Comparative study of the proximate analysis and phytochemical screening of the gel extracts and leaves residue of Aloe vera.

[1]I.A Okafor, [2]E.S Anumata, [3]S.N Anyikamba, [4]N.M Ofodum, and [5]S.I Okonkwo

Abstract— Comparative study of the proximate analysis and phytochemical screening of the gel extracts and leaves residue of Aloe vera was carried out. The results showed the values for phytochemical screening of the gel extracts as follows 1.430±0.022%, 0.68±0.14%, 0.42±0.020%, 1.07±0.010% and 0.13±0.004% for alkaloid, flavonoid, saponin, phenol and tannin respectively while the phytochemical screening for the leaves residue include 1.18±0.04%, 1.160±0.948%, 0.530±0.017%, 0.840±0.024% and 0.400±0.0017% for alkaloid, flavonoid, saponin, phenol, and tannin respectively. Furthermore, the proximate analysis of the gel extract showed the following result 0.22±0.22%, 0.11±0.636%, 92.46±0.637%, 5.660±.00%, 0.16±0.024% and 0.17±0.0124% for protein, fat, moisture, carbohydrate, fiber and ash, respectively while the proximate analysis of the leaves residue include 16.62±0.0202%, 0.35±0.12%, 24.24±1.679%, 45.51±0.00%, 16.29±1.59% and 1.33±0.023% for protein, fat, moisture, carbohydrate, fiber, ash, phytate and oxalate respectively. The proximate analysis indicated that protein, carbohydrate, fat, fiber and ash are more in the leaves residue while moisture is more abundant in the gel extract. Also, the phytochemical screening revealed the presence of more tannin and flavonoid in the leaves residue while gel extract contains more alkaloid.

Keywords – Aloe vera, Aloe gel extracts, phytochemical analysis, proximate analysis, Natural products

1 INTRODUCTION

For centuries, local communities used medicinal plants to cure certain diseases. Herbs and plants play a vital role in the treatment of different diseases and ailments which may be pathogenic or non-pathogenic in nature. World Health Organization has encouraged the use of herbs in treatment of pathogenic and non pathogenic diseases especially in the developing world to avoid the spread of such diseases [1]. These infections are invasive and the increase of their incidence in the hospitals [2], lead to the increase in mortality rate in underdeveloped countries. Due to the presence of phytochemicals in medicinal plants, they are used directly or in extracted forms to fight against such ailments. A huge number of phyto-drugs manufactured today are obtained directly or indirectly from natural sources. Herbal medication which is popular in Asian and African countries [3] gained popularity due to a perception that it has lower incidence of adverse reaction when compared with synthetic pharmaceuticals [4] and also cost effective.

Aloe barbadensis miller otherwise known as Aloe vera is made up of short stem, spiral green leaves and fibrous roots. It belongs to the family liliaceae and is widely distributed in the tropical and subtropical regions of the world [5]. Aloe vera which is often used as an ornamental plant contains 99.3% water with the remaining 0.7% made of solids containing glucose and mannose as the major constituents [6]. This wonder plant is known for its medicinal properties and one of the richest sources of health for human beings from nature. It has been used in pharmaceutical industry for the synthesis of products such as ointment, gel preparations, capsules and tablets. In food industry, it is used as a source of functional food or parts of the ingredients in other food products [7]

Chauhan in the year 2007, obtained many vitamins from Aloe vera which includes vitamin A, B1, B2, B6, C, E, and F. It was also reported to contain minerals, mono and polysaccharides, organic acids and enzymes [8]. Aloe vera gel, a colourless, viscous liquid consisting of water, polysaccharides with a bitter taste [9] is used to treat wounds, skin irritations, minor burns, constipation, cough, ulcers, diabetes, headache, arthritis, immune system deficiencies [10]. It also has anti-inflammatory, antifungal, antibacterial, anticancer, antioxidant, cytoprotective, cardiac stimulatory, immunomodulatory activities [4]. Some of the chemical constituents in Aloe vera gel include amino acids, lipids, sterols, tannins, flavonoids and mannose-6-phosphate [9],[11],[12].

