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Phyto-Chemical Analysis of Ten Selected Vegetables

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Abstract: ***Vegetables play an important role in our daily diet. The present study designed to estimate the phytochemicals in ten selected vegetables namely Lablab purpureus, Beta vulgaris, Phaseolus vulgaris, Solanum melongena, Momordica charantia, Daucus carota, Coccinia grandis, Cucumis sativus, Lycopersicon esculentum, and Trichosanthes anguina. The materials which are selected for the study contains phytochemicals like alkaloids, flavonoids, tannin, phenols and saponins. The phytochemical screening showed that methanolic extract of all the vegetables contains both saponin and phenol. In aqueous extracts, saponin was found in all vegetables but phenol was found only in two vegetables- Solanum melongena and Lablab purpureus. The quantitative estimation showed that highest amount of phenol (0.122mg/100g) was found to be in Phaseolus vulgaris. It also had considerable amounts of saponin (114.10g/100g), flavonoid (236mg/100g), alkaloid (487.81mg/100g), and tannin (9.142mg/100g). The phenol, flavonoid and tannin content of Solanum melongena (0.111mg, 376mg and 428 mg) were significantly higher than those in Lycopersicon esculentum. The vegetables play a very important role as a source of nutrients to the human body and their consumption ensures, intake of phytochemicals and nutrients, thus avoiding the health problems.***
Keywords: Methanol, Aquous extract, Flavonoid, Phenol, Saponin

I. INTRODUCTION

There are many varieties of vegetables available and many ways to prepare cook and serve them. Vegetables contain many vitamins and minerals that are good for our health. Vegetables also contain phytochemicals, or plant chemicals. They are also referred to as phytonutrients which are responsible for providing color, flavor, and odor to plant foods, such as tomatoes red color, broccolis bitter taste, and garlics pungent odor. The easiest way to get more phytochemicals is to eat more vegetables (tomato, carrot, cucumber, beetroot etc). Most the phytochemicals have antioxidant activity and protect the cells against oxidative damage and reduce the risk of developing certain types of cancer. Eating a diet rich in vegetables and fruits as part of an overall healthy diet may reduce risk for heart disease, including heart attack and stroke. Phytochemicals have the potential to stimulate the immune system, reduce inflammation, prevent DNA damage and reduce the growth rate of cancer cells.

II. MATERIALS

The following materials were used for the study.

1) *Lablab purpureus*
2) *Beta vulgaris*
3) *Phadeolus vulgaris*
4) *Solanum melongena*
5) *Momordica charantia*
6) *Daucus carota*
7) *Coccinia grandis*
8) *Cucumis sativus*
9) *Lycopersicon esculentum*
10) *Trichosanthes anguina*

III. METHODS

A. *Collection and preparation of organic extract of samples*

Well matured vegetables were selected and free from blemishes and mechanical injuries. Then it washed under running tap water. Fresh and healthy parts of materials are cut into small section using a knife. Then it was crushed and blended with mortar and pestle to get a thick paste. Then suitable solvents of methanol are used for extraction.

IV. PHYTOCHEMICAL ANALYSIS

A. *Phytochemical Screening*

Following phytochemicals were screened according to the standard procedure described by Harborne (1998). The phytochemical screening carried out in both methanolic and aqueous extract.

B. Quantitative Estimation of phytochemicals

The quantitative assay was carried out to determine the amount Tannin, Saponnin, Flavonoid, Phenol and Alkaloid in methanolic extract.

1) *Estimation of Tannin:* Total tannin content was determined by using Folin – Ciocalteu Spectrophotometric method (Swain T 1979).
2) *Estimation of Saponi:* Estimation of total Saponin content was determined by the vanillin-sulphuric acid colorimetric method (Hiai *et al*.,1976)
3) *Estimation of Flavonoid content:* The content of Flavanoid was determined by using spectrophotometric method (Zshishen *et al*., 1999 & Zou *et al.*, 2004).
4) *Estimation of Alkaloid:* The alkaloid content of the metabolic extract was determined by the method of Trease & Evans., 2002.
5) *Estimation of Phenol:* The total phenolic content of the methanolic extracts were determined by folin ciocalteau reagent method (Cai *et al*., 2004).

