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IRON AND ZINC CONTENT SOME TURKISH SESAME (*Sesamum indicum* L.) ACCESSIONS

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ABSTRACT

Micronutrients are known to play an important role in the metabolism and physiological activities of the human body. Micronutrient malnutrition, resulting from dietary deficiency of important minerals such as zinc (Zn) and iron (Fe), is a widespread food-related health problem. Iron, zinc, iodin and vitamin A deficiencies are most prevalent micronutrient deficiencies and unfortunately, more than 3 billion people affected in the world. Iron (Fe) and zinc (Zn) deficiencies rank 9th and 11th, respectively, among 20 most important nutritional deficiencies worldwide which risk factors conducing to global burden of disease. Sesame is rich sources of micronutrients and contribute to combating malnutrition caused by micronutrient deficiency. The objective of this study was evaluated the genetic variation in Fe and Zn content of sesame in 13 Turkish accessions. Fe content varied between 39.8 mg kg^{-1} (Mugla-Ortaca) and 62.23 (Ozberk-82) mg kg^{-1}. The Zn content value varied between 13.92 and 28.49 mg kg-1. The highest value obtained from Adana-Yumurtalik 2 accession, while the lowest value obtained from Baydar-2001 commercial cultivar. In conclusion, considerable variation was found in Fe and Zn content of some Turkish sesame accessions. Significant variation was observed among the sesame accessions in Fe and Zn content.

Keywords: Sesame, Iron, Zinc, accessions

1. INTRODUCTION

Human body require more than 45 nutrients to meet metabolic activities. Deficiency of even one of these nutrients will result negative effect on metabolic activities (Welch and Graham, 2004). Iron, zinc, iodin and vitamin A deficiencies are most prevalent micronutrient deficiencies and more than 3 billion people affected in the world (Tideman-Andersen *et al.* 2011). Iron (Fe) and zinc (Zn) deficiencies rank 9th and 11th, respectively, among 20 most important nutritional deficiencies worldwide which risk factors conducing to global burden of disease (Hotz *et al.*, 2004). The World Health Organization (WHO) estimates that 273 000 deaths originated in iron deficiency anemia in 2004 (Pasricha *et al.* 2013). Almost, two-thirds of all deaths of children are directly or indirectly arise from malnutrition, many from micronutrient deficiencies (Caballero,

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2002). Major reason for prevalent mineral malnutrition worldwide, people being are the high consumption of foods which very low content of micronutrient (Pandey *et al.*, 2017). Zinc is very important microelement for humans. It has serious role activity of about 300 enzymes in body which including the central nervous system, and as an integral component of zinc finger proteins that regulate DNA transcription (Levenson and Morris 2011; Gibson 2012; Kumar *et al.* 2014). Main consequences of zinc deficiency are weakening of the immune system, fertility reduction, impair immunity, losses of brain functions, learning disabilities in children. Also iron an important constituent of haemoglobin and myoglobin that help the muscle cell (Kumar *et al.* 2014). Iron deficiency results in anemia, impaired psychomotor development, reduced physical and work capacity, impaired immunity, and adverse pregnancy outcomes (Nguyen *et al.* 2012; Stoltzfus, 2001). Main factor for the widespread occurrence of micronutrient malnutrition is low concentrations and low availabilities of micronutrients in daily diets (Yang *et al.* 2007).

The primary source of all nutrients for people comes from agricultural products (Welch and Graham, 2004). If agriculture cannot provide all the essential nutrients in amounts required nutrients for good health, malnutrition would be developed (Miller and Welch, 2013). Various way including agronomic interventions and plant breeding to improve level of micronutrients in staple crops. Fertilization one of these interventions but fertilization of stable crops could enhance leaf mineral level and yields but does not always increase mineral concentrations in seed. Therefore, there is considerable interest in breeding mineral efficient crops that produce high yield and accumulate minerals in fertile soils (White and Broadley, 2005). Zinc deficiency in soil and plants is a global problem in many countries such as Turkey, Iran, India, Pakistan, China (Cakmak, 2008). Fe and Zn deficiencies are common among school children and women owing to cereal-based food in typical Turkish diets.

Sesame (*Sesamum indicum* L. - Pedaliaceae) is one of the oldest and most important oil seed crops known to mankind. Sesame seeds contain high oil, protein, vitamins, minerals and antioxidants. In Turkey, sesame is generally cultivated and import for food. Sesame seeds are used in bread and especially simit (Turkish bagel) in commercial bakeries and also made into tahin (sesame butter) in Turkey (Kurt, 2018).

