EVALUTION OF *GARCINIA CAMBOGIA* PLANT EXTRACTS AS ANTIFUNGAL, ANTIBACTERIAL AND ANTIOXIDANT

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Abstract

In the present investigation the antioxidant, antifungal and antibacterial activities of *Garcinia cambogia* plant extracts were studied. Hot and cold of aqueous extracts of 5, 7.5 and10% (w/v) concentrations were used as a natural preservative beverages. These prepared extracts were used for evaluation of their antifungal (aganist *Fusarium moniliforme* and *Aspergillus flavus*) and antibacterial properties (against gram negative bacterial strains, *Escherichia coli* and gram positive bacterial strains, *Bacillus cereus*). Such materials have a high content of polyphenol compounds such as pyrogallol, catechin, catechol, epicatechein, chlorogenic and salycilic acid in addition to flavonoides and isoflavonoides compounds. *Garcinia cambogia* contain considerable amounts of water and fat soluble vitamins. Sensory evaluation of Guava nectar supplemented with *Garcinia cambogia* extracts (7.5 and10% w/v) as a natural preservative, showed no significant difference of taste, colour, texture, flavour and appearance compared with control. The data showed no microbial spoilage in guava nectar supplemented with different *Garcinia cambogia* (cold and hot) extracts concentrations and control at zero time. After one and two weeks of storage nectar in the refrigerator showed increase in total bacterial counts in the control, meanwhile guava nectar containing *Garcinia cambogia* extracts (7.5% and 10%) cold and hot showed a slight increase in bacterial count. It could be concluded that *Garcinia cambogia* plants has high antioxidant, antibacterial, antifungal activity properties which have some benefit effects on health and can be used as natural preservative substances in food and beverages.

Key words: antioxidant, antimicrobial, antifungal, *Garcinia cambogia* and microbial spoilage

INTRODUCTION

Garcinia cambogia (Clusiaceae) is used as a traditionally medicinal plant claimed to possess antioxidant properties and the fruit of *Garcinia cambogia* showed the best antimicrobial activity (Ranjani, *et al*., 2014). It is a natural pharmaceutical and has an inhibitory bioactivity against a wide range of microbes, as well as lack of toxicity. *Garcinia cambogia* methanolic, aqueous and ethyl acetate extracts displayed broad spectrum antimicrobial activity. The extracts were effective against both gram negative and gram positive bacteria (Hart and Cock 2016). *Garcinia atroviridis* or commonly named as 'Asam gelugur' among locals is extensively used as a flavoring agent to provide sour sensation. Apart from being used as a flavoring agent, *G.*

atroviridis is also used in many ways to promote health traditionally. Previous investigations on *G. atroviridis* plant reported many interesting potential of antioxidant, antimicrobial, antifungal, antiobesity cytotoxicity, antiinflammatory, antimalarial and antinicotine stress activities (Hamidon *et al.*, 2017). The phytochemical analysis of *Garcinia gummigutta* revealed the presence of high content of alkaloids, tannins, phenolic, flavonoids, isoflavonoids, carbohydrates and low content of steroids, terpenoids, phlobatannin and cardiac glycosides (Madappa and Bopaiah, 2012). The bioactive molecules like hydroxyl citric acid (HCA), flavonoids, terpenes, polysaccharides, procyanidines and polyisoprenylated benzophenone derivatives like garcinol, xanthochymol and guttiferone were isolated from the genus *Garcinia*. They were found that the polyisoprenylated benzophenone and xanthone derivatives have antioxidant, anti-cancer, anti-inflammatory, antibacterial, anti-viral, anti-fungal, anti-ulcer and anti-protozoal properties (Naveen and Kumar, 2013). The dried fruit of *Garcinia gummigutta* extract was prepared by using three different solvents such as acetone, ethanol and distilled water. These prepared extracts were used for evaluation of the antibacterial properties against two gram negative bacterial strains (*Escherichia coli* and *Pseudomonas aeruginosa*) and two gram positive bacterial strains (*Bacillus subtitles* and *Staphylococcus aurous*). The extract (10% *Garcinia Gummigutta)* can be used as an antibacterial agent and also can be used as an antioxidant in food and pharmaceutical industries (Jacob *et al.,* 2015).

