martinez Villaluenga et al, 2009)**.Fortified products with lupine as baker's products and pastry are popular because of their high nutritional value (NV) and functionality; it is called functional foods**(Faeste et al, 2004).** Lupine kernel fiber has used as ingredient diet in pasta **(Smith et al, 2006).** Also lupine has health benefits, it could beused as clinical nutrition for example inimprovement total lipid and reduction (TC) total cholesterol "low density lipoprptein (LDL), high density lipoprotein (HDL) and very low density lipoprotein (VLDL)"**(Bettzieche et al, 2008 and Kurzbaum et al, 2008)**.Also**(Bettzieche, 2009 and Sirtori, 2004)** studied the effect of lupine consume of pigs on the level of cholesterol in total plasma, LDL and HDL more than pigs fed casein ($P < 0.05$), they proved that diets contain lupine proteins decrease cholesterol in plasma in hypercholesterolemia rats and humans**(Weisse et al, 2010)**compared to casein.In addition to (LF)or fiber reduce the level of blood glucose by controlling the level of insulin that the bodyproduce and improve the rate of obesity, so (LF)or fiber can be used successfully as hypoglycemic agents in bakery products**(Abdurrahman, 2012,Lobna et al, 2008 &Marchesi et al, 2008)**.Also thereare some studies showedhealth benefits of lupineespecially high blood glucose level for example**(Jonathan Hodgson and Ya Ping Lee,2008)** Studied the

benefit of lupine on obesity and cardiovascular disease risk in humans. They foundthat(LF) is high in protein and fiber, andsupplemented bread with (LF) can reduce appetite and improve the weight,increasing protein or fiber may reduce the risk of cardiovascular disease via effects on blood pressure, blood cholesterol and glucose and insulin metabolism.Also **(Constance et al,2015)** investigated the effect of Lupinusalbuson treating hyperglycemia in type 1 diabetes. **(Rim Bouchoucha et al,2016)**studiedtheEffect of Lupinusalbus on Glycaemic Control, Plasma Insulin Levels, Lipid Profile and Liver Enzymes in Type 2 Diabetics**.(Hassan and ElKomy, 2005)** studied the effect of lupine seeds on alloxan diabetic rats,There are an improvementin the animals group treated with dry seeds powder by recorded results.Also **(WalaaAniess et al, 2015)**reported that the addition of (LF) or fiber reduced blood glucose, (TC) and total lipids in diabetic rats and it could be used successfully as hypoglycemic in feeding diabetic patients.**(EmmaDove et al, 2011)** mentioned that lupine and soya reduce glycaemia acutely in type 2 diabetes.The results showed that lupine lowered insulin response compared to soya and adding lupine or soya to a carbohydrate-rich beverage reduces glycaemia acutely in type 2 diabetic individuals. So (LF) could be used as supplementation in bakery products and clinical nutrition such as study of **(Syed and Vijay Jayasena, 2012)**aboutthe effect of (LF)mixture on the physical and sensory properties of muffins. They mentioned that muffins are popular breakfast but poor in protein and dietary fibre contents. So they added (LF) to improve the (NV) of muffins of protein and dietary fibre. The results showed that protein and dietary fibre content increased by replacing wheat flour(WF) with (LF) up to 30% level without any significant loss in physical measurements, textural quality and sensory values. The chemical analysis of dried sweet lupine peels(LP) showed that, (LP) contain good ratio of proteins, high in ash,fibres,minerals, antioxidantsand considered as one of the needsof diabetes patients.This work studiedthe effect of addition sweet (LP) with different amounts on sensory properties and nutritional value of Patton salee product as one of the needs of diabetes patients.

Materials and Methods

Materials:

- Lupine peels were separated from sweet lupine seeds,inCairo, Egypt, 2016.
-Commercial wheat flour extraction (90-95%) was obtained from local market from Cairo – Egypt.
-Sensory evaluation form of supplemented Patton Salee product included (Taste, Color, Aroma, Pores, Texture and Overall Acceptability).
-Thirty diabetes patientsevaluatedthe supplemented Patton Salee products with (LP).

