

WONDERS OF SPICES – STUDY AND IT'S APPLICATION

***Shifa Khatri & **Sayed Sabah Zehra**

Department of Chemistry, Under the aegis of DBT-STAR College status 'JIGYAASA (SHP)', K.C. College.

Vidyasagar Principal K.M. Kundnani Chowk, D.W. Road, Churchgate, Mumbai 400 020, India.

*Email Id: *khatrishifa01@gmail.com & ** sayedsukainali@gmail.com*

Abstract:

Spices are extracted from a plant source such as root, stem, bark, seed or fruit which are used to add flavour, aroma and colour to food. The essential oils extracted from the spices contain many medicinal properties such as anti diabetic, anti carcinogenic, as well as antioxidative and antimicrobial properties. An experiment was carried out to study the physical and physiochemical properties of the spices (cinnamon) viz. Nature, colour, appearance, weight, moisture content and the solubility of cinnamon. Hexane, an organic solvent, was used to test the solubility of cinnamon. Steam distillation method was used for the extraction of essential oils from cinnamon. An online survey was conducted with the help of google docs in which questions on other spices such as turmeric and cloves were also included. Literature review was done on cinnamon, cloves, cardamom, saffron and ginger to study their medicinal and antimicrobial properties.

Keywords: *Cinnamon, Turmeric, Cloves, Essential Oils, Steam Distillation, Medicinal Properties, Anti Diabetic.*

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Introduction:

The Food and Drug Administration (FDA) has defined spices as 'aromatic vegetable substances, in the whole, broken, or ground form whose significant function in food is seasoning rather than nutrition'. Spices, usually, come from the dried part of the plant such as a bud (clove), bark (cinnamon), root (ginger, turmeric), aromatic seeds (cumin), and flower stigma (saffron), which distinguishes it from herbs, which come from the leaves of the herbaceous plants. Spices contain volatile oils and aromatic scent used for flavouring and aroma. They are also been used as preservatives, therapeutic and flavouring agents for centuries in Middle East Asian countries. India is known as 'The Land of Spices' which means that it is a reservoir of spices. Indian spices are popular and have occupied a huge position in the domestic as well as international trade market for its flavour and aroma. The warm tropical and subtropical climate in India also provides favourable conditions for the growth of spices. International Standard Association (ISO) has listed 109 spices, out of which India produces around 75 species of spices in its various climatic regions. Many spices contain medicinal properties such as anti-diabetic, anti-carcinogenic, anti-oxidative, anti-microbial, anti-hypertensive and anti-inflammatory effect which makes it a genuine reason to be added in every consumable commodity. Spices are the main ingredient in every Indian dish.

Literature Review:

1. Effects of Cinnamon, Cardamom, Saffron, and Ginger Consumption on Markers of Glycaemic Control, Lipid Profile, Oxidative Stress, and Inflammation in Type 2 Diabetes Patients.

Introduction: Type 2 diabetes is a chronic medical condition in which the body either doesn't produce insulin or it resists insulin. The pancreas secretes a hormone called insulin which helps the cells to convert glucose (a type of sugar) into energy. In type 2 diabetes, the pancreas secretes more insulin at first to bring glucose to the cells but it fails and the glucose is released into the bloodstream leading to high blood sugar level. It is caused due to inflammation, hyperglycaemia and oxidative stress. The phytochemicals present in spices are reported to have significant effects to improve and tolerate diabetic complications. This review aims to study the action of cinnamon, cardamom, saffron and ginger on glucose levels, lipid profile (cholesterol levels), inflammation and oxidative stress.

Methodology: A placebo-controlled clinical trial was conducted which included 208 type 2 diabetes patients from the Endocrine and Metabolism Research Center, Isfahan University of Medical Sciences, Isfahan, Iran. The clinical trial was of eight weeks from October 1, 2012 to September 1, 2013. The inclusion criteria were subjects with type 2 diabetes, aged ≥ 30 years, overweight, not on insulin therapy or medications. People on insulin therapy, pregnant or consumed any spices were excluded. The subjects were divided into four groups, receiving either 3g cardamom, or 3g cinnamon, or 3g ginger, or 1g saffron, with a combination of three glasses of black tea. The people in the control group consumed three glasses of tea without any spice. Dried powder from cardamom (*cardamomum*) small seed pods, ginger (*Zingiberaceae*) rhizome of the *Zingiber officinale* plant, cinnamon (*Cinnamomum verum*) sticks from the inner bark of tree, and saffron (*saffron crocus*) stigmas of the *Crocus sativus* flower, were used.

