

## COMPARATIVE EVALUATION OF PHYTOCHEMICAL CONTENT AND ANTIOXIDANT POTENTIAL IN DIFFERENT PARTS OF CUCURBITACEAE FRUITS

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### Abstract

This study presents a comparative evaluation of phytochemical composition and antioxidant potential in different parts (pulp, peel, and seeds) of *Cucumis melovar*, *Cucumis sativus*, & *Cucumis melo*. Both qualitative and quantitative analyses were performed to assess the distribution of bioactive compounds. The findings indicate that peel and exhibited higher concentrations of phytochemicals compared to pulp and seed. Seeds contributing significantly to antioxidant activity. The phenolic acids quantity in *C. melo* pulp and seeds are higher than *C sativas* and *C melo*. The study highlights the importance of utilizing whole fruit components for enhanced nutritional and therapeutic benefits.

**Keywords:** *Cucurbitaceae*, *Phytochemical analysis*, *Antioxidant activity*, *Cucumis sativus*, *Cucumis melo*, *Cucumis melovar*

## Introduction

In the plant kingdom, Cucurbitaceae is medicinally and economically valuable and biggest family. It has greatest importance due to therapeutic potent. It has 130 genera and about 825 species. Some cucurbits, fruit and seeds parts contain, emetic, purgatives (prevent constipation) and antihelmintics properties. Human nutrition mainly depends upon fruits and vegetables, which possess rich antioxidants. The family Cucurbitaceae includes crops like cucumbers and melons: i.e. *Cucumis melo* var. (Kakri), *Cucumis sativus* (Khira) and *Cucumis melo* (Kharbuza) fruit which are medicinally essential. The family Cucurbitaceae plants jointly called cucurbits. Cucurbitaceae family plants have tremendous nutritional and medicinal benefits due to distinctive properties, the plants found active agents containing pharmacological activity. The main phytoconstituents are present in these fruits parts such as, terpenoids, glycosides, tannins, saponins, carbohydrates, cardiac glycosides, alkaloids, steroids, proteins and amino acids etc. The family plant has terpenoid substance so it is known as Cucurbitacians. Fruits and vegetables constitute an essential component of the human diet and play a fundamental role in maintaining health and preventing diseases. Their importance is largely attributed to the presence of diverse bioactive compounds, including phenolics, flavonoids, carotenoids, vitamins, and minerals, which contribute significantly to human nutrition (Karakurt et al., 2015; Shahidi et al., 2015). These naturally occurring compounds exhibit strong antioxidant properties and have been widely recognized for their role in reducing the risk of chronic diseases such as hypertension, diabetes, cardiovascular disorders, cancer, and neurodegenerative conditions (Uwa et al., 2017).

One of the major underlying mechanisms in the development of these diseases is oxidative stress, which results from an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defense system. ROS are generated as natural by-products of metabolic processes, particularly during mitochondrial respiration, where incomplete reduction of oxygen leads to the formation of free radicals (Ramya et al., 2013; Shoaib et al., 2015). In addition to endogenous sources, exogenous factors such as environmental pollution, smoking, and exposure to toxic chemicals further contribute to oxidative stress. These reactive species can cause significant damage to cellular components, including lipids, proteins, and DNA, ultimately leading to cellular dysfunction and disease progression. Therefore, dietary intake of antioxidant-rich foods is essential to neutralize free radicals and maintain physiological homeostasis (Chang et al., 2018). Phytochemicals present in plant-based foods serve as natural antioxidants and play a crucial role in protecting biological systems against oxidative damage. These compounds include flavonoids, tannins, alkaloids, glycosides, coumarins, and carotenoids, all of which contribute to the overall antioxidant capacity of fruits and vegetables (Harith et al., 2018). In addition to their antioxidant activity, these phytochemicals possess various pharmacological properties, including anti-inflammatory, antimicrobial, and anticancer effects. Their presence in different plant parts, such as pulp, peel, and seeds, may vary significantly, influencing the overall nutritional and therapeutic value of the fruit.