The present study is aimed to evaluate the antioxidant, antifungal and antimicrobial activity properties of natural *Garcinia cambogia* (5, 7.5 and10% w/v) extract on some pathogenic fungi and bacteria (gram + ve and gram –ve). The extracts were estimated, also, as a natural preservative substance in preserving fresh guava nectar.

MATERIALS AND METHODS

Materials:

Garcinia combogia:

Garcinia cambogia dried fruits were purchased from the folk medicine market in Cairo. Guava fruits, sugars and citric acid were bought from the local market in Cairo.

Sources of the tested fungi and bacteria:

Pathogenic fungal isolates (*Fusarium moniliforme* and *Aspergillus flavus*) and pathogenic bacteria *Escherichia coli* (gram negative –ve) and *Bacillus cereus* (gram positive + ve) were kindly obtained from Plant Pathol. Res. Inst., Agric. Res. Center, Egypt.

Methods:

Preparation of *Garcinia cambogia* extract:

The whole dried *Garcinia cambogia* fruits were cleaned and milled by Moulinex caba (type 843, code 243, 220 vac 50 Hz 750W) at 3000 RCF for 4 minutes at room temperature to obtain a homogenate powder.

Cold extract:

Exactly 10, 15 and 20 gm of *Garcinia cambogia* powder were added to 200 ml of distilled water in each conical flask to prepare 5, 7.5 and 10% concentration (w/v) cold extract, and left for 24 hours. The extract was filtered and kept in washed and sterilised glass bottle in refrigerator at (5±1C˚) until used.

Hot extract:

Exactly 10, 15 and 20 gm of *Garcinia cambogia* powder were added to 200 ml of boiled water in conical flask to prepared 5, 7.5 and 10% (w/v) hot extracts. The flasks contain various concentrations of the extract were cover and left to cool. The prepared extracts were filtered and kept in washed and sterilised glass bottles and kept in refrigerator at (5±1C˚) until used (Abd El Hafez*,* 2012).

Preparations of *Garcinia cambogia* extract using in fungal test:

Exactly 200 g of *Garcinia cambogia* dried fruits were added to 1000 ml distilled water in a flask (2000 ml capacity) and was placed in a boiling water bath for 1hour. The extract was filtrated, the clear supernatant was used as crude extract, and the concentration of extract was 20% w/v. The extract was autoclaved for 15 mins to obtain sterilized extract.

Effect of different concentrations of the prepared extracts on fungal growth of *A. flavus* and *F. moniliforme*:

Different concretions of prepared *Garcinia cambogia* extracts fungal test 5% (25 ml), 7.5% (37.5 ml), 10% (50 ml) and (0) control, of sterilised extracts were prepared previously (20%) concentration. Fungal stock cultures were maintained on (potato dextrose (PAD slants) broth medium (200g potato, 20g glucose and 780 ml distilled water). In flask (250 ml capacity) each contained 100 ml broth medium (All flasks were incubated (autoclaved) at 1.5 Ib/ inch for 15 minutes. Each flask was inoculated with a fungal disc (0.5 ml diameter) of 7 day old culture of *F. moniliforme* or *A. flavus*. The flasks were incubated at 25˚ C for 5 days. Then the mycelia growth was filtered-off on filter paper of known weight, dried to a constant weight at 65˚C for 24 hr, and then reweighted to determine mycelia dry weight (three flasks used for each concentration). The reduction percent in fungal growth was calculated using the following formula (Mackeen *et al.,* 2000).

$$R\% = \frac{C - T}{C} \times 100$$

R% = Percent of reduction of fungal growth.

C = Fungal growth of the control.

T = Fungal growth of the treatment.

