

STUDIES ON FOOD ADULTERATION IN PULSES AND CEREALS

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CERTIFICATE

This is to certify that the project report entitled “ **STUDIES ON FOOD ADULTERATION IN PULSES AND CEREALS**” submitted to head department of chemistry Kakatiya Government College, Hanamkonda it was carried out by the following students under my guidance M.Roshini, K.Sumanth ,G.AjayKumar, P.Vishwas, P.Maneesha ,T.Ramu, M.Srikanth, M.Suresh , G.Raju , G.Sumathi .

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Introduction:

Food adulteration is the addition or removal of any substances to or from food, so that the natural composition and quality is affected. Adulterated food is impure, unsafe and not wholesome. Food can be adulterated intentionally and accidentally. Unintentional adulteration is a result of ignorance or the lack of facilities to maintain food quality. This may be caused by spill over effect from pesticides and fertilisers. Inappropriate food handling and packaging methods can also result in adulteration.

Intentional food adulteration is usually done for financial gain. The most common form of intentional adulteration is colour adulteration. Some examples of intentional adulteration are addition of water to liquid milk, extraneous matter to ground spices, or the removal or substitution of milk solids from the natural product. Natural adulteration occurs due to the presence of certain chemicals, organic compounds or radicals naturally occurring in foods which are injurious to health and are not added to the foods intentionally or unintentionally. Some of the examples are toxic varieties of pulses, mushrooms, green and other vegetables, fish and seafoods. About 5,000 species of marine fish are known to be poisonous and many of these are among edible varieties



Cereals, pulses and condiments adulteration

Adulteration of cereals and pulses are very common and the visual test is the only solution for this problem. Be careful when you buy cereals and pulses – make sure there is no worms, visible dusts, flies, wood pieces etc.

Food grains: Marbles, stones, sand particles, clay particles, soil, husk, soap pieces, straw pieces, damaged grain, insects and insect eggs, rodent excreta.

Pulses: Kesari daal adulteration with yellow color, saw dust, husk, stones in all pulses.

Black mustard seed: Adding argemon seedss which is dangerous for health and it caused epidemic dropsy. Wheat and bajra: Ergot fungus which appears like grain that floats when put in water and datura seeds that are highly poisonous. Datura seeds are flat with blacking brown color in the edges.

Black pepper: Papaya seeds mix and light black pepper seeds that are quality rejected. Put few seeds of black pepper in alcohol. Papaya and light seeds will float and heavy black pepper seeds will settle down at bottom.

Wheat and bajra: Ergot fungus which appears like grain that floats when put in water and datura seeds that are highly poisonous. Datura seeds are flat with blacking brown color in the edges.

Black pepper: Papaya seeds mix and light black pepper seeds that are quality rejected. Put few seeds of black pepper in alcohol. Papaya and light seeds will float and heavy black pepper seeds will settle down at bottom.

White rice: Plastic rice adulteration: Recently in Kerala plastic rice is detected in white rice. According to recent reports the rice that are coming from China is made by mixing potatoes, sweet potatoes and plastic. The rice stays hard even after being cooked and the soup forms a plastic sheath on its layer. This sheath while after drying burns like plastic.

Peanuts: small stones and pebbles

Methods for Detection of common adulterants in food

Food grains and their products

S.No	Food Article	Adulterant	Method for Detection	Remarks
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1	Wheat, Rice, Maize, Jawar, Bajra, Chana, Barley etc.	Dust, pebble, Stone, Straw, weed seeds, damaged grain, weevilled grain, insects, hair and excreta of rodent	These may be examined visually to see foreign matter, damaged grains, discoloured grains, insect, rodent contamination etc.	Damaged/discoloured grains should be as low as possible since they may be affected by fungal toxins, argemone seeds, Dhatura seeds etc. In moderately excessive amount can result in risk to health, Discard the damaged undesirable grains before use
2	Maida	Resultant atta or cheap flour	When dough is prepared from resultant or left out atta, more water has to be used. The normal taste of chapattis prepared out of wheat is somewhat sweetish whereas those prepared out of adulterated wheat will taste insipid.	
3	Maida/ Rice	Boric Acid	Take a small amount of sample in a test tube, add some water and shake. Add a few drops of HCl. Dip a turmeric paper strip if it turns red, boric acid is present.	
4	Wheat, bajra and other grains	Ergot (a fungus containing poisonous substance)	(i) Purple black longer sized grains in Bajra show the presence of Ergots. (ii) Put some grains in a glass tumbler containing 20 per cent salt solution (20 gm common salt to 100 ml water) purple black longer size grain Ergot floats over the surface while sound grains settle down.	

