

Determination of Heavy and Essential Metals in Different Wheat Varieties Grown in Three Districts of Sindh (Pakistan)

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ABSTRACT

Wheat varieties collected from three districts of Sindh Mirpurkhas, Nawabshah and Khairpur were analyzed to assess the accumulation of toxic (Pb, Ni & Cr) and essential (Zn & Cu) metals. Mean zinc concentration ($\mu\text{g}\cdot\text{g}^{-1}$) in the varieties, Sarsabz, Inqilab, Anmol, V- 7001, Rabel (in-line), Yakora, Mehran, Sindh- 83, V- 7005, Moomal, TD- 1, TJ- 83, Wattan and V- 5000 was 18.72, 21.29, 21.75, 30.28, 37.53, 21.17, 18.81, 20.89, 24.44, 27.70, 21.93, 24.98, 22.11 and 17.25 ($\mu\text{g}\cdot\text{g}^{-1}$), respectively. Mean copper concentration ($\mu\text{g}\cdot\text{g}^{-1}$) in these varieties was 1.64, 2.29, 2.85, 2.06, 3.87, 3.38, 3.80, 4.32, 2.86, 2.57, 1.74, 2.67, 2.17 and 2.0 ($\mu\text{g}\cdot\text{g}^{-1}$), respectively. Where as Pb, Ni and Cr were not detected in these samples. In all the varieties of Mirpurkhas, Nawabshah and Khairpur mean Zn and Cu content found were 20.95 and 2.19, 24.98 and 3.38, 21.64 and 2.20 ($\mu\text{g}\cdot\text{g}^{-1}$), respectively. It was concluded from results that wheat varieties grown in three district of Sindh were free from toxic metals contamination and safe for human consumption.

Key Words: Determination; Wheat varieties; Sindh

INTRODUCTION

Agriculture is a complex phenomenon and exerts both favorable and un-favorable consequences on environment (Ambreen, 1930). In Pakistan, agriculture is the main stay of national economy. Its share in GDP is 24%; its contribution in export earning is 35%. This sector provides employment to 51% of total labor and 70% rural population is dependant on this sector.

Among the major crops, wheat is one of the most important crops grown and consumed in Pakistan. It plays vital role in fulfilling the human requirement. It supplies carbohydrates, proteins and certain inorganic micronutrients that are vital for normal growth of human.

The elements such as Zinc and Copper are essential. Wheat plant absorbs these metals from soil and ultimately is accumulated in the grains. It is safe when accumulation is under the permissible limits (Das A.K., 1990). But when accumulation exceed the permissible limit it exert toxic hazards and may produce variety of diseases in human, plants and animals and may have adverse effect on export (Irshad *et al.*, 1997). Wheat grains also may be contaminated by heavy metals such as Cadmium, Lead, Nickel and Chromium. These metals also cause serious diseases in human even at low concentration (Avena, 1979).

Present studies were carried out to assess the levels of these essential and toxic heavy metals present in wheat grains collected from some districts of Sindh. The concentration levels of selected heavy and trace metals (Pb, Ni, Cr, Zn & Cu) were determined with on atomic absorption spectroscopy as described by Qadir *et al.* (1997).

MATERIALS AND METHODS

Ten samples of each wheat variety were collected from three districts of Sindh, Mirpurkhas, Nawabshah and Khairpur. One gram of whole wheat and 20 mL of nitric acid (65%) were taken into the digestion tube and left over night. On the next day samples were digested first at 80°C for an h. On cooling, 2 mL of perchloric acid (70%) was added and digested again at 250°C until white fumes ceased to exist and sample reached to 2 mL. At cooling, 20 mL of double deionized (DDI) water was added and filtered through Wattman No. 540. Before analysis on Flame- AAS, samples were diluted up the mark of 100 mL volumetric flask. Triplicate samples of each variety and a blank were prepared. These samples were prepared according to the recognized methods of AOAC (1990) and Ahmed *et al.* (1994). All the required glassware were washed with standard detergent following with tap water, then soaked in acid bath (30% nitric acid) placed in fuming hood, there after glassware were rinsed firstly with tap water and then with de-ionized water (Robert *et al.*, 1990). Instrument conditions for metals are given Table I.

