



# Evaluation of Phytochemicals and Antimicrobial properties of Vegetables

Deepak<sup>1</sup>, Deepak Chauhan<sup>1</sup>, Ritu Sharma<sup>1</sup>, Runjhun Mathur<sup>2</sup>, Swati Tyagi<sup>1</sup>, Abhimanyu Kumar Jha<sup>1\*</sup>

1. Faculty of Life Sciences, Institute of Applied Medicines and Research, Ghaziabad, Uttar Pradesh, India.

2. Dr. A.P.J Abdul Kalam Technical University, Lucknow, Uttar Pradesh, India

## Abstract:

Vegetables contain lots of beneficial phytochemicals and also have antioxidant and antimicrobial properties. Phytochemicals are chemical compounds which are produced by plants, generally help in resistance of fungi, bacteria and plant virus infection. Various phytochemicals found in vegetables are tannins, cardiac glycosides, terpenoids, saponins, phytosterols, alkaloids, flavanoids. Antimicrobial properties of vegetables have been found to be very effective against *Escherichia coli*, *Streptococcus pyogenes*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Bacillus subtilis* which have been examined by disc-diffusion method. This review includes the study on Bottle gourd (*Lagenaria siceraria*), cucumber (*Cucumis sativas*), pumpkin (*Cucurbita*), ridged gourd (*Luffa*), karella (*Momordica charantia*), tinda (*Praecitrullus fistulosus*). Vegetables also have therapeutic properties like anti-diabetic, anti-ulcers, anti-inflammatory, anti-oxidant, anti-tumor properties.

Keywords: Phytochemicals, antimicrobial activity, antioxidant, flavonoids, alkaloids.

## Introduction:

Vegetables are the natural sources which have the medicinal properties to cure the infections and diseases. It also contains phytochemical compounds which resist the growth of fungi, bacteria, and viruses and these phytochemicals are alkaloids, saponins, tannins, flavonoids, terpenoids etc.<sup>1</sup> Clinical and epidemiological studies explain that product of different vegetables contains phyto-protective compounds having the biological properties which are beneficial for human health.<sup>2</sup> They also contain various nutritional properties like vitamins, minerals, and other compounds and also contain 96% water.<sup>3</sup> Vegetables have therapeutic properties like anti-obesity, anti-cancer, anti-inflammatory, anti-diabetic, anti-microbial, anti-oxidant, anti-ulcers, anti-tumor etc. In this review there is a study on different vegetables like bottle gourd (*Lagenaria siceraria*), cucumber (*Cucumis sativas*), pumpkin (*Cucurbita*), ridged gourd (*Luffa*), karella (*Momordica charantia*), tinda (*Praecitrullus fistulosus*).

## Bottle Gourd (*Lagenaria siceraria*):

Bottle gourd (*Lagenaria siceraria*), a perennial, climbing plant, comprises 118 genera and 825 species. It is a very important vegetable of India and it is influenced by various factors like environmental, nutritional, plant growth regulators etc.<sup>4</sup> The fruits of *Lagenaria siceraria* have medicinal properties as it cures the pain, ulcers, bronchial disorders, asthma. It is also cardioprotective, antihepatotoxic, hypolipidemic,

antihyperlipidemic, diuretic, antioxidant and antimicrobial properties.<sup>5</sup> It shows antimicrobial activity against *Pseudomonas aeruginosa*, *Streptococcus pyogenes*.<sup>6</sup> It also contains phytochemical compounds as a nutrient source. Phytochemicals are the bioactive compounds which protect the plant against pathogens and produced as a secondary metabolites. Some of the phytochemicals are saponins, alkaloids, polyphenols, terpenoids, flavonoids etc.<sup>7</sup>

### **Cucumber ( *Cucumis sativas*):**

Cucumber ( *Cucumis sativas*) is a member of *Cucurbitaceae* family. It is the oldest vegetable crops which were cultivated in Asia and Africa and it is native to the tropical regions. 30 species of *Cucumis sativas* were found.<sup>8</sup> It is an annually growing creeping plant and its leaves are hairy, climbing type. The flowers of cucumber are yellow in color.<sup>9</sup> It has anticancer and antimicrobial properties. The shows antimicrobial activity against *Klebsiella pneumonia*, *Streptococcus pneumonia*, *Escherichia coli*, *Staphylococcus aureus*. It also contains phytochemicals like alkaloid, steroids, flavonoids etc.<sup>10</sup>

### **Pumpkin ( *Cucurbita*):**

Pumpkin belongs to the family *Cucurbitaceae* and genus *Cucurbita*. It is a gourd- like squash native to the North America. Pumpkin belongs to the species like *Cucurbita pepo*, *Cucurbitamixta*, *Cucurbita maxima*, and *Cucurbita moschata*.<sup>11</sup> *Cucurbita* has different properties like it reduces analgesia, paralysis of hindlegs, diarrhoea, and it also shows antimicrobial activity against *Bacillus subtilis*, *E. coli*.<sup>12</sup> It contains phytochemicals like carotenoids, terpenoids, sterols, phenols etc.<sup>13</sup>

### **Ridged Gourd ( *Luffa*):**

Sponge gourd or ridged gourd has fibrous vascular system. It is a medicinal plant used in the treatment of skin diseases, liver, lungs, heart and stomach. It belongs to the family *Cucurbitaceae* and the species are found in Bangladesh.<sup>14</sup> *Luffa* contains different phytochemicals like anthocyanins, flavonoids, glycosides, saponins, alkaloids etc. Its shows antimicrobial activity against *E.coli*, *Saccharomyces cerevasiae*, *Klebsiella pneumoniae*, *Bacillus cereus*, *Staphylococcus aureus* etc.<sup>15</sup>

