

Antioxidants, Bioactive Components and Biological Effect of Untraditional Beverage Preparing from Sweet Basil and Green Tea.

Rania E. El - Gammal.

Food Industries Dept., Fac. of Agric., Mansoura Univ., Egypt.



ABSTRACT

Nowadays, Consumption of phenolic-rich food and beverages were widely spread due to their effect against diseases. So, this study was a trial to prepare an untraditional beverage from green tea and sweet basil and biological and chemical properties of each beverage were studied. Results of chemical analysis showed an increase in both of moisture and protein contents in sweet basil, while observed increase in the amount of ash and carbohydrates in green tea was restricted. Sensory evaluation was conducted for combinations of green tea basil and the mixture containing an equal proportion of green tea and sweet basil(1:1) recorded highest consumer acceptance. Results of bioactive compounds indicated that green tea, sweet basil and their mixture have a high content of total phenolic and flavonoids compounds. But antioxidative effect DPPH not increased up to 70% in green tea and the mixture of green tea and sweet basil(1:1). Results also showed that presence of both Catechol and Catechins were increased in both of green tea and the mixture of green tea and sweet basil up to 1123.50, 985.24 and 987.38, 732.51 ppm, respectively. In addition, biological effect of green tea and sweet basil and their mixture on liver functions and total lipids profile in the blood serum were studied. Experimental rats were treated also with oral dosage with green tea and sweet basil showed non-significant decrease in the activity of ALT (36.91 IU/L) in compared with control sample (26.26 IU/L). Also, an improvement in all liver functions in rats treated with green tea and sweet basil against liver function in rats treated by CCl₄. Also a marked improvement in lipids profile in blood serum was observed. while, Histopathological examination for liver tissue revealed that a reduction of the effects of injury resulting from liver poisoning with carbon tetrachloride CCl₄ by using a mixture of green tea and sweet basil. So, from this present work it could be concluded the possibility of preparing rich phenolic beverage that can protect liver cells and reduce, lipids and cholesterol content through natural bioactive compounds and natural antioxidant effects.

Keywords : Green tea, sweet basil, phenolic compounds and CCl₄ toxification.

INTRODUCTION

Sweet basil (*Ocimum basilicum* L). belongs to the family Lamiaceae, included nearly 200 species were varied in different varieties and forms. Basil leaves are rich in phenolic compounds namely, flavonoids and anthocyanins, and its essential volatile oil contains different vital essential compounds were methyl cinnamate, 1-8 cineol, citral, linalool, methyl chavicol (estragole), and alcohols namely eugenol. Antioxidant activity of components in sweet basil could be clarified importance of its antioxidative effectiveness (Prakash and Gupta, 2005),

Traditionally, sweet basil has been used as a medicinal plant in the treatment of headaches, coughs, diarrhea, constipation, warts, worms, and kidney malfunctions.

Green tea is a kind of unfermented tea that is produced from *Camellia sinensis* green tea leaves have been originated in Asia, but its production has been spread to many countries. (Senanayake, 2013). Green tea was used as worldwide beverage because of its stimulative and therapeutic properties. It contains some phytochemicals compounds namely polyphenols and flavonoids. Polyphenols found include epigallocatechin gallate, epicatechin gallate, epicatechins and flavanols. (Goksu and Poyrazoglu 2013)

Liver considered as vital organ with a wide range of functions such as detoxification, protein synthesis and production of biochemical necessary for digestion. Many factors like toxic compounds, virus infection, heavily consumption of alcohols caused liver injuries. Recently liver diseases have high prevalence and become one of serious problems which taken in consideration (Tanaka *et al.*, 2011).

MATERIALS AND METHODS

Raw material: Fresh Green Basil (*Ocimum basilicum* L.) were obtained From Faculty of Agriculture Arboretum, Mansoura university, Egypt. while, commercial green tea leaves (*Camellia sinensis*) were obtained from local supermarket, El-Mansoura City, Egypt.

Chemical : All chemicals were purchased from El-Gomhouria Company, El-Mansoura City, Egypt.

