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Comparative Study on Proximate, Phytochemical and Sensory Evaluation of *Asystasia gangetica* and Market Herbal Tea

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Abstract Comparative studies on proximate, phytochemical and sensory evaluation of *Asystasia gangetica* and market herbal tea were investigated. Fresh leaf, herbal tea powder and hot water tea extract samples were subjected to proximate and phytochemical composition while hot water tea extract samples were subjected to sensory evaluation using conventional standard methods. Result obtained from the investigation ranged as follows: 10.94 to 91.96, 2.09 to 18.72, 4.94 to 7.95, 0.55 to 2.38, 1.31 to 2.99 and 3.22 to 63.38 %; 1.08 to 2.47, 0.45 to 3.89, 1.69 to 8.28, 1.01 to 6.84, 0.86 to 4.29%; 0.52 to 2.43 mg/100g for moisture, crude protein, crude fiber, fat, ash, carbohydrate, flavonoids, alkaloids, saponins, tannins, steroids and hydrogen cyanide, respectively. Sensory evaluation results for *A. gangetica* and market herbal tea hot water extract were 4.88 and 5.12; 5.6 and 5.68; 4.96 and 5.92; 5.72 and 5.88; 5.92 and 5.72; and 5.76 and 5.72 for colour, taste, astringency, aftertaste, flavour and overall acceptability, respectively. The result findings revealed that herbal tea from *A. gangetica* favourably competed (nutritionally) with the market herbal tea and was also liked slightly in overall acceptability (on a 7 point Hedonic scale). This implies that this indigenous herbal plant could be commercially used for herbal tea production since it is packed with viable bioactive ingredients.

Keywords: *comparative study, herbal tea, Asystasia gangetica herbal tea, market herbal tea, proximate composition, phytochemical composition and sensory evaluation*

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1. Introduction

Tea is an aromatic non-alcoholic beverage with a functional food effect and prepared by pouring boiled water into the fresh or cured leaves of *Camellia sinensis* [1]. It is reported that tea consumption started about five thousand years ago in China and India [2]. Traditionally, tea was consumed to improve blood flow, eliminate toxins and improve resistance to diseases [3] while several epidemiological studies have linked tea consumption to the reduction of cardiovascular disease risk, diabetes, cholesterol level [4], arthritis [5], osteoporosis and dental carriers [6]. Tea is categorized into several types such as white, green, oolong, black, puerrh, scented and herbal teas [7].

Herbal tea is made with fresh or dried flowers, leaves, seeds or roots of plants which are generally known to possess medicinal values when allowed to steep in boiled water for a few minutes before consumption. Adeyemi *et al.* [8] reported that *Asystasia gangetica* is a herbal plant commonly known as Ganges primrose, widely seen across Nigeria, South Asia, Sub-Saharan Africa, Oceania and scientifically proven edible [9]. This herbal plant is a widely used concoction in some localities in Nigeria for the management and treatment of so many ailments and was reported to have anti-diabetic and hypolipidemic properties both at acute and sub-acute levels with no toxicity infliction after seven days of study at the maximum tested dose level of 5000 mg/kg body weight [9]. The consumption of this herb is usually faced with the challenge of its odour, colour and taste as it is prepared as a crude aqueous extract thus limiting its consumption despite its huge benefits medicinally due to vital bioactive nutrients. Thus, the processing of this herbal plant to tea help decrease this offensive odour, taste and colour thereby increasing its acceptability and

utilization. Sequel to the above research findings, thus the drive to this study on the comparing the proximate, phytochemical and sensory evaluation of *Asystasia gangetica* and market herbal tea,

2. Material and Methods

2.1. Collection, Identification and Preparation of Plant Material

The *Asystasia gangetica* leaves were collected in March from the Nnamdi Azikiwe University Awka environment and were identified and authenticated by a taxonomist with a voucher specimen Number: MOUAU/VPP/16/016.