V. RESULTS AND DISCUSSION

A. Phytochemical Screening

The present work was designed to evaluate certain phyto-chemicals in ten selected vegetables namely *Lablab purpureus, Beta vulgaris, Phaseolus vulgaris, Solanum melongena, Momordica charantia, Daucus carota, Coccinia grandis, Cucumis sativus, Lycopersicon esculentum,* and *Trichosanthes anguina.* Vegetables have been used as food material since ancient times and have been playing a very important role in our diet and nutrition. They are the most common sources of carbohydrates, fats, proteins, vitamins, minerals, amino acids, and fibers. They also contained antioxidants and phytochemicals. The present study determined the presence of phytochemicals like alkaloid, flavonoid, tannin, saponin, and phenol by using two different solvents such as methanol and distilled water. A wide variation in content of different phytochemicals was observed among the selected vegetables. The results of the present study showed that methanolic extract of all the vegetables contains both saponin and phenol. In aqueous extracts saponin was found in all vegetables but phenol was found only in two vegetables- *Solanum melongena* and *Lablab purpureus*. Flavonoid was present in all the aqueous extracts except that of *Cucumis sativus*. The qualitative estimation showed that methanolic extract of *Beta vulgaris, Daucus carota, Trichosanthes anguina* and *Coccinia grandis* contain all the selected phytochemicals. But in aqueous extracts only *Lablab purpureus* contain all the mentioned phytochemicals. Compared to aqueous extract, methanolic plant extracts had higher number of phytochemicals.

B. Estimation of Phytochemicals

1) *Estimation of Tannin:* Tannins found to be present in various concentrations in many vegetables consumed by human. Tannins are widespread in plant foods, particularly in vegetables, legume seeds, cereal grains, fruits, and nuts as well as in different beverages such as wine, tea, and cider. The result of the analysis is given in the figure 1. The study showed that among all the selected vegetables, *Beta vulgaris* was the richest in tannin content (61.711mg/g). Lowest amount of tannin was estimated in *Cucumis sativus* (14.981mg/100g). This was followed by *Solanum melongena* (50.428mg/100g), *Phaseolus vulgaris* (49.142mg/100g), *Momordica charantia* (42.283 mg/100g), *Coccinia grandis* (26.428mg/100g), *Lycopersicon esculentum* (19.285g/100mg), *Daucus carota* (18.857mg/100g), *Lablab purpureus* (18.857mg/100g), and *Trichosanthes anguina* (17.713mg/100mg). Tannins were present considerably in methanolic extractof *Solanum melongena, Phaseolus vulgaris* and *Momordica charantia*. Good contribution of tannins in antioxidant activity has been observed by Joabe Gomes de Melo et al during 2010. Uchendu O. Mbah and Anthony Cemaluk C. Egbuonu (2017) had estimated the tannin content in *Solanum melongena* Linn Fruit. According to their study, tannin content (11.87 ± 1.87 mg/100 g) is comparable to the value (12.82 ± 0.14 mg/100 g) reported by Agoreyo et al. for *S. melongena* but significantly higher compared to the value (2.12 ± 0.00%) and (0.17 ± 0.07 mg/100 g) reported by Egbuonu and Nzewi, for processed bitter yam and Oyeyemi *et al*, (2015) for *Solanum anguivi respectively*. This report revealed that *S.melongena* contained large amount of tannin. Maira Oliveira Silva *et al*., (2017) had determined the phenolic compounds and tannins in two bean cultivars (*Phaseolus vulgaris L.*): the carioca bean (Pontal) and the common bean (commercial). According to their observation higher values were reported in raw Pontal bean (2.15 mg). Cooking significantly reduced the tannin content in beans (99% for Pontal and 96% for commercial). Thiyagarajan Sathishkumar and Ramakrishnan Baskar (2014) had screened and quantified the phytochemicals present in the leaves and flowers of *Tabernaemontana heyneana Wall*. Various type of phytochemicals distributed in the leaves and flowers of this plant. The concentration of tannins present in leaves and flowers was found to be 12 ± 0.13 mg/g and 6 ± 0.17 mg/g, respectively.