Antibacterial test assays:

Antimicrobial susceptibility test was carried out by the disc diffusion method. Bacterial strains were grown and diluted using Mueller-Hinton broth. Bacterial strains were grown to exponential phase in Mueller-Hinton at 37^0C for 18 hr and adjusted to a final density of 108 CFU/ml by diluting fresh cultures and comparison with Mc Farland density. The anti-bacterial activity was tested by inoculating 500µl of Mueller-Hinton broth into 25 ml of nutrient agar and allowed to cool under strict aseptic conditions. On solidification of the medium wells were made in petri plates with the help of a sterile metal borer (7mm). The microorganisms used for the antimicrobial assays were *Escherichia coli* (gram negative –ve) and *Bacillus cereus* (gram positive + ve). The Petri-dish containing agar media (nutrient agar NA) was plated with 0.1 ml *E. coli* culture and in another plate with 0.1 ml *B. cereus* micro-organism. The inoculated plats with bacteria were made in triplicate. The discs containing the cold and hot *Garcinia cambogia* extract (7.5 and 10%) were placed on the agar using sterile forceps. The control sample was contained sterilized distilled water. Plates were incubated at 37 °C for *B. cereus* and 44°C for *E. coli* for about 18-24 hours. After proper incubation, antibacterial activity was determined by measuring the diameter of the zone of the inhibition around the well by using metric scale. The diameter of resultant zone of inhibition was measured in millimetres. Three replicates were carried out for each extract against each of the test organism (Olila, *et al.,* 2001).

Analytical methods:

Vitamins (D, K and E) were determined using HPLC according to Nöll, (1996), Pérez-Ruiz *et al*., (2007) and Pyka and Sliwiok, (2001). Vitamins B, D, ascorbic acid and β-carotene were determined as described methods by AOAC, (2005). Fractionation of phenol, flavonoides and isoflavon compounds were determined according to Mattila *et al*., (2000) methods. The supernatant was collected in vials for injection into a HPLC instrument (Hewlett packed, series 1050) composed of a C_{18} hypersil BDS column with a particale size of 5 µm. Separation was carried out with methanol and actonitrile as the mobil phase, using a flow rate of 1 ml/min. Quantification of the flavonoid compounds was carried out using a standard flavonoid calibration curve. The pH values were measured by using pH meter Model Cosort pH meter P 107. TSS (°Brix) was determined by measurement of the refractive index

with an Atago model RX-1000 digital refractometer at 20 C° (Atago C,Ltd. Carnation, WA). Apparent viscosity of nectar samples was directly measured using Brookfield Digital Rheometer, Model DVIII Ultra (with SCA-21 spindle). The viscometer was operated at 10 RCF. The sample was placed in small sample adapter and constant temperature water bath was used to maintain the desired temperature (25 ±1 C°).

Preparation of tested guava nectar:

Guava fruits were washed and the seeds were removed then cut into pieces and 500g of guava pieces were added to 500 ml distilled water and mixed by Moulinex blender then mixtures were strained through stainless steel screen and 3% CMC (carboxy methyl cellulose) were added to nectar. The total soluble solid (TSS) was measured by fractometer and 110 g sucrose (Adeniyi *et al*., 2010) were added to one litter of nectar then *Garcinia cambogia* 7.5% and10% (cold and hot) extracts were added to Guava nectar samples and citric acid (0.1%) was added to control. The pH of nectar was measured to the control and treatment samples. The fresh guava nectar was pasteurized at 90 °C for 1 minute and purred in dry sterilised bottles, then immediately cooled and left in refrigerator at (5 ±1 C°) to study the microbial activity.

Microbiological examination of tested fresh guava nectar:

Microbialogical tests including total bacterial counts, yeasts and molds, in fresh nectar and after 1 and 2 weeks of storage at refrigerator temperature (5±1C°) were determined according to the method of Rivas *et al*., (2006)**.**

Sensory evaluation of tested fresh guava nectar:

The sensory quality attributes (taste, colour, flavour, appearance and texture) for guava nectar samples (control), guava nectar treated with *Garcinia cambogia* extracts (7.5 and 10% w/v cold and hot) were estimated. Ten panellists from the staff of the Special Food and Nutrition Dep., Food Technology Res. Institute Agric. Res. Centre, Giza, Egypt. Organoleptically judged the products. The qualities were scored on a scale of 1 to 10, according to Khan *et al.,* (2001).

Statistical analysis:

Data collected were subjected to the analysis of variance by SAS (2002), at $P<0.05$.using Duncan multiple range test procedure as described in the SAS soft ware.

