

Biochemical, Anti-Microbial and Organoleptic Studies of Cucumber (*Cucumis Sativus*)

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Abstract: *The cucumber (*Cucumis sativus*) is a widely cultivated plant in the gourd family Cucurbitaceae. It is a creeping vine which bears cylindrical edible fruit when ripe. Cucumbers actually come in a wide variety of colors, sizes, shapes and textures. There are white, yellow, and even orange-colored cucumbers, and they may be short, slightly oval, or even round in shape. Their skins can be smooth and thin, or thick and rough. Cucumber plants naturally thrive in both temperate and tropical environments, and generally require temperatures between 60-90°F/15-33°C. For this reason, they are native to many regions of the world. To substantiate this, an analysis of the proximate principles of the samples was carried out using bench science experiments. The proximate profiles of Carbohydrates, Minerals, proteins and Crude fibers were analysed. The study showed highest percentage of moisture content and considerable amounts of Proteins, Carbohydrates, Calcium, Iron, Phosphorous, Vitamin C and crude fibres. Result was obtained to conclude that Cucumber is high in all nutritional content. The aqueous extracts of cucumber with peel and without peel was prepared using chilled distilled water were investigated for its effect on the Salmonella Typhi. The MIC (minimal inhibitory concentration) results obtained exhibited the antimicrobial activity of the aqueous extracts of cucumber with peel and without peel. The MIC of the aqueous extract for cucumber with peel and without peel was found to be 100% respectively. The bactericidal property observed was confirmed using Real time PCR. Therefore it was found that a bacteriostatic effect can be expected but needs further evaluation, in the case of cucumber without peel extract. Whereas cucumber with peel extract has a bactericidal antimicrobial property. Further in order to project the organoleptic appeal of cucumber under study, invasive and non-invasive sensory evaluation was carried out by a semi-trained panel. This was executed with a recipe of cucumber salad with tomato salad and cucumber soup with bottle-gourd soup. The data was subjected to biostatistical analysis which proved that the cucumber recipes were accepted. The commercial appeal of cucumber was also speculated using value for money (VFM) studies. Nutritive ingredients were used in the recipes. Cucumber thus is better nutritional, sensory as well as in commercial aspects.*

Keywords: Cucumis Sativus, Salmonella Typhi, Minimum inhibitory concentration (MIC), Organoleptic, Bacteriostatic, Bactericidal, Value for money (VFM).

1. Introduction

The cucumber (*Cucumis sativus*) is a widely cultivated plant in the gourd family Cucurbitaceae. It is a creeping vine which bears cylindrical edible fruit when ripe. Cucumbers belong to the same botanical family as melons (including watermelon and cantaloupe) and squashes (including summer squash, winter squash, zucchini and pumpkin).

Cucumber plants naturally thrive in both temperate and tropical environments, and generally require temperatures between 60-90°F/15-33°C. For this reason, they are native to many regions of the world. In evolutionary terms, the first cucumbers were likely to have originated in Western Asia or parts of the Middle East. Cucumbers are mentioned in the legend of *Gilgamesh*—a Uruk king who lived around 2500 BC in what is now Iraq and Kuwait.

There are three main varieties of cucumber: “slicing”, “pickling” and “burpless”. Within these varieties, several different cultivars have emerged. Cucumbers are botanically categorized as berries, which are available in many different sizes, shapes and colors. They range from thick, stubby little fruits (10-12 cm long) to Dutch greenhouse varieties (of upto 50 cm long). The most popular variety is the long smooth salad cucumber which has a smooth, dark-green skin. Having an enclosed seed and developing from a flower, botanically cucumbers are classified as accessory fruits. Much like tomatoes and squash they are often also perceived, prepared and eaten as vegetables. Cucumbers are

usually more than 90% water. The cucumber is originally from Indian subcontinent but is now grown on most continents.