To process the leaf, it is separated into gel and cortex. The latex is located in the cortex and corresponds to the bitter yellow juice of the green part of the leaf produced in the leaf epidermis and in the spiny portion of the leaves [13].

2 MATERIALS AND METHOD

Sample collection and identification

Aloe leaves were collected from Idoh Family, Obodokoli Uli, in Ihiala L.G.A of Anambra State, Nigeria and identified by Dr. Ukpaku, a botanist in the Department of Biological Science, Chukwuemeka Odumegwu Ojukwu University, Uli.

Method of extraction

Aloe vera was dissected to separate the gel from the leaves. The rinds (leaves residue) were obtained and the remaining clear core of gel was then processed by adding 20mL of tocopherol to prevent oxidation. The gel and tocopherol were homogenized using a high speed blender under sterile condition.

Phytochemical screening for leaves residue and gel extracts
Qualitative analysis was carried out to test for the presence of tannins, saponins, flavonoids, alkaloids and phenols by methods outlined by Harborne [14]. The quantitative analysis was carried out to determine the concentration of constituent phyto-compounds in the samples. The concentration of the alkaloids, flavonoids and saponins were determined by the methods outlined by Harborne [14]. The concentration of tannins and phenols were determined as described by Pearson [15].

Proximate analysis for the leaves residue and gel extracts
The moisture content of the samples was determined by the gravimetric method as described by Pearson [15], James [16] and Bradley [17]. The ash content of the samples was determined by the furnace incineration gravimetric method described by AOAC [18] and Harborne [14]. The fat content was determined by the continuous solvent extraction method using soxlhet extractor while the carbohydrate content was determined by estimation using the arithmetic difference method described by Pearson [15] and James [16]. The crude protein content was determined by the Kjeldahl method described by James [16]. The fiber content was determined by the Weende method described by James [16].

3 RESULTS

The results of the phytochemical screening and proximate analysis are shown in Table 1-3

phytochemicals	Observation in both samples	Inference for leaf extract	Inference for gel extract
Alkaloid	Orange precipitation	Present	Present
Phenol	Greenish blue colouration	Present	Present
Tannin	Greenish black precipitation	Present	Present
Flavonoid	Yellow colouration	Present	Present
Saponin	Steady froth	Present	Present

Table 1: Phytochemical screening: Qualitative analysis of the leaves residue and gel extracts

Phytochemicals	Weight or quantity of sample used in both experiment (g)	Mean value for the leaf residue (%)	Standard deviation for the leaf residue (%)	Range value of the leaf residue (%)	Mean value for the gel extract (%)	Standard deviation for the gel extract (%)	Range value of the gel extract (%)
Alkaloid	5.0	1.18	±0.04	0.09	1.430	±0.022	0.04
Flavonoid	5.0	1.160	±0.948	0.08	0.68	±0.014	0.02
Saponin	5.0	0.530	±0.017	0.02	0.42	±0.020	0.04
Phenols	5.0	0.840	±0.024	0.05	1.07	±0.010	0.002
Tannins	5.0	0.400	±0.0017	0.003	0.13	±0.004	0.008

Table 2: Phytochemical screening: Quantitative analysis of the leaf residue and gel extract with their mean

values, standard deviation and range.

Parameters	Weight or quantity of sample used in both experiment (g)	Mean value for the leaves extract (%)	Standard deviation for the leaves extract (%)	Range of the leaves extract (%)	Mean value for the gel extract (%)	Standard deviation for the gel extract (%)	Range of the gel extract (%)
Protein	**5.0**	16.62	±0.202	0.35	0.22	±0.022	0.13
Fat	**5.0**	0.35	±0.012	0.020	0.11	±0.636	0.020
Moisture	**5.0**	24.24	±1.679	3.36	92.46	±0.637	0.12
Carbohydrate	**5.0**	46.51	±0.00	0.00	5.66	±0.00	0.00
Fiber	**5.0**	16.29	±0.159	0.28	0.16	±0.024	0.04
Ash	**5.0**	1.33	0.00055	0.04	0.17	0.012	0.01

Table 3: Result of the proximate analysis of the leaves residue and gel extract with their mean values, range and Standard deviation.

