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Research Article

Analysis of Food Adulterants in Selected Food Items Purchased From Local Grocery Stores

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Abstract

Food is one among the basic needs for every living being. Food for human consumption should be in its possible purest form without adulterants and contaminants. The present study focuses on analyzing few selected food items purchased from local grocery stores located in the twin cities of Secunderabad and Hyderabad, Telangana. The extent of different adulterant present in the food items were, edible oil samples, argemone oil (30%), prohibited color (15%), mineral oil (20%), dyes in fat (15%) and castor oil (0%). 20% of ghee samples tested positive for vanaspathi and were negative for mashed potatoes and paraffin wax (0%). Coconut oil tested negative both for any other oil (0%) and turbidity (0%). None of the honey samples tested positive for water (0%). All the jaggery samples tested were negative for sodium bicarbonate (0%). Similar results were obtained in case of curd samples (negative for dalda (0%)). 55% of the common salt samples tested positive for the presence of impurities

Keywords: Food adulterants, edible oil, ghee, coconut oil, curd, honey, jaggery and common salt.

1. Introduction

Every living being on earth requires food for their survival. Food can be defined as any substance that contains all the essential components (carbohydrates, water, fats and proteins, etc) that are required for nutrition to live a healthy life. It can be consumed (eg., in the form of cooked items, dairy products etc) or drunk in the form of liquids (eg., fruit juices, milk, coconut water, etc) by humans. Most humans consume food for nutrition although some consume food for pleasure [1]. Food for human consumption should be without or with acceptable safe levels of adulterants, contaminants or any other substances. Adulteration refers to substance that cannot be added to other substances (it can be in e.g. food, beverages, and fuels).

Introduction of contamination in food material by the addition of low quality, cheap and non-edible or toxic substances intentionally (purposefully) or unintentionally (during processing, transport or due to lack of proper hygienic conditions) is referred to as food adulteration. Addition of adulterants to food and food items can have severe consequences on human health [2-4]. Health hazardous in humans due to adulteration can also arise due to deprivation of essential nutrients that may be required for normal growth and development [5]. Example of few adulterants that are added to our daily food items are, colour dye rhodamine B (e.g., red chilli powder), metanil yellow (e.g., turmeric powder), soap stone (eg., asafoetidia), industrial starch (e.g., milk) aluminum foil (e.g., sweet) and sawdust (e.g., coriander and cumin powder) [6]. Common source of infection in humans arise due to consumption of contaminated foods and drinks [7]. Since adulteration is a major concern with respect to human health, the following project was under taken to determine the adulterants present in some commonly used food items.

1.1 Aim of the Project

The aim of the project was to analyse few food items for its adulteration since there are ever increasing reports on food adulteration and its harmful effects on human being (Table I) [8,9].

Table I: Adulteration In Food Stuff And Its Harmful Effects

Food Article	Adulterant	Harmful Effects
Edible oils	Argemone oil	Loss of eyesight, heart diseases, tumour
	Mineral oil	Damage to liver, carcinogenic effects
	Castor oil	Stomach problem
Ghee	Vanaspathi	Acute renal failure
Honey	Molasses sugar (sugar plus water)	Stomach disorder
Jaggery	Washing soda, chalk powder	Vomiting, diarrhoea
Salt	Chalk powder	Stomach disorder

2. Materials and Method

2.1 Sample collection

Food items like, edible oil, ghee, coconut oil, curd, honey, jaggery and common salt were purchased from different departmental and local grocery stores located in the twin cities of Secunderabad and Hyderabad, Telangana.

2.2 Detection of adulterants

Qualitative tests for the detection of adulterants were carried according to published method [9-16]. Brief protocol for the tests carried out for detecting different adulterants is given in the Table II.

