

Preparation of Functional Yoghurt by using Untraditional Fruit (*Passiflora edulis*).

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ABSTRACT

This study was aimed to evaluate the effect of using passiflora (*Passiflora edulis*) to produce functional yoghurt on the biochemical profile of hypothyroidism rats. Yoghurt was produced using five formulas and their chemical, physicochemical and sensory properties were determined. Biological assay was conducted on hypothyroidism rats. It was found that gallic acid and catechol were the dominant phenolic compound in passion fruit. Also, the results indicated that yoghurt made from passiflora juice prepared by water and cow milk [1:1] (sample5) contained high amounts of crude protein and crude fat, while yoghurt made from 100% cow milk (sample1) receded a high content of ash and yoghurt made from Passiflora juice prepared by water (sample2) had a highest content of Total carbohydrate. In addition PH was ranged from 4.51 to 4.63 as the type of yoghurt formula. Meanwhile the sensory evaluation data demonstrated that, the highest value of flavor and overall acceptability were 9.45 and 9.55 show in (sample1) and (sample5), respectively. Concerning the biological assay, the obtained results showed that feeding on functional yoghurt treated with passion fruit, decreased LDL-cholesterol and vLDL-cholesterol at the end of experimental period and increased HDL-cholesterol levels compared with (-ve group) and (+ve group). In addition that yoghurt enhanced with passion fruit helped to improve of liver kidney functions. On the other hand serum thyroid hormones level showed that triiodothyronine (T3) in the blood plasma was decreased in hypothyroidism groups, which fed on different yoghurt sample. Meanwhile thyroxine (T4) recorded an improvement in groups fed on yoghurt treated with passion fruit and L-thyroxin drug group (+ve). Feeding on yoghurt made from passiflora juice prepared by water and cow milk [3:1] (group 8) and [1:1] (group 7) significantly increased the level of thyroid stimulating hormone (TSH) in the blood plasma (5.02 and 4.98 μ U/ml, respectively). The previous results reported that yoghurt treated with passiflora juice helped to improve thyroid hormones level in rats.

Keywords: Hypothyroidism, thyroxin, functional yoghurt, Passiflora Edulis.

INTRODUCTION

The thyroid hormones are central to carnal development. Animals and human studies denote thyroid hormones front a charge in cardiovascular, cowardly, immune, and reproductive system development and function (Krassas, 2000). Hyperthyroidism is condition in which the thyiroid gland produces and excretes excessive amounts of the free thyroid hormones, triiodothyronine (T3) and thyroxin (T4) (Seragides, *et al.*, 2002).

Nutrition is a key requirement to supply tyrosine and iodine to the thyroid gland so it can produce a adequate amounts of T4 hormone. Cow milk and yoghurt are common sources of dietary iodine. (Johanna 2013). Passion fruit can be grown to eat or for its juice, which is often added to other fruit juices to enhance aroma. The fruit is eaten alone or in fruit salads, sherbets, ice cream, jams, cool drinks and as concentrates. The yellow variety is used for juice processing, while the purple variety is sold in fresh fruit markets (Akali and Maiti., 2006). The interest in *Passiflora edulis* has been increased because of its antioxidant compounds Coleta *et al.*, (2006). In addition *Passiflora edulis* (Passion Fruit) known for its amazing nutritional and medicinal place. Plants have been widely used throughout the world for their beneficial medicinal benefits. Plants are the richest generator of phyto-element (Phamiwon and Sheila 2016).

According to Córdova,(2005), some studies have shown the functional belongings of the passion peel, especially those related to the content and type of fiber. Due to these characteristics and functional properties, passion fruit has no longer been considered an industrial waste since it can be used in the maturation of new product.

The purpose of this study was to prepare functional yoghurt by using untraditional fruit namely passion fruit (*Passiflora edulis*). The produced yoghurt was evaluated chemically, organoleptically and biologically.

MATERIALS AND METHODS

Materials

Cow milk and fresh sweet whey were obtained from Food Technology Research Institute, Agricultural Research Center, Giza, Egypt.

Passiflora (Passiflora edulis): were obtained from local market in Cairo, Egypt.

Commercial yoghurt culture (1%) Direct Vat Set (DVS) of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* sub sp. *Bulgaricus* were purchased from Chr. Hansen, Laboratories, Capenhave, Denmark.

Thiouracil drug © (4-Hydroxy-2-mercapto-6-methylpyrimidine (MTU) and L-thyroxin drug © Thiouracil were one of product of Sanofi- Synthelabo Company, Paris, France.

Male albino rats (160 \pm 20g) were obtained from Laboratory of Animal Colony, Helwan, Egypt.

Methods

Preparation of *Passiflora edulis* juice

Passiflora was cleaned with tap water, then the selected fruits were cut in small pieces and put it in the mixer and mixed it well with water (750g fruits : 250 ml water) for 3 min. This was followed by refined by passing it through the muslin cloth to get passiflora juice (PJWA) and to prepared (PJWH) we were mixed fruits with fresh sweet whey (750 of fruits : 250 ml whey) as the same way.

yoghurt Formulation

Five yoghurt formulas were produced by varying the proportions of cow milk, passiflora and whey as follow:

Sample 1: yoghurt made from 100% cow milk (CM).

