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QUANTITATIVE ANALYSIS AND ANTIOXIDANT ACTIVITY OF CUCURBITACEAE FRUITS

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Abstract
Quantity of phytochemicals in all fruits parts of cucurbitacea (*C.melovar,C satisvas & C.melo*) were found to be in order as: flavonoid > saponin > alkaloid. Pulp and seeds of *Cucumis melovar, Cucumis satisvas Cucumis melo* have total phenolic contents.In among these fruits *C melo* 's parts contain more phenolic compoundsas compare to the peel. Pulp and peel of *Cucumis sativus* show more total phenolic contents as compare to the seeds. *Cucumis melovar, Cucumis sativus & Cucumis melo* fruits may be included in daily diet because of therapeutic potential, fruit plants can prevent from chronic diseases caused by free radicals.

Introduction:

Fruits and vegetables are fundamental components of the human diet, contributing significantly to nutritional balance and health maintenance (Karakurt et al., 2015). They are recognized as rich sources of biologically active compounds, including phenolics, phytosterols, vitamins, and other phytochemicals, which exhibit strong antioxidant properties (Shahidi et al., 2015). These bioactive constituents are increasingly studied due to their potential role in preventing chronic diseases such as cardiovascular disorders, diabetes, cancer, and neurodegenerative conditions (Joseph et al., 2000; Das et al., 2013; Uwa et al., 2017). Oxidative stress, resulting from the excessive production of reactive oxygen species (ROS), is a major factor contributing to cellular damage. This damage affects essential biomolecules such as lipids, proteins, and DNA, ultimately leading to the

development of various diseases (Ismail et al., 2010). The mitochondrial electron transport chain is one of the primary sources of ROS, where incomplete oxygen reduction leads to the formation of reactive intermediates. In addition, environmental factors such as pollution, smoking, and toxic chemicals further increase oxidative stress levels. Therefore, dietary antioxidants derived from plant sources are essential in neutralizing these free radicals and maintaining physiological balance (Chang et al., 2018).

Phytochemicals present in fruits and vegetables, such as flavonoids, tannins, alkaloids, glycosides, and carotenoids, are known to contribute significantly to antioxidant activity (Harith et al., 2018). These compounds not only act as free radical scavengers but also enhance the body's defense mechanisms against oxidative damage (Ismail et al., 2010). The quantitative estimation of such phytochemicals is crucial to understanding their biological efficacy and potential applications in nutraceutical and pharmaceutical industries. Furthermore, epidemiological evidence suggests that regular consumption of fruits and vegetables is associated with a reduced risk of chronic diseases, whereas insufficient intake may lead to increased susceptibility to metabolic disorders and nutritional deficiencies (Mehra et al., 2015).

It is estimated that more than 10,000 phytochemicals are present in plant-based foods, many of which contribute to antioxidant defense systems by regulating ROS and reactive nitrogen species. In food systems, antioxidants also play an important role in inhibiting lipid oxidation, thereby preventing the formation of undesirable compounds such as aldehydes and ketones (Marwa et al., 2016). Although synthetic antioxidants like TBHQ, BHA, and BHT are widely used, their potential toxic effects have raised concerns, highlighting the need for safer, natural alternatives (Uwa et al., 2017). Among various plant families, the Cucurbitaceae family holds significant importance due to its nutritional and medicinal value. Species such as *Cucumis melovar*, *Cucumis sativus*, and *Cucumis melo* are widely cultivated in tropical and temperate regions and are commonly consumed as part of the daily diet (Yasar et al., 2006). These fruits are not only economical but also rich in essential nutrients and antioxidant compounds, making them valuable for human health (Kumaraswamy, 2016). Cucumber, for instance, contains carotenoids and phenolic compounds that contribute to its antioxidant properties, although its total antioxidant activity has been reported to be relatively lower compared to other vegetables (Chu et al., 2002).