RESULTS AND DISCUSSION

Effect of different concentrations of *Garcinia cambogia* extracts in inhibition and reduction of fungus *Aspergillus flavus* and *Fusarium moniliforme*

Data presented in Table (1) shows the effect of different concentrations (5, 7.5 and 10%) of the *Garcinia cambogia* extracts on inhibition and reduction the growth of *A. flavus* and *F. moniliforme*. The reduction in dry weight of fungal

indicated to inhibition activities. More reduction in weight was indicated high effects on fungal activity. Dry weight of both fungi tested significantly ($p \leq 0.5$) decreased with increasing concentration of the plant extract compared to control. Moreover, the reduction in dry weight of *A. flavus* fungus was more pronounced than the reduction weight in *F. moniliforme* fungus. The reduction ratio ranged between 27.79 and 58.0 % with average of 42.39% in *A. flavus,* while, the reduction ratio in dry weight of *F. moniliforme* ranged between 21.24 and 41.44% with average of 31.34%. The data indicated that *Garcinia cambogia* extracts had a good antifungal activity and it was also, a good inhibitor for fungal growth. The highest concentration extracts have the maximum reduction in growth of fungi. Naveen and Kumar, (2013) found that the *Garcinia* genus has antioxidant, anti-cancer, anti-inflammatory, antibacterial, anti-viral, anti-fungal, anti-ulcer and anti-protozoal properties.

Table 1. Effect of different concentrations of the *Garcinia cambogia* extracts on inhibition growth of *Aspergillus flovous and Fusarium moniliforme*

Concentration of *Garcinia* extracts	*Aspergillus flovous*		*Fusarium moniliforme*	
	Dry weight (mg)	Reduction (%)	Dry weight (mg)	Reduction (%)
Control (0%)	274.67 ±1.28 [a]	-	175.33 ±1.15 [a]	-
5 % *Garcinia* extract	198.33 ±1.15 [b]	27.79	138.00 ±1.15 [b]	21.29
7.5 % *Garcinia* extract	167.00 ±1.15 [c]	39.20	126.33±1.15 [c]	27.95
10 % *Garcinia* extract	115.33 ±1.15 [d]	58.00	102.67 ±1.15 [d]	41.44

Each mean value, within the same column, followed by the same letter is not significantly different at 0.05 level. Each value, mean of three replicates, is followed by ± standard deviation.

Effect of different concentrations of *Garcinia cambogia* extract on inhibition zone of *Bacillus cereus* (gram positive + ve) and *Escherichia coli* (gram negative –ve):

The data presented in Table (2) showed that the antibacterial activity of cold and hot extracts revealed reduction in diameter of inhibition zone of both *Bacillus cereus* (gram positive + ve) and *Escherichia coli* (gram negative –ve). The reduction was positively correlated with *Garcinia cambogia* extract concentrations increment. Moreover, cold *Garcinia cambogia* extract was more effective on diameter inhibition zone of *Bacillus cereus* (gram positive + ve). The inhibition zone specific in 7.5% hot and cold extracts were 16.67: 17.67 mm and 10% were 13.67: 15.73 mm respectively in *Bacillus cereus*. Whereas, *Escherichia coli* (gram negative –ve) inhibition zone specific in 7.5% hot and cold extracts were 16: 15.37 mm and in 10% were 13: 12.67mm. The results agreed with reported by (Cock, 2013) illustrated that *G. cambogia* fruit extracts were inhibited both Gram positive and Gram negative bacteria growths.

They were more sensitive to 10% cold *Garcinia cambogia* than 10% hot extracts. Increasing the concentration of *Garcinia* extract in both treatments was associated with a more reduction in inhibition zone diameter of both tested bacteria. Maximum inhibition was recorded at 10% concentration in comparing with the other concentrations (7.5%), this means that *Garcinia cambogia* water extract 10% (cold and hot) shown a good antibacterial activity. The obtained data were in accordance with found by (Jacob *et al*., 2015) who concluded that the *Garcinia gummigutta* extract above concentrations 10% showed no growth of *E. Coli* and can be used as an antibacterial agent and also can be used as antioxidant in food industries.

