

## Evaluation of KAP and detection of adulterants in spices by physical and chemical methods

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### Abstract

Food is one of the essential needs for every living being and is very important aspect for life. But nowadays foods are affected by different adulterants. Adulteration is a substance which reduces the vital importance of food. The present study aims to detect the presence of adulterants in selected spices like chilli powder, turmeric powder, coriander powder and asafetida (the major spices used for cooking in India). Different brands of the mentioned spices were collected from local markets of Tirupati. Both branded and unbranded samples were selected for the study to determine the adulteration levels. The testes were carried out by physical and chemical analysis. After the tests, the products containing adulterants were identified in some samples like GRB, Aachi and local brands Dharani, Sparsh. Assessed the Knowledge, attitude and practice (KAP) on adulterants in selected adult subjects, before awareness KAP scores of the subjects were lower, after the awareness the subjects KAP scores were increased. Contaminated spices have been reported to cause certain food- borne illness and spoilage. The researches may concluded that basic awareness on adulteration and its health effects is most need for the community.

Adulteration in food is often present in its most crude form as prohibited substances are either added partially or wholly substituted. Contamination or adulteration in food is added for various reasons which include financial gain, carelessness and lack of proper hygienic conditions of processing, storing, transportation and selling. Therefore, the consumer is either fooled or usually becomes a victim of disease<sup>2</sup>. In backward or developing countries, such kind of adulteration is usually seen. It is essential

for the consumer to be aware of common adulterants and their effect on health<sup>3</sup>. Market has a high number of food producers and food is imported in large amounts which permit the producer to mislead and cheat consumers. There are producers who take advantage of legal rules and others who commit food adulteration and to differentiate between the two is extremely troublesome. Adulterations in foods not only decrease our social value but morality too<sup>4</sup>. The awareness of consumers

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plays an important role in preventing food adulteration. Unawareness and unfair market behavior might endanger consumer health and misleading can lead to poisoning. Therefore, basic screening tests should be known to common people to avoid the consumption of adulterated foods<sup>23</sup>.

*Nature of adulteration :*

Within the past few decades, adulteration of food has become one amongst the intense issue. Many agencies came upon the Governments of India to get rid of adulteration from food stuff. Screening of adulterated and non-adulterated food is important for daily life to make sure that such foods don't cause any health problems<sup>6</sup>. Toxic contaminants are present in ppm level therefore, it's impossible to make wholesome food solely on visual examination<sup>20</sup>. However visual examination of the food before purchase bounds to guarantee absence of insects, visual flora, foreign particles etc. In addition, label declaration on packed food is very important in order to know the ingredients and its nutritional value<sup>6</sup>. It also helps in checking the freshness of the food and the period of best before use. The buyer must avoid taking food from a place which avoids hygienic conditions. Food purchased from unhygienic places may cause various diseases<sup>5</sup>. Based on the type of contamination, intention of the producer and processing methodology, adulteration can be divided into 3 types.

*Intended adulterants :*

It may include adulterants like sand, marble chips, stone, water, coal tar dyes, mud, mineral oil and chalk powder. Such adulterants

harm the human body<sup>14</sup>.

*Metallic contamination :*

Metals like arsenic, lead and tin that are present in pesticide, water and cans respectively are responsible for metallic contamination of food products. Such adulterants unintentionally become a part of food during processing<sup>19</sup>.

*Accidental adulterants :*

Accidental adulterants are pesticides residues, dropping of rodents, larvae in foods, etc. Metallic contamination with arsenic lead, mercury can also occur accidentally. Accidental adulterants also involve pests such as rodents and insects that trespasses the food at high degree and produces impurity in the form of excreta, bodily secretion and spoilage through micro-organisms. Most common accidental adulterations are pesticides, D.D.T and residues present on the plant produce<sup>18</sup>.