Sample 2: yoghurt made from passiflora juice prepared by water (PJWA).

Sample 3: yoghurt made from passiflora juice prepared by whey (PJWH).

Sample 4: yoghurt made from passiflora juice (PJWA) and cow milk [3:1].

Sample 5: yoghurt made from passiflora juice (PJWA) and cow milk [1:1].

The samples were sweetened with 3% sucrose and pasteurized at 85°C for 15 minutes (Amanze and Amanze, 2011). The mixture was cooled to 43°C and inoculated with Commercial yoghurt culture Direct Vat Set (DVS) cultures (0.1 g/L of yoghurt mix) Lee *et al.*, (1990), transferred to 250 ml plastic cups, incubated at 45°C for 3-6 h for fully coagulation, and refrigerated. In samples 2, 3, 4 and 5 were added 0.5% gelatin. It was used as stabilizer to increase the firmness and viscosity of yoghurt (Tamime and Robinson, 1999).

Chemical analysis

Gross chemical composition

Moisture, protein, lipid and ash contents of yoghurt samples were determined using standard methods (A.O.A.C., 2000). Total carbohydrates content were calculated by difference. The pH was determined using a pH meter while acidity was measured as describe by Osundahunsi *et al.*, (2007).

HPLC analysis of phenolic compound

Phenolic compounds of *Passiflora edulis* was fractionated and identified according to the proposed method of Merfort, *et al.*, (1997).

Sensory evaluation

Sensory evaluation of tested yoghurt samples were performed by 10 panelists using a descriptive test by Bamishaiye and Bamishaiye, (2011).

Biological assay

Animals and experiential design

The study was performed on male albino rats (160±20g). The animals were housed in plastic cages with metallic stainless covers. They were kept under constant laboratory conditions room temperature 25±2°C and lighting (12L: 12d) and given free access of food and water throughout the experimental period. Rats were fed on basal diet for 7 days before the beginning of the experiment for adaptation. The standard diet prepared according to the proposed method of, Reeves, *et al.*, (1993).

Experimental design

After adaptation period the animals were randomly divided into 9 groups of 5 rats each and one of them was kept as a negative (-ve) control group. Rats were administered intraperitoneally with 6-n-propyl-2-thiouracil (PTU, 10 mg/kg) for 15 days to induce hypothyroidism by the method used by (Davidson *et al.*, 1978).

Hypothyroidism group was kept as a positive (+ve) control group and rats in group (G4-G8) were

orally administration at a dose of 2 ml yoghurt/rat/day for 28 day. The groups show as follows:

Group (1): -ve: Fed on basal diet

Group (2): +ve: Thiouracil group fed on basal diet

Group (3): Fed on basal diet and injection of L-thyroxine drug at a dose of 0.5 mg/kg according to the previous established method (Saxena *et al.*, 2012).

Group (4): Fed on basal diet and 100% cow milk yoghurt.

Group (5): Fed on basal diet and PJWA yoghurt.

Group (6): Fed on basal diet and PJWH yoghurt.

Group (7): Fed on basal diet and yoghurt with premix PJWA: cow milk [3:1] Group (8): Fed on basal diet and yoghurt with premix PJWA: cow milk [1:1]

Body weight was recorded to calculate body weight gain at the end of experiment. Food Efficiency Ratio (FER) was calculated at the end of experiment as following:

$$\text{FER} = \frac{\text{Body weight gain (g)}}{\text{Food intake (g)}}$$

Blood samples were collected at the end of experiment from the eye plexuses by fine capillary glass tubes into a dry clean centrifuged glass tube to prepare the serum. Blood samples were left 15 min at room temperature then the tubes were centrifuged for 10 min at 3000 rpm and supernatant was kept frozen at -20 °C.

Biochemical Analysis

Lipid profile: Serum total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL-c), low density lipoprotein (LDL-c) and Very low density lipoprotein (vLDL-c) were determined by the methods of Roeschlau, *et al.*, (1974) and Fossati and Prencipel (1982), respectively.

Liver functions: Serum aspartate amino-transferase (AST) and alanine amino-transferase (ALT) concentrations were determined according to (Reitman and Frankel 1957).

Kidney functions: Serum creatinine, uric acid and urea levels were determined according to Bartles, *et al.*, (1972), Caraway, (1955) and Han, *et al.*, (1984).

Thyroid hormones: Serum levels of tri-iodothyronine (T3), thyroxine (T4) and thyroid stimulating hormone (TSH) were analyzed by colorimetric competitive enzyme immunoassay using individual ELISA kits according to Larsen, (1972), Schuur and Van Weeman, (1977) and Bhowmich, *et al.*, (2007).

Statistical analysis

Results are expressed as the mean standard deviation SD. Data were statistically analyzed of variance "ANOVA" test at $P \leq 0.05$ according to (Vandallen, 1997), using SPSS statistical software, version 13.0 was used for these calculations.

