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Studies of the Arsenic Toxicity Level in Rice Crop and Paddy Straw in Chhattishgarh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

Agriculture crop especially Rice as well as Straw (Paddy straw) containing high amount of As due to Crop irrigated with high Arsenic content water or grown in soil having 0.01 ppm of arsenic even when if grains cooked in water having high Arsenic content increase the arsenic toxicity in animal as well as human being when consumed it. We wanted to justify how arsenic in plants hampers food chain circle. Arsenic accumulation in rice straw could be a direct threat for their health via presumably contaminated bovine meat and milk. Present paper deals the toxicity level of Arsenic in Rice and Paddy straw of Rajnandgaon district of Chhattisgarh found that As level in both Rice grain and Paddy straw are lower 1 mg kg-1 (WHO), which the permissible limit of arsenic toxicity in rice plant and paddy straw.

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1. INTRODUCTION

"Rice is a particularly efficient scavenger of arsenic, it takes up ten times as much as other cereal grain because rice is only grain grown under water filled field if water having high content of arsenic automatically. In July 2014,WHO set worldwide, guidelines for what it considers to be safe levels of arsenic in rice, suggesting a maximum of 200 micrograms per Kilogram for white Rice and 400 microgram per Kg for brown rice. Agriculture crop especially Rice containing high amount of As due toCrop irrigated with high Arsenic content water or grown in soil having 0.01 ppm of arsenic" [1-3].

In Paddy soil arsenic present more than permissible limit, through the rice As intake is more in humans because rice is mainly cultivated in anaerobic paddy soil, where arsenite As(III) Arsenic trivalent is more available which toxic then arsenic pentavalent. The four main As species are found in rice grains are As(III), arsenate [As(V)], monomethylarsonic acid (MMA), and dimethylarsinic acid (DMA) [4-7].

1.1 Arsenic in Plants

More than 3.4 billion populations include rice in their diet to achieve their calories Arsenic accumulation in rice grain and paddy straw could be a direct threat for animal as well as human health via presumably contaminated bovine meat and milk. After accumulation of this arsenic compound, mobilize to different parts of the plants. Intake of As is correlated with many factors as soil texture, PH, Organic matter quality which is depend on availability of minerals [8-11].

2. MATERIALS AND METHODS

2.1 Studied Area

Adjoining area of Rajnandgaon district Chhattisgarh especially Ambagarh Chowki block recognized as highly contaminated area of Arsenic (AS), is one of the dangerous bio-accumulative, poisons affecting a large number of animals as well as human beings. As with many more metals like Cu, Zn, Ni and Mn a present in ground water and villagers used it for drinking, cooking and other household purposes. "10 villages of Ambagarh chowki block of Rajnandgaon district (Kaudikasa, ParmalkasaBiharikala, Atargaon, Dhadutola, Jadutola, Mangatola, Sangali, Sonsaytola and Telitola, Sangli) have been chosen for the present study".

2.2 Sample Collection

In the study area, different crops and vegetables are cultivated in different seasons, collected after harvesting from the fields irrigated with the arsenic contaminated water and transferred to airtight polyethylene bags. Rice, Grain and Straw were collected from different fields after harvesting. Minimum 6 samples from each villages had been collected for this study.

