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The effect of adding natural gelatin from chia seeds on the qualitative properties of the Lab-manufactured jelly

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Abstract

The current study aims to identify the effect of adding natural gelatin derived from chia seeds on the microbial, chemical and sensory properties of the laboratory-made jelly. The results showed that the highest yield of seed gelatin (chia) after removing the fat from the seeds by extracting it with hexane, as the percentage of gelatin obtained after the extraction process was 3%. A microbiological examination was conducted for the gelatin of seeds (chia) by 6 treatment that included 1 (vegetable gelatin), 2 (animal gelatin), 3 (uncut milled chia), 4 (uncut whole chia), 5 (removed milled chia), 6 (Whole chia removed), as treatment 4 recorded the highest microbial contamination (4 x 10) and the least contamination for treatments, 1,2 amounting to (0). Chemical tests were conducted for gelatin extracted from seeds for the step 6 mentioned above, and step 1 (70.6) had the highest percentage of protein, and the lowest percentage was for treatment 6 (13.38). A microbial test after treatment 5 was selected "gelatin chia defatted flour", because the seeds without fat give a rate higher than gelatin, and a comparison was made between treatments 1 (Control without adding gelatin), 2 (vegetable gelatin), 3 (animal gelatin), 4 (removed milled chia). The jelly's aerobic bacteria appeared in the nutrient agar, and the treatment 2 recorded highest pollution ($1.5x\ 10^4$), and the treatment 4 less pollution ($1.1*10^4$). The jelly was also chemically examined for the four treatments, and treatment 4 (10.67) recorded the highest percentage of protein, and treatment 1 had the lowest percentage (0.63). After adding 0.5% of seed gelatin to the jelly, as treatment 4 was significantly superior in terms of appearance (7.00), flavor (taste, smell) (6.80), color (7.00), general acceptance (6.90), and appearance (7.00). It was concluded that the best percentage with its good specifications for consumer health and the least bacterial contamination was 0.5%.

Keywords: Chia seeds, Properties, Jelly.

Introduction

Chia, the English name CHIA SEED, its scientific name L Salvia hispanica, that it is known by the name of the chia plant or Spanish sage (Cahill j) 2003), the original home of chia is Mexico and northern Guatemala (Capitani, et al. 2008). Chia seeds have been used as food since (3500 BC) , so gained importance between (900 BC and 1500 BC) in central Mexico, Ayerza 2005). It is a type of medicinal and food plant used since ancient times by the Mayans and Aztecs in recent times. Recently, there has been increasing interest and spread of plant seeds for their health benefits and uses in cooking for their importance in the prevention of heart disease. Chia seeds help to reduce blood cholesterol and reduce high blood pressure (Ayerza, 2005), which prevents exposure to atherosclerosis, which in turn reduces of heart disease, it is a rich source of protein and fat and a high percentage of polyunsaturated fatty acids (Vuksan, 2007) and the most important Omega 3 (Grancieri, 2019) Several studies have been presented that regular consumption of Omega 3 has many effects on health, including the prevention of cardiovascular disease and hypertension (Albert, et al., 2005, Garg et al. 2006), especially alpha-linolenic acid, which accounts for nearly 60% of all fatty acids. Linoleic,oleic and palmite acids found in small amounts (Grancieri, 2019), dietary fiber, minerals, vitamins and antioxidants all incorporated into this tiny seed. Chia seeds are a source of the vitamins(B) thiamine (0.62 mg/100 g), riboflavin (0.17 mg/100 g), niacin (883 mg/100 gm). 100 gm) and folic acid (49 mg/100 gm) (Nutritional Nutrient Database for Standard Reference, Release 24, 2011). Chia contains flavonoids that influence many biochemical

activities such as antioxidant, hepatoprotective, antibacterial, anti-inflammatory, anticancer and antiviral (Critchfield et al., 1996 ; Cushnie et al., 2012; Zandi et al., 2011, Li et al., 2005). Chia seeds are a source of minerals as they contain sixfold more calcium, 11 times more phosphorous and 4 times more potassium than dairy cows .It meets the calcium needs of the body , thereby enhancing the health and strengthening of the bones and prevention of various bone diseases such as osteoporosis (Beltran - Orozco et al., 2003). Oilseeds and their essential oils, including chia seeds, are a source of natural medicines, as they contain metabolic by-products that have biological activity, such as anti-bacterial, anti-fungal, and anti-oxidants, (Deans and Sroboda, 1993), elimination of constipation and weight loss. Chia seeds contain dietary fiber, which has a role in the daily diet (Borderias et al., 2005), and fiber plays a role in protecting the digestive system from disorders (Borderias et al., 2005), especially it is gluten-free, and as such it is consumed by patients with disorders and it helps enhanced bowel movement leading to the elimination of constipation, hemorrhages and metabolic disorders. (Manas et al., 1994), It contains about 30-34 gm, which represents the non-soluble part is about 85-93%, while the soluble (SDF) is about 7-15%., each spoonful of chia seeds contains 5 g of fiber.