Conclusion: After 8 weeks of clinical trial, it was recorded that cinnamon, cardamom, ginger, and saffron consumption had significant effects on total cholesterol, LDL (low density lipoproteins), and HDL (high density lipoproteins) levels compared with the control consumption. It was also observed that cinnamon intake significantly decreased the level of fasting blood sugar and hs-CRP (high-sensitivity C-reactive protein) and ginger consumption showed significant decrease in F2-isoprostane (a prostaglandin) concentration and hs-CRP levels as compared to the observations recorded from the control group. Other groups showed no significant difference. However, the spices did not have any significant effects on glycemic control, inflammation, and oxidative stress. The herbal spices showed beneficial effects on cholesterol, but showed no effects on glycemic control, oxidative stress and inflammation.

2. Neuropharmacological studies on *Syzygium aromaticum* (clove) essential oil:

Introduction: Epilepsy is a brain disorder, commonly called seizures, which is characterised by sudden, violent and irregular movements of the body. It is caused due to involuntary contraction of muscles especially associated with brain disorders. Antiepileptic drug therapy, modern drug therapy and even multi-drug therapy is not effective for some epileptic patients. Therefore, researchers look forward to plant-based remedies which have beneficial effects against epilepsy. Anticonvulsants are the drugs used to treat convulsions which occur due to epilepsy. Anxiety is the displeasing feeling of fear which has affected 1/8th of the total world population. Anxiolytics are the drugs used to treat anxiety disorder. Insomnia, or sleepiness, is a disorder of sleep in which a person is unable to fall asleep. Benzodiazepines are prescribed to treat anxiety and insomnia but are limited due to its side effects. This review study aims to investigate the anticonvulsant, anxiolytic and hypnotic activities of clove essential oil.

Methodology: The experiment was done on Albino mice of both sexes. The essential oils from cloves were extracted by hydro distillation method and the components were separated by Gas Chromatography and Mass Spectrometry (GS-MS). Diazepam was used as a reference drug. Strychnine and Picrotoxin were used as anticonvulsants. Thiopental sodium was used as a hypnotic drug. 1% Tween 80 was injected in the control group. The experiment was conducted in three separate parts to observe the anticonvulsants, anxiolytic and hypnotic activities of clove essential oils.

Anticonvulsants activity: 5 groups of six mice were made randomly. Group I was injected with 1% Tween 80 (2.5 ml kg-1BW i.p.). Group II was injected with Diazepam, (5mg kg-1BW i.p.). Group III, IV and V were injected with Clove Essential Oil (0.025ml, 0.05ml and 0.1ml kg-1BW i.p.). After 30 minutes, the mice were injected with Strychnine or Picrotoxin (STC, 3 mg kg-1BW i.p or PTX, 10 mg kg-1 BW i.p.). Onset and the duration of convulsions and mortality percentage was recorded.

Anxiolytic activity: 5 groups of six mice were made randomly and assessed by Open Field Test (OFT). The latency of initial movements, ambulation, rearing and grooming was observed for 5 minutes, 30 minutes after the i.p injection of 1% Tween 80 (2.5 ml kg-1BW), Diazepam (1 mg kg-1BW) and Clove essential oils at a dose of (0.025, 0.05 and 0.1 ml kg-1BW).

Hypnotic activities: 5 groups of 6 mice were made randomly. Control group was injected with 1% Tween 80 (2.5 ml kg-1BW), reference group was injected with Diazepam (1 mg kg-1BW) and the test groups were injected with Clove essential oils at a dose of (0.025, 0.05 and 0.1 ml kg-1BW). After 30 minutes, thiopental sodium (40 mg kg-1BW i.p) was injected in each mouse to induce sleep. The duration of sleep was observed and recorded.

Conclusion: The analysis carried out by Gas Chromatography and Mass Spectrometry showed that Clove Essential oil consists of 11 components. Eugenol (62.29%), Caryophyllene (30.59%), and Humulene (3.07%) are the main components of Clove Essential Oil. There was a significant increase in the onset of convulsion and reduced its duration depending upon the dosage as compared to the control for strychnine and picrotoxin induced convulsions. All doses of clove essential oil showed increase in latency time and ambulation and decrease in grooming when compared with the control group. Clove essential oil was also effective in producing a significant decrease in the time of onset of sleep and also increased duration of sleep which was induced by thiopental sodium as compared to diazepam. Hence, we conclude that Clove Essential Oil shows anticonvulsant, anxiolytic and hypnotic activities.

