Determination of Properties of Selected Fresh and Processed Medicinal Plants

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Abstract *– The study aimed to determine the chemical properties, bioactive compounds, antioxidant activity and toxicity level of fresh and processed medicinal plants such as corn (Zea mays) silk, pancit-pancitan (Peperomiapellucida) leaves, pandan (Pandanus amaryllifolius) leaves, and commercially available tea. The toxicity level of the samples was measured using the Brine Shrimp Lethality Assay (BSLA). Statistical analysis was done using Statistical Package for Social Sciences (SPSS). Results showed that in terms of chemical properties there is significant difference between fresh and processed corn silk except in crude fiber content was noted. Based on proximate analyses of fresh and processed medicinal plants specifically in terms of % moisture, %crude protein and % total carbohydrates were also observed. In addition, there is also significant difference on bioactive compound contents such as total flavonoids and total phenolics between fresh and processed corn silk except in total vitamin E (TVE) content. Pandan and pancit-pancitan showed significant difference in all bioactive compounds except in total antioxidant content (TAC). Fresh pancit-pancitan has the highest total phenolics content (TPC) and TAC, while the fresh and processed corn silk has the lowest TAC and TVE content, respectively. Furthermore, results of BSLA for the three medicinal plants and commercially available tea extract showed after 24 hours exposure significant difference in toxicity level was observed. The percentage mortality increased with an increase in exposure time of the three medicinal plants and tea extract. The results of the study can served as baseline data for further processing and commercialization of these medicinal plants.*

Keywords *– antioxidant, bioactive compounds, medicinal plant, processing*

INTRODUCTION

Aiming a healthier lifestyle is a growing trend due to the existence of different diseases that affects human life. Different herbal leaves were utilized for the promotion of good health and treatment of different diseases from the wide variety of species present in the Philippines.

The processing of fresh fruits and vegetables can result to changes in composition of the bioactive food components. These changes can be beneficial or detrimental to the total content of health-promoting phytochemicals. The brewing of tea leaves, whether black or green, releases 69 to 85 percent of bioactive flavonoids within three to five minutes in hot water [1].

In the Philippines, medicinal plants are considered to be one of its natural living treasures. There are around 1,500 medicinal plants from the Philippines' 13,500 plants species of which more than 3,500 are considered indigenous. Only 120 medicinal plants have been scientifically validated for safety and efficacy [2].

Corn *(Zea mays)*, silk,pancit-pancitan (*Peperomia pellucida*), and pandan (*Pandanus amaryllifolius*) are medicinal plants that are potentially beneficial to human health. These medicinal plants are well-known in their numerous biologically active compounds including natural antioxidants such as flavonoids and phenolics. When utilized and processed to different products such as tea, these plants can incorporate beneficial antioxidants to the human bodies that can promote health and prevent certain diseases.

Most of the medicinal plants found were consumed by boiling and decoctions. The decoction of the fresh or dried herbal plants, are much used by the Filipinos. There are many claims about the benefits

from medicinal plants such as Corn *(Zea mays)* silk, pansit-pansitan (*Peperomiapellucida*), and pandan (*Pandanus amaryllifolius*) but not scientifically studied, specially the quantification of these components.

OBJECTIVES OF THE STUDY

The study aimed to determine the chemical properties, bioactive compounds, antioxidant activity and toxicity level of the above mentioned fresh and processed medicinal plants and the commercially available tea.

MATERIALS AND METHODS

The proximate analysis conducted were moisture content, ash content, crude fat content, crude fiber content, crude protein content and total carbohydrate content were based on [3]. The bioactive compounds that were determined using the prescribed method were total antioxidant content (TAC), total flavonoids content (TFC), total phenolics content (TPC), (4) and total tocopherols (Vitamin E) content. Antioxidant content were measured using Ultraviolet- visible spectrophotometer for Free Radical Scavenging Activity using 1,1-diphenyl-2-picrylhydrazyl (DPPH) method (5) for TAC . The toxicity levels of the samples were measured using the Brine Shrimp Lethality Assay. However, identification of specific toxin was not included in the study.