RESULTS AND DISCUSSION

Phenolic compounds content of *Passiflora Edulis*

The results presented in Fig (1) show that phenolic compound content of *Passiflora Edulis* ranged from 0.17 mg/100g to 160.54mg/100g. It clearly that gallic acid was the most predominant component, (160.54mg/100g) followed by Catechol and insenoside

(120.87 and 93.7mg/100g, respectively). While Benzo – a -pyrene, P-Hydroxycinnamic and Acetylsalicylic acid were recorded the lowest content of phenolic compounds(0.17, 0.28 and 0.357mg/100g, respectively).

These results confirmed with those of Phamiwon and Sheila (2016) who found that the passiflora had a wide ranges of phytochemical constituents from the plant like flavonoids, tannins, phenol.

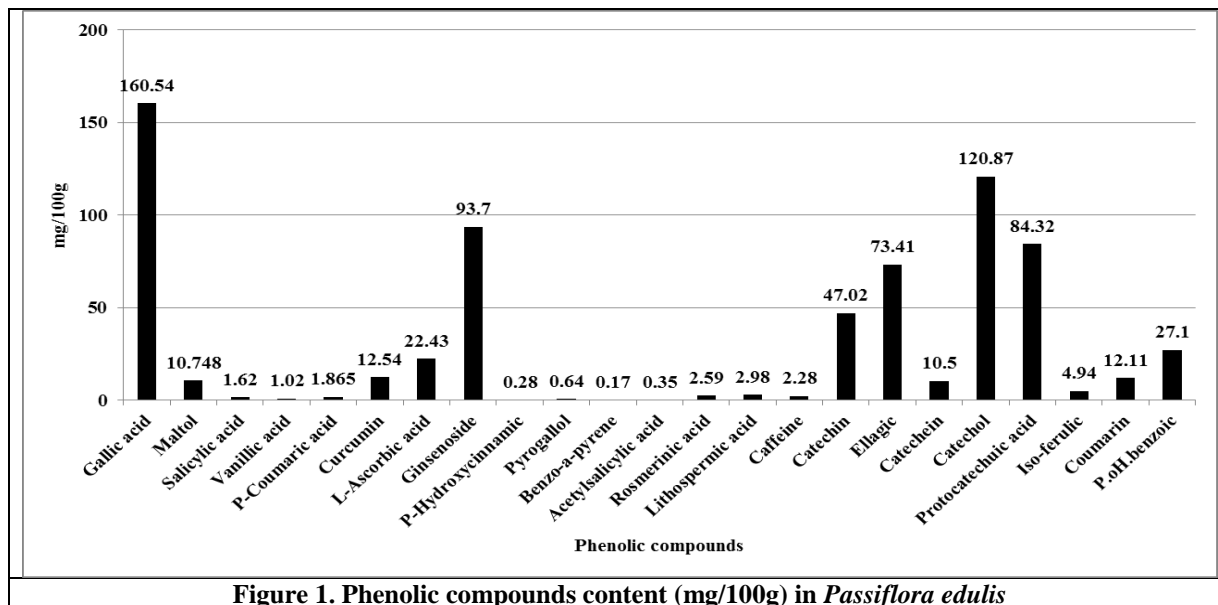


Figure 1. Phenolic compounds content (mg/100g) in *Passiflora edulis*

Chemical composition of processed functional yoghurt samples

The change in proximate compositions of yoghurt samples are shown in Table (1).

Table 1. Chemical composition of processed yoghurt samples using passiflora juice and cow milk (100g WW)

Yoghurt samples	(1)	(2)	(3)	(4)	(5)
Parameter					
Moisture%	87.91	86.92	87.47	88.91	88.01
Crud protein%	3.76	1.36	2.85	3.56	3.80
Crud fat%	3.72	1.55	2.29	2.51	3.87
Ash%	0.69	0.57	0.56	0.64	0.66
Total carbohydrate%	3.92	9.60	6.83	4.38	3.66
pH	4.51	4.62	4.63	4.60	4.55
Total acidity%	0.30	0.19	0.22	0.18	0.28

- Sample 1: yoghurt made from 100% cow milk
- Sample 2: yoghurt made from passiflora juice prepared by water
- Sample 3: yoghurt made from passiflora juice prepared by whey
- Sample 4: yoghurt made from passiflora juice prepared by water and cow milk [3:1]
- Sample 5: yoghurt made from passiflora juice prepared by water and cow milk [1:1]

All samples had a high moisture content (86.92% to 88.91%). It could be observed that crude protein in yoghurt samples(1,4 and 5) made from 100%cow milk, from passiflora juice and cow milk (3:1) and from passiflora juice and cow milk (1:1) had the highest protein contents(3.76 , 3.56 and 3.80%,

respectively) compared with the other yoghurt samples. On the other hand, (Sample2) yoghurt made from passiflora juice prepared by water had the highest amount of total carbohydrate content (9.60%). While (Sample5) had the highest fat content (3.87%) followed by (Sample1) (3.72%) and (Sample4) (2.51%).

However, ash content ranged between 0.56% (Sample3) yoghurt made from passiflora juice prepared by whey to 0.69% in (Sample1). Also, in the same table PH was ranged from 4.51 to 4.63 as the type of yoghurt formula it was within the standard pH of good quality yoghurt (Tamime, 1977). Total acidity was recorded 0.18, 0.19, 0.22, 0.28 and 0.30% to Sample4, Sample2, Sample3, Sample5 and Sample1, respectively.