3. Role of Spices and Herbs during Covid-19:

Introduction: In December 2019, an uncertain outbreak of Virus took place in Wuhan, China. The Symptoms were similar to pneumonia which was later identified as SARS-COV-2 by the World Health Organisation. It rapidly spread till October 2020 and was declared as pandemic by WHO. A severe outbreak of the virus, people kept combating it using home remedies. People used kadha, natural spices and herbs to fight against it. This study includes a survey analysis to understand people's view on spices as a helping hand in covid-19. Some basic properties of spices were studied which help as a barrier to COVID-19. Curcumina longa (Turmeric) is natively grown in India and is the best natural remedy used by Indians. It acts as an anti-inflammatory, anti-neoplastic and anti-geogenic in nature. A dose of 12 mg/ day of curcumin was declared safe for humans. It was seen that curcumin plays a major role in effectiveness against various viral diseases such as Herpes, SARS-COV-2 and hepatitis. Curcumin targets cellular pathways and thus inhibits the growth of viruses. It plays a vital role in inhibiting viral replication by targeting molecular level pathways. Cinnamon, mostly grown abundantly in the Middle East, plays an important role. It belongs to *Lauraceae*, an aromatic species. Cinnamon has about 21 chemical compounds which includes Cinnamaldehyde (60.41%) and eugenol (3.19%) which has antibacterial effects. Cinnamon also has antimicrobial, antiviral, antifungal, antioxidant, antihypertensive, antidiabetic, antitumor, gastroprotective, and immunomodulatory effects. Cloves belonging to the family *Myrtaceae* are also antibacterial. It is also used to increase shelf life of food in food industries. Cloves are well known to prevent nausea and vomiting (antiemetic in nature). They also possess antimicrobial activities and are effective against gram positive and gram negative bacteria.

Methodology: The unusual outbreak led to many catastrophic events, people by themselves came out with home remedies. Hence, an online survey was carried out to know about what home remedies people use. The survey included a random population all over the world. The response was mainly from the age group 13-68. The total population for the survey was 531, out of which 7.8% were COVID positive. Most people think that spices play an important role in these tough times. People used sanitizers and masks to boost their immunities. People prefer kadha as a best home remedy where 56% of people were found to take koradha one time a day and 26% to take koradha two times a day. People preferred lemons and oranges more. People were boosting their immunity by Vitamin C rich fruits and tablets. A clinical trial in a hospital of China was carried out, people were given 12 mg/day of vitamin, which was found to be defensive against coronavirus.

Conclusion: According to a survey most people used kadha, in which their main ingredient was cinnamon, clove, ginger, garlic, tulsi and black pepper. It was seen that cinnamon, clove, tulsi and turmeric play a vital role in SARS-COV-2, including some viral infections. Turmeric has some antiviral properties and tulsi helps in increasing helper T cells levels as well as natural killer cells. The intake of Vitamin C was increased by people by taking Vitamin C enriched fruits like Amla and lemon. Black pepper helps in relieving nasal congestion which is the most common symptom of SARS-COV 2. It also boosts immunity and has antiviral properties. 26% of people were tested and 7% were found positive for Coronavirus. 93.6% people believe spices as a best remedy against COVID 19.

Methodology:

Moisture content, pH and Solubility:

Aim: To determine the moisture content, solubility and pH of cinnamon powder (brand name-Satyam).

Requirements:

- Material- Cinnamon powder (Brand name-Satyam).
- Glasswares- Watch glass, 10 cm³ pipette, 15 cm³ test tube, 100 cm³ beaker, 250 cm³ beaker and 250 cm³ conical flask.
- Instruments- pH meter, weighing balance and Oven.
- Other- Distilled water, filter paper and test tube stand.



Procedure:

● pH and Solubility:

1. Take one gram of cinnamon powder in a 15 cm³ test tube and add distilled water to it. Shake the test tube well and check the solubility.
2. Separate the insoluble matter with the help of filter paper and measure it under weighing balance.
3. Take 1 g of cinnamon powder in a test tube and add distilled water to it. Check the pH of the solution with pH paper.
4. Take 10.0 g of cinnamon powder in a beaker and add 25 cm³ of distilled water. Stir well and note down the reading in the pH meter.

● Moisture content:

1. Measure the weight of watch glass on weighing balance.
2. Add one gram of cinnamon powder on the watch glass.

- Set the oven to 70° C and put the watch glass into the oven.
- Note down the reading after every 15 minutes for 1 hour.

Observation and Calculation:● **Moisture content:**

Moisture content after one hour= Initial weight- Final weight = 1.00 g - 0.802 g = 0.198 g

Moisture content in percentage= $0.198/1.00 \times 100 = \underline{19.80\%}$.