2.3 Sample Digestion

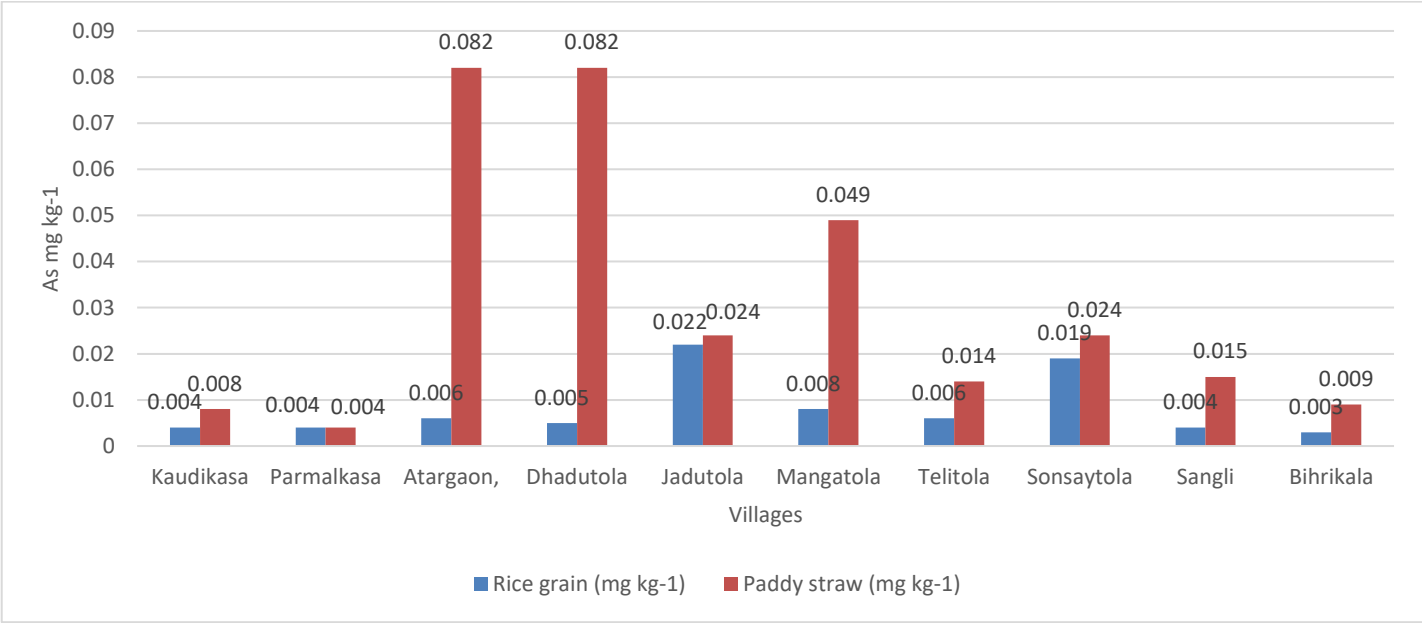
Grain portions of the rice, Straw were digested separately (heating block digestion procedure). Take one digestion tube having (0.5 g) sample mixed with 5ml of concentrated HNO3. "The mixture was allowed to stand overnight under fume hood. In the following day, the digestion tubes were placed on a heating block reached the temperature 60 ^{0}C for 2 h. allowed to cool at room temperature then mix concentrated HClO4 (2ml) to the plant samples. Spectrophotometer.. The optimum HCl concentration was 10% v/v and 0.4% NaBH4 produced the maximum sensitivity. Mean values were obtained on the basis of calculation of taking these six replicates.

3. RESULTS AND DISCUSSION

Paddy straw grown in Atargaon and Dhadutola both villages having higher level of Arsenic (0.082mg kg^{-1}) where is parmalkasa village showing lowest concentration of Arsenic in Paddy Straw (0.004 mg kg^{-1}). Jadutola and Sonsaytola villages both having same As level 0.024 mg per kg arsenic content in rice straw. Bihrikala village of Rajnandgaon district of Chhattisgarh had found As content in Rice grain was 0.003 mg kg^{-1} which is very low as compared to Jadutola block having 0.022 mg kg^{-1} As of content. In general, both the straw and grain of rice plant contained the arsenic ranged from 0.003 to 0.082 mg kg-1 which is lower than the permissible limit of arsenic.

Table 1. Showing As content in Rice grain and Paddy straw in different villages of Rajnandgaon district of Chhattisgarh

S.No.	Village	Rice grain (mg kg-^{1})	Paddy straw (mg kg-^{1})
1	Kaudikasa	0.004	0.008
2	Parmalkasa	0.004	0.004
3	Atargaon,	0.006	0.082
4	Dhadutola	0.005	0.082
5	Jadutola	0.022	0.024
6	Mangatola	0.008	0.049
7	Telitola	0.006	0.014
8	Sonsaytola	0.019	0.024
9	Sangli	0.004	0.015
10	Bihrikala	0.003	0.009



Graph 1. Showing As Level in Rice Straw and Rice Grain in Different Villages of Rajnandgaon District Chhattisgarh

4. CONCLUSION

Even when if grains cooked in water having high Arsenic content increase the arsenic toxicity in animal as well as human being when consumed it. Present paper deals the toxicity level of Arsenic in Rice and Paddy straw of Rajnandgaon district of Chhattisgarh and found that As level in both Rice grain and Paddy straw are lower 1 mg kg-1 (WHO) which the permissible limit of arsenic toxicity in rice plant and paddy straw.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist..

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