Methods

Preparation of beverages :

Green sweet basil leaves was rinsed with clean distilled water to remove any foreign matter and impurities, then dried at air dryer at 45 °C for 8 hours, and crushed using domestic grinder BRAUN, then dried green basil leaves was mixed with green tea leaves at the ratio of (2:1), (1:1) and (1:2) for green tea : green basil, respectively.

All powder mixtures were divided into two main parts, the first part was equipped to prepare hot beverage using boiled water, the other part was stored in air tight polyethylene packets until further analysis were carried out

Gross chemical analysis :

Moisture, protein, fat (ether extractable), ash content were determined according to methods A.O.A.C. (2005). While total carbohydrates were estimated by difference as follow: Total carbohydrates % = 100-(Moisture% + protein% + fat% + ash%).

Minerals content: magnesium, calcium, sodium and iron were determined according to the method described by Hesse (1971) and Cottenie *et al.* (1982) using Perkin Elmer, Atomic Absorption Spectrophotometer model 3300.

Sensory Evaluation : All prepared beverage formulas were evaluated by 10 panel testers in Food Industries

Dept.,Fac. of Agric.,Mansoura University for different attributes namely color (10), bitter taste (10), odor (10), flavor (10) and over all acceptability (10) using ideal scale, according to Dang Thi *et al.*, (2013)

Determination of total phenolic compounds (TPC) and Total flavonoids (TFC) :

Folin-Ciocalteu method used to determine total phenolic compounds (as gallic acid equivalent) using standardized spectrophotometric according to Ivanova *et al.*,(2010) and Flavonoids were determined by the method of (AOAC, 2000) . Food Technology Research Institute , Giza, Egypt.

Determination of antioxidant activity using radical scavenging activity .:

2,2 diphenyl-1-picrylhydrazyl (DPPH %) assay was carried out according to the method of Brand-Williams *et al.*,(1995) .

Identification and fractionation of Phenolic compounds .:

Phenolic compounds were identified and fractionated using HPLC. At Food Technology Research Institute , Giza, Egypt and the data were analyzed by Hewlett packaged , "HP1050" software according to (Goupy *et al.*, 1999).

Experimental design :

Healthy male albino rats weighting 150 ± 5 g. were kept in animal house at Faculty of Medicine, Mansoura University under constant conditions of temperature (24 ± 2 °C) for 7 days (adaptation period) under laboratory condition before and through the experimental being maintained on a standard diet composed of 20% casein, 15% corn oil, 55% corn starch, 5% salt mixture and 5% vitamins. Water was available .All the experiments were done in compliance with the guide for the care and use of laboratory animals.

Experimental rats were divided into five groups each group contain 6 rats fed on basal diet as well different treatments for 6 weeks as follows :

Group 1 (- ve control): were fed on basal diet only and were served as a control group.

Group 2 (+ ve control) : orally treated with CCL_4 (1mg/kg b.wt) to induce liver injury as mentioned by Wilfried *et al.*,(1994)

Group 3: orally treated with green tea extract at the level of (20 mg/kg b.w /days) .

Group 4: orally given sweet basil extract at the level of (20 mg/kg b.w /days)

Group 5: orally were treated with beverage formula contained green tea: sweet basil (1:1) at the level of (20 mg/kg b.w /days) .

Blood sampling

In the above mentioned groups blood samples were taken after 12 hours fasting at the end of the experiment. Blood were collected from vein plexus eye into dry clean centrifuged for 10 min. at 3000 rpm to separate the serum, which carefully transferred and collected into clean tubes , until further analysis was carried out .Liver functions examination .

Serum was analyzed to estimate the activity of liver function enzymes (GPT) Glutamic Pyruvic Transaminase (GPT)or Alanine Aminotransferase

(ALT) such as Glutamic Oxaloacetic Transaminase (GOT) or Aspartate aminotransferase (AST) using a commercial kit according to the method described by Tietz (1995) . And Alkaline phosphate enzymes (ALP) estimated according to King (1965) . while albumin were determined according to Lowry *et al.*, (1951) and Doumas, B.T. (1978) and bilirubin according to Malloy and Evelyn (1937).