Table 2. Effect of different concentration of water extracts of *Garcinia combogia* (cold and hot) on diameter of inhibition zones

Tested organisms	Diameter of inhibition zone (mm)			
	Cold extract		Hot extract	
	7.5%	10%	7.5%	10%
Bacillus cereus (gram positive +ve)	15.73	17.67	13.67	16.67
Escherichia coli (gram negative –ve)	13.00	16.00	12.67	15.37

Antioxidant derivatives of G*arcinia* powder, 10% cold and hot extracts:

The data of phenol, flavonoids and isoflavonoids fractionation in *Garcinia cambogia* powder, 10% cold and hot extracts were tabulated in Table (3). The results showed that *Garcinia cambojia* contain phenol compounds in different ratios (ppm) such as pyrogallol, gallic acid, 4-aminobenzoic, protocatchuic, catechin, catechol, epicatechein, P-OH-benzoic, caffeine, chlorogenic, vanillic acid, caffeic acid, P-coumaric, ferulic acid, iso-ferulic, E-vanillic acid, alpha-coumaric, benzoic acid, E-vanillic acid, coumarin, cinnamic acid, salycilic acid and 3,4,5 methoxy cinnamic acid. The highest ratio of phenol in powder was in Pyrogallol (952.11ppm). *Garcinia* powder contains also, chlorogenic, catechin, catechol, epicatechein, E-vanillic acid, protocatchuic and salycilic acid in approximately high amounts. Meanwhile, *Garcinia cambogia* contains, a moderate amounts of gallic acid, 4-aminobenzoic, caffeine, caffeic acid, P-coumaric, ferulic acid, Iso-ferulic, E-vanillic acid, alpha-coumaric, coumarin, cinnamic acid and 3, 4, 5 methoxy cinnamic acid but vanillic acid in few amounts. While phenol compounds in cold 10% extract contain the highest ratio of Pyrogallol, Protocatchuic, Epicatechein and E-Vanillic acid. *Garcinia* extract also, contains a moderate amounts of gallic acid, 4-aminobenzoic, catechin, catechol, P-OH-benzoic, caffeine, chlorogenic, vanillic acid, caffeic acid, P-coumaric, benzoic acid, salycilic acid and 3,4,5 methoxy cinnamic acid. *Garcinia cambogia* extracts contains

also, small amounts of ferulic acid, Iso-ferulic, alpha-coumaric, coumarin and cinnamic acid. The highest phenol compounds in hot extracts were pyrogallol, protocatchuic, catechol, epicatechein and E-vanillic acid.

Meanwhile, it contains a moderate amounts of gallic acid, 4-aminobenzoic, catechin, P-OH-benzoic, caffeine, chlorogenic, vanillic acid, caffeic acid, alpha-coumaric, benzoic acid, salycilic acid and 3,4,5methoxy cinnamic acid also, it contain a small amounts of P-coumaric, ferulic acid, iso-ferulic, coumarin and cinnamic acid.

The highest ratio of flavonoid (ppm) compounds in *Garcinia cambogia* powder, cold and hot extracts was Hespirdin. Powder contains a modrate amount of hespirtin, rutin, quercetrin, rosmarinic, quercetin, kampferol, apigenin, luteolin and 7-OH- flavone but naringin and naringenin are in few amounts. *Garcinia*, 10% cold extract, contains a moderate amounts of naringin, rutin, quercetin, naringenin and hespirtin and a few amounts of rosmarinic, kampferol and apigenin. Meanwhile 10% hot extract contains high amounts of naringin and rutin also, modrate amounts of quercetrin and hespirtin but contains small amounts of rosmarinic, quercetin, naringenin, kampferol and apigenin. While luteolin and 7- OH- flavone are few amounts in cold and hot extracts.