2. Aims and Objectives

- The main aim of this project is to determine and compare the physiochemical properties and proximate principles of cucumber with peel and without peel.
- To study the nutritional profile of peeled and with peel cucumber.
- To understand the biochemical, antibacterial, and genomic aspects of peeled and with peel cucumber.
- To carry out sensory evaluation using cucumber in order to underline the socio-cultural and organoleptic acceptance of cucumber.
- To quantitatively analyse the sensory evaluation data using standard biostatistical operations. The sensory evaluation is carried out with the self-administered questionnaire consisting of four parts:
 - Non-invasive evaluation
 - Sensitization
 - Invasive evaluation
 - Summing up
- A comparison between peeled and with peel cucumber is done as to determine which is better with respect to nutrition.
- The various proximate principles and physiochemical properties for each of the samples are recorded.

h. A study is carried out on the minimum inhibitory concentration of certain microorganism on the two samples of cucumber.

3. Selection of Samples

Two samples were selected for the analysis of proximate principles, minimum inhibitory concentration and DNA extraction.

- Cucumber- with peel
- Cucumber- without peel

4. Parameters Considered For Analysis:

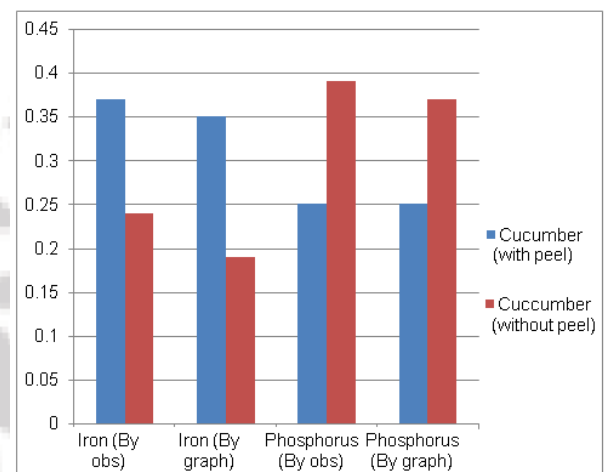
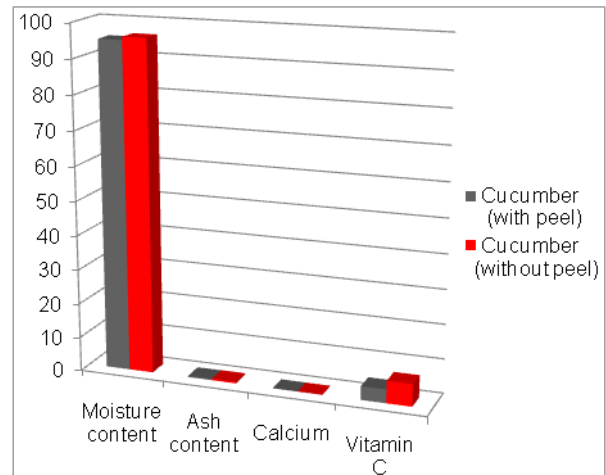
The following parameters were analyzed for the two samples of cucumber:

A. Proximate Analysis:

- 1) Estimation of Carbohydrates by Anthrone method.
- 2) Estimation of Proteins by Folin - Lowry method.
- 3) Estimation of Dietary fibre by Ash method.

B. Mineral Analysis:

- 1) Determination of moisture content by Hot air oven.
- 2) Determination of ash content in the cucumber samples.
- 3) Estimation of Calcium by EDTA method.
- 4) Estimation of Vitamin C Iodometrically.
- 5) Estimation of Iron by Wong's method.
- 6) Estimation of Phosphorus by Fiske-Subbarow method.



5. Sensory Evaluation:

a. A sensory evaluation was performed with the 2 samples of cucumber.

- Cucumber Salad & Cucumber Soup With
- Tomato Salad & Bottle-Gourd Soup

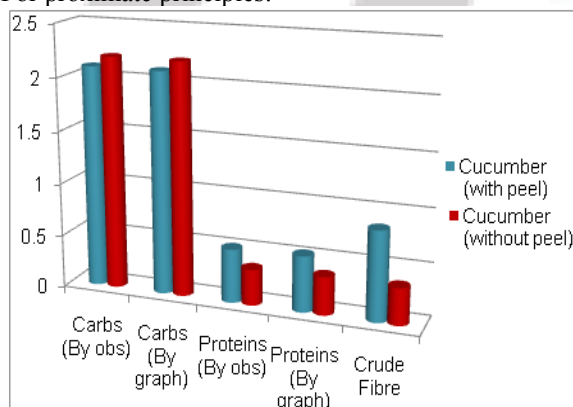
b. A questionnaire comprising of 20 questions was prepared and given to a panel of semi- trained members. The initial part of the evaluation was non invasive and latter part was invasive which includes the tasting of the samples.

c. The samples were analysed by visual, olfactory and gustatory response.

d. A biostatistical analysis was done using chi-square test.