Histopathological examination :

Livers of the scarified rats were dissected, removed, washed with normal saline and put in 10% formalin solution ,the tissue specimens were cleared in xylene , embedded in paraffin , sectioned microns thickness and finally examined using Olympus optical microscope CX31 (Tokyo, japan), at central lab. , electron microscope unit , Fac. of Agriculture , Mansoura University . as described by Bancroft *et al.* , (1996).

Determination of serum lipids profile :

Total cholesterol (TC) was determined using colorimetric method according to Richmond (1973) , Triglycerides (TG) and high density lipoprotein cholesterol (HDL-C)were carried out according to Fossati and Principe (1982) .

(LDL-C) were calculated using the following equation :{ TC- (HDL-C+ TG/5)}.

Statistical analysis;

Data were analyzed using (ANOVA) test , while comparisons were done by Duncan's test at $P < 0.05$ level of significance using SPSS (2008) version 17 program for windows.

RESULTS AND DISCUSSION

Gross Chemical composition of raw materials used in beverages preparing .

Moisture, crude protein, fat, ash and total carbohydrates were determined for both of green and basil leaves results were illustrated in Table(1) moisture content of green tea and sweet basil leaves was expressed in percentage, initial moisture content being 6.5% and 16.5 % , protein content was found to be 3.89% in dried green tea leaves in compared with 4.32 % in dried sweet basil leaves. This obtained results were in accordance with (Janine, 2011 and Meyerzon, 2012).who found that moisture content was 14.5 and 17.5 % in dried basil in hot air dryer at 50°C.

There was an observed differences in the carbohydrates content , this decrease may be due to the differences in drying process techniques between commercial green tea leaves and sweet basil leaves which effect on the amount of low molecular weight carbohydrates, which are usually lost during air- heating . Also , differences in ether extract as 3.01 and 2.50 in green and sweet basil respectively . Green tea leaves exhibited the highest ash content (4.21 %) .

In spite of the amount of mineral contents in sweet basil leaves were higher than those of green tea leaves, but the content of Ca , Mg, Fe and Na were higher than those detected in green tea. (Hu *et al.* , 2012)

Table 1. Gross Chemical composition of raw materials used in beverages preparing .

Raw material (leaves)	Chemical constitutes %								
	Moisture*	Protein *	Ash*	Carbohydrates	Ether extract*	Minerals content mg/g			
						Ca	Mg	Fe	Na
Green tea	6.5±0.1	3.89±0.02	4.21±0.01	82.39	3.01±0.01	0.25	1.36	0.02	1.1
Sweet Basil	16.5±0.2	4.32±0.01	3.01±0.01	73.67	2.50±0.01	176.30	63.14	2.31	3.2

*Each values means of three replicates ± SD

Sensory evaluation of different prepared beverage formulas .

Sensory evaluation considered as an important indicator of potential consumer preferences. In spite of its short comings, it will remain the most serious quality

assessment technique (Hu *et al .*, 2012) Results in Table(2) showed that all prepared beverage samples were evaluated for different sensory attributes, namely color, bitter taste, flavor and overall acceptability .

Table 2. Sensory evaluation of different prepared beverages formula .

Properties	Color (10)	Odor (10)	Bitter Taste (10)	Flavor (10)	Overall Acceptability (10)	Total (50)
Control	9.14±0.05 ^c	9.10±0.06 ^b	7.54±0.02 ^b	8.31±0.07 ^c	9.52±0.05 ^a	44.61±0.11 ^b
A	8.54±0.02 ^d	8.20±0.06 ^c	7.26±0.07 ^c	8.78±0.10 ^b	8.53±0.02 ^b	41.31±0.15 ^d
B	9.50±0.00 ^a	9.43±0.04 ^a	8.70±0.11 ^a	9.48±0.06 ^a	9.55±0.04 ^a	46.66±0.19 ^a
C	9.40±0.33 ^b	8.27±0.03 ^c	7.52±0.09 ^b	8.35±0.02 ^c	8.30±0.00 ^c	41.84±0.10 ^c
F value	164.50	176.03	75.42	65.37	364.35	309.88

Formula A:green tea : sweet basil (2:1) , Formula B:green tea : sweet basil (1:1) , control: green tea

Formula C:green tea : sweet basil (1:2) Mean values ± standard error (n=10).