Chia seed oil has been known since ancient times, as it was used in traditional medicine against eye infections and stomach disorders (Reyes-Caudillo et al., 2008, Lu and Foo, 2002). Chia seed oil ranges from 25 to 50% and contains high concentrations of polyunsaturated fatty acids (Ayerza and Coates, 2005). Research has shown that the oil and extracted from chia seeds also contain many phenolic compounds such as tocopherols, phytosterols and carotenoids. With its antioxidant activity, which plays a very important role in oil degradation due to fat oxidation (Matthaus, 2002; Lxtaina, et al. 2011).

The current study aims to identify the effect of adding natural gelatin extracted from chia seeds on the microbial, chemical, sensory and storage properties of the manufactured jelly).

Materials and Methods

Chia seeds were obtained from the local market, from the(Shorja market), then diagnosed by the university herbaria , according to the attached book No. 89 / D.A., after that the seeds were examined by a sensory, chemical and microbial assay.

Methods Extraction of gelatin from chia seeds: Several methods were carried out to extract gelatin and on the basis of this it was found that the best way to extract gelatin from chia seeds is:

The aqueous extraction: Water has been recovered for seeds according to method described by (Pin, 1997), Der and Gow-Chin, where 10 gm of seeds were extracted with 300 ml of distilled water at boiling point and left for 30 minutes on the magnetic stirrer, filtered through a boring cloth, then focus with a rotary evaporator at a temperature of less than 70 °C. after that pour the concentrated extract into a Petri dish and put it in the electric oven at a temperature of 40 / 24 hours to dry. The dried powder scraped and collected in sterilized boxes until use.

Extraction efficiency: The rating of gelatin extraction from the seeds was estimated according to the following equation. Extraction efficiency = Weight of the extract / 50g X 100

Microbial examinations of chia gelatin: The microbial examination was carried out by using the pour-plate method that mentioned by (Mccance and Harrigan, 1976), as the culture media used Nutrient Agar bacteria and fungi (PDA). So there have been mitigation 10-10 and three are repeated ,on the basis of that, the total number of bacteria and fungi was calculated and incubated at a temperature of 37 ° C ,24 hours to bacteria and 5 days for fungi at a temperature 35 c

Chemical tests for Chia gelatin: Chemical tests were carried out for gelatin extracted from chia seeds, and the chemical components of Chia seeds gelatin were estimated, including the ratios (fat, protein, ash, moisture and total carbohydrates).

Statistical analysis: The (Statistical Analysis System 2012) SAS was used to analyze the data to study the effect of different treatments on the studied traits according to a complete random design (CRD), and the significant differences between the means were compared with the LSD - Least (Significant Difference) test. The best Gelatin in terms of the ratio and cost of chia seeds to introduce the product into the jelly industry.

Manufacturing:

Jelly industry: Weights of ingredients used in the jelly industry included: 4 cup cranberry juice, 1 cup water 1, 1 cutting apple, 1.5 gelatin. Put it in pot and mashing it a little and adding cup of water to each 4 cups of it and covered the pot ,finally put it on low heat, better add a sliced apple with it. Liquidates juice and concentrate in the general way

To make jelly , add the sugar to the juice by account cup to each one and the way is finished by general way to make jelly.

Treatments and the average of adding: The gelatin excerpted is used by 0.5%, after that we get the following treatments:

1- Control without adding gelatin
2- Industrial vegetable gelatin
3- Animal gelatin
4- The best proportion of chia seed gelatin

Chemical test, microbial test, sensory test, parameters, percentage of addition %, control without adding gelatin, industrial vegetable gelatin, industrial animal gelatin, the best percentage of gelatin from seeds chia,

Sensory test: the product (jelly) was evaluated according to the form approved by the Department of Food and Nutrition in the US state of Kansas (1975). The above product was evaluated by 10 assessors in terms of sensory characteristics, including (appearance, texture, flavor (taste + smell), color, and general acceptance)

Results and Discussion

Percentages of gelatin extracted by using the three Methods: Table (1) shows the efficiency ratios of extraction by different methods, as it was noted that there were significant differences at the probability level of $P < 0.05$ between the treatments, as the highest extraction rate was found when treatment (3) and the lowest extraction rates when treatment (1) These differences are due to following the different methods of extracting natural gelatin to the chia seeds by water extraction at a ratio of (1:20) (one), which was removed from the seeds by extracting it with hexane, and that the gelatin extracted with boiling water only without exposing it to a direct heat source is better in terms of obtaining golden- gelatin. As exposure to a direct heat source leads to obtaining dark colored gelatin due to the presence of tannins (Jani et al., 2009).