In addition to their antioxidant potential, cucurbit fruits possess a wide range of pharmacological properties, including anti-inflammatory, antimicrobial, anti-diabetic, and wound healing activities (Rajasree et al., 2016; Bidkar et al., 2012; Ru et al., 2018; Sahu et al., 2015; Vishwakarma et al., 2017). Their nutritional composition further enhances their value, as they contain vitamins, minerals, dietary fiber, and bioactive compounds essential for metabolic processes (Roberts, 2018). Similarly, *Cucumis melo* is recognized as a rich source of vitamins A and C, minerals, and natural sugars, along with significant antioxidant potential (Mumeena et al., 2017). Despite the recognized importance of these fruits, there is limited comprehensive data regarding the quantitative estimation of their phytochemical constituents and their correlation with antioxidant activity. Understanding the concentration of key phytochemicals such as flavonoids, alkaloids, saponins, and phenolics is essential for evaluating their biological significance. Therefore, the present study focuses on the quantitative analysis of phytochemicals and the assessment of antioxidant activity in *Cucumis melovar*, *Cucumis sativus*, and *Cucumis melo*. This work aims to provide a deeper understanding of their nutritional and therapeutic potential and to support their utilization in functional foods and natural antioxidant formulations.

Materials and Methods:

The fruits *Cucumis sativus* (Khira), *Cucumis melovar* (Kakri) and *Cucumis melo* (Kharbuza) were collected from the local market of Sukkur. Fruits of these plant were taken same size and shape. Materials identified and verified by the Department of Botany. Extremely pure and analytical grade chemicals used in the experiments. Ferric chloride, Folin-ciocalteu reagent, anhydrous sodium carbonate, chloroform, sodium hydroxide, Mayer's reagent, methanol, glacial acetic acid, sulphuric acid, acetic anhydride, acetic acid, Molisch's reagent, ninhydrin, glacial acetic acid, ammonium hydroxide, diethyl ether, butanol, hydrochloric acid, sodium chloride, sodium carbonate, dimethyl sulphoxide, n- hexane, iodine solution and dimethyl sulphoxide.

Sampling:

The fruits were cleaned with fresh (distilled) water to eradicate dirt substances. Different parts of all fruits were separated and cut into fine small pieces. The sample materials were dried under shade for 15 days and ground into fine powder by grinding machine. After sieving 22 m.m, they were transferred to air-tight polyethylene zipper bags to protect from sunlight and air, labeled for further use.

Seed Peel Pulp

Fig: 1 *Cucumis melovar* (Kakri) fruit parts

Seed Pulp Peel

Fig: 2 *Cucumis sativus* (Khira) fruit parts

Seed Pulp Peel

Fig: 3 *Cucumis melo* (Kharbuza) fruit parts

Preparation of Extracts:

Dry powder (1 kg) of all parts (pulp, peel and seed) fruits *Cucumis melovar, Cucumis sativus* and *Cucumis melo* punched in 2 liters of crude methanol and shaken several intervals. Later 72 hours of soaking, they were purified with filter paper and filtrates were concentrated with the rotary vacuum evaporator on low pressure to get the rough methanol extract.

Remains were put off in 10% dimethyl sulphoxide and deposited to screen phytochemicals (Abbas, M, et al; 2013).

Fig: 4 Preparation of methanolic extracts in the laboratory

Fig: 5 Preparation of hexane extracts in the laboratory

Quantitative analysis:

1. Alkaloids measurement:

The methanol 200 ml of 10% of acetic acid dissolve, 5g of the all crushed illustration were mixed to 250 ml beaker fully wrapped. Left to stand for 4hrs and filtered. The extract was intense to water bath to one fourth part of the initial volume. Thickened NH_4OH was mixed to drop to drop till the precipitation was finished. Precipitates received were established and washed with diluted ammonium hydroxide filtered, dried and measured.