Means of samples having the same letter(s) within a column are not significantly different (P<0.05)

Taste of the beverage is played basic role in sensory evaluation, it can be attributed to main components , results of this criteria could be observed that control formula contained only green tea had an intense , slight sourness and clear bitter taste, which was effect on the sensory quality of the beverage with score 7.54±0.02, while addition of sweet basil : green tea at the ratio of (1:1) enhance the taste to be more accepted .Also, from the same table an observed non significance differences in flavor was found in the formulas A and B contained both of green tea and sweet basil with the percentage of (2:1) and (1:1) while the formula C containing (1:2) of sweet basil have a pungency and sharp flavor than the other formulas.

Concerning to the results of taste and flavor the improvement of these criteria's may be due to addition of sweet basil which contained bioactive compounds namely polyphenols, caffeine, organic acids and volatile terpens , beside green tea have a special polyphenolic compounds like catechol and cathechien which improve the taste and flavor . (Someswararao, *et al .*, 2013).

With regarding to data it can appeared that, all examined formulas have non-significant differences in color at P< 0.05 in compare with control one , addition of sweet basil in formula A at the ratio of (2:1) induced a dark color as the panel testers pointed out, which resulted in decreasing the color score in compare with the other formula containing equal amount of green tea : sweet basil have ideal accepted color score .

overall sensory evaluation showed that formula B contained green tea : sweet basil (1:1) was the most accepted one having an acceptance level 46.66 ±0.19 while the formula containing green tea : sweet basil with (2:1) and (1:2) nearly showed the same acceptance which were. 41.31 and 41.84±0.11 respectively .

Therefore, it is clear from the above-mentioned results that addition of basil at 1:1 of green tea improved sensory characteristics for color , taste , odor , flavor and overall acceptability in hot proposed studied beverages .

Bioactive compounds :Total phenolic compound (TPC) , Total flavonoids (TFC) and antioxidant activity (DPPH) of raw materials and selected formula .

Bioactive compounds especially phenolic and flavonoids compounds depend on their active groups, such as the hydroxyl groups and the position they occupied(Szymanowska *et al .*, 2015) . Data in Table (3)showed that total phenolic and total flavonoids compounds beside antioxidant activity (DPPH) of raw materials and selected formulae used in beverage preparing . Results in Table (3) revealed that green tea exhibited a higher content of total phenols being 65.43 mg GAE/g. in compare with 45.91 mg GAE/g. for sweet basil

Table 3. Bioactive compounds (total phenolic compounds (TPC) , total flavonoids (TFC) and antioxidant activity (DPPH) of raw materials and selected formula.

Bioactive compounds	materials		
	Green tea	Sweet basil	Green tea : sweet basil (1:1)
Total phenols as mg GAE/g.	65.43	45.91	56.73
Total flavonoids mg/g.	78.35	75.32	77.32
DPPH %	70.02	68.72	70.01

Also, the descending order of total phenolic compounds could be arranged as follow : green tea > green tea : sweet basil > sweet basil

Also results in the same table indicated that formula contained Green tea exhibited the highest amount of total flavonoids content was 78.35 mg/g followed by 77.32 mg/g for green tea :sweet basil (1:1)

Addition of sweet basil to green tea improved the radical scavenging activity DPPH to 70.01% against 70.02 % for green tea only this may be due the high flavonoid content of total bioactive compound.

These results were particularly in accordance with (Thasleema, 2013) who stated that Green tea rich in polyphenols and also contains carotenoids. Our results indicated that green tea with sweet basil has a good antioxidant activity compared to green tea only, that is may be due to the presence of additional phenolic compounds from basil which provides the optimal antioxidants properties for potential health benefits.

From abovementioned data it could be observed that green tea has a positive antioxidant effect which is responsible for important biological activity and have many health advantages properties.

Identification and fractionation of green tea , sweet basil leaves and their mixtures.