Sensory evaluation of processed functional yoghurt samples

Sensory score of yoghurt samples from the five formulas is shown in Table (2). The results showed no significant difference in color in the formulas yoghurt 100% cow milk (sample1) , yoghurt made from passiflora juice prepared by water and cow milk [1:1] (sample5) and yoghurt made from passiflora juice prepared by water and cow milk [3:1] (sample 4) with average scores of 9.72 , 9.60 and 9.20, respectively. While in (sample 3) yoghurt made from passiflora juice prepared by whey and (sample2) yoghurt made from passiflora juice prepared by water it was recorded 8.77 and 8.55, respectively. However, Taste scores of yoghurt samples ranged from 7.00 to 9.98 in (sample2) and (sample5), respectively.

Table 2. Organoleptic properties of processed yoghurt samples using passiflora juice and cow milk

Yoghurt samples	Sensory evaluation	Color (10)	Taste (10)	Flavor (10)	Texture (10)	Overall acceptability (10)
(1)		9.72±0.38 ^a	9.91±0.32 ^a	9.45±0.42 ^a	9.15±0.31 ^a	9.55±0.39 ^a
(2)		8.55±0.42 ^b	7.00±0.49 ^b	8.22±0.36 ^b	8.89±0.42 ^a	8.17±0.45 ^b
(3)		8.77±0.43 ^b	7.45±0.44 ^b	8.35±0.33 ^b	7.95±0.49 ^b	8.14±0.46 ^b
(4)		9.20±0.37 ^a	8.98±0.34 ^b	8.64±0.31 ^b	8.86±0.37 ^a	8.92±0.42 ^b
(5)		9.60±0.38 ^a	9.98±0.32 ^a	8.94±0.32 ^b	8.86±0.37 ^a	9.35±0.38 ^a

Means values in having the same letter(s) within each column are not significantly different (P< 0.05).

Sample 1: yoghurt made from 100% cow milk

Sample 2: yoghurt made from passiflora juice prepared by water

Sample 3: yoghurt made from passiflora juice prepared by whey

Sample 4: yoghurt made from passiflora juice prepared by water and cow milk [3:1]

Sample 5: yoghurt made from passiflora juice prepared by water and cow milk [1:1]

While texture scores were recorded significant differences between sample (3) and other yoghurt samples. On the other hand tabulated data revealed that the highest value of flavor and overall acceptability were 9.45 and 9.55, respectively show in (sample1) compared with other yoghurt samples flowed by (sample5) and (sample4). It could be noticed that consumers generally expect a clean white color in yoghurt which is the case with non-fruit or unflavored yoghurts (Tamime and Robinson, 2004).

Biochemical evaluation of functional yoghurt

Body weight feeding parameter

The body weights of rats during the housing period in each group are shown in Table (3). The results

indicate that weight gain of the hypothyroidism group (+ve control) was significantly lower than control (20.64 < 98.76g). But when this group treated with L-thyroxin drug, this value improved and increased to 97.59 g. Where weight gain reached 92.44g in group (5) which feed on yoghurt enhanced with passiflora water juice and cow milk 1:1 (group5). There were no differences (P>0.05) in food intake between experimental groups and - ve control group except in +ve control group which recorded the lowest score (13.94g/d). On the other hand the same trend was observed in food efficiency ratio, where it was 0.187 (-ve control) group and 0.67 in (+ve control) group.

Table 3. Body weight, feed intake and FRE of hypothyroidism rats fed on yoghurt enhanced with passiflora juice

Groups	Parameters	Weight gain (g)	Daily food intake (g/d)	Food efficiency Ratio (FER)
Group (1): -ve		98.76±8.11 ^a	17.94± 2.20 ^a	0.187±0.03 ^a
Group (2): +ve		20.64±8.11 ^d	13.94± 2.20 ^d	0.67±0.06 ^c
Group (3): L-thyroxin		97.59± 6.11 ^a	17.80± 2.03 ^a	0.182±0.02 ^b
Treated groups	Group (4)	82.13±9.11 ^d	16.57±2.28 ^a	0.180±0.07 ^c
	Group (5)	85.13±9.13 ^c	16.66±2.32 ^a	0.185±0.04 ^{ab}
	Group (6)	88.77±9.17 ^c	16.65±2.21 ^a	0.183±0.03 ^b
	Group (7)	89.44±9.17 ^b	16.68±2.92 ^a	0.185±0.04 ^{ab}
	Group (8)	92.44±9.17 ^b	16.66±2.32 ^a	0.180±0.04 ^c

Means values in having the same letter(s) within each column are not significantly different (P< 0.05).

G1 to G8 see materials and methods.