Epidemiological studies have consistently demonstrated that regular consumption of fruits and vegetables is associated with a reduced risk of chronic diseases, whereas inadequate intake can lead to increased susceptibility to metabolic disorders, nutritional deficiencies, and certain types of cancer (Mehra et al., 2015). It is estimated that more than 10,000 phytochemicals are present in plant-derived foods, many of which contribute to antioxidant defense mechanisms by regulating ROS and reactive nitrogen species (Zhang et al., 2015). In addition to their biological significance, antioxidants also play an important role in food preservation by inhibiting lipid oxidation, which can lead to the formation of undesirable compounds such as aldehydes, ketones, and organic acids (Marwa et al., 2016). Although synthetic antioxidants are widely used in the food industry, their potential toxic and carcinogenic effects have raised concerns, thereby increasing interest in natural antioxidant sources (Uwa et al., 2017).

Among the various plant families, the Cucurbitaceae family is of considerable importance due to its nutritional, medicinal, and economic value. This family includes commonly consumed fruits such as *Cucumis melovar* (Kakri), *Cucumis sativus* (Khira), and *Cucumis melo* (Kharbuza), which are widely cultivated in tropical and temperate regions (Sabrin et al., 2012). These fruits are not only affordable and easily available but also rich in essential nutrients and bioactive compounds, making them an integral part of daily diets (Kumaraswamy, 2016). Cucumber, for instance, is known to contain carotenoids and phenolic compounds that contribute to its antioxidant properties, although its overall antioxidant activity may be lower compared to other vegetables (Chu et al., 2002). In addition to their nutritional value, cucurbit fruits have been extensively used in traditional medicine for the treatment of various ailments. These include their use as anti-inflammatory, antimicrobial, anti-diabetic, and wound-healing agents (Rajasree et al., 2016). Furthermore, studies have reported that these fruits exhibit a wide range of biological activities such as antioxidant, anti-cancer, anti-ulcer, hepatoprotective, and immunomodulatory effects (Ru et al., 2018; Vishwakarma et al., 2017). The nutritional composition of these fruits further enhances their importance, as they are rich in vitamins, minerals, dietary fiber, and phytonutrients that support metabolic functions and overall health (Chakravarty, 2017; Abbey et al., 2017; Mumeena et al., 2017).

An important aspect that has gained increasing attention in recent years is the distribution of phytochemicals and antioxidants in different parts of fruits. While the edible pulp is commonly consumed, other parts such as peel and seeds are often discarded despite being rich sources of bioactive compounds. Previous studies have indicated that fruit peels and seeds may contain higher concentrations of phytochemicals compared to the pulp, thereby contributing significantly to antioxidant activity. However, comprehensive comparative studies focusing on the distribution of these compounds among different fruit parts are still limited. Therefore, the present study aims to provide a comparative evaluation of phytochemical content and antioxidant potential in different parts (pulp, peel, and seeds) of *Cucumis melovar*, *Cucumis sativus*, and *Cucumis melo*. By integrating both qualitative and quantitative approaches, this study seeks to highlight the significance of utilizing all parts of these fruits rather than limiting their use to pulp alone. The

findings of this research are expected to contribute to the development of functional foods, nutraceuticals, and natural antioxidant sources, thereby promoting the sustainable utilization of plant resources.

### Material and Methods

Extremely pure and analytical-grade chemicals were used in the experiments, categorized as follows:

- Acids and reagents: Folin–Ciocalteu reagent, sulphuric acid, acetic acid, glacial acetic acid, hydrochloric acid, Molisch’s reagent, Mayer’s reagent, ninhydrin
- Solvents: Methanol, chloroform, diethyl ether, butanol, dimethyl sulphoxide, n-hexane
- Salts and bases: Sodium carbonate, anhydrous sodium carbonate, sodium hydroxide, sodium chloride, ammonium hydroxide
- Other chemicals: Ferric chloride, acetic anhydride, iodine solution

### Sample Preparation

Collect fresh fruits (same size and color). Wash thoroughly with distilled water several times then separate into: Peel, Pulp and Seeds. Dried samples in shed or drying air dry or oven dry at 40–50°C. Grind into fine powder and store in airtight containers.



Fig.1 *Cucumis melo*



Fig 2. *Cucumis sativus*



Fig 3. *Cucumis melovar*



Fig.4 seed



Fig.5 pulp



Fig.6 peel



Fig.7 Pulp



Fig.8 Seed



Fig.9 Peel

### Extraction Procedure

Weigh 1 g dried sample, add 10 mL 99% methanol Shake for 24 hours (orbital shaker). Solutions were thickened by rotary vacuum evaporator on low pressure. Collect extracts and further used in qualitative analysis of phytochemicals (Abbas, M, et al; 2013).

