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A Study on Heavy Metal Content in Urad Dal Flour in India

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ABSTRACT

Black gram (Vigna Mungo) is commonly known as black lentils, mungo beans, and matpe beans. It is one of the most vital varieties of pulse in the Indian subcontinent, and has a lot of nutrients in Urad Dal powder. It is one of the famous lentils used in southern part of Asia.

Out of 21 samples of Urad Dal flour analysed, Lead (Pb) content ranges from 0.0708 ppm to 1.8633 ppm. The Lead (Pb) content was "Not detected" in 05 samples of The Urad Dal flour. As per FSSAI, the maximum permissible limit in "food not specified category" is 2 ppm (max.). It was found that 17 samples contain Lead (Pb) within the permissible limit as specified by FSSAI.

Out of 21 samples of Urad Dal flour samples analysed, all samples were found to contain low level of Copper (Cu) content ranges from 0.7171 ppm to 6.8433 ppm.

Keywords: Urad Dal flour; heavy metal; Atomic absorption spectrometry; Lead (Pb), Copper (Cu).

1. INTRODUCTION:

Urad is grown all over India, mainly in the monsoon season, the main areas of production being Madhya Pradesh, Uttar Pradesh, Punjab, Maharashtra, West Bengal, Andhra Pradesh and Karnataka. India is the largest producer and consumer of Black Gram in the world. Other producing countries are Myanmar, Thailand, Singapore, Japan, Bangladesh, Canada, Iran, Greece, East African countries. Urad dal is very nutritious. There are many health benefits of split black gram including its ability to aid in digestion, boost energy, improve the skin health and many others. Urad dal is improve our digestion because its having rich Fibre(soluble & Insoluble). Urad dal play an Important role in improving your bone mineral density because urad dal; contains minerals such as magnesium, iron, potassium, phosphorus and calcium. Urad Dal is more effective in Healing piles, colic disorder and good liver stimulant. It is very good for patients with diabetes as it regulates the glucose levels in the blood. It is good for your skin and can help fight dark spots, acne, and marks. It helps with joint pain, is extremely good for the heart, and is also a diuretic that helps keep your body clean. Adding black gram to your diet can boost your overall health by a significant margine. The main sources of heavy metals in plants are their growth media, nutrients, agro inputs, soil and others factor such as pesticides and fertilizers . Heavy metals along with other pollutants are discharged to the environment through industrial activity, automobile exhaust, heavy duty electric power generators and pesticides used in agriculture etc and enter into the food chain. Heavy metals have great significance due to their tendency to accumulate in the vital human organs over prolonged period of time. Heavy metals especially Lead (Pb) is a physiological and neurological toxin that can affect several organs in the human body. Lead can also damage kidneys and reproductive systems . Heavy metal such as Copper is essential for human body as it is an integral part of numerous and plays a role in iron metabolism. However, chronic (long term) effects of copper exposure can damage the liver and kidneys. Acute symptoms of copper poisoning by ingestion leads to various gastrointestinal distress. Presence of these pollutants (Pb and Cu) in Urad Dal flour above the permissible limit may lead to severe health hazards to the people consuming it So, estimation of their levels in contaminated food is very important for the safety of human health [1,2,3].

There are no reports available in the literature about any study on the level of Heavy metals in the Urad Dal flour available in India. Therefore, it is important to study the heavy metal contamination in the Urad Dal flour. In the present study, the concentration of these two heavy metals including Lead (Pb) and Copper (Cu) was determined in Urad Dal flour collected from various regions of India.