Results of fractionated phenolic compounds are tabulated in Table (4) which indicated that 12 phenolic compounds were fractionated and identified in all examined samples . Catechol was the predominant phenolic compounds presented in all examined beverages with the amount of 1123.50 , 985.24, 857.32 ppm in green tea , sweet basil : green tea and sweet basil respectively. Also the same trend could be observed in the other main phenolic compounds namely,

Catechins, epicatechin gallate and epigallocatechin, while in green tea and sweet basil with green tea epicatechin and procatechuic exhibited the highest amount were (225.3 and 150.80 ppm) and (115.84 and 112.32 ppm) respectively in compare with sweet basil only . the amount of Ferulic acid were nearly the same in green tea and sweet basil with green tea

On the other hand, there were a minor content of phenolic compounds detected such as ellagic acid and vanilic acid ,while Gallic acid not exceeded than 2.23 ppm in all prepared beverage .

From abovementioned data in Table (4) addition of sweet basil to green tea could be considered as a physical method to prepare a phenolic rich beverage

beside retaining with its bioactive and essential compounds .

From results in Tables 3 and 4 it could be mentioned that antioxidant activity, total phenolic and flavonoids compounds content have predominating correlated with phenolic compounds content . So, Highest antioxidant activities of green tea and sweet basil may be referred their high content of catechins, epigallocatechin and catechol which presented more than 60% of the phenolic compounds .

Table 4. Identification and fractionation of phenolic compounds (ppm) of green tea , sweet basil beverage and their mixtures.

Phenolic compound (ppm)	beverage		
	Sweet Basil	Green tea	Sweet Basil : green tea (50:50)
Catechins	472.33	987.38	732.51
Epigallocatechin	175.32	456.58	298.34
Epicatechin gallate	103.56	582.24	365.64
Caffeic acid	93.54	73.21	90.54
Catechol	857.32	1123.50	985.24
Gallic acid	1.13	2.23	2.03
Procatechuic	98.25	115.84	112.32
Epicatechin	45.19	225.3	150.80
Caffeine	4.32	2.35	3.94
Ferulic acid	1.37	52.34	50.35
Ellagic acid	1.04	3.26	1.99
Vanilic	0.75	0.58	0.65

Hepatoprotective effect of different prepared beverages :

a) Biochemical examination :

ALT(GPT), AST(GOT) enzymes were presented in the cell cytoplasm under normal conditions . Due to treated with carbon tetrachloride which induced hepatotoxicity the membranes of hepatocytes become damaged releasing the enzymes into circulation causing elevation.(Merra *et al.* , 2009)

Results in Table (5) showed that group 5 which treated with oral dosage with green tea and sweet basil beverage showed non-significant decrease in the activity of ALT(GPT) (36.91 IU/L) in compared with group 1-ve control (26.26 IU/L).

Table 5 . Hepatoprotective effect of green tea and sweet basil beverage on liver functions:

Groups	Lipid fractions	ALT (IU/L)	AST (IU/L)	ALP (IU/L)	Bilirubin (mg/dl)	Albumin (mg/dl)
1 -ve Control		26.26±0.86 ^a	76.59±1.38 ^a	162.93±1.38 ^a	0.33±0.01 ^a	5.87±0.23 ^a
2+ve Control (CCl ₄)		67.63±0.77 ^e	133.03±1.33 ^d	254.32±3.16 ^d	0.83±0.05 ^d	2.87±0.17 ^d
3 – green tea beverage		49.42±0.56 ^d	99.47±0.58 ^c	184.57±0.60 ^b	0.63±0.01 ^c	4.11±0.08 ^{bc}
4-sweet basil beverage		42.87±1.32 ^c	95.85±1.40 ^c	194.60±2.35 ^c	0.68±0.02 ^c	3.67±0.09 ^c
5- Green tea+ sweet basil beverage		36.91±0.76 ^b	87.71±1.42 ^b	182.82±1.15 ^b	0.48±0.02 ^b	4.41±0.22 ^b
F value		300.28	281.55	314.19	60.11	42.19

Mean values ± standard error (n=3). Means of samples having the same letter(s) within a column are not significantly different (P<0.05).