2. Flavonoids measurement:

10 g of each fruit part of C. melovar (kakri), C. melo (kharbuza) and C. sativus (khira) was taken out with 100 ml of 80% of aqueous CH3 OH at room temperature. What man filter paper no. 42 was used to filter the solution. Later it was transported into container and put into water bath to evaporate and to dry till endless weight (Dhandapani, R, et al; 2008).

3. Saponins measurement:

The extracts were pulverized and 20g of all were placed to 250 ml a conical flask were taken and mixed with 100ml of 20% of aqueous CH3OH mixed well. The extracts were flamed at 55oC for four hours with constant moving on a hot water bath. After filtering the solution, it was deposit to obtain which were retaken with 200 ml 20% CH3OH. The mixed substance was thickened to 40 ml around 90oc on water bath and later relocated with separatory funnel and 20ml of C2H6O (diethyl ether) was mixed and shaken constantly. The ether deposit was discarded to recover the aqueous layer. The distillation procedure earned by mixing with 6o ml of n-butanol, the collective solution cleaned two times with ten ml of 5% aq: NaCl. To concentrate the residue of solution, it was kept in water bath and dehydrated in an oven till constant mass. The substances of saponin were taken as percentage (Sadiq, M. E, et al; 2012).

Antioxidant activity:

1. Total phenolic content (TPC) measurement:

Total phenolic content (TPC) was quantified by Folin-ciocalteu reagent method. The procedure displayed the existence of total phenolic contents in the extracts. The solutions were added with 2ml of 2% solution of sodium chloride and 2.5 ml of 10 % Folin- ciocalteu reagent and to protect its mixture at 25 ° C temperature for 15 minutes. Gallic acid taken as a standard to measure the mixture absorbance three times at 765 nm. Final results were taken from the standard bends and expressed through Gallic acid correspondent (mg/g) of received compound (Yadav, R.N, et al; 2011, Hossain, M, et al; 2013, Singh, J, et al; 2016).

RESULT AND DISCUSSION

Table:1 Quantity of methanolic extract of *C. melovar, C. sativus and C. melo* fruit parts from 20 g powder

Samples	Dried powder wt.(g) in 100 ml methanol	Wt. of extract obtained (g)
1.Pulp (*C. melovar*)	20 g	3.71
Peel	20 g	2.403
Seed	20 g	3.573
2. Pulp (*C. sativus*)	20 g	2.816
Peel	20 g	1.832
Seed	20 g	2.39
3.Pulp (*C. melo*)	20 g	5.262
Peel	20 g	2.95
Seed	20 g	2.532

Table no.1 shows the highest extract weight (g) obtained from C. *melo* pulp (5.262 g) and lowest extract wt. value got from C. *sativus* peel (1.832 g) in methanolic extract.

Table: 2

Total phenolic content of *C. melovar* (kakri), *C. sativus* (khira) and *C. melo* (kharbuza) fruit parts (mg/g) in methanlic solvent at 765 nm

Samples	Pulp	Peel	Seed
C. melovar (Kakri)	2.9	1.52	1.02
C. sativus (Khira)	2.80	2.63	1.21

C.melo (Kharbuza)	4.5	3.72	2.27

The changed quantity of TPC (antioxidant activity) of methanolic extract was determined from different parts of C. *melovar,* C. *sativus* and C. *melo* e.g. pulp, peel and seeds.

The quantity of total phenolic content showed in methanolic extracts from three plants of Cucurbitaceae family fruits, present in this order *Cucumis melo* > *Cucumis sativus* > *Cucumis melovar* different parts.

Total phenolic content was shown in Table: no.2, it indicates that TPC content among three fruits has highest in C. *melo* then C. *melovar and* C. *sativus.* Study showed three fruits pulp have more phenomena than peel and seeds. C. *melo*'s pulp has highest 4.50 mg/g. TPC found in C. *melovar* pulp, 2.93 mg/g and C. *sativus*'s pulp contained 2.80 mg/g quantity of TPC. TPC content which is highest amongst these three-fruit pulp. It is matching well with literature. (Sahar, A, et al; 2013, Ismail, H. I, et al, 2010, Marwa, E. E. D. I, et al; 2016). Besides this, lowest phenolic content showed in peel of C. *melovar,* C. *sativus* and C. *melo* in methanolic extract. Table (2) showed TPC in pulp, peel and seed of C. *melovar* methanolic extract is 2.9 mg/g, 1.5 mg/g,1.0mg/g among three fruit parts, pulp possess more value. The highest value of TPC among three fruit parts of C. *sativus*, pulp has more value 2.80mg/g than peel (2.63mg/g) and seed (1.21mg/g).