### Qualitative phytochemical Tests of *C. melovar*, *C. sativus* and *C. melo* fruit parts:

**Tannins (FeCl<sub>3</sub> Test):** 0.5 ml extract +1 ml double distilled water+FeCl<sub>3</sub> few drops were added, greenish black color obtained (Devi, M. K, et al; 2018).

**Flavonoids (Alkaline reagent Test):** 0.5 ml dried extract + NaOH put few drops, deep yellow color appeared then added HCl solution color disappeared (Arvin, B. P et al; 2014, Gaikwad, M, et al; 2018).

**Alkaloids (Mayer's Test):** 0.5 ml extract +Mayer's reagent few drops, creamy color showed (Joy, G.S., et al; 2014).

**Saponins (Foam Test):** 1 ml extract + deionized water to produced foam (Joseph, N, et al; 2018).

**Steroids (Liebermann-Burchard Test):** 4 mg (0.04 g) extract+ 0.5 mg of acetic acid + 0.5 ml of chloroform.+ Conc. + H<sub>2</sub>SO<sub>4</sub> added gradually, it twisted bluish green color (Zohra, S. F, et al; 2012).

**Terpenoids (Salkowski Test):** 0.5 ml dried extract + 2ml of chloroform +Conc. H<sub>2</sub>SO<sub>4</sub>, brown reddish color appeared (Harith, S. S, et al; 2018).

**Cardiac glycosides (Keller-Kilani Test):** 0.5 ml of dried extract + 15ml glacial acetic acid + 1to 2 droplets of FeCl<sub>3</sub>+ 1 ml H<sub>2</sub>SO<sub>4</sub>. Produced chocolate ring at the surface (DSD, S. J, et al; 2017).

**Carbohydrates (Molisch's Test):** 3 ml sample extract + 1 to 2 drops of Molisch's reagent, mixed well. Appearance of violent ring at the junction layer due to the accumulation of Con. H<sub>2</sub> SO<sub>4</sub> in the substance indication of sugars.

**Iodine test:** 0.5 ml extract + 2 ml iodine solution, the dark blue or purple color indicated the occurrence of carbohydrates ( Jardat, N, et al;2015)

**Proteins and amino acids (Ninhydrin Test):** 0.2% ninhydrin solution + crude samples extract and boiled, well along purplish-blue color seems, existence of amino acids and proteins (Yadav, R.N et al; 2011).

#### **Quantitative analysis:**

**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  $\text{NH}_4\text{OH}$  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. (Mir, A. M, et al; 2013).

**Flavonoids measurement:** 10 g of each fruit part of *C. melovar* (kakri), *C. melo* (kharbuza) and *C. sativus* (khira) was taken out with 50 ml of 99% of aqueous  $\text{CH}_3\text{OH}$  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).

#### **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  $\text{CH}_3\text{OH}$  mixed well. The extracts were flamed at  $55^\circ\text{C}$  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%  $\text{CH}_3\text{OH}$ . The mixed substance was thickened to 40 ml around  $90^\circ\text{C}$  on water bath and later relocated with separatory funnel and 20ml of  $\text{C}_2\text{H}_6\text{O}$  (diethyl ether) was mixed and shaken constantly. The ether deposit was discarded to recover the aqueous layer. The distillation procedure earned by mixing with 60 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).

#### **Total phenolic content (TPC) measurement:**

Total phenolic content (TPC) was determined using the Folin–Ciocalteu reagent method. This method confirmed the presence of phenolic compounds in the extracts. Briefly, 2 mL of the sample solution was mixed with 2 mL of 2% sodium carbonate solution, followed by the addition of 2.5 mL of 10% Folin–Ciocalteu reagent. The reaction mixture was incubated at  $25^\circ\text{C}$  for 15 minutes. The absorbance of the mixture was measured at 765 nm in triplicate. Gallic acid was used as the standard for calibration, and the results were expressed as milligrams of gallic acid equivalents (mg GAE/g) of the extract (Singh et al., 2016)