*Impact of adulterants :*

Nowadays it is very common to read and hear in print and electronic media about the food items being adulterated and such products are being openly sold out and are consumed by people, which causes various health hazards. The economically motivated adulteration of spices can have serious implications for public health and industry. In some instances, spices were found to be adulterated with highly toxic materials such as heavy metals and unapproved color additives. In other incidents, the bulking material adulterant added to the spice contained undeclared allergens that caused adverse reactions in individuals with food allergies<sup>21</sup>. Few health hazards include stomach ach, body ach, anemia, paralysis

and increase within the incidence of tumors, pathological lesions in very important organs, abnormalities of skin and eyes. Thus food adulteration is thought to be very important because of its impact within the health significance of public<sup>7</sup>. The individuals are laid low with heart disease, kidney failure, skin disease, asthma attack and alternative chronic disease.

#### *Spices :*

Spice is a seed, fruit, root, bark, bud or vegetable substance primarily used for flavoring, coloring or preserving food. Common and rare spices have their respective adulterants that either are mixed while preparation of the spices or completely replace the original spices. The common adulterants of spices are sand, dirt, earth gritty matter, artificial colour, starch, chalk powder, bark, stone, saw dust, horse dung, lead chromate and argemone, papaya seed etc. A manufacturer may use a cheap filler that is easily disguised in the spice to increase the volume sold there by cutting the cost of pure spice, and thereby increasing the ultimate profit margin. Sudan dyes are indirect carcinogens therefore they are banned for foodstuffs<sup>10</sup>.

Based on this background the present study was planned to test the adulterants in the selected (Turmeric powder, Chilli powder, Coriander powder, cumin seeds, asafetida) spice brands and also assess the selected subjects knowledge, attitude and practice (KAP) score before and after education.

Food products like chili powder, turmeric powder, pepper, coriander powder, cumin seeds, asafoetida which were collected

from local market Tirupati region. Acetic anhydride, concentrated. Sulfuric acid, acetic acid, concentrated nitric acid. Concentrated. HCl, diluted, HNO<sub>3</sub>, KI solution, diluted HCl, Kesari Dal, lead chromate, concentrated. HCl, CCl<sub>4</sub> are some chemical reagents were used in analysis of adulterants. All reagents were of analytical grade. The methods adopted for detection of adulterants are given below- 8 random samples are collected and the following methods are referred to check adulteration.

#### *Chilli powder :*

##### ***a. To detect the presence of Red lead salts:***

Dilute nitric acid is added to the sample of chilli powder. The solution is filtered. Next 2 drops of Potassium Iodide are added to the filtrate. Formation of yellow colored precipitate indicates the presence of red lead salts.

##### ***b. To detect the presence of oil soluble Coal***

***Tar:*** (2 g) of Chilli powder is taken in a test tube. Few ml of ether solvent is added and the test tube is shaken well. Ether layer is decanted into a test tube containing 2 ml of dilute Hydrochloric acid. It is shaken properly<sup>1</sup>. Distinct pink to red colour of the lower acid layer will indicate the presence of oil soluble coal tar.

##### ***c. To detect the presence of brick powder:***

Chilli powder is added in a beaker containing water. Brick powder settles down while pure chilli powder floats<sup>1</sup>.

##### ***d. To detect the presence of Rhodamine B:***

(2 g) of Chilli powder is taken in a test tube and 5 ml of acetone is added. Immediate red coloration indicates the presence of Rhodamine B.

*Turmeric Powder :*

**a. To detect the presence of yellow lead salts:** Two gram of turmeric powder is taken in a test tube. Conc. Hydrochloric acid is added to it. Magenta coloration indicates presence of yellow oxides of lead.

**b. To detect the presence of chalk:** Two gram of turmeric powder is taken in a test tube. Few drops of water and then few drops of Hydrochloric acid are added to it. Effervescence will indicate the presence of chalk.

**c. To detect the presence of Metanil yellow:** A sample of turmeric powder is taken. To it 13N sulphuric acid is added. Disappearance of red colour on adding distilled water indicates the presence of metanil yellow<sup>1</sup>.

**d. To detect the presence of aniline dyes:** To a sample of turmeric powder few drops of water are added. To it 5 ml of spirit is added. Immediate disappearance of yellow colour indicates the presence of aniline dye.

*Coriander powder :*

**a. To detect the presence of dung powder:** Soak a sample of coriander powder in water. Dung/sawdust will float and can easily be detected by its foul smell.