Table II: Qualitative detection of different adulterants

Food	Adulterant	Experiment	Observation
Edible oil	**Argemone oil**	To 1 mL of oil sample few drops of Conc. HNO_3 was added and the contents were vortexed.	Red to reddish brown colour in the acid layer indicates the presence of argemone oil.
	Prohibited colour	To 5 mL of oil sample, 5 mL of Conc. HCl was added. After mixing gently, the contents were left undisturbed for 5 min.	Colour separation in upper layer of solution indicates the presence of prohibited colour.
	Mineral oil	To 2 mL of oil sample an equal volume of ehanolic KOH was added. After mixing, the contents were boiled in boiling water bath for 15 min. After cooling, distilled water was added to it.	Appearance of turbidity indicates the presence of mineral oil.
	Dyes in fat	1 mL of oil sample was mixed with 1 mL of Conc.H_2SO_4 and 4 mL of acetic acid.	Appearance of pink or red colour indicates the presence of dyes in fat.
	Castor oil	To 0.5 mL of oil sample, 2 mL of petroleum ether was added and the contents were chilled for 5 min.	Formation of turbidity within 5 min indicates the presence of castor oil.
Ghee	**Dalda or vanaspathi**	To a small quantity of ghee sample 10 drops of Conc. HCl or muratic acid and a small amount of sugar was added and the contents were mixed thoroughly.	Red colouration indicates presence of dalda in ghee.
	Mashed potatoes	To a small quantity of ghee sample few drops of iodine solution was added.	Brownish colour turns to blue in the presence of mashed potatoes.
	Paraffin wax and hydrocarbon	A small amount of ghee sample was heated with acetic anhydride.	Droplets of oil floating on the surface of unused acetic anhydride indicates the presence of wax or hydrocarbon.
Coconut oil	**Any other oil**	A small volume of the coconut oil sample was placed in refrigerator.	Coconut oil solidifies leaving the adulterant as a separate layer.
Sweet curd	**Dalda**	To a small amount of sweet curd sample 10 drops of Conc. HCl and a small amount of sugar was added. The contents were mixed thoroughly.	Red colouration indicates presence of dalda in sweet curd.
Honey	**Water**	A cotton wick dipped in honey sample was ignited with a match stick.	Presence of water in adulterated sample will not allow the honey to burn; if it does it will produce a cracking sound.
Jaggery	**Sodium bicarbonate**	To a small amount of jaggery sample 3 mL of muratic acid was added.	Effervescence indicates the presence of sodium bicarbonate.
Common salt	**White powdered stone or impurities.**	A spoonful of common salt sample was dissolved in a glass of water.	Chalk powder makes the solution white and insoluble impurities will settle down at the bottom.

3. Result and discussion

3.1 Adulteration in Edible Oil

The percentages of different adulterant varied significantly for each of the adulterant tested (Table III and Figure 1). The highest percentage was found for argemone oil (30%) and the lowest percentage was found for prohibited colour (15%) and dyes in fat (15%). The percentages of different adulterants in edible oil were argemone oil (30%) (Figure 2), prohibited colour (15%) (Figure 3) mineral oil (20%), and dyes in fat (15%). All the samples tested negative for castor oil (0%).

Table III: Adulteration in Edible Oil

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Edible oil	Argemone oil	70	30
	Prohibited colour	85	15
	Mineral oil	80	20
	Dyes in fat	75	15
	Castor oil	100	0