RESULTS AND DISCUSSION

Data (Table II) revealed that zinc content in the varieties collected from Mirpurkhas, Nawabshah and Khairpur ranged from 18.72 to 22.38 $\mu\text{g}/\text{g}$ with the mean of 20.95 $\mu\text{g}/\text{g}$, 18.81 to 37.53 with the mean of 24.98 $\mu\text{g}/\text{g}$ and 17.25 to 24.48 with mean of 21.64 $\mu\text{g}/\text{g}$, respectively. Copper content in the varieties of these districts ranged

Table I. Instrument conditions for metals

	Metal				
	Zn	Cu	Pb	Ni	Cr
Lamp Current	5mA	4.0mA	10.0mA	4.0mA	7.0mA
Wave Length	213.9nm	324.8nm	217.0nm	232.0nm	357.9nm
Slid width	1.0nm	0.5nm	1.0nm	0.2nm	0.2nm
Flame Type	Air/Acetylene	Air/Acetylene	Air/Acetylene	Air/Acetylene	Air / Acetylene
Air Flow	12.24 L-min ⁻¹	11.89 L-min ⁻¹	12.79 L-min ⁻¹	12.39 L-min ⁻¹	13.08 L-min ⁻¹
Acetylene Flow	2.25 L-min ⁻¹	2.21 L-min ⁻¹	2.39 L-min ⁻¹	2.39 L-min ⁻¹	2.64 L-min ⁻¹
Burner Height	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm
Measurement Time	5.0s	5.0s	5.0s	5.0s	5.0s
Pre-read Delay	25s	25s	25s	25s	25s
Neb.up-take rate	5 ml-min ⁻¹	5 ml-min ⁻¹	5 ml-min ⁻¹	5 ml-min ⁻¹	5 ml-min ⁻¹
Conc. Unit	mg-L ⁻¹	mg-L ⁻¹	mg-L ⁻¹	mg-L ⁻¹	mg-L ⁻¹
Instrument Mode	Absorbance	Absorbance	Absorbance	Absorbance	Absorbance
Calibration Algorithm	Linear	Linear	Linear	Linear	Linear

Table II. Metals concentration in different wheat varieties

Districts	Varieties	Metals (µg/g)				
		Zn	Cu	Pb	Ni	Cr
		Std level				
		40	5	1.5	—	—
Mirpurkhas	Sarsabz	18.72	1.64	****	****	****
	Inquilab 91	22.38	2.10	****	****	****
	Anmol	21.75	2.85	****	****	****
	Mean	20.95	2.19	****	****	****
	V.7001	30.28	2.06	****	****	****
Nawabshah	Rabel (in line)	37.53	3.87	****	****	****
	Inqalab-91	19.09	4.25	****	****	****
	Yakora	21.17	3.38	****	****	****
	Mehran	18.81	3.80	****	****	****
	Sindh-83	20.89	4.32	****	****	****
Khairpur	V-7005	24.44	2.86	****	****	****
	Moomal	27.70	2.57	****	****	****
	Mean	24.98	3.38	****	****	****
	Inqalab-91	22.42	2.41	****	****	****
	TD-1	21.93	1.74	****	****	****
Khairpur	TJ-83	24.48	2.67	****	****	****
	Wattan	22.11	2.17	****	****	****
	V-5000	17.25	2.00	****	****	****
	Mean	21.64	2.20	****	****	****

**** (Not Detected)

between 1.64 to 2.85 µg/g with the mean of 2.19, 2.06 to 4.25 with mean of 3.38 µg/g and 1.74 to 2.67 µg/g with the mean of 2.20 µg/g, respectively. Where as Pb, Ni and Cr were not detected at the ppm level in all the varieties of these districts. The result presented in Table II showed that Zinc and Copper content found were under the permissible standard limits given by National Health and Medical Research Council (1987) and Robert, H.R. (1981).

CONCLUSION

It was concluded from results that wheat varieties grown in three district of Sindh were free from toxic metals contamination and safe for human consumption.

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