## Results and Discussion:

**Table no: 1 Quality Tests of Phytochemicals in *C. melovar* (Kakri) in methanolic solvent.**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	++ve	+ve	+ve	+++ve	+_ve	++ve	+ve	+ve	++ve	+ve
Peel	+ve	+ve	+ve	+ve	+_ve	+ve	++ve	+ve	+ve	+ve
Seed	+_ve	+ve	+ve	+ve	_ve	+++ve	++ve	+ve	+ve	+ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table no: 2 Quality Tests of phytochemicals in *C. sativus* in methanolic solvent**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	+ ve	+ ve	+ ve	++ ve	+_ ve	+ ve	++ ve	+ ve	+ ve	+ ve
Peel	+ ve	++ +ve	+ ve	+ ve	_ ve	+++ ve	+ ve	+ ve	+ ve	+ ve
Seed	+ ve	++ +ve	+ ve	+ ve	_ ve	++ ve	+_ ve	++ ve	+ ve	++ ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table: 3 Quality Tests of phytochemicals in *C. melo* in methanolic solvent**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	++ ve	++ ve	+_ ve	_ ve	_ ve	+++ ve	+ ve	+ ve	++ ve	+ ve
Peel	+_ ve	+ ve	+ ve	++ ve	_ ve	+ ve	++ ve	+ ve	+_ ve	+ ve
Seed	+ ve	+++ ve	+ ve	+ ve	+_ ve	++ ve	+ ve	+ ve	+ ve	+++ ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table no: 4 Quality Tests of Phytochemicals in *C. melovar* in hexane solvent**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	++ ve	_ ve	_ ve	+++ ve	_ ve	++ ve	_ ve	+ ve	+ ve	+ve
Peel	+++ ve	++ ve	_ ve	+ ve	_ ve	+_ ve	_ ve	+_ ve	_ ve	_ ve
Seed	_ ve	+++ ve	_ ve	+ ve	_ ve	+++ ve	_ ve	+ ve	+ ve	_ ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table no: 5 Quality Tests of Phytochemicals in *C. sativus* in hexane solvent**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	_ve	++_ve	_ve	+++ve	_ve	++ve	_ve	+ve	+ve	++_ve
Peel	+_ve	+_ve	_ve	+++ve	+_ve	+ve	+_ve	+ve	+ve	_ve
Seed	_ve	+_ve	+_ve	+ve	_ve	+++ve	_ve	+ve	+ve	+_ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table no: 6 Quality Tests of phytochemical in *C. melo* in hexane solvent**

Sample 1	Tannins	Flavonoid	Alkaloid	Saponins	Steroid	Glycoside	Terpenoid	Cardiac Glycoside	Carbo hydrates	Protein& amino acid
Pulp	_ve	++_ve	_ve	+ve	_ve	+ve	_ve	+ve	+ve	+_ve
Peel	_ve	_ve	_ve	++ve	_ve	+v++ve	_ve	+ve	+ve	_ve
Seed	_ve	+_ve	_ve	+ve	_ve	+ve	_ve	++ve	+ve	++ve

+++ = high presence | ++ = moderate | + = low | ± = trace | - = absent

**Table: 7**

**Quantity of methanolic extract of *C. melovar*, *C. sativus* and *C. melo* fruit parts from 10 g powder**

Samples	Dried powder wt.(g) in 50 ml methanol	Wt. of extract obtained (g)
<b>1.Pulp (<i>C. melovar</i>)</b>	<b>10 g</b>	<b>2.51</b>
<b>Peel</b>	<b>10 g</b>	<b>2.03</b>
<b>Seed</b>	<b>10 g</b>	<b>1.54</b>
<b>2. Pulp (<i>C. sativus</i>)</b>	<b>10 g</b>	<b>1.72</b>
<b>Peel</b>	<b>10 g</b>	<b>1.23</b>
<b>Seed</b>	<b>10 g</b>	<b>1.19</b>
<b>Seed</b>		
<b>3.Pulp (<i>C. melo</i>)</b>	<b>10 g</b>	<b>4.262</b>
<b>Peel</b>	<b>10 g</b>	<b>2.95</b>
<b>Seed</b>	<b>10 g</b>	<b>1.532</b>

Table no. 7 shows the highest extract weight (g) obtained from *C. melo* pulp (4.262 g) and lowest extract wt. value got from *C. sativus* peel (1.23 g) in methanolic extract.