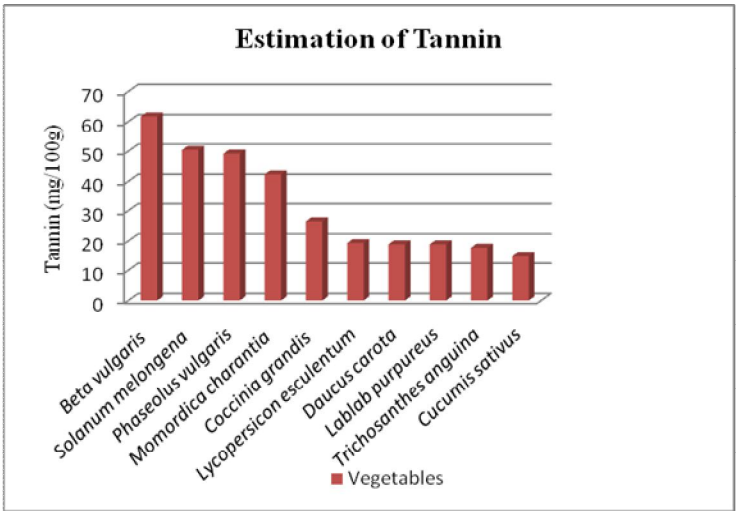

Fig1: Estimation of Tannin

2) *Estimation of Saponin:* Saponins are naturally occurring phytochemicals which are widely distributed in many vegetables, beans and some herbs. Saponins can provide a bitter taste - peas and soybeans are the most common examples. The result of the estimation of saponin is given as figure 2. Among the ten selected vegetables, it was determined that Lablab purpureus had the highest amount of Saponin (131.785mg/100gm) and Momordica charantia had the lowest amount of saponin(52.634mg/100gm). It was followed by Phaseolus vulgaris (114.101mg/100gm), Coccinia grandis (109.89mg/100gm), Lycopersicon esculentum (90.018mg/100gm), Beta vulgaris (89.681mg/100gm), Daucus carota (582.102mg/100gm), Solanum melongena (76.881mg/100gm), Cucumis sativus (63.998mg/100gm) and Trichosanthes anguina (58.942mg/100gm). Sodepo and Arinze (1985) reported beans to contain a considerable amount of saponin which is about 245.0mg/100gm. M. Amin Mir et al., (2016) reported the saponin content in various extracts of Crocus sativa. It was found to be 1.2 and 3.4 mg/gm in methanol and water extract of the Crocus sativa. Rachel Nimenido Uadia et al., (2017) reported the saponin content in leaf, root and stem of Vernonia amygdalina. The result showed that saponin content in the leaf was 4.407 ± 0.079%, Root (1.951 ± 0.037%) and Stem (1.505 ± 0.045%).

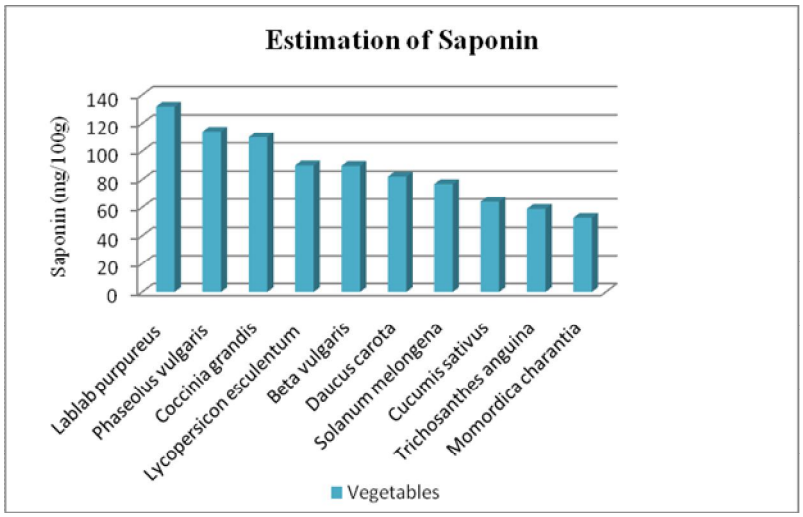

Fig 2: Estimation of Saponin

3) *Estimation of Flavonoid:* Flavonoids are a plant chemicals widely distributed in almost all vegetables and fruits . Along with carotenoids, they are responsible for the colors in fruits and vegetables. Flavonoids are known as the largest group of phytonutrients and best-known flavonoids are quercetin and kaempferol. Members of the nightshade family including tomatoes and eggplants are rich in the flavonoid contents. The result of the analysis is given in the figure 3. Among the ten selected vegetables, it was determined that *Solanum melongena* had the highest amount of flavonoid (376mg/100gm) and *Cucumis*

