IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Assessment On The Levels Of Selected Essential And Non-Essential Metals In Sesame Seed (*Sesamum Indicum* L.) Through Atomic Absorption Spectrophotometer

Roshni Sahu[1] and S.S Sandhu[2]

Department of P. G. Studies and Research in Biological Science
Rani Durgavati University, Jabalpur (M.P.)

Abstract

The purpose of this study was to determine the levels of essential and non-essential metals in sesame seeds (*Sesamum indicum* L.). Twenty five accessions of sesame seeds were analysed through Atomic Absorption spectrophotometer for the levels of Fe, Zn, Cu, and Pb. Five gm of dried and homogenized samples were digested using 30 mL of HNO3 (70%) and 25 mL of HCl (37%) at 120^{o}C for 5 hours. The efficiency of the procedure was validated by spiking and the percent recovery for all studied metals varied from 80-133%. The mean levels of the metals (mg L^{-1}) were found in the ranges 24.0 to 108, 10.75 to 79.7, 6.0 to 19.3, 0.01 to 0.08 for Fe, Zn, Cu and Pb, respectively. Analysis of variance at 95% confidence level indicated significant variations only for Cu and Zn. Thus, the sesame seeds analysed are safe for human consumption.

KEY WORDS: *Sesamum indicum* L., Essential metals, Non-Essential metals

Introduction

Sesame seeds (*Sesamum indicum* L.) are one of the edible seeds. Sesame seeds are probably the most ancient oilseed cultivated in several countries such as India, Sudan, China, Ethiopia and Burma which are considered as the major producers (60% of its total world production) [1&2]. Micro-elements play important roles in chemical, biological, biochemical, metabolic, catabolic and enzymatic reactions in the living cells of plants, animals and human beings [3]. Among these, zinc is found in several enzymes and involved in genetic material transcription [4]. Copper is also a key component of oxidation-reduction enzymes [5]. Iron is vital in oxygen transport and also enables metabolism [4]. These micro-elements are required in very small amounts. Otherwise, their deficiency causes diseases and their presence in excess results in toxicity to human life by disturbing the normal functioning of organs and central nervous system [6].

Material and methods

Reagents and chemicals: During the study 70% HNO3 and 37% HCl were used for the digestion of sesame seed samples. Stock standard solutions containing 1000 mg/L, in 2% HNO3, of the metals Fe, Zn, Cu, and Pb were used for the preparation of calibration standards and spiking experiments. De-ionized water was used throughout the experiments for sample preparation, dilution and rinsing apparatus prior and during analysis. The reagents used during the analysis were all of analytical grade.

Instruments The sesame seed samples were washed with deionized water and then dried in an oven. Mortar and pestle were also used to grind and powder the dried sesame seed samples. A digital analytical balance was used to weigh the sesame seed samples. The dried and powdered sesame seed samples were digested in hot plate using 100 mL beaker in the laboratory.

After cooling, 15 mL of de-ionized water was added and then the residue was filtered through Whatsman No. 42 (75 µm size) filter paper and diluted to 50 mL with de-ionized water. The essential and non-essential metals (Fe, Zn, Cu, and Pb) were determined using a Varian AA240 FS Fast Sequential Atomic Absorption Spectrophotometer (FAAS) (Varian, Australia), fully automated and PC-controlled using Apectra AA Base and PRO software versions equipped with fast sequential operation for multi-element flame determinations with four lamp positions and automatic lamp selection. A deuterium background corrector was used for background corrections. For flame measurements, a 10 cm long slot-burner head, a lamp and an air-acetylene flame were used. The operating parameters of FAAS for the elements determined in this study are presented in Table 1.

Element	Wavelength (nm)	Instrument Detection Limit (mg/L)
Pb	217.0	0.01
Cu	324.8	0.003
Zn	213.9	0.001
Fe	248.3	0.006

Statistical analysis All data were statistically analyzed by evaluating the mean and standard deviation. Mean values obtained for the elemental concentrations of sesame seed samples were compared by One-Way ANOVA using SPSS 20.0 for Windows. Level of significance was set at $p < 0.05$.