TPC among the *Cucumis* fruit parts, highest in pulp (4.5mg/g) then peel (3.72mg/g) and seed (2.27mg/g) it is good agreement with literature (Singh, J, et al; 2016, Rolim, P.M et al; 2018). Phenolic compounds reveal antioxidant ability determined in melon seed and peel extract. Melon residue showed anti-tumor properties in methanolic extract. Melon peel and seeds used in food industries as by products. Melon residue showing the ability in methanolic extract to performing important role to prevent humans from chronic diseases i.e. cervical cancers, colon, cardiovascular and kidney diseases due to anti-proliferative property and contained bioactive substances (Rolim, P. M, et al; 2018).7 C. *sativus* fruit parts of the crude methanol extract contained antioxidant TPC properties i.e cytotoxic, free radical scavenging property, membrane stabilizing, antimicrobial and thrombolytic properties (Sharmin, T, et al; 2017).

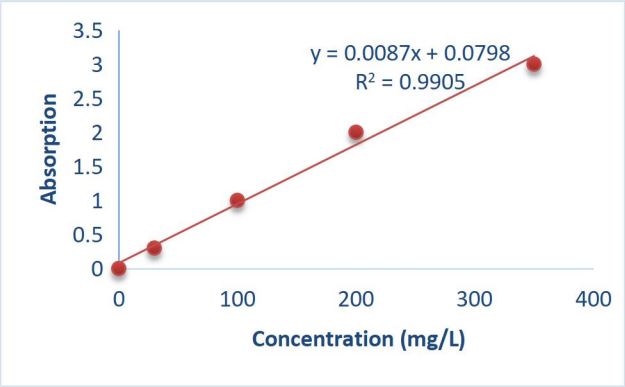

Fig 4.7 Total phenolic content in pulp of *Cucumis melovar* at 765 nm

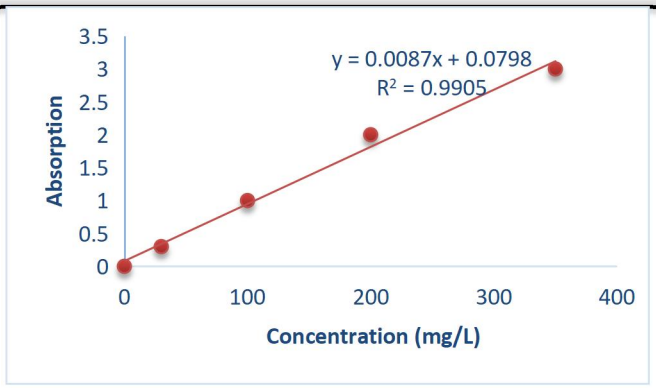

Fig 6 Total phenolic content in peel of *Cucumis melovar* at 765 nm

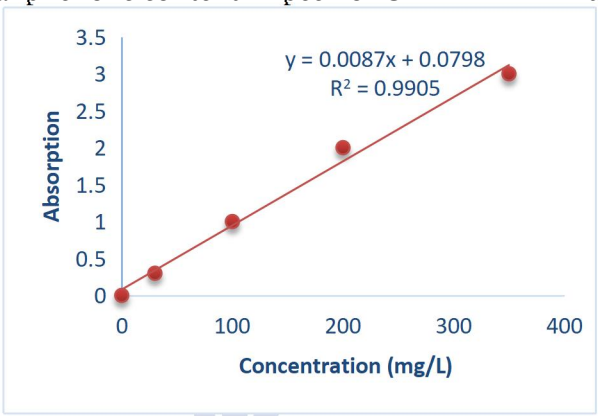

Fig 7 Total phenolic content in seed of *Cucumis melovar* at 765 nm

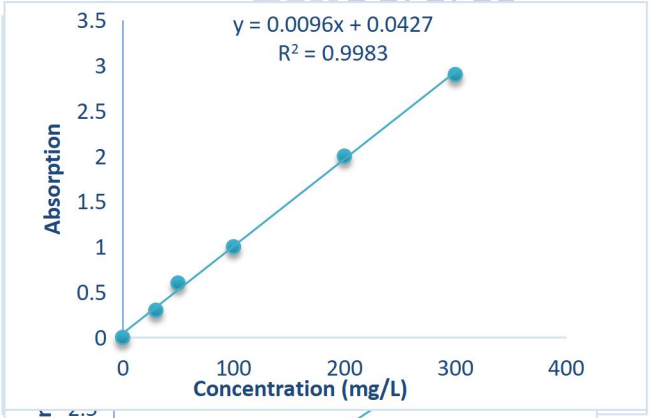