Weight of insoluble matter= 0.563 g.

Percentage of insoluble matter= $0.563/1.00 \times 100 = \underline{56.30\%}$.

TIME	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
Initial weight- Final weight (with watch glass)	26.817-25.82 7= 0.99 g	26.718-25.82 7= 0.891 g	26.663-25.82 7= 0.836 g	26.629-25.82 7= 0.802 g
Final weight (without watch glass)	0.99 g	0.891 g	0.836 g	0.802 g

● **pH testing:**

pH of soluble matter (by pH meter) = 7.33.

pH of Cinnamon powder in water-

	pH	Nature
pH paper	5	Acidic
pH meter	5.19	Acidic

Steam Distillation:

Steam distillation is the simplest and easiest method for extraction of volatile components of a compound. Cinnamon has lot's of phenolic and essential oil components. The major essential oil in cinnamon is Cinnamaldehyde. It comprises about 90% of essential oil components. Other chemical components like eugenol, coumaric acid and cinnamyl alcohol are also present. Hence , steam distillation of cinnamon powder was done to extract cinnamon essential oil. Cinnamon bark was first grounded into powder. Powdered cinnamon was used for further analysis. 50 g of cinnamon powder with 50 cm³ of water and 50 cm³ of solvent was taken in a round bottomed flask. The flask was shaken well and then distilled. Solvent used was organic solvent, n-Hexane. n-Hexane or DCM (Dichloromethane) are best suitable for



cinnamon essential oil extraction, because it has low boiling point and evaporates faster leaving desired essential oil behind.

Results:

1. Moisture content of 1 gm cinnamon powder after one hour= 0.198 g.
2. Moisture content in percentage= $0.198/1.00 \times 100 = 19.80\%$.
3. Weight of Insoluble matter of 1 gm cinnamon powder= 0.563 g.
4. Percentage of insoluble matter of 1 gm cinnamon powder= 56.30%.
5. pH of soluble matter of 10 gm cinnamon powder by pH meter= 7.33
6. pH of 10 gm cinnamon powder in water (by pH meter) = 5.19.
7. pH of 1 gm cinnamon powder in water (by pH paper) = 5.

Conclusion:

Cinnamon is hard and brittle. It contains 11% of water and 83% of carbohydrates (53% is mainly dietary fibres), 4% of proteins and very little fat (1%). It is highly fibrous and hence, it is insoluble in water. About 1 mg/ L can be dissolved in water. It is 2-3 m in height. It can bear harsh conditions of soil and temperature. It is acidic in nature. It contains many monoterpenes, Sesquiterpenes and phenol terpenes. These compounds contribute to the aroma and flavour of cinnamon. Cinnamon bark consists of 5-75% of essential oil. The major cinnamon essential oil is cinnamaldehyde which constitutes 90% of essential oil. Besides Cinnamaldehyde there are other cinnamon oil chemical components such as cinnamic acid, coumaric acid, cinnamyl alcohol, and eugenol.

Survey Analysis

Introduction:

Spices are considered to be the heart of Indian cooking. Spices are known as one of the most remarkable ingredients for its indigenous flavour, nutritional value and medicinal properties. The present study is aimed to identify the most frequently consumed spices at households and to assess the consumer knowledge and perception about organic spices. The survey method using questionnaire was carried out to elicit the required information from female respondents, of different areas in Mumbai. A general survey was done to gather information about the most commonly used spices by people in day to day life. We included some experimental activities by FSSAI, which were too basic and helped us to know whether the spices used in day to day life are adulterated or not.

Hypothesis:

Null hypothesis- “People use soft and rollable cinnamon.”

Methodology- An online survey was conducted by using google docs. It included three parts-

1. Introduction.
2. Some general questions on spices and
3. Some basic household activities using water to understand basic properties and adulteration of spices used by people.

Observation

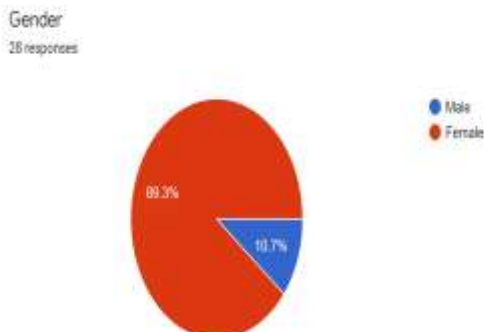
28 Random samples were collected for survey analysis.

The target population were mostly women. The friends were asked to fill the forms by their mothers or sisters.

Hence, there are only 3 male and 25 female responses.