Methods:

Patients:

- A random sample of thirty diabetespatients (type 2), female,age range about (45 years), sensory evaluation form is distributed to evaluate the supplemented Patton Saleewith different amounts(10%, 20%, 30%) of (LP)compared to control sample.
- Sensory evaluation of supplemented Patton Salee with (LP) was carried out according to the method of **(Fairdi and Rulenthaler, 1984).**

Preparation of sweet lupine peels:

-Sweet lupine was obtained from local market of Egypt in January 2016. The seeds were washed well by water and Soaked in water for (12 hours), boiled and the peels were removed. The pulp and peels were dried by sun for (7 days), the pulp was grinded alone also peelswere grinded alone in blenderto get soft powder .These werestored in freezer at -18 °C until used. Drying sweet lupine (pulp and peels) carried out by sun drying methods according to **(Kiremire et al, 2010).**We made Paton Salee as a control sample and supplemented samples with three different amounts (10%, 20% and 30%) of (LP),the samples were sensory evaluated (taste, colore, Aroma, pores, texture, and overall acceptability), the samples weredivided into two main groups. The first main group is the control group (no supplemented), the second main group is the supplemented Paton Salee with different amounts (10%, 20% and 30%) of dried lupine Peels (DLP).Composition of Patton Salle is shown in table (1)

Preparation of wheat flour with lupine peelsand groups of samples:

- Adding three different amounts (10%, 20% and 30%) of (DLP) to (100 g) (WF) extraction (90%-95%),mixedother well with little of water, then

adding contents to makePatton Salee.This group divided (the second main group)to three subgroups as follow:

-The first subgroup is consisted of supplemented Patton Salee with (10%) LP, thesecond subgroup is consisted of supplemented Patton Salee with (20%) LP andthethird subgroup is consisted of supplemented Patton Salee with (30%) LP. All these samples were evaluated sensory evaluation(SE)comparedtocontrol sample.

Analytical methods (macronutrients, micronutrients and rare compounds):

- Chemical analysis of macronutrients (proteins, fats, Ash, Moisture and crude Fiber) of (LF) without peels, (DLP) and supplemented Patton Salee with (10% , 20% , 30%) was carried out according to**(A.O.A.C, 2007)**and carbohydrates were calculated by difference**:** Total carbohydrates= 100 - (g protein + g fat + g ash).

-Chemical analysis of minerals (Ca, Fe and Mg)was determined according to**(A.O.A.C, 2007).**

- The rare compounds (total antioxidants and phenolic)were determined throw DPPH assay according to**(Sujak and Strobel, 2006).**

Statistical analysis:

The obtained data were statistical analyzed using computer (programme of Statistical Analysis system"SAS"). The results were expressed as mean ± standard diviation"SD" and tested for significance using one way analysis of variance "ANOVA" test. And least significant difference "LSD" tests at a probability P<0.05 calculated according to **(Armitaage and Berry, 1987)**, a value of P< 0.05 was considered to be statistically significant.

Results and Discussion:

Table (1): Patton salee composition

Samples / Parameters	Formula 1 (0) Amount g/100 g	Formula (2) (10%)	Formula (3) (20%)	Formula (4) (30%)
WF	100	100	100	100
Water	٣٣	35	40	٤٣
Yeast	5	5	5	5
Salt	5	5	5	5
cumin	10	10	10	10
Sugar	10	10	10	10
DLP	0	10	20	30