The medicinal plants used, corn silk,pancit-pancitan, and pandan (*Pandanus amaryllifolius*), were collected at Rosario, Batangas, Mataas na Kahoy, Lipa City and Bolboc, Batangas City, respectively. These plants are selected because aside from being abundant and accessible, they are also known to have therapeutic effects.

The samples were processed as tea and compared to the commercially available tea in terms of chemical properties, bioactive compounds, antioxidant activity and toxicity level.

Three (3) trials were considered prior to the analyses of fresh and processed medicinal plants such as corn silk,pancit-pancitan, and pandan and commercially available tea.

The proximate analysis results of the fresh medicinal plants were compared to that of the processed ones. The antioxidant activities of the processed medicinal plants were compared to that of the commercially available one.

Extracts for Toxicity Level Determination

The assay was made according to authors [6-8] with slight modifications. The processed medicinal plants were grinded to a coarse powder. Two grams of powdered plant materials such as processed form of corn silk ,pancit-pancitan, and pandan and commercially available tea were individually extracted with 240 ml of hot water for two (2) minutes and then filtered. Filtrates were subjected for lethality assay.

Statistical Treatment

Data were presented as means ± standard deviation. Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 14.0. Each experiment was repeated three times. T-test was used in treatment of analysis and was considered at the 0.05 level of significance.

RESULTS AND DISCUSSION

Proximate analysis was determined for each medicinal plant (fresh and processed into tea) and the commercially available tea. The study focused on the determination of bioactive compounds, antioxidant activity and toxicity level of corn silk, pancit-pancitan, pandan and commercially available tea.

Table 1. Proximate Analysis of Fresh and Processed Medicinal Plants

Parameter (%)	Sample					
	Fresh			Processed		
	Pancit-pancitan	Pandan	Corn silk	Pansit-pansitan	Pandan	Corn silk
Moisture	94.53±0.10	77.49±0.33	44.47±0.41	40.22±0.14	4.52±0.03	10.19±0.17
Ash	1.08±0.02	2.70±0.07	9.87±0.01	12.49±0.06	10.48±0.11	5.93±0.17
Crude Fat	0.95±0.82	1.96±0.86	0.00±0.00	2.84±0.13	0.03±0.16	0.64±0.20
Crude Fiber	0.92±0.10	8.27±0.42	6.77±0.01	13.88±0.38	26.68±1.12	13.47±0.13
Crude Protein	1.37±0.13	3.7±0.11	15.31±1.42	13.61±0.27	15.91±0.35	13.70±0.36
Carbohydrates	2.17±0.48	4.14±1.12	0.35±1.58	0.85±0.47	0.47±0.23	69.54±0.27

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Table 1 shows that fresh pancit-pancitan had the highest moisture content of 94.53 ± 0.10 percent but had the lowest crude fiber and crude protein content with 0.92 ± 0.10 percent and 1.37 ± 0.13, respectively among the medicinal samples. However, processed pancit-pancitan obtained the highest ash content and crude fat content, 12.49 ± 0.06 percent and 2.84±0.13 percent, respectively. While processed pandan had the lowest moisture with 4.52±0.03 percent but had the highest crude fiber and crude protein with 26.68 ± 1.12 percent and 15.91±0.35 percent, respectively. On the other hand, fresh pandan had the lowest ash content with 2.70 ± 0.07 percent. Fresh corn silk had no crude fat and had the lowest carbohydrates content with 0.35±1.58 percent; however processed corn silk showed the highest value of carbohydrates with 69.54 ± 0.27% percent.