2.2. Herbal Tea Production

The picked fresh leaves from the plants were washed with distilled water and processed into herbal tea according to the method of Gabriel and Nkemakonam [10] with little modification. The picked leaves were weighed, washed, drained and withered for 6 hours under room temperature open air. It was then dried at 50°C for six hours, cooled, rolled and packaged in a teabag.

2.3. Proximate Composition Analysis

The percentage moisture, fat, crude protein, ash and crude fiber content of the samples were determined according to the conventional standard method of AOAC [11]. Moisture content was determined by air oven drying. Fat content was by the Soxhlet fat extraction method. Crude protein was determined using the Micro Kjeldahl method. The crude fibre was determined by hydrolysis while ash content was by muffle furnace. Carbohydrate determination was by difference according to the method of Pearson [12] as %carbohydrate = 100 – (%moisture content + %fat + %ash + %crude protein + %crude fiber).

2.4. Phytochemical Determination

The tannins, flavonoids and saponins contents of the samples were determined according to the standard conventional method of AOAC [13] in percentage. The steroids content was determined according to the conventional standard method of Kirk and Sawyer [14] in percentage. The alkaloids of the samples were determined according to the conventional standard method of Harbone [15] in percentage while the hydrogen cyanide (HCN) content of the samples was determined according to the standard conventional method of Bradbury *et al.* [16] in mg/100g.

2.5. Sensory Evaluation

The sensory properties (colour, taste, astringency, flavour, after taste and overall acceptability) of the herbal tea hot water extracts samples were evaluated using a conventional standard method of seven-point Hedonic scale and scores as 1 = strongly dislike, 2= moderately dislike, 3= slightly disliked, 4= indifferent, 5= slightly like, 6= moderately liked and 7= strongly liked. The panel was made of 25 students and staff of the Department of Food Science and Technology, Faculty of Agriculture, Nnamdi Azikiwe University Awka, Nigeria who are conversant with herbal tea.

2.6. Statistical Analysis

Data analysis results generated from the study was expressed as mean ± standard deviation of three replicate determinations. Statistical analysis was performed on the data using one-way analysis of variance (ANOVA) using statistical package for social sciences (SPSS) software version 18.0 and differences in means were compared by Duncan's multiple range test. Significance was accepted at $P < 0.05$.

3. Results and Discussion

3.1. Proximate Composition of the Samples

The proximate composition of fresh *Asystasian gangetica* leaves, herbal tea powder and herbal tea hot water extract; market herbal tea powder and herbal tea hot water extract in percentage is shown in Table 1. The samples studied significantly ($p<0.05$) differed in all the proximate parameters except the ash content of both tea hot water extracts. The moisture content of the herbal tea powder is below that reported by Ifemeje *et al.* [17] while the tea extract is higher, which could be due to water used for the extraction. The moisture content of the powdered herbal tea samples studied was higher than the proposed standard value of 6.5% [18] for a good storage value. This finding denotes a negative implication on the shelflife of the herbal tea powder studied. The protein and fat content of the herbal tea powder samples analyzed were higher and not in agreement with the report of Rehman *et al.* [19] who suggested 1 to 2% and 0.9 to 1.62% of protein and fat for a better quality of tea sample. However, the protein values were also higher than that reported by Ifemeje *et al.*, [17] (0.3 to 1.06%) but the fat content (3.6 to 5.8%) is lower than that. The ash content of the studied samples was in line with the report of Rehman *et al.* [19] who proposed that ash content should not exceed 5.54% to maintain the quality of tea during storage while the studied samples were in close range with that reported by Ifemeje *et al.* [17] (1 to 2.5%). Though crude fiber was not present in the hot water herbal extract, the values in powdered herbal samples were below that reported by Ifemeje *et al.*, [17] (76.63 to 80.35%) but were within the range proposed by Venkatesan *et al.*, [20] (16.5%) for maintenance of high-quality tea during storage. The high values of carbohydrates in the sample could be due to other nutrients packed together with it since it was determined by difference.