Table (2)showsthe sensory evaluation of control sample and supplemented samples with different amounts (10%, 20%, and 30%) of (DLP) as means.It was observed that all the supplemented Patton saleesamples were sensory acceptable until level (30%) compared to control sample.Adding (LP) to Patton Salee improved sensory propertiesat level (10%), the taste improved from (4.55±0.35 to 4.9±0.31),Aroma improved from (4.7±0.34 to 4.9±0.31), texture improved from (4.9±0.20 to 4.9±0.31)and overall acceptability was the same (23.9) in the control and supplemented with (10%). The results of color and pores were (4.5±0.39 and 4.7±0.41) and the control were (4.85±0.33 and 4.9±0.33), also the level of (20%) LP given good results in sensory evaluation (4.02±0.36, 4.2±0.41, 3.8±0.55, 3.9±0.44, 4.00±0.42, 19.92) compared to the control.But the third level (30%) of (LP) appeared decreasing in (SE), the value of taste decreased from (4.55±0.35 to 3.53±0.43), color decreased from (4.85±0.33 to 3.4±0.40),Aroma decreased from (4.7±0.34 to 3.33±0.36), pores decreased from (4.9±0.33 to 3.33±0.38), texture decreased from (4.9±0.20 to 3.28±0.34) and Overall acceptability decreased from (23.9 to 16.87). In the final, there are significant differencesin sensory evaluation values between the groups (10%, 20%, 30%) compared to control sample, the values of LSD at level ($P<0.05\%$) were (0.1874, 0.1962, 0.2041, 0.2002, 0.1661, 0.473), this mean that there are significant difference. These results agreement with **(Abdurrahman M.Sc, 2012)** who recommended by using lupine flour or fiber in bakery products.Also the study of **(Syed M and Vijay Jayasena, 2012)**showed improvement in nutritional value (increase in protein and dietary fibre content) of muffins by replacing (WF) with (LF) up to 30% level without any significant loss in physical measurements, textural quality and sensory values.

Table (2): Mean values of sensory evaluation(S E) of supplemented Patton Salee product with different amounts of (DLP) and control (0).

S EL P %	Sensory evaluation					
	Taste	**Color**	**Aroma**	**Pores**	**Texture**	**Overall acceptability**
0	4.55±0.35	4.85±0.33	4.7±0.34	4.9±0.33	4.9±0.20	4.78
10	4.9±0.31	4.5±0.39	4.9±0.31	4.7±0.41	4.9±0.31	4.78
20	4.02±0.36	4.2±0.41	3.8±0.55	3.9±0.44	4.00±0.42	3.98
30	3.53±0.43	3.4±0.40	3.33±0.36	3.33±0.38	3.28±0.34	3.37
LSD at level P < 0.05	0.1874	0.1962	0.2041	0.2002	0.1661	0.473

All data are the means ± SD (n = 30); means with the different letters within a column are significantly different (P < 0.05).(

The results of chemical analysis of (WF), (LF),(LP) and supplemented Patton Saleewith different amounts (10%, 20%, 30%) of (DLP) appeared in **Table (3).**(LP) shows highin the level of carbohydrates, fiber and ash (86.39±0.26, 42.24±0.45 and 4.243±0.61) more than LF (50.34±0.04, 4.33 ± 0.34 and 2.171±0.07)respectively, Conversely(LF) showed highlevel ofproteins, fats and moisture (38.6 ± 0.77, 8.89±0.02 and 8.05±0.71) compared to LP(6.566±0.13, 2.801±0.21 and 5.146±0.26).The results of supplemented Patton Salee with different amounts of (LP)showed increasing the level of protein , from (10.668±0.28) to (14.002±0.23) , increasing level of fats from (1.773±0.32)to (2.809±0.72) , decreasing level of carbohydrates from (86.049±0.11) to (81.089±0.41), increasing level of crude fibers from (4.244±0.51)to (12. 672±0.52) also increasing ash level from (1.126±0.12)to (2.10±07) compared to control sample (10.07±0.03, 1.6±0.46, 87.2±0.34, 4.00±35and 1.13±0.03) respectively,but the results of moisture showeddecreasing from (3.988±0.61) to (1.329±0.14) compared to control sample (4.67±83).In the end, all nutrients showed increasing except the level of moisture and carbohydrates showeddecreasing compared to control sample.Theseresults go parallel with **(Andersson et al,1993)**whose mentioned that chemical analysis of (WF)contain carbohydrates (74-86 gm), Protein (8-18 gm), Ash (0.5%-0.7%), fiber (2.7%- 4 %). **(Chavan, J.andKadam,S,1993)** and**(Messina, 1998)** reported that nutritional value of bakery products can be raised by supplementation or addition of legumes proteins and dietary fibers,also

the study of **(Nalle et al, 2010)** reported that lupine is characterized by higher content of protein (30–40%), (6-10%) fat and dietary fiber (up to 50%) compared to other cereals and the contain of lysine a higher in lupine.