### **Karella ( *Momordica charantia*):**

*Momordica charantia* or bitter gourd has therapeutic properties like curing of wounds, hepatitis, infection, measles, fever etc. Bitter gourd has antioxidants, antidiabetic, antiviral, anticancerous properties. It also shows antimicrobial activity against *E. coli*, *Staphylococcus*, *Pseudomonas*, *Klebsiella pneumonia* etc.<sup>16</sup>

### **Tinda ( *Praecitrullus fistulosus*):**

*Praecitrullus fistulosus* belongs to the *Cucurbitaceae* family, its common name is tinda or apple gourd or round melon. Mostly cultivated in North and Northwest parts of the country.<sup>17</sup> It contain phytochemical like tanins, flavonoids etc.<sup>18</sup>



Fig-1



Fig-2



Fig-3



Fig-4



Fig-5



Fig-6

Fig-1: Bottle gourd, Fig-2: Cucumber, Fig-3: Pumpkin, Fig-4: Ridged gourd, Fig-5: Karella, Fig-6: Tinda

### Phytochemical properties of Cucurbitaceae family:

Phytochemicals are the chemical constituents of plants that occurs naturally, or the chemicals which are obtained by plants are known as phytochemicals. Phytochemicals which are present in Cucurbitaceae family plants are tannins, cardiac glycosides, terpenoids, carbohydrates, resins, saponins, carotenoids and phytosterols.<sup>19</sup> The high level of bioactive compounds are also found like triterpenes, sterols, and alkaloids. Biogenetically terpenoids obtained from active isoprene, and also their basic structure is based on six isoprene units.<sup>20</sup>

Cucurbitacins consists a group of triterpenoid substances which known for their bitterness and toxicity. They are mainly oxygenated, tetracyclic triterpenes containing cucurbitane skeleton.<sup>21</sup> There are atleast 100 species of cucurbitacins exists which includes 30 genera of Cucurbitaceae family including *Momordica charantia*, *Cucumis sativas*, and *Bryonia*. Cucurbitacins have pharmacological properties like anti- inflammatory, antipyretic, anticancer activities etc.<sup>22</sup> Cucurbitacins cannot be isolated from species which contain hydrolytic enzyme like glycosidase, which are also known as elaterase ( isolated from dried juice of *Ecballium elaterium*). The first cucurbitacin which named as elaterin was isolated from elaterium in 1831.<sup>23</sup> HPLC-MS ( atmospheric chemical ionization), was a method for analysis of cucurbitacins in medicinal plants. HPLC was performed on Zorbax SB- C- 18 column by using 0.01% trifluoroacetic acid: acetonitrile gradient and diode array detection. It is a very sensitive method used for the analysis of cucurbitacins.<sup>24</sup>

### Antimicrobial properties of Cucurbitaceae family:

Species	Compounds	Antimicrobial Properties	References
Bottle gourd ( <i>Lagenaria siceraria</i> ) Whole plant	Flavonoids,terpenoids	<i>Pseudomonas aeruginosa</i> , <i>Streptococcus pyogenes</i>	25
Cucumber ( <i>Cucumis sativas</i> ) Stem	Sphingolipids	<i>Bacillus subtilis</i>	26
Pumpkin ( <i>Cucurbita</i> ) Fruit	Carotenoids	<i>Salmonella typhii</i> , <i>E. coli</i> , <i>Bacillus cereus</i>	27
Ridged gourd ( <i>Luffa</i> ) Seed	Saponins, alkaloids	<i>Pseudomonas aeruginosa</i> , <i>Klebsiella pneumoniae</i>	28
Karella ( <i>Momordica charantia</i> ) Fruit and leaves	Alkaloids, glycosides, saponins	<i>Klebsiella pneumonia</i> , <i>E. coli</i> , <i>Bacillus subtilis</i>	29
Tinda	Steroids, terpenoids,	<i>Streptococcus</i>	30, 31

( <i>Praecitrullus fistulosus</i> ) Fruit	flavanoids	<i>thermophilus</i>	
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The vegetables of Cucurbitaceae family show antimicrobial activity against different microorganisms due to their additional compounds secreted by plants commonly known as phytochemicals. Basically these phytochemicals are secreted from plants but rich quantity of these compounds are present in different parts of plants such as the compounds flavonoids, terpenoids in bottle gourd (*Lagenaria siceraria*) are present in whole body of plant whereas carotenoids in pumpkin (*Cucurbita*) are present in fruit part of plant. Like these sphingolipids are present in stem of cucumber (*Cucumis sativas*) whereas saponins and alkaloids are present in seeds of ridged gourd (*Luffa*). Along these alkaloids, glycosides, saponins compounds in karella (*Momordica charantia*) are present in fruit and leaves part of plant whereas steroids, terpenoids, flavanoids are present in fruit part of tinda (*Praecitrullus fistulosus*). The plants of these family shows their antimicrobial activity against different microorganisms, some of these microorganisms are *Pseudomonas aeruginosa*, *Streptococcus pyogenes*, *Klebsiella pneumonia*, *E. coli*, *Bacillus subtilis*, *Streptococcus thermophilus* etc.

### Conclusion:

It is concluded that plants of Cucurbitaceae family shows antimicrobial activity against different microorganisms due to the compound naturally present in plants known as phytochemicals. Some of the phytochemicals which are present in plants are tannins, alkaloids, saponins, glycosides, terpenoids, flavonoids, carotenoids etc. Due to these phytochemicals plants of these family shows antimicrobial activity against *Pseudomonas aeruginosa*, *Streptococcus pyogenes*, *Klebsiella pneumonia*, *E. coli*, *Bacillus subtilis*, *Streptococcus thermophilus* etc.

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