sativus had the lowest amount (75.4mg/100gm). The second position was for *Beta vulgaris* (322mg/100gm), followed by *Phaseolus vulgaris* (236mg/100gm), Lablab purpureus (235 mg/100gm), *Lycopersicon esculentum* (218mg/100g), *Coccinia grandis* (175mg/100gm), *Daucus carota* (114.8mg/100gm), *Trichosanthes anguina* (79.9 mg/100gm), and *Momordica charantia* (76.3mg/100gm). Nayanathara A.R *et al.*, (2016) determined flavonoid content in different varieties of eggplant (*Solanum melongena*). The result of the estimation showed that highest flavonoid content was obtained in violet suphol that was 102.01 mg/gm. The lowest was obtained in long green with 22.62 mg/gm. Violet nadan have second highest flavonoid content that was 62.41 mg/gm. The flavonoid content of small round green and violet with white stripe was 46.28 mg/gm and 35.55 mg/gm respectively. Olajire A.A and Azeez L (2011) had determined the flavonoid content of Nigerian vegetables. *Solanum macrocarpon* had the highest value of 215.39 mg quercetin g^{-1} and *Allium cepa* had the lowest value of 10.23 mg quercetin g^{-1}.

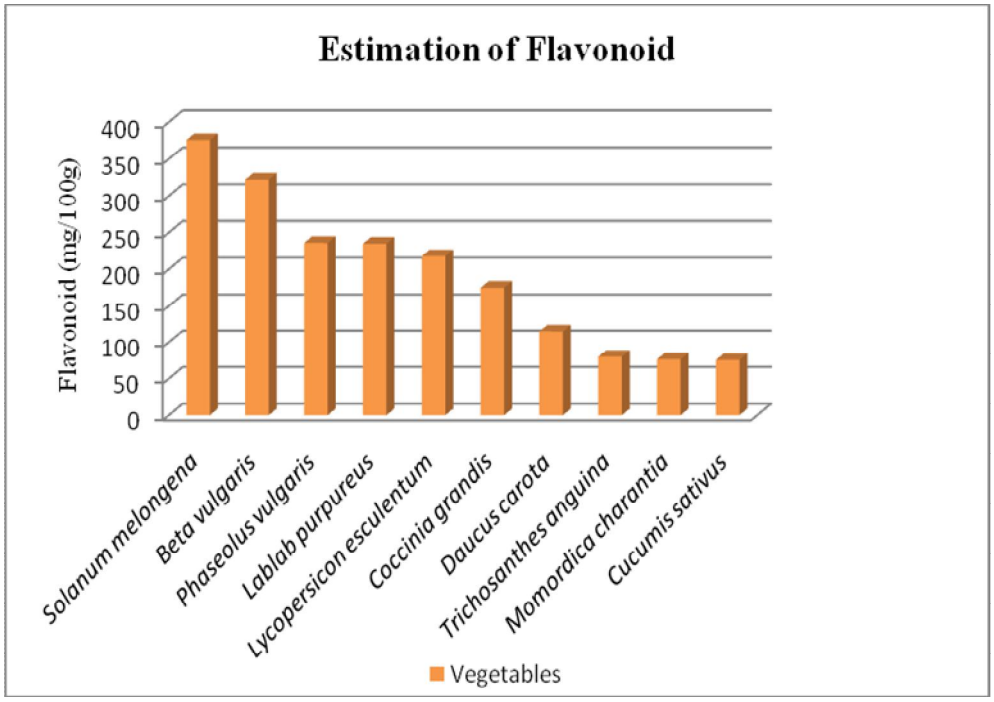

Fig 3: Estimation of Flavonoid

4) *Estimation of Alkaloid:* The alkaloids are nitrogen-containing compounds with a pronounced physiological action. They are biologically very useful and it can occur in all parts of the plant.But they accumulate only in particular organs (e.g., in barks, roots, leaves, and fruits) in the form of salts of organic acids, glycosides of sugar. The result of analysis was given in the figure 4. Among the ten selected vegetables, *Lablab purpureus* (628.21mg/100gm) contained highest amount of alkaloid and the least amount was found in *Beta vulgaris* (277.46 mg/100gm). It was followed by *Momordica charantia* (536.84mg/100gm), *Phaseolus vulgaris* (487.81 mg/100gm), *Daucus carota* (438.51 mg/100gm), Cucumis sativus (430.02 mg/100gm), *Trichosanthes anguina* (424.54mg/100gm), *Lycopersicon esculentum* (399.89mg/100gm), *Coccinia grandis* (359.08mg/100gm) and Solanum melongena (304.02 mg/100gm). The alkaloid content of *Phaseolus vulgaris, Daucus carota* and *Cucumis sativus*, where significantly higher than *Coccinia grandis, Solanum melongena* and *Beta vulgaris*. Vijay D Tambe and Rajendra S Bhambar (2014) had estimate the alkaloid content in *Hibiscus tiliaceus Linn*. wood extracts. The extract contains alkaloids of 66.01 as mg of atropine equivalents. Soladoye M, O and Chukwuma E. C (2012) had estimate the total alkaloid content in leaves of *Cissus populnea Guill. & Perr*. (Vitaceae). The study obtained 2.49% (0.15±0.07mg/g) of alkaloid in sample. Bikash Debnath *et al.