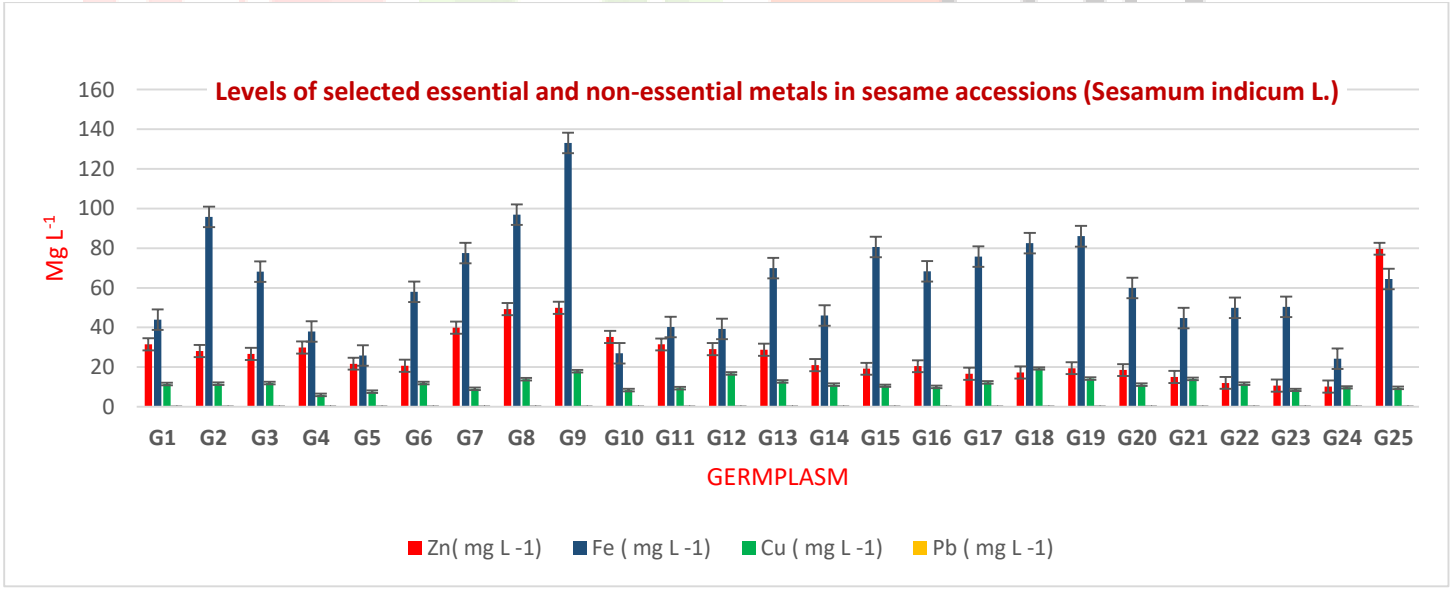
RESULTS AND DISCUSSION

Instrument Calibration: Calibration curves were used to understand the instrumental response to the metal analyzed and predict the concentration in an unknown sample. Accordingly, a set of standard solutions were prepared at various concentrations with a range that includes the unknown of the metal concentration. In this regard, concentrations of the working standards, analytical wavelengths, regression equation, and value of correlation coefficient for each analyzed metal

Limits of Detection (LOD) The LOD values for Fe, Cu, Zn, and Pb elements are given in **Table 2.**

Table 2. Levels of selected essential and non-essential metals in sesame accessions (*Sesamum indicum* L.)

S.No.	Germplasm	Germplasm	Zn(mg L $^{-1}$)	Fe (mg L^{-1})	Cu (mg L^{-1})	Pb (mg L^{-1})
1	IC-132408	G1	31.47	43.9	11.5	0.08
2	IC-204979	G2	28.10	95.8	11.7	0.07
3	IC-1634-3	G3	26.61	68.1	11.9	0.08
4	IC-204137	G4	29.85	37.9	6.0	0.05
5	IC-96222	G5	21.72	25.8	7.6	0.05
6	IC-56162	G6	20.71	58.0	11.9	0.04
7	IC-204354	G7	39.87	77.6	9.0	0.03
8	IC-132283	G8	49.26	96.9	13.9	0.04
9	IC-157-B	G9	49.96	108	17.9	0.06
10	IC-204063	G10	35.17	26.9	8.4	0.02
11	IC-204741	G11	31.43	40.3	9.4	0.04
12	IC-204159	G12	29.03	39.3	16.8	0.05
13	IC-205576	G13	28.71	69.9	12.8	0.04
14	IC-17477	G14	21.03	46.1	11.1	0.03
15	IC-204836	G15	19.16	80.6	10.6	0.02
16	IC-52887	G16	20.45	68.3	10.0	0.01
17	IC-131499	G17	16.68	75.7	12.3	0.07
18	IC-132181	G18	17.34	82.5	19.3	0.05
19	IC-132167	G19	19.45	86.0	14.2	0.07
20	IC-110315	G20	18.53	59.9	11.2	0.03
21	IC-32-C	G21	15.08	44.8	14.1	0.02
22	IC-14053	G22	12.03	49.9	11.7	0.04
23	IC-23253	G23	10.66	50.4	8.5	0.02
24	IC-132410	G24	10.15	24.3	9.8	0.01
25	IC-27066	G25	79.70	64.5	9.6	0.07
		Max	79.7	108	19.3	0.08
		Min	10.15	24.3	6	0.01