Fig 8 Total phenolic content in pulp of *Cucumis sativus* at 765 nm

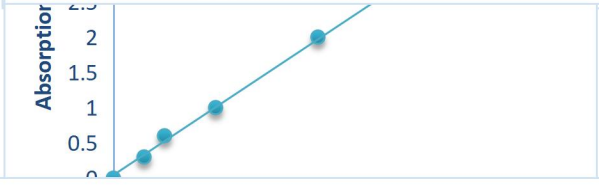

Fig 9 Total phenolic content in peel of *C. sativus* at 765 nm

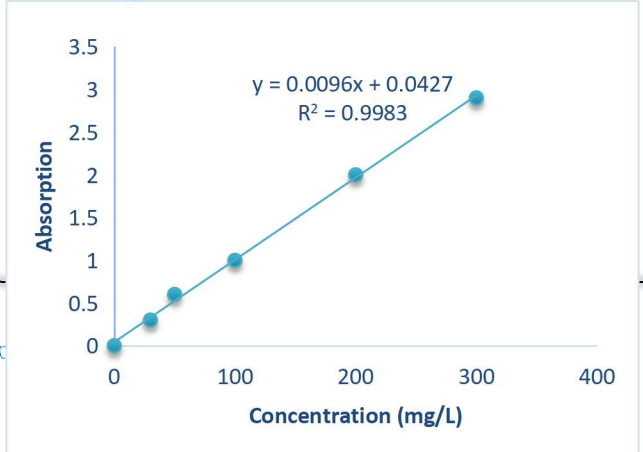

Fig 10 Total phenolic content in seed of *Cucumis sativus* at 765 nm

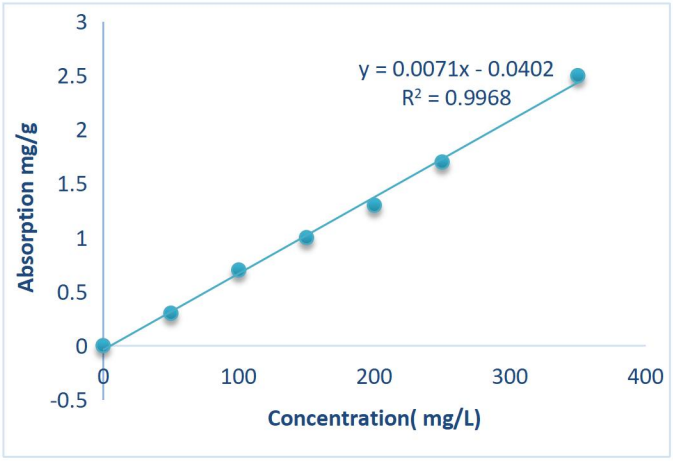

Fig : 11 Total phenolic content in pulp of *Cucumis melo* at 765 nm

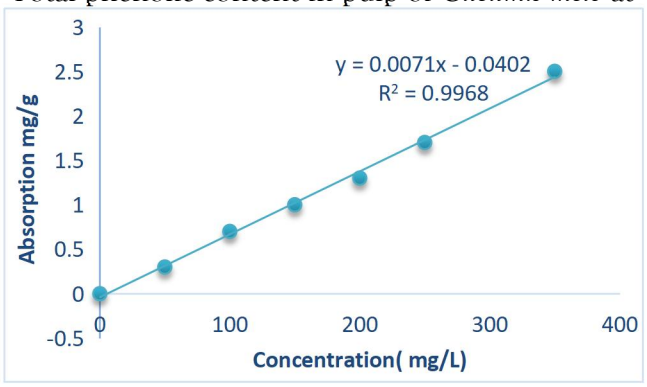

Fig: 12 Total phenolic content in peel of *Cucumis melo* at 765 nm

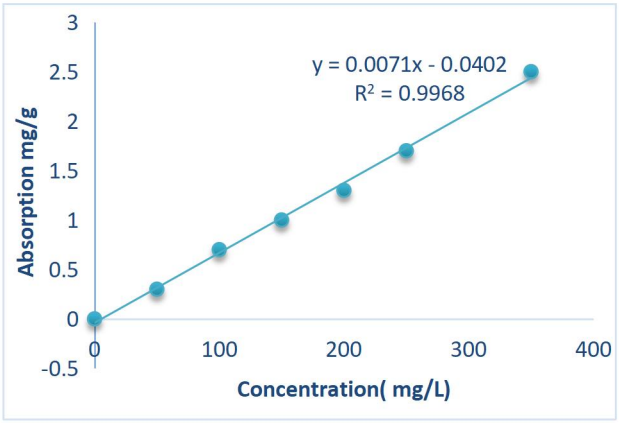

Fig: 13 Total phenolic content in seed of *Cucumis melo* at 765

Flavonoids:

All fruits have different concentration of flavonoids in the methanol extract. C. *melo* is estimated to have the highest concentration of flavonoids followed by C. *melovar* and C. *sativus* among the three fruits. The current study found that C. *melo's* pulp has the highest concentration of flavonoids among three fruits. Peel has the second most level of flavonoids and seed has the lowest concentration of flavonoids among sample fruits. The results are in accordance to the literature (Pranooti, E.K et al; 2014).

Alkaloids:

The concentration of alkaloids present in methanolic extract fruit of C. *melovar* pulp, peel and seeds possessing 12.30%, 10.72% and 9.50% respectively with highest in pulp.