*, (2015) had estimated the alkaloid content in five edible cucurbitaceous plant. The result showed that alkaloids content of five Cucurbitaceous plants were found to vary from 1.15 g % to 1.34 g % and phenol content was varied from 4.54 mg/g to 10.13 mg/g. Michael O. Soladoye and Emmanuel C. Chukwuma (2012) had determined the alkaloid content in the stem and root of *Cissus populnea* (Vitaceae). Results revealed that alkaloid content in the stem was the highest, with 49.8%. Similarly, there was also significant amount of alkaloids (26.7%) in the root.

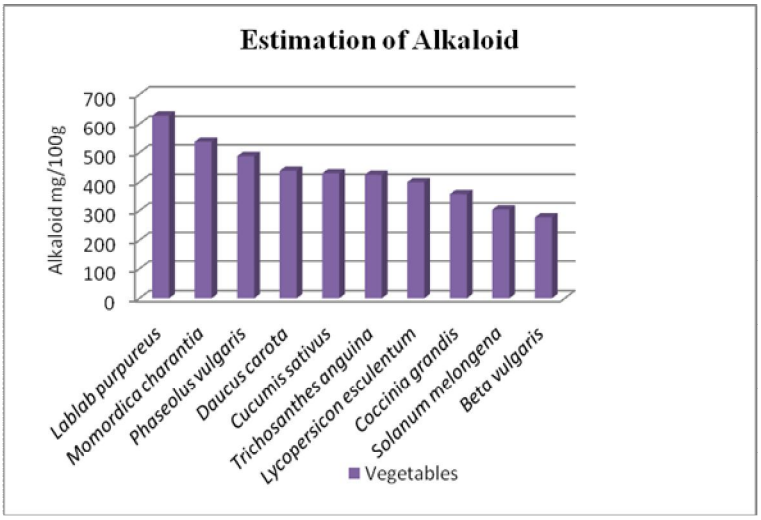

Fig 4: Estimation of Alkaloid

5) *Estimation of Phenol:* Phenol are large group of chemical compounds found in many plants. Thousands of organic compounds which contain one or more phenolic residue i.e., a functional hydroxyl group on a benzene ring are produced by plants and are called as phenolic compounds or plant phenolics.These chemicals which are responsible for controlling the activity of a range of enzymes and cell receptors, thus protecting the plant from bacterial and fungal infections. The result of the present study was given as figure 5. Among the 10 selected vegetables, it was determined that Phaseolus vulgaris had the highest amount of Phenol (0.122g/100g), and the lowest amount of Phenol was found in Cucumis sativus (0.026mg/100g). It was followed by Solanum melongena (0.111mg/100g), Beta vulgaris (0.107mg/100g), Coccinia grandis (0.076mg/100g), Lablab purpureus (0.072mg/100g), Momordica charantia (0.071mg/100g), Lycopersicon esculentum (0.040mg/100g), Daucus carrots (0.035mg/100g) and Trichosanthes anguina (0.028mg/100g). Sandip D Tapkir et al., 2013, had conducted a study on cucurbits to analyze their antioxidant activity especially phenol and flavonoids. The highest phenolic content was found in Lagenaria siceraria Mol. (121-g/g) followed by Coccinia grandis L. (115-g/g). The lowest amount of Phenolic content was determined in Cucumis sativus and Trichosanthes anguina L. Kaur. C et al., 2014, evaluated the total Phenolic content of 34 Indian eggplant genotypes (8 wild, 4 green, 2 white and 20 purple) and they found values range of 22-234, 44-90, 50-56, 22-73 mg GAE/100g FW for wild, green, white and purple genotypes.