PDA, Microbial examination of gelatin seeds (chia): Table (2) shows Preparation of aerobic bacteria, staphylococcus, coliform bacteria, and fungi (molds and yeasts), since bacteria and fungi did not appear in the culture media (Nutrient Agar, MacConkey Agar, Isolation and diagnosis of colon bacteria) Mental Acar Sale (Counting Staphylococcus aureus), PDA (fungus isolation and identification), while no significant differences were found between all treatments. Aerobic bacteria appeared in the Nutrien Agar culture medium in the treatments, which were 1 (vegetable gelatin), 2 (animal gelatin), 3 (ground chia seeds), 4 (whole chia seeds), (5 sifted chia seeds), 6 (whole chia seeds). The highest numbers were in treatment (4), which reached, and the lowest numbers were in treatment (5), which reached, and these numbers above are less than the permissible limits when compared with what was mentioned in the standard specification No. 2270/16 (2006), which is (1 × 10).

Table (3) shows that there are significant differences at the probability level ($P < 0.05$ between all the mentioned treatments are 1 (vegetable gelatin), 2 (animal gelatin), 3 (ground chia, 4 (ground whole chia), 5 (ground removed whole chia), 6 (whole ground chia), with the highest percentage reaching Carbohydrates in treatment 4 amounted to (38.59), and the lowest percentage in treatment 1 was (0.35), being a gelatinous substance extracted from green herbs. Marine fish consisting of a mixture of carbohydrates extracted (2015) Frank D, while the protein reached the highest percentage in model 1 of (87) because it is a mixture of peptides and proteins made of hydrolyzed collagen made from bones, skin and connective tissue of animals (Ahmed T 2017), and the lowest percentage in Model 6 and contains the chia role on the top. Chia seeds contain the highest percentage of protein compared to other grains and according to varieties such as wheat (11.8) oats (13.6 g), barley (11.5 g), rice (6.8 g) and maize (11.1 g), Ayerza and Coates, (2005; USDA 2007). Gopalan, et al. (2011). Chia seeds are an important source of peptides. Biologically active as it contains a high concentration of proteins and essential amino acids, while the high percentage of fat in treatment 4 reached (35.56), and the lowest percentage of lipid in treatment 1 amounted to (0.66), and ash reached the highest percentage in treatment 6, 6.610 and the lowest percentage in treatment 1 (3.0), and moisture was the highest percentage in treatment 3 and reached (11.69) and the lowest percentage in treatment 2 was (5.66), so treatment 5 was adopted in the fortification of jelly because it contains a high percentage of protein, defatted seeds produce a higher percentage of gelatin than seeds.

Microbial examination results for the jelly : Table (4) shows the numbers of aerobic bacteria, coliform bacteria, staphylococcus bacteria and fungi (molds and yeasts) if they did not appear bacteria and fungi in culture media, Mental Sale Acar, PDA, MacConkey Agar, in the aforementioned treatments (1-4), treatment 2 had the highest bacterial contamination, amounting to (1.5 x 10), while the lowest number in treatment 4, which amounted to (1.1 x 10). It is less than the permissible limit mentioned above, but from a statistical point of view, its highest numbers were in treatment 2 of (1.5 x 10) and the lowest bacterial load in treatment 5 (0

x 10), and these numbers above fall within the permissible limits when compared with what was mentioned in the specification the standard (2020) is (1 x 10). Statistically speaking, no significant differences were observed between all the above-mentioned treatments.

The results of the chemical jelly examination: Observed table (5) showed that there were significant differences at the probability level ($P < 0.05$) between all treatments in terms of moisture, ash, fat, protein and carbohydrates, It was found that the percentage of moisture in treatment 1 had the highest value of (75.6) compared to treatments (2, 3, 4), while factor 4 had the lowest percentage, which amounted to (66.5). As for ash, the highest percentage was in treatment 2, which amounted to (2.13), and the lowest percentage in treatment 1 was (1.23). Fat percentages also reached the highest percentage in treatment 4 (8.16), and the lowest percentage in treatment 1 (0.63). As for protein, the highest percentage was in treatment 4 (9.15), and the lowest percentage was in treatment 1 (0.63), and carbohydrates had the highest percentage in treatment 3 (22.76) and the lowest percentage in treatment 4 (13.01).