Saponins:

Quantitative analysis showed that all fruits have the concentration of saponins in the methanol extract. C. *melovar* is estimated to have the highest concentration (22.4 %) of saponins followed by C. *melo* (22 %) and C. *sativus* (20 %) among the three fruits. The current study found that peel has the highest concentration of saponins among three fruits parts. Pulp has the second most level of saponins and seed has the lowest concentration (9.9%) of saponins among sample fruits. The results are in accordance to the literature .

Conclusion:

TPC content among three fruits has highest in C. *melo* then C. *melovar and* C. *sativus.* Study showed three fruits pulp have more phenolic contents than peel and seeds. C. *melo*'s pulp has highest 4.50 mg/g. TPC found in C. *melovar* pulp, 2.93 mg/g and C. *sativus's* pulp contained 2.80 mg/g quantity of TPC. TPC content which is highest amongst these three fruit pulp. Quantity of phytochemicals in C. *melovar* and C. *melo*'s all parts pulp, peel seed were found to be in order as: Flavonoid > Saponin > Alkaloid. Quantity of phytochemicals in C. *sativus* seed found to be in order as Flavonoid >Alkaloid > Saponin. Besides this, lowest phenolic content showed in peel of C. *melovar,* C. *sativus* and C. *melo* in methanolic extract.