Figure 1: Adulteration in Edible Oil

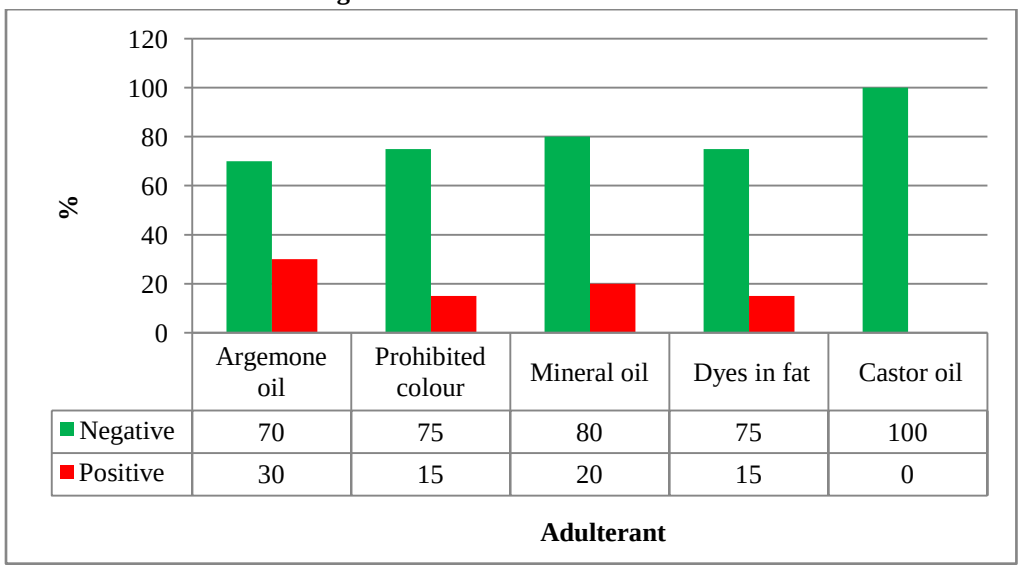


Figure 2: Argemone Oil Adulteration

Negative Positive

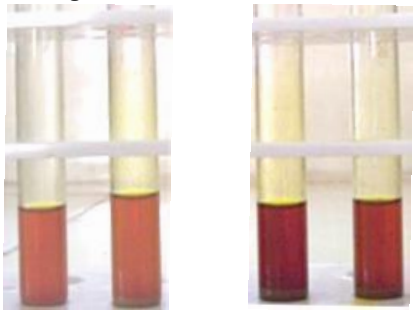
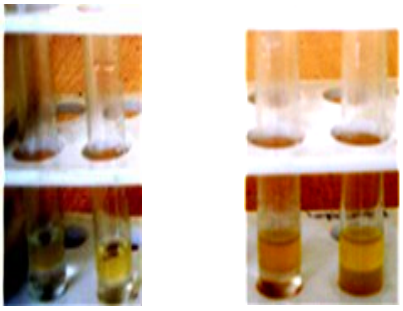


Figure 3: Prohibited Color Adulteration

Negative Positive



3.2 Adulteration in Ghee

20% of the ghee samples tested positive for the presence of vanaspathi (Table IV & Figures 4 & 5). All the samples tested negative for mashed potatoes and paraffin (0%). (Table IV). Similar findings were reported by Abhirami S., *et al* [12].

Table IV: Adulteration in Ghee

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Ghee	Vanaspathi	80	20
	Mashed potatoes	100	0
	Paraffin wax	100	0

Figure 4: Adulteration in Ghee

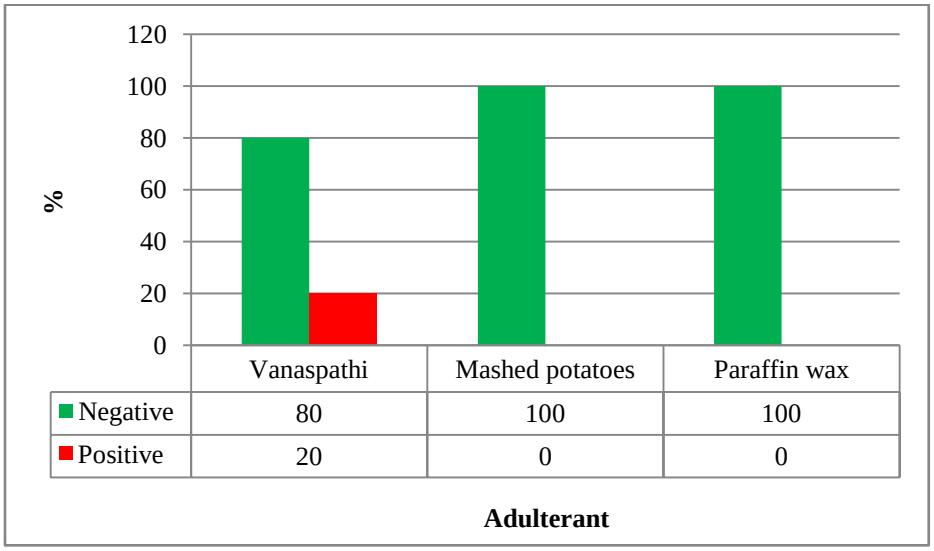
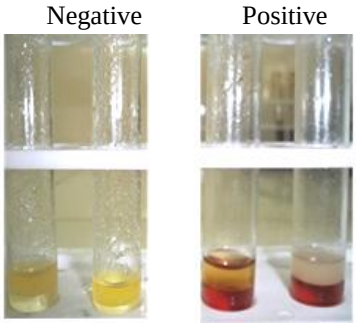