Lipids lipid profile:

The results in Table (4) show the effect of different yoghurt samples on total cholesterol (TC), triglycerides (TG), LDL-c, HDL-c and vLDL-c of normal and hypothyroidism rats. From the obtained data, it could be observed that, levels of, LDL-cholesterol and vLDL-cholesterol at the end of experimental period, were decreased in groups which fed yoghurt samples which prepared by passiflora juice with or without cow milk. While (+ve group) was recorded the higher blood LDL-cholesterol and vLDL-Cholesterol levels. It was the lowest decline in LDL-cholesterol and vLDL-Cholesterol levels appeared in the G4 fed on yoghurt made from Passiflora juice prepared

by water followed by G5 yoghurt made from passiflora juice prepared by water then G8 yoghurt made from passiflora juice prepared by water and cow milk [1:1] and G7 yoghurt made from passiflora juice prepared by water and cow milk [3:1], respectively. On the contrary, the groups which fed yoghurt samples which prepared by passiflora juice with or without cow milk significantly increase HDL-cholesterol levels compared with (-ve group) and (+ve group) to reach its highest level in G4 reaching 53.97mg/dl. Similar results were found that *P. edulis* juice increased HDL-c levels and decreased total cholesterol and LDLc, Maricelma *et al.*, (2012).

Table 4. Effect of feeding on yoghurt enhanced with passiflora juice and cow milk on serum lipid profile of rats

Groups	Parameters	TC mg/dl	TG mg/dl	LDL-c mg/dl	HDL-c mg/dl	vLDL-c mg/dl
Group (1): -ve		75.49 ±3.86 ^e	45.16±2.28 ^e	28.35±0.71 ^b	38.30±2.25 ^d	9.03±0.457 ^c
Group (2): +ve		121.46 ±3.84 ^a	75.43±4.15 ^a	86.21±2.83 ^a	19.47±1.18 ^e	15.85±0.83 ^a
Treated groups	Group (3): L- thyroxin	76.48±4.28 ^d	45.34 ±3.03 ^e	28.38 ±1.76 ^b	39.02±2.76 ^d	9.79±0.75 ^b
	Group (4)	90.27±4.71 ^b	60.19±4.02 ^b	22.03±0.42 ^e	53.97±2.61 ^a	9.09±0.61 ^{bc}
	Group (5)	81.27±4.54 ^c	51.19±3.46 ^c	24.03±0.37 ^d	46.97±2.75 ^b	9.43±0.62 ^b
	Group (6)	80.14±3.65 ^c	49.18±2.795 ^c	27. 71 ±2.36 ^c	42.60±1.74 ^b	9.83±0.59 ^b
	Group (7)	77.46±3.65 ^d	47.76±2.75 ^d	26.96 ±2.36 ^c	40.97±1.74 ^c	9.57±0.59 ^b
	Group (8)	77.11±3.65 ^d	47.19±2.75 ^d	26. 92 ±2.36 ^c	40.70±1.74 ^c	9.45±0.59 ^b

Means values in having the same letter(s) within each column are not significantly different (P< 0.05).

G1 to G8 see materials and methods.

Concerning the results of triglycerides in blood serum recorded 45.16 mg/dL blood serum for negative group, while, increased to 75.43 mg/dL in positive group. Also it was observed that no significant deference between rats treated with L- thyroxin and (-ve group) (45.34 and 45.16 mg/dl, respectively). The feeding of hypothyroidism rats on yoghurt samples which prepared by passiflora juice with or without cow milk reduced significantly blood triglycerides levels compared with those of +ve group (47.19, 47.76 , 49.18 , 51.19 and 60.19 mg/dl) for (G8, G7 , G6, G5and G4, respectively). While the total cholesterol of groups feed on yoghurt contained passiflora were seen decreased significantly from 121.46 to 77.11mg/dl in +ve group and group (8), respectively.

Liver functions

Table (5) summarized effect of the studied yoghurt samples on liver functions in male rats. As for liver function, aspartate amino-transferase (AST) and alanine amino-transferase (ALT) enzymes activity were analyzed.

Table 5. Effect of feeding on yoghurt enhanced with passiflora juice and cow milk on liver functions in male rats

Parameters Groups	AST (U/L)	ALT (U/L)	
Group (1): -ve	43.82±2.11 ^d	22.51±1.78 ^d	
Group (2): +ve	84.07±5.58 ^a	46.36±3.27 ^a	
Treated groups	Group (3): L-thyroxin	42.86±2.75 ^d	22.46±2.13 ^d
	Group (4)	60.08±5.12 ^b	37.99±3.18 ^b
	Group (5)	50.08±4.28 ^c	27. 99±3.43 ^c
	Group (6)	46.82±3.02 ^c	26.73±2.14 ^c
	Group (7)	47.08±4.13 ^c	25.13±3.43 ^c
	Group (8)	46.82±3.12 ^c	24.53±2.14 ^c

Means values in having the same letter(s) within each column are not significantly different (P< 0.05).

G1 to G8 see materials and methods.

Tabulated data in Table(5) show that as a result of hypothyroidism AST and ALT sharply increased from 43.82 and 22.51 U/L to 84.07 and 46.36 U/L, respectively. L-thyroxin drug reduced these values to 42.86 and 22.46 U/L, respectively. while feeding of hypothyroidism rats on yoghurt samples which prepared by passiflora juice with or without cow milk reduced significantly AST levels in compared with those of +ve group there values were 46.82, 46.82 , 47.08 , 50.08 and 60.08 U/L for G8, G6 , G7, G5and G4, respectively. On

the other hand ALT levels in yoghurt treated group were ranged from 24.53 U/L in G8 to 37.99 U/L in G4. These results are in agreement with those of Pragati *et al.*, (2015) demonstrate that *Passiflora nepalensis* extracts has potent hepatoprotective activity against simvastatin induced liver damage in rats. The results also imply that the hepatoprotective effects of *Passiflora nepalensis* may be due to its antioxidant activity.