All of the nutrients that humans consume are derived from the soil–plant system, and a new approach to tackling the problem of micronutrient deficiencies in the diet has consisted of increasing the density and bioavailability of micronutrients in edible parts of plants through biofortification. This approach has proved to be sustainable, can be implemented at a relatively low cost, is highly efficacious and has a large coverage, especially in the poorer regions of the world (Bouis 1996; Graham *et al.* 2001; Welch and Graham 1999, 2002, 2004; Welch 2002; Poletti *et al.* 2004; Yang *et al.* 2007). Exploring natural biodiversity as a source of novel alleles

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to improve the productivity, adaptation, quality, and nutritional value of crops is very important plant breeding programs and landraces are a valuable source of genetic variation.

The aim of this study was evaluated the genetic variation in Fe and Zn content of sesame in 13 Turkish accessions. The information obtained will be useful to sesame breeders for planning efficient breeding strategies for improve Fe and Zn content.

2. MATERIALS AND METHOD

2.1. Plant Materials

The 13 sesame populations and cultivars analyzed in this study (Table 1). The represent material collected from 9 different cities with 3 commercial cultivars. The accessions were grown in 2013 and their Fe and Zn contents were evaluated.

Table 1: The list of sesame accessions from different location of Turkey

	Accessions		**Accessions**
1	Batman-Merkez	**8**	Antalya
2	Mugla-Ortaca	**9**	Diyarbakir-Ergani- Ziyaret Koyu
3	Adana-Yumurtalik 1	**10**	Mardin
4	Adana-Yumurtalik 2	**11**	Baydar-2001 ©
5	Bitlis-Merkez	**12**	Muganli-57 ©
6	Adıyaman-Cakmazi Koyu	**13**	Ozberk-82 ©
7	Manisa-Kula		

©: Cultivar

2.2. Fe and Zn Analysis

Some amount of seed samples was taken from every accession with 3 replications and seeds were bulked. Seed samples (0.4 g) were digested in a closed microwave digestion system (MARSxpress, CEM Corp.) in 5 mL of concentrated HNO_3 and 2 mL of concentrated H_2O and were then analyzed for Fe and Zn with an inductively coupled plasma optical emission spectrometer (ICP-OES; Vista-Pro Axial; Varian Pty Ltd., Australia).

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2.3. Statistical analysis

The data were statistically analyzed using a JMP 8.1.0 statistical software package. The Least Significant Differences (LSD) test was used to compare the treatments at the 0.05 level.

3. RESULTS AND DISCUSSION

The concentrations of Fe and Zn of some Turkish sesame accessions are presented in Table 2. All data are results of average of three measurements on each sample. Fe and Zn contents had varied significantly ($p \leq 0.05$) among accessions (Table 2). The highest Fe content was recorded for Ozberk-82 (62.23 mg kg^{-1}) commercial cultivar, while the lowest Fe content recorded for Mugla-Ortaca (39.8 mg kg^{-1}) accessions. The most of sesame accessions Fe content value higher than mean value (48.2 mg kg^{-1}) and commercial sesame cultivars contain the highest Fe content among experiment materials.

Table 2: Fe and Zn content of some Turkish sesame accessions

Accessions	Fe (mg kg^{-1})	Zn (mg kg^{-1})
Batman-Merkez	50.93	24,87
Mugla-Ortaca	39.80	20,21
Adana-Yumurtalik 1	48.05	23,52
Bitlis-Merkez	41.64	22,81
Adana-Yumurtalik 2	40.01	28,49
Adıyaman-Cakmazi Koyu	40.40	23,61
Manisa-Kula	39.97	20,86
Diyarbakir-Ergani- Ziyaret Koyu	51.57	20,65
Mardin	54.66	27,08
Antalya	48.62	19,14
Baydar-2001 ©	51.81	13,92
Muganli-57 ©	56.86	20,68
Ozberk-82 ©	62.23	21,88
Average	48.2	22.13
RDA	**8.0-18.0**	**8.0-11.0**

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LDS (0.05)	**9.062*** **	**7.828***
CV (%)	**11.18**	**20.31**

©: Cultivar; RDA: The US recommended daily allowances; *: Significant at p <0.05; ***: Significant at p < 0.001

The Zn content value varied between 13.92 and 28.49 mg kg^{-1}. The highest value obtained from Adana-Yumurtalik 2 accession, while the lowest value obtained from Baydar-2001 commercial cultivar. In contrast to, Fe content commercial sesame cultivars contain the lowest Zn content and their values lower than average value (22.13 mg kg^{-1}). In the present study, Fe and Zn contents are lower than earlier studies (Obiajunwa *et al.*, 2005; Ozcan, 2006; Kanu, 2011; Bhardwaj *et al.* 2014; Deme *et al.* 2017). This variation might be due to genotype, agronomic practices and environmental conditions (Baloch *et al.* 2014).

CONCLUSION

In this study, considerable variation was found in Fe and Zn content of some Turkish sesame accessions. Significant variation was observed among the sesame accessions in Fe and Zn content. Among sesame accessions, Turkish commercial sesame cultivars were showed high Fe content. Mardin accession has higher Fe and Zn content when compared to each other. But more research required for micronutrient analysis in Turkish sesame germplasm.

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