Garcinia combogia contains some Isoflavonoid compounds (ppm) such as diadazein, genistein, iso-formentine and biochanine. The data showed, also, that the cold extract contains the highest ratio of diadazein than powder and hot extract but the powder contains the highest ratio of biochanine than cold and hot extracts. The genistein was in moderate amounts in all treatments, the other component iso-formentine was in moderate amounts in powder extract and small quantity in cold and hot. Bektas, and Ozturk, (2007) reported that *Garcinia combogia* plants are a vital source of antioxidants in nature, they contain chemical compounds like flavonoids, phenols, and other compounds which show high natural antioxidant activity.

Table 3. Fractionation of phenol, flavonoids and isoflavonoids compounds in *Garcinia cambogia* powder, 10% cold and hot extract (ppm):

Phenols (ppm)				Flavonoids (ppm)				Isoflavonoids (ppm)			
phenols Name	Dry fruit powder	Cold Extract 10%	Hot Extract 10%	Flavonoids compounds	Dry fruit powder	Cold extract 10%	Hot Extract 10%	Iisoflavonoids Compounds	Dry fruit powder	Cold extract 10%	Hot extract 10%
Pyrogallol	952.11	73.73	69.13	Naringin	10.371	5.926	5.308	Diadazein	4.59	6.68	2.31
Gallic acid	6.28	2.12	2.25	Hespirdin	102.59	15.792	10.374	Genistein	13.18	2.21	1.72
4-aminobenzoic	35.04	2.96	1.61	Rutin	23.79	7.291	5.750	Iso-Formentine	10.15	6.24	2.35
Protocatchuic	69.54	19.29	18.78	Quercetrin	7.87	1.066	1.747	Biochanine	24.19	0.52	0.04
Catechin	143.50	5.30	4.62	Rosmarinic	8.42	0.317	0.145				
Catechol	135.85	6.46	14.53	Quercetin	14.29	1.857	0.336				
Epicatechein	128.24	28.82	10.03	Naringenin	N.D	1.486	0.575				
P-OH-benzoic	35.67	2.44	2.80	Hespirtin	160.87	1.703	1.692				
Caffeine	25.45	3.03	6.87	Kampferol	25.58	0.419	0.197				
Chlorogenic	278.02	7.75	5.21	Apigenin	11.14	0.276	0.040				
Vanillic acid	6.25	3.19	3.87	Luteolin	46.79	4.32	3.87				
Caffeic acid	48.37	2.70	1.39	7- OH-	12.60	4.87	3.21s				
P-Coumaric	37.97	1.13	0.95	Flavone							
Ferulic acid	27.70	0.93	0.99								
Iso-Ferulic	26.62	0.34	0.12								
E-Vanillic acid	86.03	27.24	25.20								
Alpha-coumaric	10.27	0.66	1.16								
Benzoic acid	27.98	1.74	3.76								
Ellagic acid	72.96	9.83	23.28								
Coumarin	17.92	0.42	0.48								
Cinnamic acid	20.51	0.05	0.16								
Salycilic acid	96.50	1.40	4.1								
3,4,5methoxy cinnamic acid	5.20	2.11	2.33								

Water and fat soluble vitamins in G*arcinia cambogia*:

Garcinia cambogia fruits contain considerable amounts of water and fat soluble vitamins and the data was recorded in **Table (4)**. It contains a high ratio of vitamin C (130.3 ppm), Nicotinic (647.14 ppm) and B_{12} (228.3 ppm), meanwhile, thaymin, B6, folic acid and riboflavine were found in a considerable amounts. These results mean that *Garcinia cambogia* fruits are rich in water soluble vitamins. While the highest amounts of fat soluble vitamins were in vitamins K (242.08 ppm) and β-Carotene (185.44 ppm). It was contains moderate amounts of vitamin D2 and a few amount of vitamin E.

Table 4. Water and fat soluble vitamins (ppm) in *Garcinia cambogia* powder:

Water soluble vitamins		Fat soluble vitamins	
Vit C*	130.30	E*	0.48
Vit B*		K*	242.08
Nicotinic	637.14	D2*	3.89
Thaymin	90.88	β-Carotene*	185.44
B6	25.89		
Folic acid	43.62		
Riboflavine	37.69		
B12	228.30		

*determined in ppm

Viscosity, pH and TSS of tested guava nectar contain *Garcinia cambogia* extracts:

The data illustrated in Table (5), showed an increase in viscosity (at 10 RCF and 25°C after addition of some *Garcinia cambogia* extracts (cold and hot either 7.5 or 10%) than guava nectar (control). The pH values showed a slight increase in guava nectar containing *Garcinia cambogia* (cold and hot) extracts in 7.5 and 10% comparing with control. TSS (Total Soluble Solids) was showed also, slight increase with control in all guava nectar treatments. The variation in viscosity, pH and TSS values may be return to ratio of *Garcinia cambogia* extracts added.