5	Wheat, bajra and other grain	Dhatura	Dhatura seeds are flat with edges with blackish brown colour which can be separated out by close examination.
6	Wheat, bajra and other grain	Karnal Bunt	The affected wheat kernel have a dull appearance, blackish in colour and rotten fish smell,
7	Sella Rice (Parboiled Rice)	Metanil yellow(a non-permitted coal tar colour)	Rub a few grains in the palms of two hands. Yellow would get reduced or disappear. Add a few drops of dilute Hydrochloric acid to a few rice grains mixed with little water, presence of pink colour indicates presence of Metanil yellow
8		Turmeric (colouring for golden appearance)	Take a small amount of sample in a test tube, add some water and shake. Dip Boric acid paper (filter paper dipped in Boric acid solution) If it turns pink turmeric is present (ii) Take some rice and sprinkle on it a small amount of soaked lime for some time, grains will turn red if turmeric is present.

9	Parched rice	Urea	Take 30 numbers of parched rice in a test tube. Add 5ml of distilled water in it. Mix up the contents thoroughly, by shaking the test tube. After 5 minutes, filter the water -contents, and add ½ teaspoon of powder of arhar or soybean in it. Leave it for 5 minutes, and then dip a red litmus paper in the mixture. Take out the litmus paper after 30 seconds and examine it. A blue colouration indicates the presence of urea in the parched rice.	
10	Wheat flour	Excess bran	Sprinkle on water surface. Bran will float on the surface.	
11	Wheat flour	Chalk powder	Shake sample with dil.HCl Effervescence indicates chalk	Chalk powder is used as an adulterant due to its weight.
12	Dal whole and spilt	Khesari Dal	(i) Khesari dal has edged type appearance showing a slant on one side and square in appearance in contrast to other daIs. (ii) Add 50 ml of dilute Hydrochloric acid to the sample and keep on simmering water for about 15minutes.The pink color developed indicates the presence of Khesari dal.	The test is only for Khesari dal.(Metanil yellow if present will give a similar colour immediately even without simmering).
13		Clay, stone, gravels, webs, insects, rodent hair and excreta	Visual examination will detect these adulterants	Reject if the number of Insects is large or if the odour is unpleasant and taste bitter or gritty

14		Metanil yellow (a non permitted coal tar colour)	Take 5 gms of the sample with 5ml. Of water in a test tube and add a few drops of concentrated Hydrochloric acid. A pink colour shows presence of Metanil yellow	
15	Atta, Maida Suji (Rawa)	Sand, soil, insects, webs, lumps, rodent hair and excrete	These can be identified by visual examination.	
16		Iron filings	By moving a magnet through the sample, iron filings can be separated.	
17	Bajra	Ergot infested Bajra.	Soak bajra in water, swollen and black Ergot infested grains will turn light in weight and will float in water	
18	Sago	Sand or talcum	Put a little quantity of sago in mouth, it will have a gritty feel, if adulterated. Burn the sago, if pure, it will swell and leave hardly any ash. Adulterated sago will leave behind appreciable quantity of ash.	
19	Besan	Metanil Yellow	Take ½ teaspoon of the besan in a test tube. Pour 3 ml of alcohol in the test tube. Mix up the contents thoroughly by shaking the test tube. Add 10 drops of hydrochloric acid to it. A pink colouration indicates presence of metanil yellow in the gram powder.	

20		Khesari Flour	Add 50 ml of dilute Hydrochloric acid to 10 gms of sample and keep on simmering water for about 15 minutes. The pink colour, if developed, indicates, the presence of Khesari flour	The test is only for Khesari dal (Metanil yellow, if present will give a similar colour even without simmering).
21	Pulses	Lead Chromate	Shake 5 gm. Of pulse with 5 ml. Of water and add a few drops of HCl. Pink colour indicates Lead Chromate.	