Values of (AST) GOT were elevated significantly in hepatic damage group 2 +ve which toxic with CCL₄ also, adequate changes activity were observed in the group 5 treated with green tea and sweet basil beverage. ALT (GPT) level was increased significantly by the toxicity of CCL₄ and experimental rats group 5 with the formula green tea : sweet basil

which reduced the amount of ALT(GPT) but not reached to group 1-ve (normal group) .

Serum protein level is a synoptic measure of protein situation and major changes in the liver functions. Liver is the site of synthesis and storage of many proteins. Hepatotoxins impair the capacity of liver to synthesize protein. Liver is the major site of protein metabolism

and a healthy functioning liver is required for the synthesis of the serum proteins. (Iweala and Obidoa 2010). Also from results in the same table it could be observed that albumin was reduced by the treatment of (green tea : sweet basil) compared with those of control group 1-ve control .

At the same table, bilirubin values was increased significantly by toxicity CCL_4 . Bilirubin levels were increased in all treated rats group , but treated rats in groups (4 and 5) were nearly the same values .

From abovementioned data it could be observed that hepatic damaged rats in group 2+ve control was elevated in all values than any other treated groups.

It is noteworthy, that the beverage of green tea and sweet basil has a profound effect in restoration of ALT and AST levels towards their respective normal values that may be attributed to their phenolic and flavonoid compounds .

b)Histopathological examinations :

Micrographs in Fig .(1) showed a histological section in liver of a control rat –ve this figure showed that there were a normal histological liver picture in which the central vein lies at the center of the lobule surrounded by the hepatocytes with strongly eosinophilia granulated cytoplasm and distinct nuclei. Akilavalli *et al.* (2011) and Gopal *et al.* (2008)