Table (3): Chemical analysis of wheat flour (WF), lupine flour (LF), lupine peels (LP) and supplemented samples with differentamountsof LP (g/100gm).

Raw materials and samples / Macronutrients (g)	WF extraction (90%-95%)	LF	LP	Supplemented Patton Salee with different amounts of lupine peel (g /100g)			
				Control sample	10%	20%	30%
Protein	13.03 ± 0.70	38.6 ± 0.77	6.566 ±0.13	10.07 ±0.03	10.668 ±0.28	11.335 ±0.24	14.002 ±0.23
Fat	2.62 ± 0.21	8.89 ±0.02	2.801 ±0.21	1.6 ±0.46	1.773 ±0.32	2.16 ±53	2.809 ±0.72
Carbohydrate	83.21 ± 0.36	50.34 ±0.04	86.39 ±0.26	87.2 ±0.34	86.049 ±0.11	84.716 ±0.66	81.089 ±0.41
Crude fiber	12.12 ± 0.13	4.33 ± 0.34	42.24 ±0.45	4.00 ±35	4.244 ±0.51	7.448 ±0.48	12. 672 ±0.52
Ash	1.14 ± 0.04	2.171 ±0.07	4.243 ±0.61	1.13 ±0.03	1.51 ±0.12	1.789 ±0.33	2.10 ±0.07
Moisture	11.56 ±47	8.05 ±0.71	5.146 ±0.26	4.67 ±83	3.988 ±0.61	2.659 ±0.25	1.329 ±0.14

WF: Wheat flour. LF: Lupine flour. LP: Lupine peels

Data in **table (4)** showsthe content of minerals (Ca, Fe and Mg) in (WF), (LF), (LP) and supplemented Patton Salee with different amounts (10%, 20%, 30%) of (LP). the content of minerals (Ca, Fe and Mg) in lupine peels werehigh (526.69±1.1, 33.67±0.98 and 331.02±0.51), conversely the content of minerals in (LF)were low (449.5± 0.33, 25.57±0.22 and 232.82±1.0). Supplemented Patton Saleeshowed increasing incalcium, iron and magnesiumfrom (89.04±1.5, 10.305±0.9, 121.69±1.7) to (270.12±1.6, 33.91±1.2, 245.07 ± 2.2) respectively compared to control sample (31.51± 1.15,3.77±0.51,101.72±2.3). The results showed that increasing the level of (LP),the mineralsin Patton Salle increased. These results agree with**(Martinez Villaluenga et al, 2009)** whose mentioned that lupine is a good source of dietary fiber, carbohydrates, vitamins and minerals.

Table (4): Chemical analysis of minerals of wheat flour, lupine flour, lupine peel and supplemented Patton Salee with different amounts of sweet lupine peels (mg/100gm).

Raw materials and samples / Minerals (mg/ g)	WF Extraction (90%-95%)	LF	LP	Control sample	Supplemented Patton Salee with differentamounts of lupine peels		
					10%	20%	30%
Ca	29.00 ±2.3	449.5 ±0.33	526.69 ±1.1	31.51 ±1.15	89.04 ±1.5	182.08 ±2.2	270.12 ±1.6
Fe	3.98 ±0.02	25.57 ±0.22	33.67 ±0.98	3.77 ±0.51	10.305 ±0.9	23.61 ±1.9	33.91 ±1.2
Mg	126.00 ±2.6	232.82 ±1.0	331.02 ±0.51	101.72 ±2.3	121.69 ±1.7	161.38 ±2.6	245.07 ±2.2