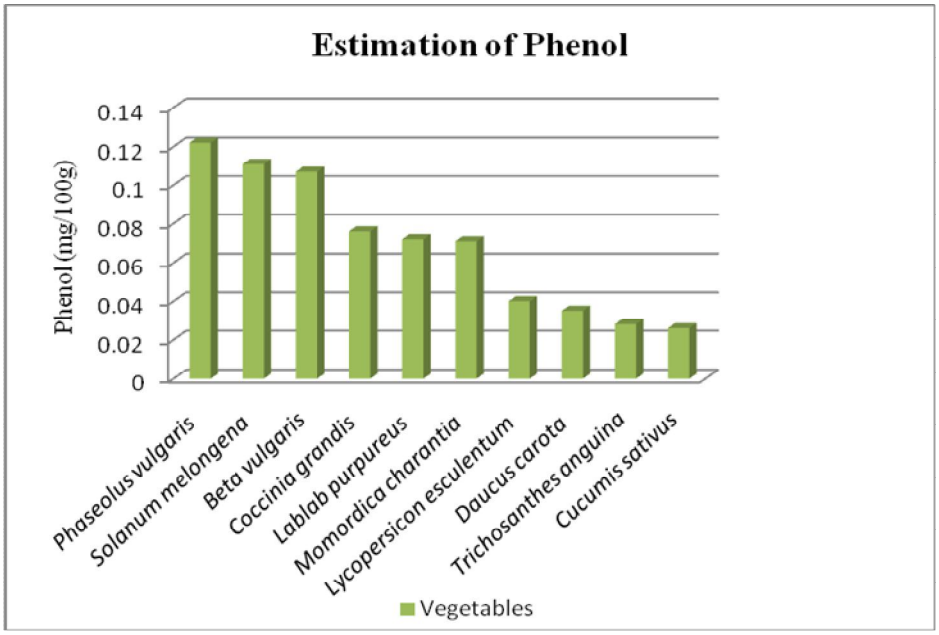

Fig 5: Estimation of Phenol

VI. CONCLUSION

Fresh vegetables endowed with almost all of the nutrients that our body requires. They are good source of vitamins, minerals, antioxidants and dietary fibre. It also contained non-nutritive plant chemicals called phytochemicals they protect from many diseases. The phytochemicals are non-essential nutrient. Some of the well-known examples are lycopene in tomatoes, isoflavones in soy and flavanoids in fruits. In this study, an attempt was made to estimate the phytochemicals and nutrients in ten selected vegetables namely Lablab purpureus, Beta vulgaris, Phaseolus vulgaris, Solanum melongena, Momordica charantia, Daucus carota, Coccinia grandi, Cucumis sativus, Lycopersicon esculentum, and Trichosanthes anguina.

The phytochemical screening showed that methanolic extract of all the vegetables contains both saponin and phenol. In aqueous extracts saponin was found in all vegetables but phenol was found only in two vegetables- Solanum melongena and Lablab purpureus. Flavonoid was present in all the aqueous extracts except that of Cucumis sativus. The qualitative estimation showed that methanolic extract of Beta vulgaris, Daucus carota, Trichosanthes anguina and Coccinia grandis contain all the selected phytochemicals. But in aqueous extracts only Lablab purpureus contain all the mentioned phytochemicals. The phytochemical estimation showed that Lablab purpureus have the highest amount of saponin (131.785mg/100g) and alkaloid (628.21mg/100g). Solanum melongena contain high amount of flavonoid (376mg/100g). It also contained a high concentration of phenol and tannin. The amount of phenol was high in Phaseolus vulgaris (0.122mg/100g). The lowest amount was found in Cucumis sativus (0.026mg/100g). The estimation of tannin showed that, highest amount was found to be in Beta vulgaris (61.711mg/100). Cucumis sativus have lowest amount of tannin (14.981mg/100g). The present study showed that Cucumis sativus have a less amount of phenol, tannin and flavonoid. The phenol, flavonoid and tannin content of Solanum melongena (0.111mg, 376mg and 50.428mg) were significantly higher than those in Lycopersicon esculentum. This preliminary study can be used as an indicator for including healthy vegetables in our daily diet. As vegetables like Cucumis sativus contains least anti- nutritional factors like tannin, flavonoid and phenol, and the vegetables like Phaseolus vulgaris, Solanum melongena contain sufficient amount of phytochemicals, they can be included in our diet.