**b. To detect the presence of common salt:** A sample of coriander powder is taken. To it 5 ml of water is added. Next few drops of silver nitrate are added to it. White precipitate confirms presence of salt.

*Adulteration in Asafoetida:* Common adulterants are chalk and soap stone which are detected as:

**a. Detection of chalk:** Shake sample with  $\text{CCl}_4$  settled down, decant the top layer and add dil. HCl to the residue, effervescence indicates the presence of chalk in the sample.

**b. Detection of Soapstone:** Shake the little quantity of powdered sample with water some heavy particle like soap stone or earthy matter settle at the bottom.

*Cumin seeds :*

**(a) Grass seed and charcoal dust:** One teaspoon of cumin powder is added to a glass of water and let it stay still for a few minutes. The charcoal dust will float on the surface while the pure spice will settle at the bottom of the glass.

**(b) Colour coated seed :** Sometimes the cumin seeds are coated with colour to have good lustre and appealing colour. To know this the cumin seeds are rubbed vigorously on palms. Appearance of colour in the palm indicates the cumin seeds are coated with artificial colour.

*Black pepper (Kali mirch) :*

**Papaya seeds:** Drop some black peppers in a glass of water. The black pepper will settle at the bottom of water in the glass whereas the papaya seeds will float.

**Knowledge, attitude and practice:** Face to face interview was conducted to collect the KAP data. The data were collected in 2 time intervals *i.e* before and after knowledge transfer to the participants; the participants were given DART manual by FSSAI and demonstrated the simple adulteration tests to conduct at home, The questionnaire contains questions like; are

you aware of food adulteration, how food is adulterated, do you know the brick powder is an adulterant in chilli powder, do you believe artificial colours are added in spices, do you check the label/ Brand before buying the product. Overall, the questionnaire comprised 15 questions; 5 on knowledge, 5 on attitude, and 5 questions on practice. Each question scores 2 marks, total score is 30. A stratified sampling was done on food adulteration knowledge, attitude and practice of consumers who are responsible for food purchase and preparation, from Tirupati urban. The total sample was 180 members apart from those 70 male respondents and 110 female respondents.

The observed outcomes of various food samples are recorded in table 1. Food products like chilli powder, turmeric powder, pepper, coriander powder, cumin seeds, asafoetida samples (Branded and unbranded) were collected from Tirupati market. Appearance of colour, change in colour, and formation of ppt., evolution of gas and floating of foreign particles over the surface of food sample has been mentioned in table-1.

Among 8 samples of chilli powder B2, B5 & B8 samples were found the adulterant *i.e* red lead salts; B4 & B7 chilli powder samples contained oil soluble coal tar; B1, B4 & B5 samples contained brick powder, B1 and B6 samples of chilli powder contained rodamine-B respectively.

In 8 samples of turmeric powder adulterants like yellow lead salts and chalk powder were not found. B3 & B7 samples

were found to contain metanil yellow and B2 & B5 samples contained aniline dye. The remaining spices coriander powder contained dung powder in B2, B4 and B5 samples, no adulterants were found in asafoetida, cumin seeds and black pepper. Without addition of species Indian food is incomplete. But before purchasing the spices, consumer has to take care of the adulterants and its side effects and detection of the adulterants in the spices. These type of practices also one of the causative factor for the increase of incidence of the cancers. Consumers need to be more active against adulteration across the country<sup>22</sup>.

The data from the table -2 shows that the majority of the respondents' education status was graduate in Male -30%, Female-30.9percentage were in intermediate qualification; it indicates female respondents are less knowledgeable on food adulteration. The data of mode of family belongs to nuclear families (male-81.4 percent, Female-83.6 percentage) it indicates young adults were mishandling the food because of lack of knowledge in safe food handling. The data of economic status belonged to the middle-income group *i.e* male respondents (57.1%) and female respondents (45.4%) the income have direct effect over following good food practices.

The distribution of the scores before and after imparting knowledge, attitude and practices of food adulteration is presented in table-3. Before imparting adulteration knowledge the selected respondents knowledge scores were between low (<10) to medium (<10-20). After imparting the knowledge the subjects scores were increased and placed between medium (>10-20) to high (>20).