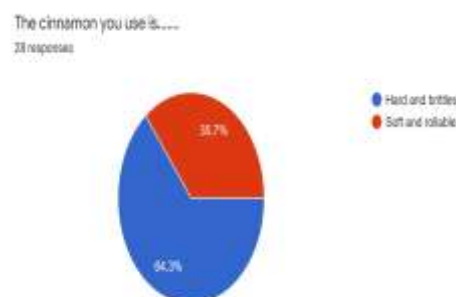
Survey consisted of some general FSSAI mentioned activities to find out whether the spices used are adulterated or

not.



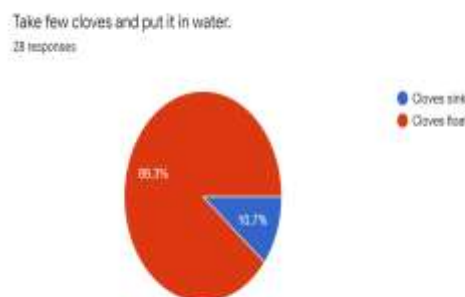
1. Question- What type of Cinnamon you use?

- 36.70% of people were using soft and rollable cinnamon.
- 64.30% of people were using hard and brittle cinnamon.
- 18 people amongst 28 were using hard and brittle whereas 10 were using soft and rollable.

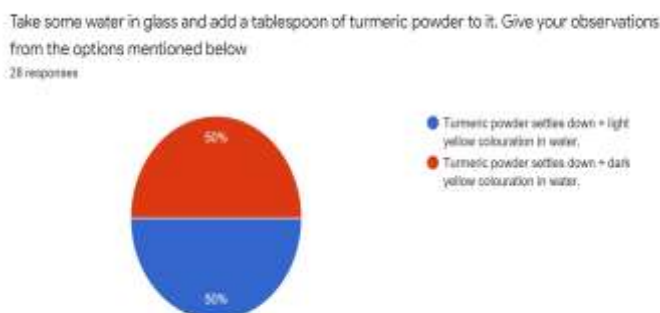


2. Question- Take some clove and put it in water.

- Out of a total 28 responses, cloves of 25 people floated whereas only of 3 people sank.
- 89.30% of people's cloves floated.
- 10.70% of people's cloves sank.



3. Question- Take some water in a glass and add a tablespoon of turmeric powder to it. Give your observations from the options mentioned below.



Calculation

- A Chi-Square calculation was done on the cinnamon part.

- A null hypothesis was set “People used soft and rollable cinnamon.”
- Formula- $\chi^2 = \sum(O_i - E_i)^2/E_i$
- Level of significance= 0.05 (i.e 5%)
- Degree of = $(n-1) = (2-1) = \text{freedom}1$
- Observed value (**O_i**) = 10 (Soft and Rollable)
- Observed value (**O_i**) = 18 (Hard and brittle)
- Expected value (**E_i**) = observation 1+ observation 2/ 2
 - = $10+18/2$
 - = $28/2$
 - = 14
- χ^2 (Hard and brittle)= $(18)^2/14$
 - = $324/14$
 - = 23.14
- χ^2 (Soft and rollable)= $(10)^2/14$
 - = $100/14$
 - = 7.14
- χ^2 (Hard and brittle) + χ^2 (Soft and rollable) = $23.14+ 7.14 = 30.28$
- χ^2 ($\alpha=0.05, n=1$) = 3.34
- χ^2 (calculated) $>$ χ^2 (tabulated)

Hence, the Null hypothesis is rejected and an alternate hypothesis is accepted.

People use hard and brittle cinnamon instead of soft and rollable.

Conclusion:

Survey method was used to understand the people’s opinion about organic spices, most commonly used spices and adulteration of spices. There were 25 female respondents and only 3 male respondents. People were asked whether they prefer ground or whole spices, 57% of people use both types of spices. People use spices for medicinal use as well. Spices have many antimicrobial, antifungal and anti diabetic properties. Cloves of 25 people were old and adulterated whereas only 3 respondents were fresh. Since cinnamon was our main interest further statistical analysis on it was done. A chi-square calculation was carried out and a null hypothesis was set- ‘People use soft and rollable species of cinnamon’. Chi calculated value was greater than Chi tabulated value. Hence, null hypothesis- ‘People use soft and rollable cinnamon’ was rejected and alternate hypothesis- ‘People use hard and brittle cinnamon’ was accepted. It was seen most of the people use general spices and very few of them preferred organic spices. Only 16 people knew about organic spices whereas the other 12 had no knowledge about organic spices. Most of the people used spices which were months old. It was concluded that most people use adulterated spices.

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