Kidney functions

Data in Table (6) show that uric acid content increased from 1.51 to 2.99 mg/dL for -ve group and +ve group, respectively. L-thyroxin drug could reduce this value to 1.62 mg/dL and still approaching to the -ve group. The groups fed on yoghurt samples reduced uric acid value to be near of group treated with L-thyroxin drug. Concerning the results of creatinine content recorded 1.34, 3.91, 1.45, 2.82, 2.07, 2.00, 1.83 and 1.63g/dL in (-ve group), (+ve group), L-thyroxin drug, G4, G5, G6, G7 and G8, respectively. While results show that the mean values of urea levels was significantly different (P<0.05) in all groups. Positive group has the highest urea level (62.96 mg/dl) flowed by G5 (53.28 mg/dl), copared with (-ve group) (35.99 mg/dl).

Table 6. Effect of feeding on yoghurt enhanced with passiflora juice and cow milk on kidney functions in male rats

Parameters Groups	Uric acid mg/dl	Creatinine mg/dl	Urea nitrogen mg/dl	
Group (1): -ve	1.51±0.42 ^d	1.34±0. 54 ^d	35.99± 2.91 ^d	
Group (2): +ve	2.99±0.62 ^a	3.91±0.47 ^a	62.96±3.57 ^a	
Treated groups	Group(3): L-thyroxin	1.62±0.14 ^c	1.45±0.13 ^c	36.70±2.39 ^c
	Group (4)	1.98±0.34 ^b	2.82±0.32 ^b	53.28±4.76 ^a
	Group (5)	1.91±0.16 ^b	2.07±0.17 ^b	40.39±4.48 ^b
	Group (6)	1.84±0. 80 ^b	2.00±0.25 ^b	40.21±3.38 ^b
	Group (7)	1.80±0. 70 ^b	1.83±0.25 ^c	37.76±3.38 ^c
	Group (8)	1.75±0. 60 ^b	1.63±0.25 ^c	37.21±3.38 ^c

Means values in having the same letter(s) within each column are not significantly different (P< 0.05).

G1 to G8 see materials and methods.

Serum thyroid hormone

The level of thyroid hormone in the blood plasma of rats fed on different yoghurt samples was presented in Table (7). The maximum rate of increase of triiodothyronine (T3) in the blood plasma was observed at (+ve group) 6.82 µg/dl and markedly decreased levels

in hypothyroidism groups, both under normal(-ve group) and different yoghurt sample diets,(3.81,2.96, 2.81, 2.71, 2.52 , 2.32 and 2.30 µg/dl) for (G4 , G5, G6, G7, G1, G3 and G8,respectively). While thyroxine (T4) had the least value of 9.87 µg/dl in (-ve group) control and recorded the highest value of 18.33 µg/dl in (+ve) control. Meanwhile, it relatively decreased in L--thyroxin drug group and groups fed on different yoghurt samples with value of 11.81and 10.02 µg/dl, respectively.

Table 7. Effect of feeding on yoghurt enhanced with passiflora juice and cow milk on serum thyroid hormones in male rats

Parameter Groups	T3 (µg/dl)	T4 (µg/dl)	TSH (µIU/ml)	
Group (1): -ve	2.52±1.7 ^c	9.87±6.75 ^d	5.13±0.32 ^a	
Group (2): +ve	6.82±2.01 ^a	18.33±4.55 ^a	1.84±0.16 ^c	
Group(3):L--thyroxin	2.32±0.01 ^b	10.02±0.65 ^c	4.98±0.33 ^{ab}	
Treated groups	Group (4)	3.816±0.21 ^b	11.81±2.30 ^b	2.55±0.15 ^d
	Group (5)	2.96±0.11 ^b	11.15±0.80 ^b	3.65±0.13 ^d
	Group (6)	2.81±0.10 ^b	10.89±0.09 ^b	4.47±0.37 ^c
	Group (7)	2.71±0.12 ^c	10.59±0.70 ^c	4.98±0.21 ^b
	Group (8)	2.30±0.12 ^c	10.43±0.70 ^c	5.02±0.23 ^b

Means values in having the same letter(s) within each column are not significantly different (P< 0.05). G1 to G8 see materials and methods.

The level of thyroid stimulating hormone (TSH) in the blood plasma increased significantly in groups treated with yoghurt samples and L-thyroxin drug compared with (+ve group). The feeding of diets with yoghurt made from Passiflora juice prepared by water and cow milk [3:1] and [1:1] significantly increase the level of TSH in the blood plasma 5.02 and 4.98 µIU/ml, respectively. The previous results reported that yoghurt enhanced with passiflora juice helped to improve thyroid hormone level.