Figure 5: Vanaspathi Adulteration

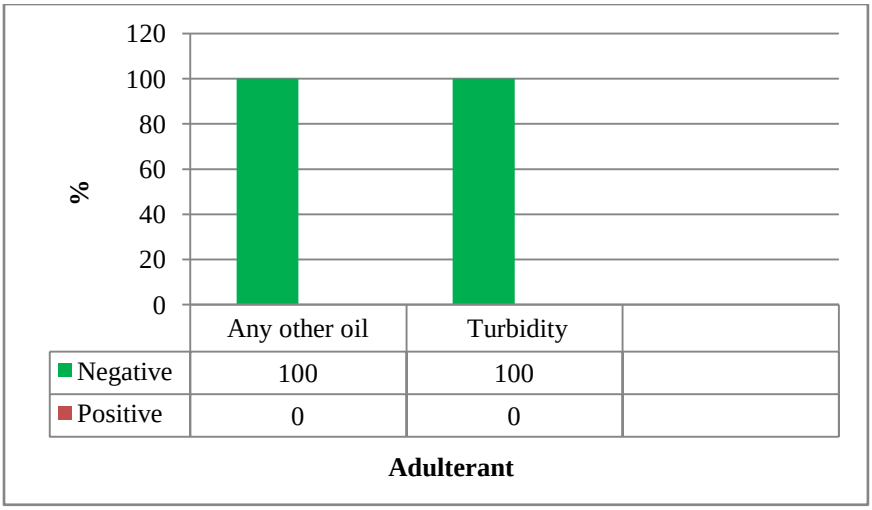


3.3 Adulteration in Coconut Oil: None of the coconut oil samples tested showed the presence of any other oil and turbidity (0%) (Table V & Figure 6).

Table V: Adulteration in Coconut Oil

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Coconut Oil	Any other oil	100	0
	Turbidity	100	0

Figure 6: Adulteration in Coconut oil



3.4 Adulteration in Curd

All the curd samples tested were negative for dalda as adulterant (Table VI & Figures 7 and 8).

Table VI: Adulteration in Curd

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Curd	Dalda	100	0

Figure 7: Adulteration in Curd

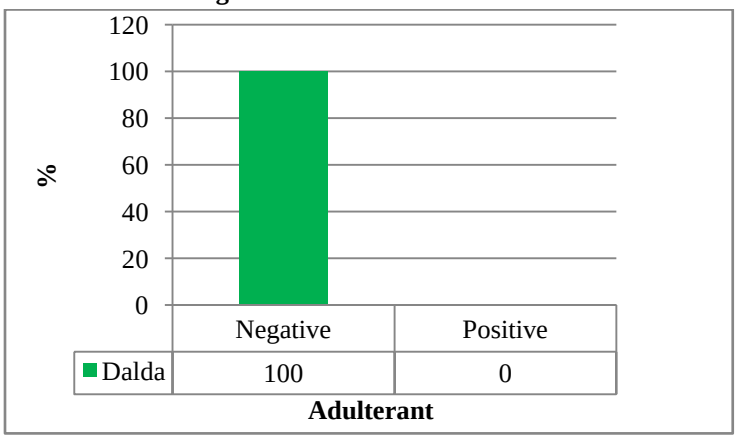


Figure 8: Dalda Adulteration

Negative

3.5 Adulteration in Honey

All the honey samples tested negative for water as adulterant (Table VII & Figures 9 & 10). Our results are in accordance with those reported in literature [12].

Table VII: Adulteration in Honey

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Honey	Water	100	0

Figure 9: Adulteration in Honey

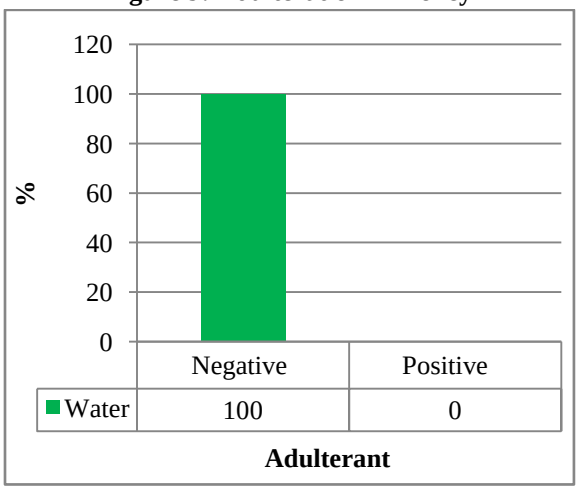


Figure 10: Water Adulteration

Negative

3.6 Adulteration in Jaggery

All the jaggery samples tested were negative for sodium bicarbonate as adulterant (Table VIII & Figures 11 and 12).