As shown in Table 2, the processed pancit-pancitan had the highest total flavonoids content (TFC) of 76.37 mg $QUEg^{-1}$, while its fresh form had the TFC of 44.42 mg $QUEg^{-1}$. Findings showed that fresh pancit-pancitan had the highest total phenol content (TPC) of 1862.25 mg $GAEg^{-1}$ while total anthocyanin content (TAC) of 71.67 mg g^{-1} and percent antioxidant of 73.70, while fresh pandan had the lowest TPC of 35.21mg$GAEg^{-1}$ and processed corn silk had the lowest TAC of -117.51 mg g^{-1} among the medicinal plants. This result is similar to the results of the study conducted by (9) where it was found that TPC of pancit-pancitan was highly associated with antioxidant properties. Fresh pandan had the highest total Vitamin E (TVE) content of 700.66 mg g^{-1}, while fresh cornsilk had the lowest value of TVE content of 1.38 mg g^{-1}. The result of this study is comparable to the study made by (10), they noted that high total tocopherol (Vitamin E) content was major component of *Pandanus amaryllifolius*. Antioxidant activity in terms of DPPH radical scavenging activity of fresh corn silk had the highest value with 88.63 percent while processed pandan had the lowest with 3.72 percent. The obtained result is comparable to the result of study conducted by (11)where antioxidant properties of ethanol-water extract from corn silk were estimated by different methods and the percentage of DPPH radical scavenged by corn silk extract was 92.6 at a concentration of 1.6 mg ml^{-1}.

There was no significant difference in crude fiber in fresh and processed corn silk; likewise there was also no significant difference in crude fat in fresh and processed pancit-pancitan and pandan. Fresh and processed corn silk reflects no significant difference in total Vitamin E content while, fresh and processed pancit-pancitan and pandan implied no significant difference in TAC. Crude protein in fresh and processed corn silk did not differ significantly, while all proximate analyses results in pancit-pancitan and pandan differed significantly. Moreover, fresh and processed corn silk and pancit-pancitan and pandan did not differ significantly in terms of TVE and TAC, respectively (Tables 3 and 4).

Table 2. Bioactive Compounds and Antioxidant Activity of Fresh and Processed Medicinal Plants

Parameter	Sample					
	Fresh			Processed		
	Pancit-pancitan	Pandan	Corn silk	Pansit-pansitan	Pandan	Corn silk
FLAVONOIDS (mg $QUEg^{-1}$)	44.42±0.63	58.84±1.60	72.74±1.18	76.37±3.83	52.69±3.18	61.03±0.65
PHENOLICS (mg $GAEg^{-1}$)	1862.25±76.9	35.21±2.48	68.61±3.56	66.94±3.84	218.62±19.92	232.38±6.17
ANTHOCYANIN (mg g^{-1})	71.67±9.70	1.05±3.47	0.02±2.08	39.08±0.07	6.41±36.01	-107.01
VITAMIN E (mg g^{-1})	558.71±199.4	700.66±92.20	1.38±0.11	501.23±14.84	664.80±40.65	4.97±0.40
% ANTIOXIDANT ACTIVITY	73.70±2.31	51.58±2.89	88.63±1.65	39.09±0.97	3.72±7.53	70.29±1.84

Table 3. Comparison of Proximate Analyses between Fresh and Processed Medicinal Plants

	p- values	Computed t-value	Decision	Interpretation
Corn silk				
%Moisture	0.00	133.783	Reject Ho	Significant
%Ash	0.00	39.89	Reject Ho	Significant
%Crude fat	0.01	-5.628	Reject Ho	Significant
%Crude protein	0.00	-70.429	Reject Ho	Significant
%Crude fiber	0.13	1.892	Accept Ho	Not Significant
%Carbohydrate	0.00	-42.3	Reject Ho	Significant
Pancit-pancitan				
%Moisture	0.00	543.1	Reject Ho	Significant
%Ash	0.00	-313.603	Reject Ho	Significant
%Crude fat	0.17	-3.92	Accept Ho	Not Significant
%Crude protein	0.00	-57.805	Reject Ho	Significant
%Crude fiber	0.00	-70.603	Reject Ho	Significant
%Carbohydrate	0.00	-73.703	Reject Ho	Significant
Pandan				
%Moisture	0.00	376.241	Reject Ho	Significant
%Ash	0.00	-106.663	Reject Ho	Significant
%Crude fat	0.00	-0.126	Accept Ho	Not Significant
%Crude protein	0.91	-27.609	Reject Ho	Significant
%Crude fiber	0.00	-58.09	Reject Ho	Significant
%Carbohydrate	0.00	-80.324	Reject Ho	Significant