**Table. 8: Total phenolic content of *C. melovar* (kakri), *C. sativus* (khira) and *C. melo* (kharbuza) fruit parts (mg/g) in methanolic solvent at 765 nm**

Samples	Pulp	Peel	Seed
<i>C. melovar</i> (Kakri)	3.00	1.52	1.02
<i>C. sativus</i> (Khira)	2.79	2.53	1.11
<i>C.melo</i> ( Kharbuza)	3.5	2.72	2.23

Total phenolic content was shown in Table: no.8, 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 phenolic contents than peel and seeds. *C. melo*'s pulp has highest 3.5 mg/g. TPC found in *C. melovar* pulp, 3.00 mg/g and *C. sativus*'s pulp contained 2.79 mg/g quantity of TPC. TPC content which is highest amongst these three-fruit pulp. It is matching well with literature. ( 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 (8) 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). *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.

**Table. 9: Phytochemicals in *C. melovar* extract in methanolic solvent**

<i>Cucumis melovar</i>	Alkaloid %	Saponin %	Flavonoid %
<b>Pulp</b>	<b>12.30</b>	<b>15.8</b>	<b>73.1</b>
<b>Peel</b>	<b>10.72</b>	<b>22.4</b>	<b>43.5</b>
<b>Seed</b>	<b>9.50</b>	<b>12.0</b>	<b>33.0</b>

Table: 9 indicated the phytochemical screening in *C. melovar* (%) of alkaloid, saponin and flavonoid in *C. melovar* fruit parts (pulp, peel and seed). Among these three fruit parts, highest alkaloid (12.3%) estimated in pulp then peel and seed have (10.72%) and (9.0%). Saponin percentage also estimated in methanolic solvent, highest value showed in peel (22.4%), pulp (15.8%) and seed has lowest value of saponin (12.0%). According to my analysis 73.1% in pulp, peel 43.5% and 33.0% of flavonoid were estimated. Pulp has highest percentage than peel and pulp.

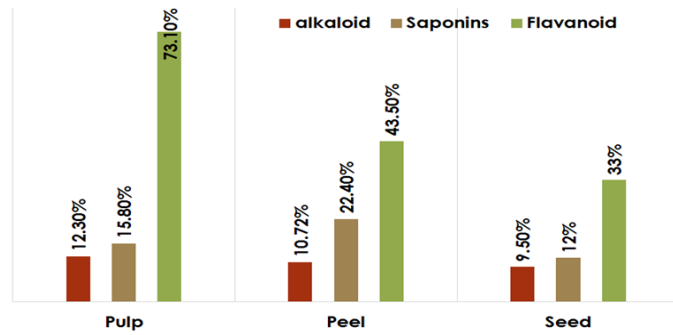


Fig: 10 (%) of flavonoid,

saponin and alkaloid in *Cucumis melo* pulp, peel and seed in methanolic solvent

**Table.10: Phytochemicals in *C. sativus* extract in methanolic solvent**

<i>Cucumis sativus</i>	Alkaloid %	Saponin %	Flavonoid %
<b>Pulp</b>	<b>13</b>	<b>17</b>	<b>69</b>
<b>Peel</b>	<b>11</b>	<b>20</b>	<b>44</b>
<b>Seed</b>	<b>12</b>	<b>9.9</b>	<b>36</b>

The concentrations of alkaloid, saponin and flavonoid of *C. sativus* extract fruit parts were estimated in methanolic solvent. My study shows in (table: no.4.10) highest value of alkaloid in pulp (13%), then seed (12%) and peel (11%). Percentage of saponins was observed highest value in peel (20%), pulp (17%) then seeds (9.9%). Flavonoid possessed highest (%) in pulp (69%) peel (44%) and lowest in seed (36%) in *C. sativus*.