The results of percent recoveries of the heavy metals in the sesame seed samples were ranged from 80-133%, which falls within the acceptable range (80-120%) [6]. Iron is an essential element in human body metabolism acting as a catalyst and its acceptable limit for human consumption is 80 to 110 mg/L [7]. In the absence of enzymatic catalysis, most biochemical reactions are so slow that they would not occur under the mild conditions of temperature and pressure that are compatible with life [9]. The iron content obtained from sesame samples was ranged from 24.0 to 108 mgL^{-1}, which is below the recommended safety limits for

consumption (80 to 110 mg/L) [7]. Therefore, sesame seeds which contain iron can be consumed without any health problems.

Zinc is also an important element in human body which is needed for the proper work of the immune systems. It plays a great role in cell division, cell growth, wound healing, and the catabolism of carbohydrates [9]. The acceptable limit for human consumption of zinc is 150 mg/L [9]. The mean levels of Zn in the analyzed sesame seed samples were within the range of 10.75 to 79.7 mg/L, which is below the recommended safety limit for human consumption. Therefore, sesame seeds which contain zinc can be consumed without any health risks.

Copper is also an essential element which is necessary for normal biological activities of amino-oxides and tyrosinase enzymes [8]. Therefore, certain amount of copper is vitally necessary for human beings. The acceptable limit for human consumption of copper is 20.4 mg/L [9]. The present investigation showed that the mean levels of copper varied from 6.0 to 19.3 mg/L, which is found slightly below the safety limit set for copper consumption. Thus, our findings indicated that sesame seeds which contain copper can be consumed without any health problems for human.

Lead is one of the chemical pollutants of the environment and is known to be toxic to human being [10]. In the present study, the lead content varied from 0.01 to 0.08 mg/kg, which is recorded below the safety limit (2 mg/L) set for human consumption. Accession IC-157-B followed by IC-132283 are of great important and valuable for biofortification purpose.

Acknowedgement: Authors are acknowledge to PC Unit sesame and niger JNKVV Jabalpur for providing seed material and DIC RDVV for providing research facilities.

Conflict of interest: None Declared

References

1. Abou-Gharbia, H.A.; Shehata, A.A.Y.; Shahidi, F.(2000) Effect of processing on oxidative stability and lipid classes of sesame oil. Food Res. Int., 33, 331-340.

2. Bikora, G. Oilseed Production and Marketing Situation in Ethiopia, Ministry of Trade, Addis Ababa; 2013.

3. Hashmi, D.R.; Ismail, S.; Shaikh, G.H. Assessment of the level of trace metals in commonly edible vegetables locally available in the markets of Karachi City. Pak. J. Bot. 2007, 39, 747-751.

4. MacPherson, S.; Larochelle, M.; Turcotte, B. A fungal family of transcriptional regulators: The zinc cluster proteins. Microbiol. Mol. Biol. Rev. 2006, 70, 583-604.

5. Orcutt, D. M.; Nilsen, E.T. The Physiology of Plants Under Stress: Soil and Biotic Factors, 1st ed., John Wiley and Sons, 2000; p 683.

6. Winter, W.E.; Bazydlo, L.B.L.; Harris, N.S. The molecular biology of human iron metabolism. Lab. Med. 2014, 45, 92-102.

7. Seno, S.; Ohtake, S.; Kohno, H. Analytical validation in practice at a quality control laboratory in the Japanese pharmaceutical industry. Accred. Qual. Assur. 1997, 2, 140-145.

8. Cooper, G.M. The Cell: A Molecular Approach. 2nd ed., Sunderland (MA): Sinauer Associates. The Central Role of Enzymes as Biological Catalysts 2000. Available at: https://www.ncbi.nlm.nih.gov/books/NBK9921/

9. Roohani, N.; Hurrell, R.; Kelishadi, R.; Schulin, R. Zinc and its importance for human health: An integrative review. J. Res. Med. Sci. 2013, 18, 144-157. 32. ATSDR, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Zinc and Cobalt, US Department of Health and Human Service, Public Health Service, 1994

10. Tchounwou, P.B.; Yedjou, C.G.; Patlolla, A.K.; Sutton, D.J. Heavy metals toxicity and the environment. Exp. Suppl. 2012, 101, 133-164.