Table VIII: Adulteration in Jaggery

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Jaggery	Sodium bicarbonate	100	0

Figure 11: Adulteration in Jaggery

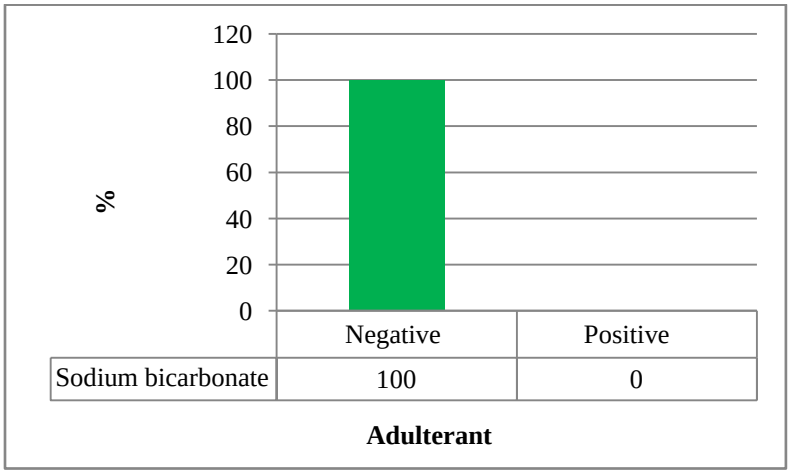


Figure 12: Sodium Bicarbonate Adulteration

Negative

3.7 Adulteration in Salt

Among the common salt samples tested, 45% of the samples were positive for the presence of impurities (Table IX & Figures 13 and 14).

Table IX: Adulteration in Salt

Sample	Adulterant	No of negative samples (%)	No of positive samples (%)
Salt	Impurities	55	45

Figure 13: Adulteration in Salt

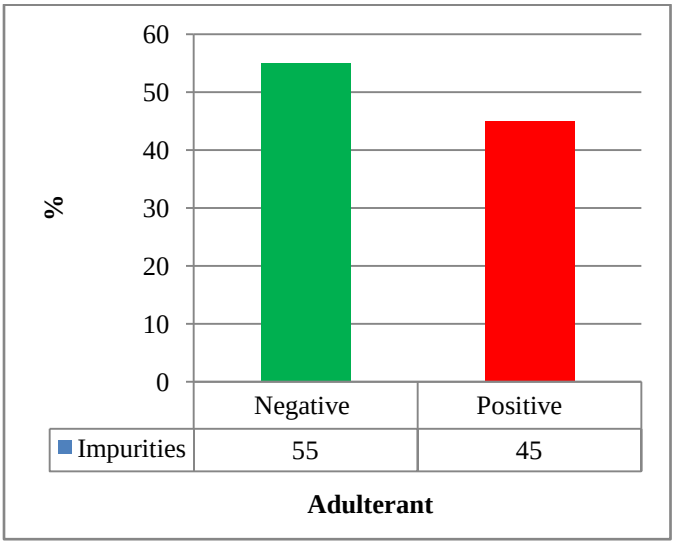
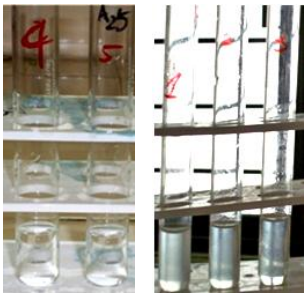


Figure 14: Impurities Adulteration

Negative Positive



4. Conclusion

The greed of fraudsters to gain higher profits within short time span makes them to indulge in malpractice such as food adulteration. Major proportions of adulteration are intentional adulteration. Many people lack knowledge about adulteration and its harmful effects on human health (people of all age groups). Although several measures are being taken to prevent adulteration, fraudsters are devolving more sophisticated techniques when it comes to detecting adulteration. In the present era adulteration in food industry contributes to enormous economic gains. More costly the food item is, sophisticated methods are being developed to mimic the original product with cheap alternatives. The only way a consumer can avoids talking adulterated food is (i) eating food that are prepared under unhygienic conditions (ii) avoid buying low quality local grocery food item that are sold for cheaper price (iii) buying good quality grocery food item with a proper bar code billing (can be bit costlier but can provide good health (iv) to approach consumer forums if adulterants are found in food items.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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