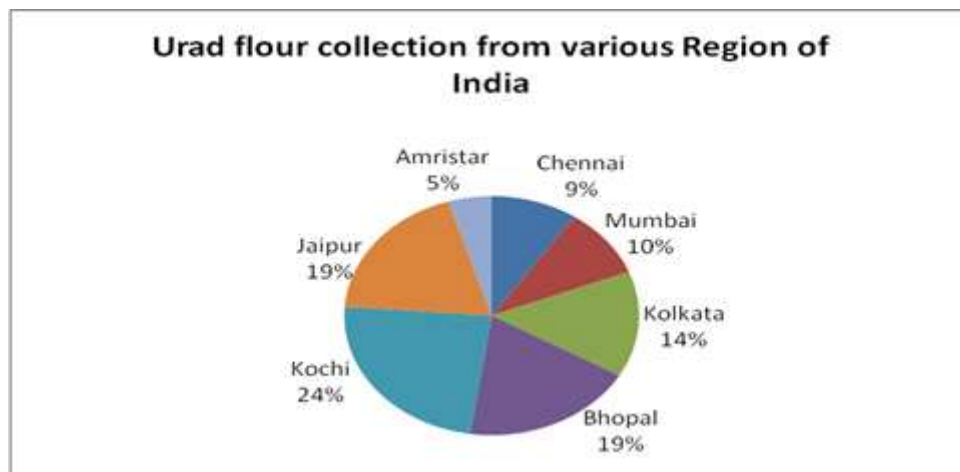
2. MATERIALS AND METHODS:

2.1 Sample Collection

A total of 21 samples of Urad Dal flour were collected from various regions of India.

2.2 APPARATUS AND REAGENTS

Atomic Absorption Spectrophotometer AAS 7000SP with air-acetylene base for flame; Microwave Digestion System (Model 3000, Anton Paar), Contaminated free digestion vessels are used for digestion, Mixer – For grinding the sample, Volumetric Flask (100 ml), Pipettes, Funnels (Glass or plastic), Filter paper Watman No.4 or equivalent and Glass rods Concentrated HCl (AR Grade), Concentrated HNO₃ (AR Grade), Distilled water, Lead standard (99.99%) and Copper Standard (99.99%).



2.3 SAMPLE PREPARATION AND DIGESTION:

0.1g of Urad flour sample was weighed and kept for digestion in digestion Teflon vessel. 6 ml concentrated HNO₃ and 1 ml concentrated HCl was added in the sample in fume hood. Teflon vessels were closed in position in Microwave Digestion System (Model 3000, Anton Paar. Instrument operation protocol was followed for digestion of sample. The digested solution was filtered into 100 ml volumetric flask and made upto volume. A reagent blank, sample blank, spike samples were prepared in the same manner with the same quantity of acid as for samples.

2.4 PREPARATION OF STANDARDS:

2.4.1 Stock standard solution (1000 ppm)

0.10 g Pb (99.99%) / Cu (99.99%) powder was dissolved into 2 ml HNO₃: H₂O(1:1) solution. Then it was made up to 100 ml volumetric flask with distilled water.

2.4.2 Intermediate standard (100 ppm)

10 ml of 1000 ppm solution was pipetted out into 100 ml volumetric flask and made up to mark with distilled water.

2.4.3 Working Standards

The range of working/calibration standards were prepared such as blank (0), 0.5ppm, 1 ppm, 2 ppm, 4 ppm and 6 ppm in 100 ml volumetric flask.

2.5 ANALYSIS OF LEAD (PB) AND COPPER (CU) BY AAS:

Analysis of Lead and Copper in White pepper samples was carried out using Flame and air-acetylene AAS 7000.

3. RESULTS AND DISCUSSION:

A total of 21 samples of Urad Dal flour were analysed for the presence of Lead (Pb) and Copper (Cu) on AAS 7000 at Central Agmark Laboratory, Nagpur. The samples were received from various regions of India. Table 1 showed the Analytical conditions for analyzing heavy metal in Urad Dal flour samples for AAS. The results of Lead and copper are summarized in Table-2.