Table (5): Shows the total antioxidants and phenoliccontent in (LF), (LP) and supplemented Patton Salee with different amounts of (LP). Total antioxidants content increased from (0.565±0.5 to 1.70±0.35) with adding (LP), also phenolic content increased from (159.5 ± 5.10 to184.54±4.7).This is because of increasing the levels of total antioxidants and phenolic in (LP) more than (LF).These results are in accordancewith **(Oomah et al, 2006)**who reported that lupine contains phytochemicals with antioxidant capacity, such as polyphenols, mainly tannins and flavonoids. Also **(AbdelrahmanRagab, 2012)** he mentioned that the content of phenolics in (LF)was (138.17 ± 8.35).

Table (5): Chemical analysis of rare compounds of raw material and supplemented products of Patton Salee with different amounts of sweet lupine peels.

Raw materials and samples / Rare compounds	Materials		Supplemented Patton Salee with different amounts of lupine peels		
	LF	LP	10%	20%	30%
Total antioxidants	1.55±0.2	2.24±0.11	0.565±0.5	1.23±0.41	1.70±0.35
Total phenolic	136.37 ± 7.15	148.28±0.15	159.5 ± 5.10	171.15±3.3	184.54±4.7

Conclusion:

On the basis of the above mentioned data, sweet lupine peels consists of a good ratios of proteins, fibers, ash, minerals,phenolic and total antioxidants, Phytochemicals playvery important role in human

nutrition and good health, and with increasing the levels of lupine peels, (proteins, fat , fiber, ash, minerals, phenolic and total antioxidants) increased,converselymoisture and carbohydrates showed lowerwith increasing the level of lupine peels compared to control sample. This means that lupine peels could be used to raise nutritional value in some bakery products.

Recommendations:

According to the obtained results, this study recommended the following:

1-Making nutrition education programmefor people about health benefits of the Legumes peels especially lupine peels.

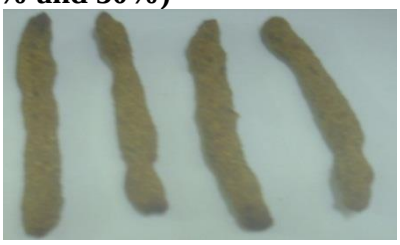
2-Incourege people to eat lupine seeds with peels fresh as snakes, because itcontains useful nutrients for cholesterol, obesity, heart disease and diabetes patients.

3-Rreplacing lupine pulp with lupine peels to improve sensory propertiesespecially aroma and taste in somebakery products like (Patton salee, bread, pizza and biscuit).

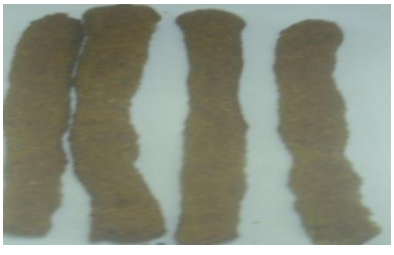
4-Incoureg people to use legumes with peels to increase the nutritional value of vitamins, minerals and rare compounds (antioxidants and phenolics).

Samples of Patton Salee (control and supplemented with different levels of lupine peels 10% 20% and 30%)

20 % DLP



30 %DLP



Control

10 % DLP

Abbreviation

Abbreviation	Mean
TC	Total Cholesterol.
LDL	Low Density Lipoprotein.
HDL	High Density Lipoprotein.
VLDL	Very Low Density Lipoprotein.
LF	Lupine Flour.
NV	NutritionalValue.
LP	Lupine Peels.
WF	Wheat Flour.
DLP	Dried Lupine Peels.
SE	Sensory Evaluation.
GM	Gram.
A.O.A.C	Association of Official Analytical Chemists.
Ca	Calcium.
Fe	Iron.
Mg	Magnesium.
DPPH	Organic chemical compound 2, 2-diphenyl-1-picrylhydrazy.
SAS	programme of Statistical analysis system
SD	Standard Diviation.
ANOVA	Analysis Of Variance
LSD	Least Significant Difference.
P	Probability.