Table 5. Viscosity, pH and TSS of guava nectar treatments:

Samples types	Viscosity	pH	TSS
Control nectar	380	3.87	16
Guava nectar 7.5% cold *G.extract*	390	3.88	16.06
Guava nectar 10% cold *G.extract*	420	3.9	16.08
Guava nectar 7.5 % hot *G.extract*	400	4.02	16.07
Guava nectar 10% hot *G.extract*	440	4.04	16.09

Sensory evaluation of guava nectar treatments:

Sensory evaluation of taste, colour, appearance, flavour and texture of guava nectar treatments was reported in Table (6). The results showed no significant difference in taste in nectar guava containing different *Garcinia cambogia* extracts

either cold (7.5 and 10%) and hot *Garcinia cambogia* extracts 10% in comparing with control. The guava nectar containing cold *Garcinia cambogia* extracts had also, a higher score of taste than that in guava nectar containing hot *Garcinia cambogia* extracts. Colour showed no significant difference between guava nectar containing cold *Garcinia cambogia* extracts and control, meanwhile, guava nectar containing hot *Garcinia cambogia* extracts showed a significant difference with lower score than the others. Texture, flavour and appearance of guava nectar treatments showed no significant difference comparing with control. Total score (%) showed that nectar supplemented with10% of cold *Garcinia cambogia* extracts was near to control score.

Table 6. Sensory evaluation of fresh guava nectar treatments:

Guava juice	Taste	Colour	texture	flavor	Appearance	Total score %
1	9.10±0.23 [a]	8.60±0.23 [a]	8.60± 0.16 [a]	9.50±0.17 [a]	9.40±0.16 [a]	90.4
2	9.10±0.18 [a]	8.60±0.22 [a]	8.50± 0.17 [a]	9.30±0.15 [a]	9.40±0.16 [a]	89.8
3	8.90±0.23 [ab]	9.10±0.22 [a]	8.50±0.17 [a]	9.40±0.16 [a]	9.20±0.13 [a]	90.2
4	8.40±o.16 [b]	7.40±0.16 [b]	8.60±0.16 [a]	9.40±0.16 [a]	9.40±0.16 [a]	86.4
5	8.60±0.16 [ab]	7.80±0.20 [b]	8.60±0.16 [a]	9.30±0.15 [a]	9.30±0.15 [a]	87.2

1: control, 2: guava nectar containing cold 7.5% *Garcinia* extract, 3: guava nectar containing cold 10% *Garcinia* extract, 4: guava nectar containing hot 7.5% *Garcinia* extract, 5: guava nectar containing hot 10% *Garcinia* extract. Each mean value, within the same column, followed by the same letter is not significantly different at 0.05 level. Each value, mean of three replicates, is followed by ± standard deviation.

Total bacterial counts, yeast and mold cells of fresh guava nectar treatments during storage at refrigerator:

The effect of fresh nectar guava containing *Garcinia cambogia* extracts on total bacteria counts, yeast and mold during storage at refrigerator was investigated (Table 7). The data showed that no any detected microbial spoilage in control nectar and guava nectar supplemented with *Garcinia cambogia* extracted (10% of cold and hot) at zero time. After one week along storage in refrigerator, showed increase in total bacterial count in control, it was recorded (log 11 CFU/ml), meanwhile, guava nectar supplemented with 7.5 and10% cold and hot *Garcinia cambogia* extract showed slight increase in microbial spoilage and the total bacterial count were (2 and 2 CFU/ml) in 10 % and (log 3 and 4 CFU/ml) in 7.5% *Garcinia* extracts. After two weeks of storage fresh nectar guava in refrigerator, showed more increase in total bacterial counts in control was detected (log 20 CFU/ml), and meanwhile, guava nectar containing *Garcinia* extracts (10% and 7.5%) cold and hot showed a slight increase . The decrease in total bacterial counts may be due to the addition of *Garcinia cambogia* extracts which contains high antioxidants and hydroxyl citric acid

which acts as preservative substances in nectar. Mold and yeast were absent after one and two weeks in all treatments and control. Adeniyi *et al.*, (2010) reported that the uses of the higher concentration of the preservations guide to the longer shelf life of the product.