References:

1. Chang, S.K., Alasalvar, C. and Shahidi, F., 2018. Superfruits: Phytochemicals, antioxidant efficacies, and health effects–A comprehensive review. Critical reviews in food science and nutrition, pp.1-25.
2. Chu YF, Sun J, Wu X, Liu RH. 2002. Antioxidant and antiproliferative activities of common vegetables. Journal of Agricultural and Food Chemistry 2002; 50(23):6910- 6916.
3. Das, A., Biswas, P. and Chakrabarty, P., 2011. Hepatotoxicity and hepatoprotectism herbs: Herbal remedies. International Journal of Research in Ayurveda & Pharmacy, 2(4).
4. Dhandapani, R. and Sabna, B., 2008. Phytochemical constituents of some Indian medicinal plants. Ancient science of life, 27(4), p.1.
5. Chang, S.K., Alasalvar, C. and Shahidi, F., 2018. Superfruits: Phytochemicals, antioxidant efficacies, and health effects–A comprehensive review. Critical reviews in food science and nutrition, pp.1-25.
6. Gracelin, D.H.S., Britto, A. and Kumar, B.J.R.P., 2013. Qualitative and quantitative analysis of phytochemicals in five Pteris species. Int J Pharm Pharma Sci, 5, pp.105-7.

7. Harith, S.S., Mazlun, M.H., Mydin, M.M., Nawi, L. and Saat, R., 2018. Studies on phytochemical constituents and antimicrobial properties of Citrullus lanatus peels. Malaysian Journal of Analytical Sciences, 22(1), pp.151-156.
8. Hossain, M.A., AL-Raqmi, K.A.S., AL-Mijizy, Z.H., Weli, A.M. and Al-Riyami, Q., 2013. Study of total phenol, flavonoids contents and phytochemical screening of various leaves crude extracts of locally grown Thymus vulgaris. Asian Pacific journal of tropical biomedicine, 3(9), p.705
9. Hussain., Rasul, A., Anwar, H., Aziz, N., Razzaq, A., Wei, W., Ali, M., Li, J. and Li, X., 2018. Role of Plant Derived Alkaloids and Their Mechanism in Neurodegenerative Disorders. International journal of biological sciences, 14(3), p.341.
10. Ismail, H.I., Chan, K.W., Mariod, A.A. and Ismail, M., 2010. Phenolic content and antioxidant activity of cantaloupe (Cucumis melo) methanolic extracts. Food Chemistry, 119(2), pp.643-647.
11. Joseph, N., Morel, E.M.A., Mushagalusa, F., Kasali, K.K. and Claudine, N.E., 2018. Preliminary phytochemical screening and antimicrobial evaluation of leaves and barks extracts from Cola anomala (Schott and Endlicher). Journal of Pharmacognosy and Phytochemistry, 7(5), pp.2262-2266.
12. Karakurt, Y., et al. 2015 "Antioxidant compounds and activity in cucumber fruit in response to foliar and soil humic acid application." Eur. J. Hortic. Sci 80.2 (2015): 76-80.
13. Krishnamachari, H. and Nithyalakshmi, V., 2017. Phytochemical Analysis and Antioxidant Potential of Cucumis Melo Seeds. Int. J. Life. Sci. Scienti. Res, 3(1), pp.863-867.
14. Kumaraswamy. L, 2016. Cucumber-A Natural Medicine and its Therapeutic Potential. International Journal of Research in Biotechnology and Biochemistry; 6(1): 1-5
15. Marwa Ezz El-Din Ibrahim, Hany Gaber El-Masry, 2016. Phenolic Content and Antioxidant Activity of Cantaloupe (Cucumis melo var. cantalupensis) and Food Application. International Journal of Nutrition and Food Sciences. Vol. 5, No. (1), pp.1 Mumeena, S., Srilakshmi, C., Tejeswini, B. and Aruna, T., 2017. Phytochemical investigation and evaluation of in-vitro antilithiatic activity of muskmelon fruit. International Journal of Pharma and Chemical Research, 3(2), pp.267-273.
16. Mehra, M., Pasricha, V. and Gupta, R.K., 2015. Estimation of nutritional, phytochemical and antioxidant activity of seeds of musk melon (Cucumismelo) and watermelon (Citrulluslanatus) and nutritional analysis of their respective oils. Journal of Pharmacognosy and Phytochemistry, 3(6), pp.98-102.
17. Mumeena, S., Srilakshmi, C., Tejeswini, B. and Aruna, T., 2017. Phytochemical investigation and evaluation of in-vitro antilithiatic activity of muskmelon fruit. International Journal of Pharma and Chemical Research, 3(2), pp.267-273.
18. Pulok. K. Mukherjee, Neelash.K.Nema, NiladviMaity, Birendrak.Saker, 2013. Phytochemical and therapeutic potential of cucumber. Fitoterapia 84(2013) 227-236.
19. Rajasree, R.S., Sibi, P.I., Francis, F. and William, H., 2016. Phytochemicals of Cucurbitaceae family, A review. IJPPR, 8(1), pp.113-123.
20. Roberts, D.L., 2018. The Best Green Smoothies for Weight Loss: Over 30 Simple Recipes for Healthy Eating. One Jacked Monkey LLC via Publish Drive.