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اثراء منتج الباتون سالية باستخدام مسحوق قشر الترمس الحلو لتعزيز الخواص الحسية والقيمة الغذائية كأحد متطلبات مرضى البول السكرى

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الملخص العربى

تعد صحة الجسم مؤشر طبيعي للتغذية الجيدة والسليمة, كذلك خلو الجسم من الأمراض المزمنة منها مرض السكر, مرض القلب و ضغط الدم, وهناك بعض الأطعمة التى تعرف بالأطعمة الصحية أو الأطعمة الوظيفية على سبيل المثال البقوليات, التى تعتبر مصدر جيد للعناصر الغذائية , لذلك البقوليات ربما تكون مسؤلة عن منع الأمراض المزمنة. هدف هذا البحثإلى دراسة تأثير إضافة قشر الترمس الحلو بمستويات مختلفة على الخواص الحسية والقيمة الغذائية لمنتج الباتون سالية كأحد متطلبات مرضى البول السكرى, حيث تم تدعيم منتج الباتون سالية بمستويات مختلفة من قشر الترمس الحلو المجفف (١٠%, ٢٠% , ٣٠%). أوضحت نتائج التقييم الحسى أن منتج الباتون سالية المدعم كان مقبولاً حسياً من حيث (الطعم ،اللون، الرائحة،المسام ،القوام والتقبل العام) على مستوى نسب التدعيم الثلاثة من قشر الترمس (١٠% , ٢٠% و ٣٠%), وظهرت أفضل النتائج فمنتج الباتون سالية المدعم بنسبة منخفضة (١٠%) , حيث تحسنت قيم الطعم من (٤,٥٥ الى ٤,٩), الرائحة تحسنت من (٤,٧ الى ٤,٩). كذلك تحسنت نتائج التحليل الكيمائى, فأظهرت النتائج بزيادة معدلات البروتين, الدهون, الألياف, الرماد ,المعادن, مضادات الأكسدة الكلية الفينولات الكلية بزيادة معدل قشر الترمس مقارنة بالعينة الضابطة, لذلك قشر الترمس ربما يقلل من خطر الإصابة بأمراض القلب والأوعية الدموية عن طريق التأثير على مستوى ضغط الدم,مسوى كوليسترول الدم, مستوى جلوكوز الدم و تمثيل الأنسولين.الخلاصة: أضحت النتائج أن إضافة قشر الترمس حسن من التقييم الحسى والتركيب الكيميائى أو القيمة الغذائية لمنتج الباتون سالية; هذا يوضح مدى أهمية قشور البقوليات خاصة قشر الترمس لأطعمة مرضى البول السكرى.

الخلاصة:

اتضح من البيانات الموضحة اعلاه, أن قشر الترمس الحلو حسّن من الخواص الحسّية لمنتج الباتون سالية (الطعم، اللون، الرائحة،المسام،القوام والتقبل العام) وكذلك أوضحت نتائج التحليل الكيميائي أنه يحتوى على معدلات جيدة من البروتينات، الألياف، الرماد، المعادن،الفينولات ومضادات الأكسدة الكلية، حيث تلعب المواد الفيتو كيميائية دوراً هاماً في تغذية الانسان والصحة الجيدة، وبالتالي فإن زيادة مستوى قشر الترمس تزداد معدلات كلاً من البروتينات، الدهون، الألياف، الرماد، المعادن،الفينولات ومضادات الأكسدة، على عكس معدلات الرطوبة والكربوهيدرات أوضحت إنخفاض فيها بزيادة مستوى قشر الترمس مقارنة بالعينة الضابطة. مما سبق اتضح مدى أهمية قشور البقوليات خاصة قشر الترمس الحلو في رفع القيمة الغذائية لبعض منتجات المخابز وكأحد متطلبات أطعمة مرضى البول السكرى.