Sensory evaluation results for jelly: Table (6) shows the parameters, which are 1 (control) 2 (vegetable gelatin), 3 (animal gelatin), 4 (ground chia seeds removed). All the aforementioned sensory characteristics (appearance, texture, flavor (taste + smell), color, general receptivity). As treatment 4 was significantly superior in terms of appearance (7.00), flavor (6.80), color (7.00), and general acceptance (6.90). And treatment 4 was outperformed by appearance (7.00). As for treatment 2, it got the lowest score of 6.50 in terms of appearance. And treatments (1, 2) got the lowest percentage of flavor, which is 6.30.

Table (1) Percentages of extracted gelatin

Extraction methods	percentage
1-extracte gelatin with boiling water by heat source	0.4%
2-extracte by chemical methods	1%
3-extracte boiling water	3%
4-volue of LSD	1.027*

*(p<0.05).

Table (2) Microbial examination of chia seed gelatin

Treatment	Nutrient agar	Mental agar	MacConkey agar	PDA
Vegetable gelatin	-	-	-	-
Animal gelatin	-	-	-	-
Ground chia gelatin	2*10	-	-	-
Whole gelatin chia	4*10	-	-	-
Ground removed chia gelatin	1.3*10	-	-	-
Whole ground chia gelatin	3.1*10	-	-	-
LSD value	14.07*	NS	NS	NS

(p<0.05)*

*Each number represents 3 average replicates, * The symbol - indicates that no microbial contamination appeared in the culture media * NS: Not significant, *: Significant Results of the chemical examination of seed gelatin (chia):

Table (3): Results for Chemical Assay of (Chia seeds)

Treatment	Carbohydrates	Protein	Lipid	Ash	Moisture
Vegetable gelatin	0.35	70.6	0.66	3.0	8.54
Animal gelatin	20.13	87	0.70	3.16	5.66
Ground chia gelatin	27	25.60	35.52	3.63	11.69
Whole gelatin chia	38.59	14.83	35.56	5.76	8.89
Ground removed chia gelatin	34.66	13.56	29.20	5.32	7.66
Whole ground chia gelatin	37.52	13.38	32.19	6.61	8.13
LSD value	5.28*	4.98*	7.72*	2.66*	2.05*

*(p<0.05)

Table (4) of the results of the microbiological examination of the jelly

Treatment	Nutrient agar	MacConkey agar	Mental Agar sale	PDA
Control	1.4*10	-	-	-
Vegetable gelatin	1.5*10	-	-	-
Animal gelatin	1.4*10	-	-	-
Removed ground chia	1.1*10	-	-	-
LSD value	0.07NS	NS	NS	NS

*Each number represents an average of 3 replicates, * The results are averaged for three replicates, * Symbol - indicates that no microbial contamination appeared in the culture media * *NS: Not significant

Table (5) The results of the chemical examination of the jelly

Treatment	Moisture	Ash	Protein	Carbohydrate
Control	75.6	1.23	0.63	22.02
Vegetable gelatin	69.89	2.13	4.5	17.79
Animal gelatin	70.36	2.11	8.13	22.76
Removed ground chia gelatin	66.5	1.66	9.15	13.01
Value LSD	4.83*	0.771*	2.66*	4.07*

Table (6) Sensory evaluation results for the average jelly

Treatment	appearance	Heavy overall	Flavor (tastes and smells)	Color	Public acceptance
Jelly free from any add	6.80+-0.20	+_0.226.40	6.30_+0.30	+-0.206.80	6.40+_0.30
Gelly+ vegetable gelatin	6.50+-0.27	_+0.166.60	6.30+_0.26	+_0.136.80	6.30+_0.26
Animal gelatin	6.70+-0.21	+-0.067.00	6.60+-0.22	+_0.226.40	6.50+_0.31
Gelatin chia	7.00+-0.05	+_0.206.80	6.80+-0.13	+_0.057.00	6.90+_0.10

The degrees : *7 excellent , 6 very good ,5 good, 4 medium , 3 accepted ,2 poor, 1 very poor, *Every number in the table represents a rate of 10 denominators, *general acceptance represents the sum of sensory qualities, *NS, unreasonable , *reasonable

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