Table-1. Observations made during analysis of spices

Food sample	No. of samples	Adulterants			
		Red lead salts	Oil soluble coal tar	Brick powder	Rodamine B
Chilli powder	B1	Absent	Absent	Present	Present
	B2	Present	Absent	Absent	Absent
	B3	Absent	Absent	Absent	Absent
	B4	Absent	Present	Present	Absent
	B5	Present	Absent	Present	Absent
	B6	Absent	Absent	Absent	Present
	B7	Absent	Present	Absent	Absent
	B8	Present	Absent	Absent	Absent
Turmeric powder		<b>Yellow lead salts</b>	<b>Chalk powder</b>	<b>Metanil yellow</b>	<b>Aniline dyes</b>
	B1	Absent	Absent	Absent	Absent
	B2	Absent	Absent	Absent	Present
	B3	Absent	Absent	Present	Absent
	B4	Absent	Absent	Absent	Absent
	B5	Absent	Absent	Absent	Present
	B6	Absent	Absent	Absent	Absent
	B7	Absent	Absent	Present	Absent
	B8	Absent	Absent	Absent	Absent
Coriander powder		<b>Dung powder</b>	<b>Common salt</b>	-	-
	B1	Absent	Absent		
	B2	Present	Absent		
	B3	Absent	Absent		
	B4	Present	Absent		
	B5	Present	Absent		
	B6	Absent	Absent		

Table-2. Demographic Profiles of the Respondents

Respondents	Male		Female	
	N	%	N	%
<b>Education</b>				
High school	14	20	30	27.2
Intermediate	16	22.8	34	30.9
Graduate	21	30	31	28.1
Post graduate	19	27.1	15	13.6
<b>Marital status</b>				
Married	50	71.4	90	81.1
Unmarried	20	28.5	20	18.1
<b>Mode of family</b>				
Joint	13	18.5	18	16.3
Nuclear	57	18.4	92	83.6
<b>Economic status</b>				
Lower (10,000)	10	14.2	40	36.3
Middle (10,000-40,000)	40	57.1	50	45.4
High (Above 40,000)	20	28.5	20	18.1

Table-3. Knowledge score obtained by the subjects before and after demonstration of food adulteration.

Score	Pre - test		Post - test	
	N	%	N	%
Low < 10	70	38.8	45	25
Medium > 10-20	100	55.5	92	51.1
High > 20	10	5.5	43	23.3

After demonstrating the detection of food adulteration at laboratory and household protocols, the consumer's knowledge and attitude was changed based on the test results. The knowledge scores of the respondents were increased. The majority of the respondents' scores (51.5%) were between 13-18 and 27.7% of the respondents scored between 25-

30. The studies<sup>16,17</sup> also revealed that homemakers tend to take almost all the decisions related to purchase of food for the entire family, so the people unaware about food adulteration are more affected by infections like diarrhea, food poisons, cold etc. Unbranded and fake products create damage to consumers' health. "Knowledge and awareness about

adulterated foods, laws and it's related to adulterated food is crucial in a society where technology heightens opportunities for perpetrators of fraud deception and misrepresentation"<sup>11</sup>.

Adulterated food not only consists of the physical adulterated particles other than food, but it also hosts pathogens, which can cause harmful diseases. Adulterated food causes both physical and mental disorders along with malnutrition. Adulterants like Red lead salts, Oil soluble coal tar, brick powder, Rodamine B, Metanil yellow, Aniline dyes, cow dung like toxic substances were observed in the selected samples of the spices, they added to gain profit and lower the cost to compete with the market. Spices are any pungent, aromatic plant substances used to flavor food or beverages. Contaminated spices have been reported to cause certain food- borne illness and spoilage. Hence, we must avoid eating such foods. In addition, the government needs to take necessary actions against the companies and individuals who for the sake of their own profit are manufacturing and selling adulterated products to consumers. The objective of current study is to bring awareness in the society, which helps to select the best and suitable food items and how to find out the adulterants. As we know that contamination in food is done either for financial gain or due to carelessness. The study reported low awareness of food safety and adulteration can lead to food borne illnesses. It may be knowingly or unknowingly. Thus, we concluded that educating the consumers to detect and avoid food adulteration.

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