21. Rolim, P.M., Fidelis, G.P., Padilha, C.E.A., Santos, E.S., Rocha, H.A.O. and Macedo, G.R., 2018. Phenolic profile and antioxidant activity from peels and seeds of melon (Cucumis melo L. var. reticulatus) and their antiproliferative effect in cancer cells.
22. Ru, Y., Chen, X., Wang, J., Guo, L., Lin, Z., Peng, X. and Qiu, B., 2018. Polysaccharides from Tetrastigmahemsleyanum Diels Gilg: Extraction optimization, structural characterizations, antioxidant and antihyperlipidemic activities in hyperlipidemic mice. International Journal of Biological Macromolecules.
23. Sadiq. M.E., Abdul Fattah,A.Inuwa, H. M, 2012. Quantitative Phytochemical and Restriction Digest Analysis of Ocimum Gratissimum and Hyptis Suaveolens: A Comperative Study. Nigerian (2012) Journal of Pharmaceutical Sciences. Vol. 11 No.1, P.77-83.
24. Shahidi, F., and P. Ambigaipalan. 2015. Phenolics and polyphenolics in foods, beverages and spices: Antioxidant activity and health effects – A review. Journal of Functional Foods 18:820–897.
25. Sharmin, T. and Sarkar, S., 2017. Screening of biological activities of Cucumissativus leaf, growing in Bangladesh. Journal of Pharmacognosy and Phytochemistry, 6(1), pp.254-257.
26. Singh, J., Singh, V., Shukla, S. and Rai, A.K., 2016. Phenolic content and antioxidant capacity of selected cucurbit fruits extracted with different solvents. J Nutria Food Sci, 6(6), pp.1-8.
27. Uwa, L. M, 2017.The anti-aging efficiency of anti-oxidants. Current Trends in Biochemical Engineering & Biosciences ISSN: 2572-1151 Vol: 7 Issue 4-2017.
28. Vishwakarma,V. K., Gupta, J.K. and Upadhyay, P.K., 2017. Pharmacological importance of Cucumis melo L.: An overview. Asian Journal of Pharmaceutical and Clinical Research, 10(3), pp.8-12.
29. Yadav, R.N.S. and Agarwala, M., 2011. Phytochemical analysis of some medicinal plants. Journal of phytology. 3(12): 10-14.
30. Yasir, M., Sultana, B., Nigam, P.S. and Owusu-Apenten, R., 2016. Antioxidant and genoprotective activity of selected cucurbitaceae seed extracts and LC–ESIMS/MS identification of phenolic components. Food chemistry, 199, pp.307-313.