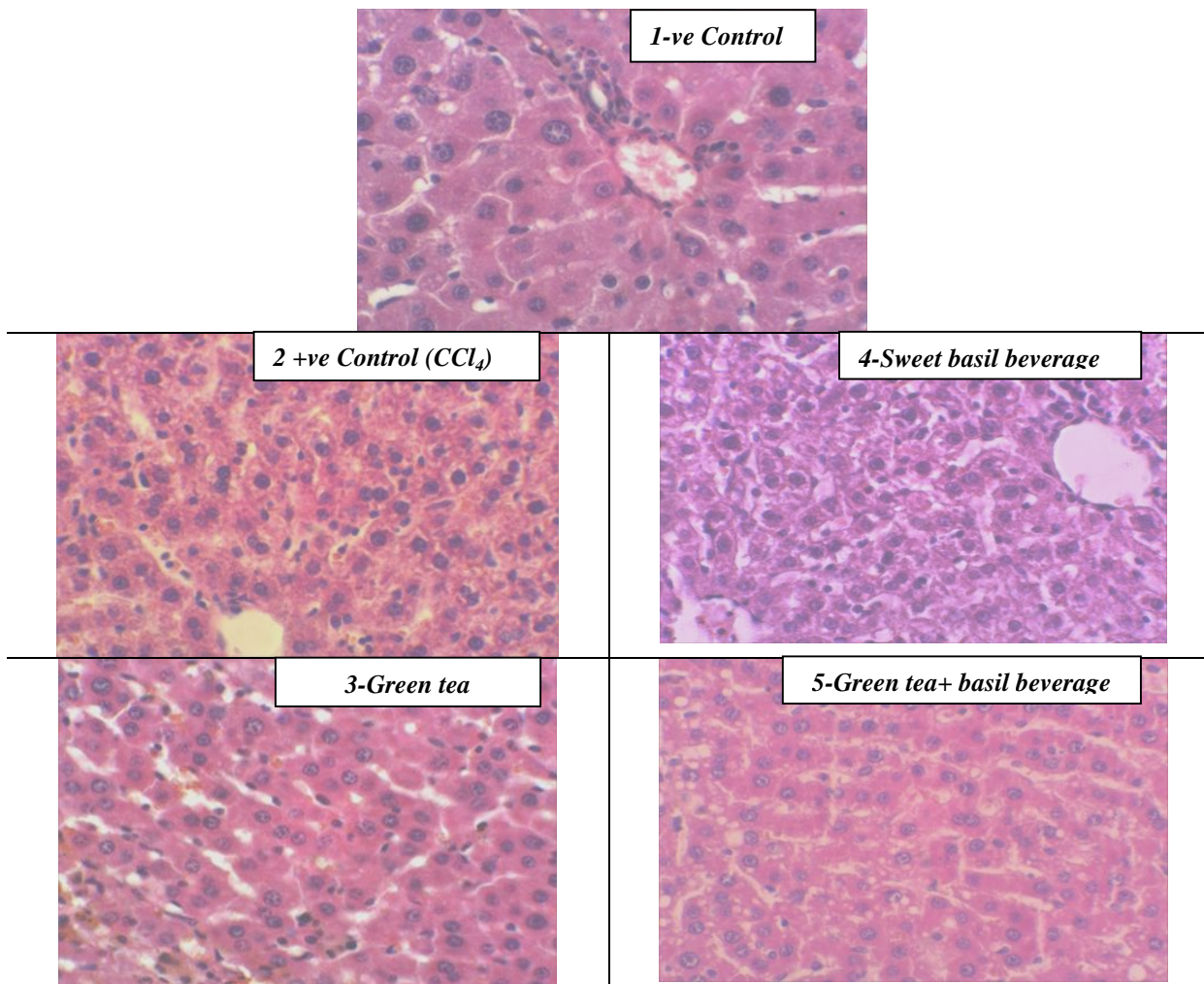


Figure 1. Histopathological effect on liver tissues treated with different prepared beverage.

Histological changes in the examined sections of the liver tissues in rats toxic with CCL_4 showed ballooning ,necrosis ,lymphocytic infiltration and vacuolar degeneration of hepatic around the central veins and lipid droplets in the mid and periportal areas and edema in the portal traid cellular boundaries, blood cells between hepatocytes in some lobules and abnormal arrangement of blood sinusoid . (Fig. 1). This obtained results were nearly in agreement with Akilavalli *et al.* (2011) and Houa *et al.* (2013)

The hepatic cells in groups (3and 4) treated with green tea and the other with sweet basil showed a moderate improvement in the histological lesions and

observed decrease in ballooning cells and also the number of kupffer could be detected .

It could be seen that treated group 5 with (green tea: sweet basil) showed an improvement in the histological photos of hepatocytes . This means that regeneration and renovation were occurred, an decrease number in ballooning cells and an observed increase in kupffer cells number .

Effect of different prepared beverages on lipid profile in hepatotoxic rats .

It is clear from results in Table (6) the toxicity with CCL_4 caused a significant elevation in serum lipid fractions compared with control group(-ve) . A

significant decreases were observed in lipid profile fractions namely, total cholesterol (TC) ,and triglycerides(TG) , low density cholesterol(LDL-c) and high density cholesterol (HDL-c) , in all groups treated with different prepared beverages in comparison to positive control(+ve).

These obtained results were in agreement with those reported by Gopal and Sengottuvelu 2008 and Houa et al., 2013 who stated that CCL₄ intoxicated rats has inhibited higher levels of TC, TG, HDL-c and LDL-c, this may be due to liver damage.

Table 6 . Lipid profile as affected by different prepared beverage :

Groups	Lipid fractions	TC mg/dL	TG mg/dL	LDL mg/dL	HDL mg/dL
1-ve Control		88.30±1.00 ^a	77.94±1.05 ^a	48.96±0.86 ^a	28.31±1.46 ^a
2+ve Control (CCl ₄)		129.51±0.69 ^e	111.27±1.78 ^d	92.86±1.49 ^e	17.87±0.22 ^c
3-Green tea beverage		96.67±0.48 ^d	95.77±0.83 ^c	68.60±0.65 ^d	30.65±0.90 ^a
4- Sweet beverage		99.12±1.33 ^c	96.71±0.80 ^c	78.05±1.48 ^c	28.57±1.01 ^a
Green tea +sweet basil beverage		92.77±1.43 ^b	83.62±1.67 ^b	59.50±1.06 ^b	24.53±0.57 ^b
F value		240.75	100.15	215.73	29.33

Mean values ± standard error (n=3).

Means of samples having the same letter(s) within a column are not significantly different (P<0.05).