3.2. Phytochemical Composition of the Samples

The phytochemical content of *Asystasia gangetica* leaves, herbal tea powder and herbal tea hot water extract; market herbal tea powder and tea hot water extract are shown in Table 2. Generally, hot water herbal tea extract

from *A. gangetica* was compared significantly ($p<0.05$) with market tea extract. It is observed that all the phytochemicals in the fresh *A. gangetica* leaves were higher than the values found in the tea powder and extract. This could be due to the negative and positive (hydrogen cyanide) effects of heat involved in the processing. It is also discovered the phytonutrients in both the tea powder and hot water extract of *A. gangetica* are significantly ($p<0.05$) higher when compared with the market sample. The resulting trend of this study disagrees with the trend reported by Gabriel and Nkemakonam [10] who reported an increase in the phytochemical composition with heat processing during tea production as a result of nutrient concentration. This could also be related to the moisture content of the tea, as Gaberiel and Nkemakonam [10] reported 10.37% while this finding had 11.45%, meaning that theirs was more concentrated than in this study. Both the herbal tea powder and hot water tea extract from *A. gangetica* leaves were favourably higher in all the phytochemical (flavonoid, alkaloid, saponin, tannin, steroids and hydrogen cyanide) analyzed when compared with market samples. The results obtained from the tea samples for saponins, steroids, alkaloids and hydrogen cyanide are within the same range as that reported by Gabriel and Nkemakonam [10] for moringa black and green tea as 2.25 to 5.5, 1.05 to 5.05, 0.65 to 2.20 and 0.55 to 2%, respectively while tannins and flavonoids are higher and below, respectively when compared with the same work by the above-named author as 0.22 to 1.32 and 6 to 16.50 %, respectively.

3.3. Sensory Evaluation of Hot Aqueous Herbal Tea Extract Samples

The sensory evaluation of the hot water herbal tea extract from *A. gangetica* and market samples is shown in Table 3. The herbal tea hot water extract from *A. gangetica* significantly differed in colour, taste, astringency and after taste when compared with the market sample but was the same at $p<0.05$ for flavour and overall acceptability. This means that the *A. gangetica* herbal tea competed favourably based on its higher values of flavour (5.92) and overall acceptability (5.76) showing liked slightly based on the seven-point Hedonic scale. It implies that if *A. gangetica* herbal tea is commercialized it could sell competitively in the market.

Table 1. Proximate composition of fresh *Asystasia gangetica* leaf, herbal tea *and* herbal tea extract; market herbal tea powder and herbal tea hot water extract in percentage

Sample	Moisture	Crude protein	Crude Fibre	Fat	Ash	Carbohydrate
***A.gangetica* fresh Leaf sample**	$65.44^{c}\pm0.02$	$18.72^{a}\pm0.01$	$4.94^{c}\pm0.00$	$2.32^{b}\pm0.01$	$2.91^{b}\pm0.00$	$5.67^{c}\pm0.02$
***A.gangetica* herbal tea powder**	$11.45^{d}\pm0.02$	$14.68^{b}\pm0.01$	$5.12^{b}\pm0.00$	$2.38^{a}\pm0.01$	$2.99^{a}\pm0.01$	$63.38^{a}\pm0.02$
Market herbal tea powder	$10.94^{e}\pm0.02$	$13.52^{c}\pm0.01$	$7.95^{a}\pm0.02$	$2.2^{c}\pm0.01$	$2.84^{c}\pm0.00$	$62.54^{b}\pm0.02$
***A.gangetica* herbal tea extract**	$90.85^{b}\pm0.02$	$3.97^{d}\pm0.01$	- -	$0.63^{d}\pm0.00$	$1.33^{de}\pm0.01$	$3.22^{e}\pm0.03$
Market herbal tea extract	$91.96^{a}\pm0.02$	$2.09^{e}\pm0.02$	- -	$0.55^{e}\pm0.01$	$1.31^{de}\pm0.01$	$4.09^{d}\pm0.02$

In the same column, means with different lower superscripts indicate a significant difference ($p<0.05$).