4 DISCUSSION

Table 1 showed the result for the qualitative analysis of the phytochemicals present in the leaves residue and gel extract of Aloe vera. The test for the presence of alkaloids, saponin, flavonoids, tannins and phenols in both samples were positive. Table 2 which represents the quantitative analysis indicated that the leaf residue contains more flavonoid, saponin, and tannins whereas the gel extract have abundant alkaloid and phenols. These compounds have been known to possess medicinal properties. Alkaloids have been reported to be a pain killer and tannins are useful in the treatment of inflamed tissues and cancer [19]. Also, flavonoids are used in the fight against microorganisms, allergies, free radicals and ulcer [20]. Saponins possess antimicrobial property due to its ability to cause leakage of proteins and certain diseases and phenols are known to have curative properties [21].

Table 3 shows that Aloe vera gel extract contains more moisture than the leaves residue while the leaves residue is richer in protein, carbohydrates and fats. Also, the anti-nutritional (fiber and ash) values of the samples indicated that the leaves residue contains more fiber and ash than the gel extract. These compounds are essential to human health and can be incorporated into the food through the use of Aloe vera leaves. It is also clear from the result that the gel extract has a high moisture content which has both industrial and medicinal uses.

5 CONCLUSION

Conclusively, it is clear from the analysis that the leaves residue of Aloe vera is as important as the gel extract and should not be discarded but rather should be use in the production of different cosmetic and pharmaceutical products. Furthermore, Aloe vera gel extract should be used in the production of body cream and lotion due to its high moisture content and ability to penetrate the skin to restore lost fluids and help protect the body from microorganisms. Therefore, Aloe vera leave residue is equally as important as the gel extract and should be use simultaneously for maximum health benefits

REFERENCE

[1] World Health Organization (1995). The World Health Report. Bridging the gap, Geneva. 1, pp. 118
[2] Santos JDG, Branco A, Silva AF, Pinheiro CSR, Goes Neto A, Uetanabaro APT, Queiroz SROD, Osuna JTA (2009). Antimicrobial Activity of the Bark of Bridelia fermginea (Euphorbiceae). Int. j. Pharmacl. 34:87-90.
[3] Patel DK, Laloo D, Kumar R, Hemalatha S (2011). Pedalium murex Linn.: an overview of its phytopharmacological aspects. Asian Pac J Trop Med 4(9): 748-755
[4] Sitara U, Hassan N, Naseem J (2011). Antifungal activity of Aloe vera gel against plant pathogenic fungi. Pak J Botm: 43(4): 2231-2233.
[5] Lanjhiyana S, Garabadu D, Ahirwar D, Bigoniya P, Rana AC, Patra KC, Lanjhiyana SK, Karuppiah m (2011). Antihyperglycemic potential of Aloe vera gel in experimental animal model. Ann Biol Res: 2(1): 17-31.
[6] Agary OO, Olaleye MT, Bello-Micheal CO (2005). Comparative activities of Aloe vera gel and leaf, Afr. J. Biotehnol., 4(12): 1413-1414.