So, the observed improvement of different lipid profile fractions could be probably indicative of hepatoprotective effect of green tea and sweet basil and their antioxidant activity and the content of essential bioactive compounds namely Catechol, Catechins and Epicatechin gallate.

Finally, from obtained results, in this study, it could be suggested that green tea, sweet basil and their mixture could protect liver cells from CCL₄ induced liver damage may be by their antioxidative properties which effect on hepatocytes and eliminating the serious effect of toxic metabolites from CCL₄. Also, the study recommended that rich phenolic beverages contained bioactive natural compounds should be taken a daily portion of our regular diet and may be useful for patients suffering from liver diseases.

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تأثير المركبات النشطة حيويًا ومضادات الأكسدة والتأثيرات البيولوجية لمشروب غير تقليدي مجهز من الشاي الأخضر والريحان الحلو.

رانيا ابراهيم الجمال
قسم الصناعات الغذائية – كلية الزراعة – جامعة المنصورة – مصر .

انتشر في الآونة الحالية استهلاك الاغذية والمشروبات الغنية بالمركبات الفينولية ، لما لها من تأثير واقى ضد الاصابة بالأمراض . اجريت هذه الدراسة كمحاولة لإعداد مشروبات غير تقليدية من الريحان والشاي الأخضر وتمت دراسة التقييم الكيماوي والبيولوجي لهذا المشروب . وظهرت نتائج التحليل الكيماوي ارتفاع نسبة كلا من الرطوبة والبروتين في الريحان الحلو مقارنة بالشاي الاخضر ،متبوعا بزيادة في نسبة الرماد والكربوهيدرات في الشاي الاخضر . وتم اجراء التقييم الحسي لمجموعة توليفات من الشاي الاخضر والريحان الحلو واعطت التوليفة المحتوية على نسبة متساوية من الشاي الاخضر والريحان(1:1) اعلى نسبة قبول للمستهلك . اعطت نتائج تحليل المركبات الحيوية الطبيعية الكلية احتواء الشاي الاخضر والريحان وتوليفتهما على نسب مرتفعة من الفينولات والالفانويدات الكلية ، في حين لم يرتفع عن 70 % التأثير المضاد للأكسدة DPPH لكلا من للشاي الاخضر وتوليفة الشاي الاخضر و الريحان الحلو . كما اظهرت النتائج وجود كلا Catechols و Catechins بنسبة عالية لكلا من الشاي الاخضر وتوليفة الشاي الاخضر والريحان الي 1123.50 ، 985.24 و 987.38 ، 732.51 جزء في المليون على التوالي . علاوة على ما سبق تم دراسة التأثير البيولوجي لمشروب الشاي الاخضر والريحان على وظائف الكبد والمحتوي الكلي من الليبيدات في الدم وظهرت النتائج حدوث انخفاض غير معنوي في مستوي ALT لفئران التجارب التي تناولت جرعات من الشاي الاخضر والريحان الحلو (39.91 وحدة دولية/مليتر دم) مقارنة بـ26.26 (وحدة دولية/مليتر دم) في عينة الكونترول السالبة وايضا حدوث تحسن ملحوظ في جميع وظائف الكبد للفئران التي تناولت توليفة الشاي الاخضر والريحان مقارنة الفئران المصابة بالتسمم الكبدى برابع كلوريد الكربون بالإضافة تحسن ملحوظ في مستوي ليبيدات سيرم الدم . بينما اوضح الفحص التشريحي لأنسجة الكبد امكانية الحد من تأثيرات الاصابة الناتجة عن التسمم الكبدى برابع كلوريد الكربون عن طريق توليفة الشاي الاخضر والريحان الحلو . لذا نخلص من هذه الدراسة الي إمكانية إعداد مشروبات غنية بالمواد الفينولية يمكن ان تحمي خلايا الكبد وتقلل من نسب الدهون والكوليسترول بالدم من خلال تأثير مضادات الاكسدة الطبيعية والمركبات الحيوية.

الكلمات الدالة : الشاي الأخضر – الريحان الحلو – المركبات الفينولية – التسمم برابع كلوريد الكربون .