α =0.05 level of significance

Table 4. Comparison of Bioactive Compounds and Antioxidant Activity between Fresh and Processed Medicinal Plants

	p- values	Computed t-value	Decision	Interpretation
Corn silk				
Flavonoids	0.00	45.06	Reject Ho	Significant
Phenolics	0.00	-24.097	Reject Ho	Significant
Anthocyanin	0.00	19.10	Reject Ho	Significant
Vitamin E	0.67	0.50	Accept Ho	Not Significant
Antioxidant Activity	0.00	12.87	Reject Ho	Significant
Pancit-pancitan				
Flavonoids	0.03	-3.49	Reject Ho	Significant
Phenolics	0.00	-35.83	Reject Ho	Significant
Anthocyanin	0.19	1.56	Accept Ho	Not Significant
Vitamin E	0.01	-8.22	Reject Ho	Significant
Antioxidant Activity	0.04	3.06	Reject Ho	Significant
Pandan				
Flavonoids	0.00	2.995	Reject Ho	Significant
Phenolics	0.00	-39.820	Reject Ho	Significant
Anthocyanin	0.91	-0.870	Accept Ho	Not Significant
Vitamin E	0.00	0.410	Reject Ho	Significant
Antioxidant Activity	0.002	10.280	Reject Ho	Significant

α =0.05 level of significance

It is shown in Table 5 that the p-value obtained for crude protein in corn silk was 0.059, which is higher than the p-value obtained at 0.05 level of significance. On the other hand, pandan and pancit-pancitan obtained values which were less than the value at 0.05 level of significance in all the proximate analyses. Thus, the null hypothesis is accepted with regard to the crude protein content of processed corn silk and commercially available tea while, the null hypothesis was rejected in all proximate analyses of processed and pancit-pancitan against commercially available tea. This means that there is no significant difference on crude protein content between processed corn silk and commercially available tea but there is a significant difference in the proximate analyses of processed pandan and pancit-pancitan against commercially available tea.

The statistical analyses of the Bioactive compound between the processed medicinal plants and the commercially available tea as presented in Table 6 revealed that there is no significant difference on TVE content between processed corn silk and commercially available tea. There is also no significant difference on TAC between pancit-pancitan and pandan and commercially available tea. Results infer that the medicinal plants used in this study have comparable vitamin E and antioxidant content to that of commercially available tea, however significant differences may be noted in other bioactive compounds and antioxidant activity between medicinal plants and commercially available tea

Table 5. Comparison of Proximate Analyses in Processed Medicinal Plants and Commercially Available Tea

	p- values	**Computed t-value**	**Decision**	**Interpretation**
Corn silk				
%Moisture	0.00	12.86	Reject Ho	Significant
%Ash	0.003	6.234	Reject Ho	Significant
%Crude fat	0.020	-4.52	Reject Ho	Significant
%Crude protein	0.059	3.94	Accept Ho	Not Significant
%Crude fiber	0.13	-20.81	Reject Ho	Significant
%Carbohydrate	0.00	8.36	Reject Ho	Significant
Pancit-pancitan				
%Moisture	0.00	249.35	Reject Ho	Significant
%Ash	0.00	89.00	Reject Ho	Significant
%Crude fat	0.00	11.23	Reject Ho	Significant
%Crude protein	0.002	4.88	Reject Ho	Significant
%Crude fiber	0.00	-23.20	Reject Ho	Significant
%Carbohydrate	0.00	-59.12	Reject Ho	Significant
Pandan				
%Moisture	0.00	-38.653	Reject Ho	Significant
%Ash	0.00	54.523	Reject Ho	Significant
%Crude fat	0.023	4.323	Reject Ho	Significant
%Crude protein	0.003	-16.874	Reject Ho	Significant
%Crude fiber	0.00	-14.111	Reject Ho	Significant
%Carbohydrate	0.02	3.79	Reject Ho	Significant