Table 1. Analytical Conditions of AAS 7000 SP for analyzing heavy metals in Urad Dal flour

Parameter	Lead	Copper
Wavelength (nm)	217	324.7

Slit width (nm)	0.4	0.2
Lamp current (mA)	4.0	2.0
Types of Flame	Air-Acetylene	Air-Acetylene
Fuel Gas pressure (M Pa)	0.0	0.10
Burner Height (mm)	8.0	8.0
Fuel Gas Flow rate (L/mm)	1.70	1.70
Combustion-supporting gas	Air	Air
Sampling speed	10	50
Integral time (s)	1.0	2.0
Smooth curve factor	1	10
Units	Ppm	Ppm

3.1 Lead (Pb) content in Urad Dal flour

It has been found that out of 21 Urad Dal flour samples, 17 samples were positive for Lead (Pb). The Lead (Pb) content has not been detected i.e '0.00' ppm in 05 samples of Urad Dal flour. Table 2 indicates the level of Lead Content in ppm in Urad Dal flour. The range of Lead (Pb) content Urad Dal flour is from 0.0708 ppm(Minimum) to 1.8633ppm(Maximum). The lead contamination were found as 9.5% (0.0708 to 0.7085ppm) in Mumbai , 14.3 % (1.6118 to 1.8633 ppm) at Bhopal, 19.0 % not deducted from Kochi, 4.8% (0.7405 ppm) from Guntur, 9.5% (0.7269 to 1.1674 ppm) from Chennai and 23.8% (0.9434 to 1.8465ppm) from Jaipur, 4.8% Not deducted and 14.3%(0.2233 to 1.2306 ppm) from Amristar.

Table 2. Level of Lead (Pb) and Copper (Cu) in ppm in Urad Dal flour samples obtained from various regions of India

S.No	Location	Lead (Pb) content (ppm)	Copper (Cu) content (ppm)
1	Mumbai	0.0708	5.5884
2	Mumbai	0.7085	4.9704
3	Bhopal	1.1649	2.1039
4	Bhopal	1.8633	1.4781
5	Bhopal	1.6118	6.1449
6	Kochi	ND	1.4823
7	Kochi	ND	1.7798
8	Kochi	ND	6.8433
9	Kochi	ND	6.0509
10	Chennai	0.7269	2.3364
11	Chennai	1.1674	2.5296
12	Jaipur	1.351	4.745
13	Jaipur	1.406	0.7171
14	Jaipur	0.9434	1.1212
15	Jaipur	1.309	3.1674
16	Jaipur	1.8465	5.2344
17	Amristar	ND	5.9599
18	Amristar	1.2306	5.6019
19	Amristar	0.3594	4.0468

20	Amristar	0.2233	4.1586
21	Guntur	0.7405	3.4762

3.2 Copper (Cu) content in Urad Dal flour

It has been found that out of 21 Urad Dal flour samples analysed, All samples were found to be positive for copper (Cu). Table 3 indicates the copper concentration in ppm in Urad Dal flour samples received from various regions of India. The Copper (Cu) content ranges from 0.7171ppm to 6.8433 ppm in Urad Dal flour samples. The copper contamination were found as 9.5% (5.5884 to 4.9704ppm) in Mumbai , 14.3 % (1.4781 to 6.1449 ppm) at Bhopal, 19.1 % (1.4823 to 6.8433ppm) from Kochi, 4.8% (3.4762 ppm) from Guntur, 9.5% (2.3364 to 2.5296 ppm) from Chennai and 23.8% (0.7171 to 5.2344ppm) from Jaipur, 19.0 % (4.0468 to 5.9599ppm) from Amristar.

4. CONCLUSION:

The permissible level for Lead (Pb) as per FSSAI (Food Safety and Standards Authority of India) under category “foods not specified” in India is 2 ppm (max). In Urad Dal flour, the maximum Lead content (Pb) was 1.8633 ppm which was found to be the permissible limit.

The permissible level of Copper (Cu) as per FSSAI under category “foods not specified” is 30 ppm (maximum) in India. In Urad Dal flour, the maximum Copper content (Cu) was 6.8433ppm which was found to be within the permissible limit. The Lead and copper content of Urad Dal flour in the present study was within the permissible limits as defined by the Indian legislation. Hence, it does not pose a serious health risk on consumption.

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