Table 2. Phytochemical content of *Asystasia gangetica* leaf, herbal tea *and* herbal tea extract; market herbal tea powder and herbal tea hot water extract in percentage

Sample	Flavonoid	Alkaloid	Saponin	Tannin	Hydrogen Cyanide (mg/100g)	Steroid
***A.gangetica* fresh leaf sample**	$2.47^{a}\pm0.02$	$3.89^{a}\pm0.01$	$8.28^{a}\pm0.02$	$6.84^{a}\pm0.01$	$2.43^{b}\pm0.02$	$4.29^{a}\pm0.01$
***A.gangetica* herbal tea powder**	$2.21^{b}\pm0.00$	$3.07^{b}\pm0.01$	$7.42^{b}\pm0.01$	$5.28^{b}\pm0.01$	$1.60^{c}\pm0.00$	$2.29^{b}\pm0.01$
Market herbal tea powder	$2.02^{c}\pm0.01$	$2.78^{c}\pm0.01$	$4.54^{c}\pm0.03$	$4.02^{c}\pm0.01$	$3.56^{a}\pm0.02$	$1.75^{c}\pm0.02$
***A.gangetica* herbal tea extract**	$1.24^{d}\pm0.02$	$1.02^{d\pm}0.02$	$2.04^{d}\pm0.02$	$1.82^{d}\pm0.02$	$0.67^{d}\pm0.00$	$1.06^{d}\pm0.01$
Market herbal tea extract	$1.08^{e}\pm0.00$	$0.45^{e}\pm0.01$	$1.69^{e}\pm0.00$	$1.01^{e}\pm0.01$	$0.52^{e}\pm0.00$	$0.86^{e}\pm0.01$

In the same column, means with different lower superscripts indicate a significant difference ($p<0.05$).

Table 3. Sensory Evaluation of *Asystasia gangetica* and market herbal tea hot water extract

Sample	Colour	Taste	Astringency	after taste	Flavour	Overall acceptability
A.gangetica tea extract	$4.88^{a}\pm1.94$	$5.60^{a}\pm1.77$	$4.96^{a}\pm2.20$	$5.72^{a}\pm2.18$	$5.92^{ab}\pm1.99$	$5.76^{ab}\pm1.98$
Market herbal tea extract	$5.12^{b}\pm2.06$	$5.68^{b}\pm1.97$	$5.92^{b}\pm1.91$	$5.88^{b}\pm1.71$	$5.72^{ab}\pm1.76$	$5.72^{ab}\pm1.79$

In the same column, means with different lower superscripts indicate a significant difference ($p<0.05$).

4. Conclusion

The comparative investigation revealed that *A. gangetica* herbal tea has an advantage over market herbal tea samples in terms of proximate composition, phytochemical composition and sensory evaluation. The findings suggest that this *A. gangetica* herbal tea could enhance the nutrition, antioxidant properties and immune system of the body. Sequel to these research findings on *A. gangetica* ethanolic extract, further in vivo animal assay to ascertain also its hot water extract efficacy be encouraged.

Competing Interest

The authors declared that no conflicts of interest exist.

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References

[1] Sharma, V., Gulati, A. and Ravindranath, S. D. (2005). Extractability of tea catechins as a function of manufacture procedure and temperature of infusion. *Food Chemistry*, 93(1): 141-148.

[2] Dufresne, C. J. and Farnworth, E. R. (2001). A review of latest research findings on the health promotion properties of tea. *Journal of Nutrition Biochemistry*, 12: 404-421.

[3] Balentine, D. A., Wiseman S. A. and Bouwens, L. C. (1997). The chemistry of tea flavonoids. *Critical Revolutions of Food Science Nutrition*, 37: 693-704.