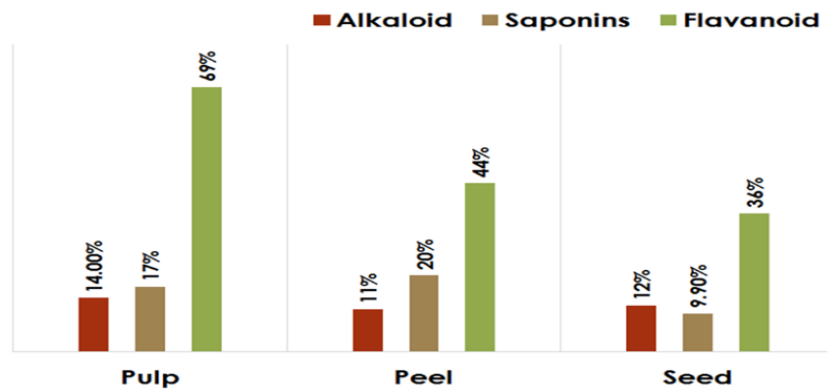


Fig: 11 (%) of flavonoid, saponin and alkaloid in *Cucumis sativus* pulp, peel and seed in methanolic solvent

**Table.11 Phytochemicals in *C. melo* extract in methanolic solvent**

<i>Cucumis melo</i>	Alkaloid %	Saponin %	Flavonoid %
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<b>Pulp</b>	<b>12.5</b>	<b>18</b>	<b>78</b>
<b>Peel</b>	<b>10.9</b>	<b>23</b>	<b>48</b>
<b>Seed</b>	<b>9.8</b>	<b>14</b>	<b>35</b>

Phytochemical tests of *C. melo* extract showed the values of alkaloid, saponin and flavonoid (%) in methanolic solvent. Different (%) of these phyto constituents were estimated. My study investigated the fruit pulp has highest value (12.5%) of alkaloid, secondly fruit peel (10.9%) and lowest value found in seed (9.8%). %age of saponin found highest in peel (23%), pulp (18%) and lowest in seed part(14%). The concentration of flavonoid contained more in pulp than peel seed of the fruit, (78%), (48%) and (35%).

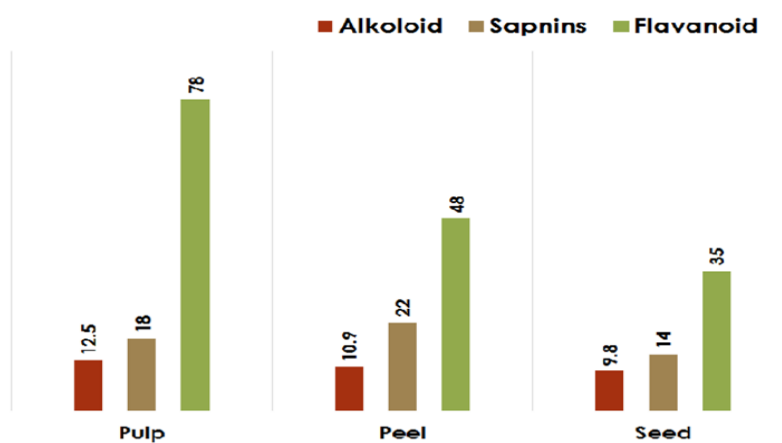


Fig: 12 (%) of flavonoid, saponins and alkaloid in *Cucumis melo* pulp, peel and seed in methanolic solvent.

### Flavonoids:

All fruits have different concentrations 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.

### Alkaloids:

The concentration of alkaloids presents 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. melo var* 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 (Gracelin, D. H. S, et al; 2013). Pulp shows highest TPC and TFC across all fruits *Cucumis melo var.* shows highest overall phytochemical content.

**Conclusion:**

Cucurbitaceae fruits vary significantly in both qualitative presence and quantitative concentration of phytochemicals. Peels are the richest source of phytochemicals across all three fruits *Cucumis melo (Musk melon)* shows higher quantitative phytochemical content than cucumber. Seeds are underutilized but valuable for oil and antioxidant extraction and food industries. *Cucumis melo var.* (highest phytochemicals) and *Cucumis Melo, Cucumis sativus* Peel (highest bioactive compounds), Seeds (moderate) and Pulp (lowest but nutritionally important) This comparative profile supports the use of fruit waste (peels & seeds) in pharmaceutical a UV–Visible spectroscopic analysis revealed that peel extracts exhibited the highest absorbance values, corresponding to significantly higher phenolic and flavonoid contents. Among the samples studied, *Cucumis melo* showed superior phytochemical concentration and antioxidant activity, while cucumber exhibited comparatively lower values. These findings highlight the importance of fruit by-products (peel and seeds) as potential sources of natural antioxidants.

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