Adulterants present in cereals, cereal products and pulses

The cereal tested for was parboiled rice, cereal products were parched rice, rice flour, wheat flour and maida. Analysis revealed that samples of parboiled rice and parched rice were free from the adulterants tested for viz boric acid, metanil yellow and urea. Rice flour collected from the different outlets were tested for commonly used adulterants in cereal flours namely chalk powder and boric acid and was found absent. Samples of maida were free from adulterants such as boric acid, metanil yellow and urea. In the sample of wheat flour from supplyco of coastal area, sand and bran were present. The samples of wheat flour from provision shop of both the coastal and urban area were also adulterated with its bran alone. All the other cereal and cereal products were free from adulterants. Pulses (dhal) were also free from adulterants such as added colour and kesari dhal. Hence it was seen that among the cereals, cereal products and pulses, only wheat flour was found to be adulterated in both coastal and urban area purchased from supplyco and provision



Mustard seeds



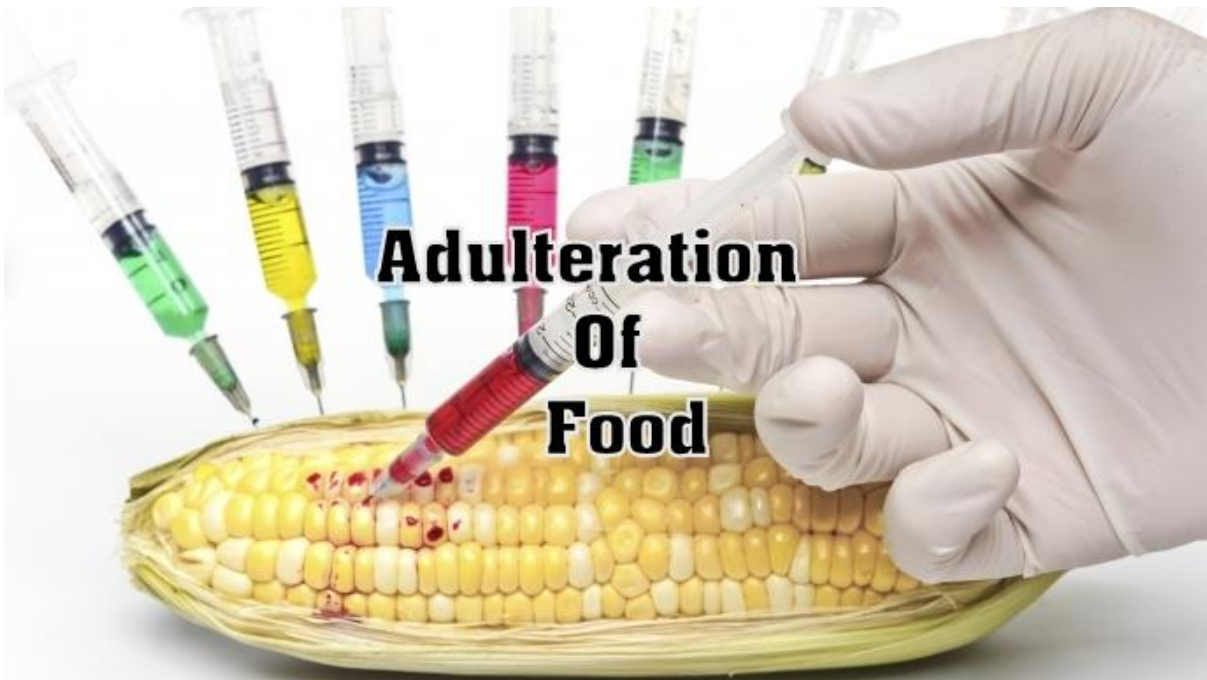
Argemone seeds



Common Adulterants

- Food grains and grams- marble pieces, sand particles, clay gilts, soap stone pieces.
- Pulses- kesari dhal – Colours
- Wheat flour Maida-powdered lime – talcum powder
- Turmeric powder (Haldi)- metanil yellow
- Pepper- dry papaya seeds
- Chilli powder- coloured saw dust
- Sweets- colours not permitted
- Honey- jaggery – sugar
- Tea- coloured tea leaves after removing the essence





INTRODUCTION:

Pulses are adulterated with Sand, marble chips, stones, filth , khesari dal or other pulses , Metanil yellow, Soluble coal tar dye. These adulterants are deleterious to Human Health. The Present study conducted to know the adulteration of pulses in our region.

METHODS & MATERIALS: The pulses brought to the laboratory voluntarily by the Traders, consumers, food inspectors for analyses of the food material for the food safety. The materials were tested for the following using the following test methods.