α =0.05 level of significance

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Table 6. Comparison of Bioactive compounds and Antioxidant Activity between Processed Medicinal Plants and Commercially Available Tea

	p- values	Computed t-value	Decision	Interpretation
Corn silk				
Flavonoids	0.00	45.06	Reject Ho	Significant
Phenolics	0.00	-24.097	Reject Ho	Significant
Anthocyanin	0.00	19.10	Reject Ho	Significant
Vitamin E	0.67	0.50	Accept Ho	Not Significant
Antioxidant Activity	0.00	12.87	Reject Ho	Significant
Pancit-pancitan				
Flavonoids	0.03	-3.49	Reject Ho	Significant
Phenolics	0.00	-35.83	Reject Ho	Significant
Anthocyanin	0.19	1.56	Accept Ho	Not Significant
Vitamin E	0.01	-8.22	Reject Ho	Significant
Antioxidant Activity	0.04	3.06	Reject Ho	Significant
Pandan				
Flavonoids	0.00	2.995	Reject Ho	Significant
Phenolics	0.00	-39.820	Reject Ho	Significant
Anthocyanin	0.91	-0.870	Accept Ho	Not Significant
Vitamin E	0.00	0.410	Reject Ho	Significant
Antioxidant Activity	0.002	10.280	Reject Ho	Significant

α =0.05 level of significance

Toxicity level of processed medicinal plants as compared to the commercially available tea

Table 7. Difference on Toxicity Level of Processed Medicinal Plants and Commercially Available Tea

	p- values	**Computed t-value**	**Decision**	**Interpretation**
Corn silk				
6 hours	1.00	1.00	Accept Ho	Not Significant
12 hours	0.468	-0.802	Accept Ho	Not Significant
24 hours	0.013	-4.243	Reject Ho	Significant
Pancit-pancitan				
6 hours	0.374	1.00	Accept Ho	Not Significant
12 hours	0.507	0.728	Accept Ho	Not Significant
24 hours	0.013	-4.243	Reject Ho	Significant
Pandan				
6 hours	0.678	0.148	Accept Ho	Not Significant
12 hours	0.643	-0.500	Accept Ho	Not Significant
24 hours	0.013	-4.243	Reject Ho	Significant

α =0.05 level of significance

The results of Brine Shrimp Bio Assay (BSLA) on extract of three medicinal plants and commercially available tea (% mortality rate at different time) are shown in Table 7. The percentage mortality increased with an increase in exposure time to the three medicinal plants and tea extract.

After six (6) and twelve (12) hours, the p-values obtained in all medicinal plants were all greater than the value obtained at 0.05 level of significance, thus accepting the null hypothesis. But after 24 hours, all the p-values of processed medicinal plant became less than the value at 0.05 level of significance. This means that there is a significant difference in toxicity

level of processed medicinal plant and commercially available tea within 24 hours. In the study of (12), the differences in the BSLA results may be due to the difference in the amount and kind of cytotoxic substances (e.g. tannins, flavonoids, triterpenoids, or coumarins) which can be also be present in the medicinal plants in this study.

CONCLUSION

Based on the results of the study, there is a marked difference in the proximate analyses of fresh and processed medicinal plants specifically in terms of percent moisture, percent crude protein and percent total carbohydrates. Fresh pancit-pancitan has the highest TPC and TAC, while the fresh and processed cornsilk had the lowest TAC and TVE content, respectively.

Generally, there is a significant difference on the properties based on the proximate analyses, bioactive compound and antioxidant activity of fresh and processed medicinal plants. In addition, significant difference in proximate analyses, bioactive compound and antioxidant activity of processed medicinal plants and commercially available tea is also noted.

In terms of toxicity level, there is no significant difference between processed medicinal plants and commercially available tea after six and 12 hours exposure, however significant difference in toxicity level after 24 hours exposure is noted

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