[4] Vinson, J. A., Su, X., Zubik, L. and Bose, P. (2001). Phenol antioxidant quantity and quality in foods: Fruits. *Journal of Agricultural Food Chemistry* 49: 5315-5321.

[5] Haqqi, T. M., Anthony, D. D., Gupta, S., Ahmad, N., Lee, M. S., Kumar, G. K. and Mukhtar, H. (1999). Prevention of collagen-induced arthritis in mice by a polyphenolic fraction from green tea. *Proceedings of National Academy of Science of the United States of America*, 96: 4524-4529.

[6] Hegarty, V. M., May, H. M. and Khaw, K. T. (2000). Tea drinking and bone mineral density in older women. *American Journal of Clinical Nutrition*, 71: 1003-1007.

[7] Horzic, D., Komes, D., Belscak, A., Ganic, K. K., Ivekovic, D. and Karlovic, D. (2009). The composition of polyphenols and methylxanthines in teas and herbal infusions. *Food Chemistry*, 115: 441-448.

[8] Adeyemi, O. O., Aigbe, F. and Uyalabasi, G. N. (2011). Analgesic and anti-inflammatory activities of the aqueous stem and leaf extract of Asystasia gangetica (Linn)T.Anderson. *Nigeria Quartely Journal of Hospital Medicine*, 21(2): 129-34.

[9] Ezembu, E. N., Okolo, C. A., Obiegbuna, J. E. and Ikeogu, F. C. (2020). Acute toxicity and antidiabetic activity of Asystacia gangetica leaf ethanol extract. *Nutrition and Food Science*, 50(1): 179-196.

[10] Okafor, G. I. and Ogbodo, M. N. (2015). Production and Quality Evaluation of Green and Black Herbal Teas from *Moringa oleifera* Leaf. *Journal of Food Resource Science*, *4*: 62-72.

[11] AOAC (2010). *Official Methods of Analysis.* Association of Official Analytical Chemists, Washington DC.

[12] Pearson, D. (1976). *The Chemical Analysis of Foods, London*: Churchill Livingstone.

[13] AOAC (2002). *Official Method of Analysis.* Association of Official Analytical Chemists, Washington DC.

[14] Kirk, R. S. and Sawyer, R. (1991). Pearson's Composition and analysis of foods, 9th ed. London:Addisoa-WesleymLongman, Inc. chapter 2 and 14.

[15] Harbone, J. B. (1973). Phytochemical Methods: *A Guide to Modern Techniques of Plant Analysis.*

[16] Bradbury, M. G., Egan, S. and Bradbury, J. H. (1999). Picrat Paperkits for Determination of Total Cyanogens in Cassava Roots and all Forms of Cyanogens in Cassava Products. *Journal of the Science of Food and Agriculture*, 79:598-601.

[17] Ifemeje, J., Ifemeje, M., Egbuna, C. and Olisah, M. (2020). Proximate, Phytochemical and antioxidant mineral composition of four different brands of tea. *Advanced Journal of Graduates*, 8(1): 1-7.

[18] Muhammad, A., Asif, A., Anwaar, A., Nauman, K., Imran, H. and Lftikhar, A. (2013). Chemical composition and sensory evaluation of tea (*Camellia senensis*) commercialized in Pakistan. *Pakistan Journal of Botany*, 45(3): 901-7.

[19] Rehman, S.U., Almas, K., Shahizadi, N., Bhatti, N. and Saleem, A. (2002). Effect of time and temperature on infusion of tannins from commercial brands of tea. International Journal of Agriculture and Biology 4(2): 285-7.

[20] Venkatesan, S., Senthurpandian, V.K., Murugesan, S., Maibuam, W. and Ganapathy, M.N. (2006). Quality standards of CTC black tea as influenced by sources potassium fertilizer. Journal of the Science of Food and Agriculture 86(5): 799-803.