Sl. No.	Tested for	Procedure followed
1	Moisture	Ovan drying method
2	Foreign matter, fifth	Physical examination
3	Other edible grains	Physical examination
4	Damaged grains	Physical examination
5	Weevil led grains	Physical examination
6	Kesari dhal	Physical examination
7	Synthetic colours (Metanil yellow/ Tartrazine dye)	Paper Chromatography

RESULTS:

Total No. of Food samples tested in the year 2013-2014	Total No. of Pulses samples tested in the year 2013-2014	percentage
765	77	10.065%

Table 1: Percentage of Pulses samples tested

Common name	Other names	Scientific Name	No. of samples	Percentage
Red Gram Dal	ARHAR / Masur dal	Cajanus Cajal/ Leril esculanta moench/Leril Culinaris medik/ Ervem lens Linn.	30	38.96%
Black Gram Dal	URD	Phaseous mungo Linn	23	29.67%
Green Gram Dal	Moong Dal	Phaseolous aurues roxb/ Phaselous Radiatus Roxb	3	3.896%
Bengal Gram Dal	Chana Dal	Cicer aritnum Linn	21	27.27%

Table 2: Distribution of pulses tested

	No. of Samples	No. samples Adulteration detected	Percentage % of adulteration

1.Moisture	77	Nil	0%
2.Extraneous matter (Foreign matter)	77	4	5.194%
3.other Edible grains(Kasari dal)	77	Nil	0%
4.Damaged grains	77	1	1.29%
5.Weevilled grains	77	Nil	0%
6. Synthetic colour (Metallic yellow /Tartagenic dye)	77	6	7.792%
Table 3: Results of the Samples with percentage of Adulteration			

DISCUSSION: Pulses are annual leguminous crops that include lentils, beans, chick peas and yellow peas. Pulse crops are high in protein, antioxidants and fiber and low in fat and energy, all these factors contribute to the reduction of CVD and Type 2 Diabetes mellitus risk.¹ Pulses are the major dietary source for the Vitamin D in Vegetarians.²

Adulteration is deliberate contamination of food material with low quality, cheap and non-edible or toxic substances. The prohibited substances are either added or partly or wholly substituted. In India normally the contamination /adulteration in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. This ultimately results that the consumer is either cheated or often become the victim of diseases. Food adulteration can lead to slow poisoning and various kinds of diseases, which can even result in death. Adulteration makes the food items used in our daily life unsafe and unhygienic for use. The Adulterates added are:

Type	Substances Added
Intentional Adulterants	Sand, marble chips, stones, mud, other fifth, Talc, Chalk powder, Water, mineral oil and harmful colour.
Incidental adulterants	Pesticide residues, droppings of rodents, larva in food.
Metallic Contaminants	Arsenic from pesticides, Lead from water, effluent from chemical industries, tin from Cans,
Table 4	

In the present retrospective study it is noted among the 765 food samples 77 (10.065%) samples were the pulses (Table.1) The samples tested are Red gram dhal 38.96%, Black gram dal 29.87%, Bengal Gram dal 27.27%, Green gram dal 3.896%, (Table.2) Among them 14.28% of the samples are adulterated (Table.3) as per the food safety act 2006 (Table.4)

Table 4. Food safety & Standards for pulses as per act 2006, Rules 2011.³

	Red Gram ARHAR	Black Gram URD	Bengal Gram CHANNA	Greengram MOONG
1.Moisture	Not more than 14% by weight		Not more than 16% by weight	Not more than 14% by weight
2.Foreign matter- Extraneous matter	Not more than 1%. By weight by which not more than 0.25%. By wt. shall be mineral matter and not more than 0.10% .By wt. shall be impurities of animal origin.			
b) Kesaridhal seeds	Not to be added.			
3.Other Edible grains	Not more than 3%	Not more than 4%		
4.Damaged Grains	Not more than 5%			
6.Metalic yellow	Not to be added			
7. Tartaric dye.	Not to be added			
Table 5				

Filth and Foreign Matter: Filth and extraneous material including any objectionable substances in foods these include:

i. Inorganic mater consisting of metallic pieces, sand, gravel, dirt, pebbles, stones, lumps of earth, clay and mud, animal filth.

ii. Organic matter consists of husk, straws, weed seeds and other inedible grains.