Table 7. Total bacterial Count, mold and yeast of tested fresh guava nectar (Log CFU/ml) during storage at refrigerator.

Guava nectar addition extract	Zero time		First week		Second week	
	Total count	Mold and Yeast	Total count	Mold and Yeast	Total count	Mold and Yeast
Control	N.D	N.D	11	N.D	20	N.D
10% cold *G.extract*	N.D	N.D	2	N.D	3	N.D
7.5 cold *G.extract*	N.D	N.D	3	N.D	4	N.D
10% hot *G.extract*	N.D	N.D	2	N.D	3	N.D
7.5 hot *G.extract*	N.D	N.D	4	N.D	5	N.D

N.D: Not detected Log CFU/ml: logarithm colony-forming unit

CONCLUSION

From the data, it could be concluded that aqueous *Garcinia cambogia* extracts were a good antibacterial and antifungal activity. The natural plant contains many of phytoconstituent such as phenols, flavanoids and isoflavanoides which have nature antioxidants and act as a protective agent against free radical substances in the body. These potential beneficial effects include its anti-oxidant property, anti- bacterial, antifungal which can be used as a preservative substance in beverages and confirmed the food safely.

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تقييم مستخلص نبات الجارسنيا كمبوجيا كمضاد لنشاط للفطريات والبكتريا والنشاط التأكسدى

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فى هذه الدراسة المقدمة تم دراسة النشاط التأكسدى والمضاد للبكتريا والفطريات لمستخلص نبات الجارسنيا وذلك بأستخدام مستخلصات مائية للجارسنيا (٧,٥ و١٠ %) الساخن والبارد لاستخدامه كمادة طبيعية لحفظ المشروبات،

وتم دراسة تأثيرها المضاد للفطريات (*Fusarium moniliforme* and *Aspergillus Flavus*) والبكتيريا السالبة جرام (*Escherichia coli*) والموجبة جرام (*Bacillus Cereus*) وقد وجد من الدراسة أن هذه المستخلاصات تحتوى على بولى فينولات عالية مثل البيروجالول والكتاشين و الكتيكول والابيكتاشين والكلوروجنك والسلسيلك بالأضافة لوجود بعض مركبات الفينولات والأيزوفينولات وتحتوى الجارسنيا على كمية من الفيتامينات الذائبة فى الماء والدهن. ووجد من خلال التذوق الحسى لنكتار الجوافة المحتوى على مستخلص الجارسنيا (٧,٥ و ١٠%) المضاف كمادة حفظ طبيعية. لم يلاحظ أى فروق معنوية فى الطعم واللون والقوام والرائحة مقارنتة بالكنترول وأظهرت النتائج عدم وجود نمو للميكروبات فى بداية الحفظ بأستخدام العد الميكروبى و بعد أسبوع ثم أسبوعين من تخزين النكتار فى الثلاجة وجد نمو ملحوظ ومعنوى فى العد الميكروبى فى الكنترول مقارنة بنكتار الجوافة المضاف اليه مستخلص الجارسنيا بارد وساخن بتركيز ٧,٥ و١٠% لمدة أسبوع ثم أسيوعين من الحفظ فى الثلاجة وجد نمو قليل لايوخذ فى الاعتبار مقارنة بالكنترول وخاصة تركيز (10%) للمستخلص.

نستبط من هذه الدراسة أن نبات الجارسنيا كمبوجيا تحتوى على نسبة عالية من المواد المضادة للتأكسد ومثبط لنموالميكروبات ولها فوائد صحية يمكن أستخدامها كمادة حفظ طبيعية فى المشروبات والطعام.