[7] Hamman JH (2008). Composition and Application f Aloe vera Gel. Molecules vol. 13 pp 1599-1616
[8] Arunkumar S, Muthuselvan M (2009). Analysis of phytochemical constituents and antimicrobial activities of Aloe vera L. against clinical pathogen. World J. Agric. Sci. 5 (5): 572-576
[9] Brinelon J (1995). Pharmacognosy Phytochemistry. Medicinal plants. Paris Lavoisier.
[10] Bozzi A, Perrin C, Austin S, Vera FA (2007). Quality and authenticity of commercial Aloe vera gel powders. Food chem.: 103(1): 22-30.
[11] Santrel International (1998). Aloe vera. Its Chemical Properties. Int. J. Dermatol. 30: 679-683.
[12] Davis Ph, Robson MC (1999). Anti-inflammatory and would healing of growth substances in Aloe vera. J. Ame. Pediatric Med. Assoc. 84: 77-81.
[13] Reynolds T, Dwec AC (1999) Aloe vera leaf gel: a review update. Journal of Ethnopharmacology
[14] Harborne J.B, (1973). Phytochemicals methods: A guide to modern techniques of plant analysis. Chapman and Hill, London.
[15] Pearson D. (1976). Chemical Analysis of Food. Church-hill Livingston, Edinburgh, UK. Pp. 103-110.
[16] James C.S (1995). Analytical chemistry of foods. Chapman and Hill, London.
[17] Bradley R.L, (2003). Moistures and total solids analysis in food analysis. Kluwer Academic/Plenum Publishers, New York. Pp 83-85.
[18] AOAC (2000). Official method of analysis of the association of official analytical chemist, 17th Edition. AOAC International, Gaithersburg MD.
[19] Igbinosa OO, Igbinosa EO, Aiyegoro OA, (2009). Antimicrobial activity and phytochemical screening of stem bark extracts from jatropha curcas (Linn). Afr. J. Pharma. And Pharmacol. 3(2): 058-062.
[20] Aiyegoro OA, Okoh AIR (2010). Preliminary phytochemical screening and in vitro antioxidant of the aqueous extract of Helichrysum longifolium DC. BMC Complement Altern Med 10: 21 [24] Lalnundanga NL, Lalrinkima R (2012). Phytochemical analysis of themethanol extract of root bark of Hiptage benghalensis (L.). Kurz Sci Vis 2012; 12(1): 8-10
[21] Lalnundanga NL, Lalrinkima R (2012). Phytochemical analysis of themethanol extract of root bark of Hiptage benghalensis (L.). Kurz Sci Vis 2012; 12(1): 8-10

AUTHOR'S PROFILE

Dr. Ifeoma Anastasia Okafor obtained her Higher National Diploma in Science Technology (Chemistry Option) from The Polytechnic Calabar Cross River State, 1994. She also obtained Post Graduate Diploma in Industrial Chemistry in the year 2000, M.Sc Analytical Chemistry in 2005, and Ph.D Environmental Chemistry in 2017 from Nnamdi Azikiwe University, Awka. She is currently employed in the National Agency for Food and Drug Administration Control (NAFDAC), Chemical Evaluation and Research Directorate.

CO-AUTHOR'S PROFILE

1. Mr. Stanley Anumata is a Lecturer in the Department of Chemistry/Biochemistry, Federal Polytechnic Nekede, Owerri, Nigeria. He obtained his degree from Imo State University, Department of Pure and Industrial Chemistry and is currently pursuing his Masters in Pharmaceutical Chemistry in Nnamdi Azikiwe University.

2. Mr. Stanley Anyikamba is a graduate of Pure and Industrial Chemistry from Chukwuemeka Odumegwu Ojukwu University Uli, Anambra State. He is also a Master's Degree holder in Analytical Chemistry from Chukwuemeka Odumegwu Ojukwu University Uli, Anambra State.

3. Mr. Nnamdi Modestus Ofodum graduated in 2016 with a Bachelors Degree from Chukwuemeka Odumegwu Ojukwu University Uli, Anambra State, Nigeria, Department of Pure and Industrial Chemistry. He also obtained his National Diploma in Science Technology from Federal Polytechnic Nekede, Owerri, Nigeria.

4. Professor Sylvia Ifeyinwa Okonkwo was born in Ihiala, Nigeria. She graduated in 2006 with degree from Nnamdi Azikiwe University Awka, Anambra State, Nigeria department of Pure and Industrial Chemistry and obtained her Masters in 2005. She got her Ph.D in Analytical Chemistry from Federal University of Technology Owerri in 2008. She is currently a Professor in Chukwuemeka Odumegwu Ojukwu University Uli in the Department of Pure and Industrial Chemistry. She has attended conferences all over the world and has over 31 publications in reputed journals.