B) Poisonous, toxic, and /or harmful seeds- mean any seed which is present in quantities above permissible limit may have damaging or dangerous effect on health. Ex. Kesaridhal seeds in pulses.

1. Other edible grains means any edible grains (Including oil seeds) other than the one which is under consideration.
2. Damaged grains means kernels or pieces of kernels that are sprouted or internally damaged as a result of heat, microbe, moisture or whether, viz., ergot affected grain and kernel burnt grains.

3. Weevil led grains means kernels that are partially or wholly bored by insects injurious to grains but does not include germ eaten grains and egg spotted grains.

4. kesari dal (*Lathyrus sativus*).

L. sativus pulse is considered as an inexpensive legume, which does not require much irrigational inputs.

Lathyrus sativus forms a staple food for the low-income group population in several parts of Central India. Its continued consumption in appreciable quantities for a period of 2-3 months causes progressive spastic paralysis of lower limbs, which is commonly referred to as lathyrism.⁴

The disease can be Categorized in 4 Stages of Spastic Paralysis:

1. i. Nonstick stage: in mild cases, victims walk with short steps and jerky movements
2. ii. One stick stage: in advanced cases, victims walk with bent knees, raising of heels and with the support of one stick;
3. Two stick stage: the victims show scissoring and crossed gait and are able to walk with the help of two sticks
4. Crawler stage: in the advanced stage of disease, the victims are forced to crawl on palms and knees as they cannot walk even with the support of two sticks.

The disease has been responsible for crippling several thousand people. (The etiological agent for neurolathyrism was found to be an unusual amino acid, beta oxaly amino alanine (BOAA).

In India, majority of the states have imposed restrictions on its cultivation/ sale excluding West Bengal, Bihar and Madhya Pradesh.

However, it was observed that some of the predisposing factors like ascorbic acid deficiency and low levels of manganese exposure could be instrumental in producing lathyrism.

Efforts to propagate genetically engineered low toxin varieties of *L. sativus* by Indian Council of Agriculture Research (ICAR) are in progress. Once the toxin is removed, lathyrus has all the potential to offer not only affordable pulse for the vast section of the society but also an extraordinarily environmentally tolerant, pest resistant, low irrigational need, hardy crop which is otherwise quite rich in high protein, economical and acceptable taste. But at present it is evident that the consumption of *L. Sativus* would result in paralysis.⁵

Synthetic Colours: Pulses are adulterated with Toxic chemical such as metanil yellow and Tartazine dye for adding the color to old stocks of pulses to improve their color appearance.

The test results are compared with the standards .The test results showed that 14.285% (11 out of 77 samples) showing adulteration. In our study it shows that the adding of synthetic colour 7.792% is common followed by adding of extraneous matter (5.194%) and damaged grains (1.29%)

The Harmful effects of these adulterated substances on the human are:

Sl. No	Adulterant	Purpose of adding the Adulterants	Diseases or Health Effects
1	Sand, marble chips, stones, filth	For financial gains	Affect the digestive tract
2	Khesari dal stones	For financial gains	Crippling spastic paraplegia paralysis of the limbs
3	Metanil yellow	Added to old stocks of pulses to enhance color	Carcinogenic and causes stomach disorders. It also causes testicular degeneration in the male if consumed for long
4	Soluble coal tar dye	Used to enhance quality and make the pulses look clean	Is highly injurious to health

Table 6

The present study shows that there is no adulteration of moisture and kersaridhal. But Extraneous matter (Foreign matter) 5.194% and damaged grains 1.29% and synthetic colours of 7.792% are adulterated.

As familiar saying “Corruption is universal and not confined to India”, the adulteration is also universal not confined to one region in India. It is present all the regions of India with difference in measure. Hence knowledge of the adulteration is needed for the consumers particularly on food items.⁶

CONCLUSION: As the adulteration is universal and not pertaining to one region and the food frauds literally constitute a high tech industry because of enormous economic gains inherent in adulteration.

Interestingly costlier the food product, more incentive is available for evolving appropriate methods to mimic the original product with cheap alternatives. So it is time to pledge “stop buying adulterated pulses.” Buy pulses and other food items only from approved sources. Ensure that the storage space is clean. If health is wealth and if you believe that a healthy mind rests in a healthy body, start consuming unadulterated pulses.



Group of students participated in project work with the project guide

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