CONCLUSION

In conclusion, results of this study increase the current knowledge on the bioactive components of *Passiflora edulis*. These results provide important information for research on the health benefits of these fruits. It could be demonstrated that use of *Passiflora edulis* improved the level of thyroid hormones.

REFERENCES

A.O.A.C. (2000). Official Methods of Analysis Association of Official Analytical Chemists. 13th Ed. Published Chemists, Washington D.C, USA.
 Akali Sema and C S Maiti.(2006). Status and Prospects of Passion Fruit Industry in Northeast India. Central Institute of Horticulture, Medziphema-797 106,
 Amanze, K.O. and J.O. Amanze.(2011). Quality evaluation of yoghurt from cowmilk, soymilk and cow/soymilk. JORIND, 9(2): 44-47.
 Bamishaiye, E.I. and O.M. Bamishaiye. (2011). Tiger nut: as a plant, its Derivatives and benefits. African Journal of Food, Agriculture, Nutrition and Development, 11: 5157-5169.

Bartels, H.; Bohemer, M. and Heirli, C.(1972).Colorimetric kinetic method of creatinine. Clin. Chem. Acta., 37: 193.
 Bhowmich, S.K., Dasari, G., Leavens, K.L. and Rettig, K.R.(2007). The prevalence of elevated serum thyroid-stimulating hormone in childhood/adolescent obesity and of autoimmune thyroid diseases in a subgroup. J. of the National Medical Association. 99: 773-776.
 Caraway, W. T.(1955). Determination of uric acid in serum by a carbonate method. Amer. J. clin. Path., 25, 840.
 Coleta, M., Batista, M. T., Campos, M. G., Carvalho, R., Cotrim, M. D., de Lima, T. C. M. (2006). Neuropharmacological evaluation of the putative anxiolytic effects of *Passiflora edulis* Sims, its sub-fractions and flavonoid constituents. Phytotherapy Research, 20(12), 1067–1073.
 Córdova, K. R. (2005). Características físicas e químicas da casca do maracujá amarelo (*Passiflora edulis* Flavicarpa Degener) obtida por secagem. Boletim. CEPPA, v. 23, n. 2, p. 221-230.,
 Davidson, B., Soodak, M., Neary, J.T., Strout, H.V., Kieffer, J.D., Mover, H. and Maloof, F.(1978). The irreversible inactivation of thyroid peroxidase by methylmercaptoimidazole, thiouracil, and propylthiouracil in vitro and its relationship to in vivo findings. Endocrinology, 103, 871–882.
 Fossati P. and Prencipel L.(1982).Determination of triglycerides,Bicon Diagnostics, made in Germany. Clinical Chemistry; 28: 2077-2078
 Han, B.H.; Park, M.H.; Han, Y.N.and Shin, S.C.(1984).Studies on the antioxidant components of Korean ginseng Antifatigue active components. Yakhakhoe Chi , 28, 231–235.
 Johanna W. Lampe(2013). Fermented Foods: Intake and Implications for Cancer Risk. AICR's , Annual Research Conference on Food, Nutrition, Physical Activity and Cancer Can Food Processing Enhance Cancer Protection? November 7-8, 2013, Bethesda, MD.
 Krassas GE. (2000). Thyroid disease and female reproduction. Fertil Steril 74:1063–1070.
 Larsen, P.R.(1972). Triiodothyronine: Review of recent studies of its physiology and pathophysiology in man. Metabolism. 21:1073-1092.
 Lee, S.Y., Morr, C.V. and Gruber, V.A.(1990). Comparison of milk-based and soymilk-based yoghurt. J. Food Sci. 55:532-536.
 Maricelma da Silva Soares de Souza, Sandra Maria Barbalho, De'ora Cristina Damasceno, Marilza Vieira Cunha Rudge, Kleber Eduardo de Campos, Ana Carolina Goyos Madi, Bruno Ribeiro Coelho, Rodrigo Ce'sar Oliveira, Rodrigo Cartaxo de Melo, and Vin'cius Castrequini Donda.,(2012). Effects of *Passiflora edulis* (Yellow Passion) on Serum Lipids and Oxidative Stress Status of Wistar Rats. J. Med. Food 15 (1), 78–82 .