6. Results

A) For proximate principles:



B) For MIC:

Minimum inhibitory concentration for cucumber (with and without peel) extract.

Concentration(%)	Inhibition
20	+++++
40	++++
60	+++
80	++
100	-
Positive Control	+
Negative Control	-
Medium Control	-

Abbreviation: (+) - Growth, (-) - No Growth. The MIC for cucumber (with and without peel) was found to be 100%

Qualitative analysis of DNA using agarose gel electrophoresis

- Genomic DNA from MIC tubes treated with aqueous extracts of cucumber (with and without peel).
- DNA from the MIC sample (cucumber with and without peel) was extracted using Phenol Chloroform method. The presence of genomic DNA was confirmed by running DNA sample on 1% agarose gel at 50 to 60 Volts. The DNA bands obtained was observed using U.V transilluminator.
- A real time PCR was run for both the MIC samples. It was found that a bacteriostatic effect can be expected but needs further evaluation, in the case of cucumber without

peel extract. Whereas cucumber with peel extract has a bactericidal antimicrobial property.

7. Conclusion

- A comparative study on the nutritive value and physiochemical principles of cucumber with and without peel was done. Its health benefits were explored.
- The MIC (minimal inhibitory concentration) results obtained exhibited the antimicrobial activity of the aqueous extracts of cucumber with peel and without peel. The MIC of the aqueous extract for cucumber with peel and without peel was found to be 100% respectively.
- A real time PCR was run for both the MIC samples. It was found that a bacteriostatic effect can be expected but needs further evaluation, in the case of cucumber without peel extract. Whereas cucumber with peel extract has a bactericidal antimicrobial property.
- A sensory evaluation was performed using cucumber in order to underline the socio-cultural and organoleptic acceptance of cucumber. Quantitative analysis of the sensory evaluation data using standard biostatistical operations was done. Semi-trained panellists tasted the samples and answered the questionnaires accordingly for cucumber salad as well as soup. Expert suggestions were given by the panellists which included if any improvement in the product. Useful suggestions based on taste, making of the recipe, garnishing, accompaniment of any product were given by the panellists.

8. Future Aspects of Cucumber

Cucumber is known to have many health benefits, few to be said are:

1. **Skin care:** The presence of several vitamins like A, B and C, high water content and various minerals like potassium, magnesium or silicon makes it a substantial part of skin care.
2. **Rehydrating body:** Cucumber contains 96% of water content in it. It is more nutritious and healthy than the normal drinking water.
3. **Stimulate hair growth:** Cucumber contains high content of silicon and sulphur. Silicon and sulphur provides high nourishments and nutrients required for hair growth.
4. **Beneficial for teeth and gums:** Cucumber juice proves to be highly beneficial in curing teeth and gum problems. Cucumber juice is generally used to balance the damage caused by chocolates.
5. **Aid digestion and wait loss:** Cucumber is an ideal diet for those who want to lose their weights due to high water content and low calorie. Daily consumption of cucumber juice helps in curing various digestive disorders. It acts as a drug against the problem of constipation.
6. **Antioxidant and anti-inflammatory benefits:** Cucumbers are a valuable source of conventional antioxidant nutrients including vitamin C, beta-carotene, and manganese. Fresh extracts from cucumber have been shown to provide specific antioxidant benefits. Fresh cucumber extracts have also been shown to reduce unwanted inflammation.
7. **Connective tissues, building:** The excellent source of silica contributes to the proper construction of connective

tissues in the body as in the bones, muscles, cartilage, ligaments and tendons.

8. **Reduces cholesterol.** A compound called sterols in cucumber helps reduce bad cholesterol.
9. **Controls blood pressure:** Cucumber is very rich in magnesium, potassium, silicon and sulphur. The presence of all these minerals greatly helps in regulating blood pressure and maintaining body temperature

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