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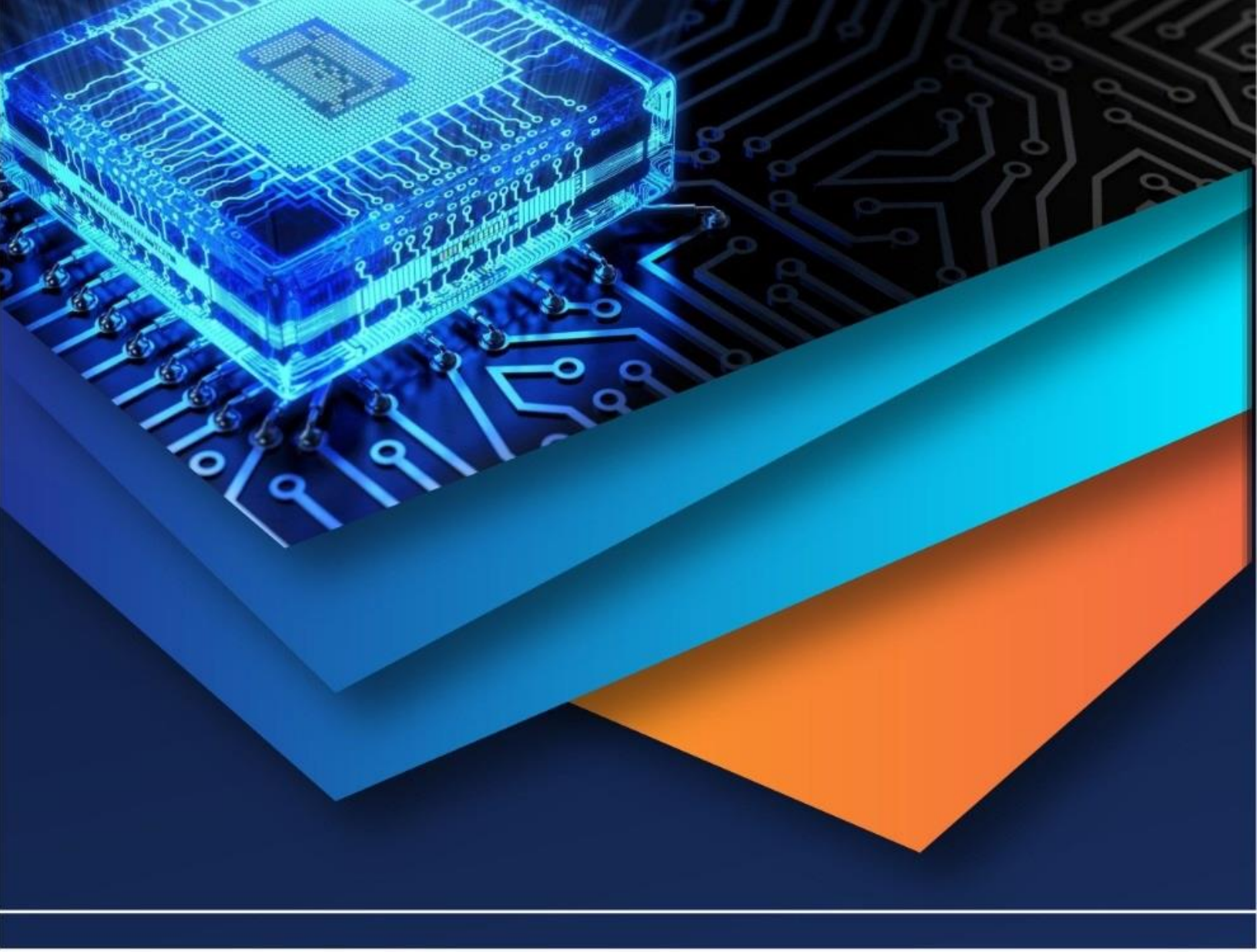

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