- Merfort, I.; Wary, V.S.M. and Willuhan, G.(1997). Flavonol triglycerides from seeds of *Nigella Sativa*. *Phytochem.* 46(2):359-363.
- Osundahunsi, O., Amosu, D. and Ifesan, B.O.(2007). Quality evaluation and acceptability of soy youhurt with different colours and fruit flavours. *American. J. Food Techn.* 2(4):273-280.
- Phamiwon Z. A. S. and Sheila John(2016). Diabetes And Medicinal Benefits Of *Passiflora Edulis*. *World Journal of Pharmaceutical Research . V 5, Issue 3, 453-465.*
- Pragati Khare, Shashi Verma , Noopur Khare and Ghanshyam Yadav.,(2015). Investigation of Hepatoprotective Activity of *Passiflora nepalensis*. *Global Journal of Pharmacology . 9 (3): 256-259.*
- Reeves P.G., Nielson F.H. and Fahmy G.C.(1993). Reports of the American Institute of Nutrition, Adhoc Wiling Committee on reformulation of the AIN 93. *Rodent Diet. J. Nutri.*; 123: 1939-51 Lee
- Reitman S. and Frankel S.(1957). Estimation of serum alanine and aspartate aminotransferases. *Clin .Path. Am. J.*; 28: 57-63.
- Roeschlau, P.; Bernt, E. and Gruber, W.(1974). Enzymatic colorimetric test with lipid clearing factor (LCF) . *J. Clin.Chem. and Clin. Biochem.*, 12:403-408.
- Saxena, Z., Dharamveer, A., Gupta, R. and Saraf, S.A.(2012). *Ficus carica* leaf extract in regulation of thyrodism using ELISA technique. *Asian. J. of Pharma. and Clinical Res.* 5:44-48.
- Schuurs, W.M. and Van Weeman, B.K.(1997). Review, enzyme- immunoassay *Clin. Chem.Acta.* 81:1-40.
- Seragides, R.; Nunes, V.A.; Silva, C.M. (2002). Influência do hipogonadismo na histomorfometria e função tireoidiana de ratas hipotireóideas. *Arq. Bras. Med. Vet. Zootec.*, v.54, p.473-477.
- Tamime, A.Y. and J.K.Robinson,(1999). *Yoghurt Science and Technology.* (2ed) C.R.C.Press, Boca Rrtion. P.450.
- Tamime AY, Robinson RK.,(2004). *Yoghurt Science and Technology*, Woodhead Publishing Ltd, Abington Hall, Cambridge England.
- Tamine, A. Y.(1977). Effects of temperature on Micro Organisms in yoghurt Production; *J. Food Science and Technology*; 30:772-773.
- Vandallen, D.B.,(1997). *Research methods and statistically analysis.* Egyptian, Anglo Library Cairo, Egypt, 942-943.

تحضير زبادي وظيفي باستخدام فاكهه غير تقليديه (الباشن فروت)

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الهدف من هذه الدراسة هو تقييم تأثير استخدام الباشن فروت في انتاج زبادي وظيفي على الصفات الحيوية في الفئران المصابة بالعدة الدرقية. تم إنتاج الزبادي باستخدام خمس خلطات وتم تقدير التركيب الكيميائي والخواص الفيزيائية الصفات الحسية للخلطات وكذلك التقييم البيولوجي للفئران المصابة بالعدة الدرقية. ووضحت نتائج تحليل المركبات الفينولية ان مركب حمض الجاليك والكاتيكول هما الحمضان الرئيسيان في الباشن فروت وايضا اوضحت النتائج ان الزبادي المصنوع من عصير الباشن فروت المحضر بالماء و اللبن البقري بنسبه [١:١] (العينة ٥) احتوت على اعلى نسبة من البروتين والدهن الخام بينما احتوى الزبادي المحضر من ١٠٠% لبن بقرى (عينة ١) على اعلى نسبة من الرماد و احتوى الزبادي المحضر من عصير الباشن فروت المحضر بالماء (عينة ٢) على اعلى نسبة من الكربوهيدرات الكلية. بالإضافة الى ذلك فقد تراوحت قيمه ال pH من ٤.٥ الى ٤.٦٧. وذلك تبعا لتركيب الخلطة بينما اظهرت نتائج التقييم الحسى اعلى قيم للنكهة و القبول الكلى (٩.٤٥ و ٩.٥٥) في العينات ١ و ٥ على التوالي. فيما اظهرت نتائج التقييم البيولوجي في نهاية التجربة ان التغذية على الزبادي الوظيفي المعامل بالباشن فروت ادت الى خفض نسبة الكوليسترول المنخفض الكثافة HDL والكوليسترول المنخفض جدا في الكثافة vLDL بينما ارتفعت قيم الكوليسترول العالى الكثافة HDL مقارنة بالمجموعة السالبة و المجموعة الموجبة. بالإضافة الى ذلك فان معاملة الزبادي بالباشن فروت ساعد على تحسين وظائف الكبد و الكلى. و من ناحيه اخرى اظهرت مستويات هرمونات الغدة الدرقية انخفاض في مستوى هرمون الثيروكسين الثلاثي (T3) في بلازما الدم في المجموعات المصابة بالعدة الدرقية والتي تم تغذيتها على عينات الزبادي بينما سجل الثيروكسين (T4) تحسنا في المجموعات التي تغذت على الزبادي المعامل بالباشن فروت و مجموعه عقار L-thyroxin. وادت التغذية على الزبادي المصنوع من عصير الباشن فروت المحضر بالماء و اللبن البقري بنسبه [١:٣] مجموعه ٨ و [١:١] مجموعه ٧ الى زياده في مستوى هرمون تحفيز الغدة الدرقية (TSH) في بلازما الدم ٥.٠٢ و ٤.٤٨ ملليمول/مل على التوالي اوضحت النتائج السابقة ان الزبادي المعامل بالباشن فروت ساعد على تحسين مستوى هرمونات الغدة الدرقية في الفئران المصابة.

الكلمات الدالة: مرض الغدة الدرقية – هرمون الثيروكسين – الزبادي الوظيفي - فاكهه الباشن.