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Anti-nutritional factors and mineral content of different oat (*Avena sativa* L.) varieties

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Five oat varieties namely HJ-8, HFO-114, OS-6, OS-346 and KENT were examined for their antinutritional factors and total and available minerals. The results showed that anti-nutritional factors like phytic acid and polyphenols were found highest (137.33 and 231.80 mg/100g) in OS-6 variety and lowest (112.80 and 203.60 mg/100g) in OS-346 variety. OS-346 variety contained significantly higher calcium, phosphorus, magnesium, iron and zinc content as compared to other four varieties. *In vitro* availability of calcium of different oat varieties varied from 42.80 to 49.16 per cent, respectively, the highest (49.16%) being observed for OS-346 variety and the lowest (42.80%) in OS-6 variety. *In vitro* availability of iron was also found maximum in OS-346 variety. Among the five oat varieties, OS-6 variety exhibited minimum (30.96%) in *vitro* availability of iron and OS-346 variety showed maximum (40.70%) *in vitro* availability of iron. *In vitro* availability of zinc varied from 31.56 to 35.82 per cent, with variety OS-6 had lowest (31.56%) and variety OS-346 exhibited highest (35.82 %) *in vitro* availability of zinc. On the whole, it was concluded that the OS-346 variety was found superior than other four oat varieties used in this study.

Key Words : Oat varieties, Total and available minerals, Anti-nutritional factors

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INTRODUCTION

Oats are unique among the cereals; one of the rich sources of dietary fibres among cereals belongs to the Poaceae family like all other grain varieties (Butt *et al*., 2008). Oats contain a high percentage of oat protein and balanced composition of amino acids which have proved them highly nutritive in comparison to other cereals (Petkov *et al*., 2001). Oat comprises a very balanced profile of both soluble and insoluble dietary fibre. A high intake of dietary fibre is positively related to several preventive medical and nutritional effects (Spiller, 2001).Besides this, oats contain relatively high level of minerals, lipids (unsaturated fatty acids), vitamins, antioxidants (avenanthramides, tocotrienols and tocopherols) and phenolic compounds (Skoglund *et al.*, 2008 and Wani *et al.*, 2014). Oats has recently attracted research and commercial attention mainly due to its high content of β-glucans and compounds with antioxidant activity. Due to poor grains quality characteristics such as rough texture, difficulty in removing large proportion of hulls from the grain, require more cooking time and have relatively poor digestibility and low availability of minerals due to presence of some inherent antinutritional factors (Tiwari and Awasthi, 2014) which still limit their uses in various food preparations. Several processing techniques like malting, roasting, flaking, popping etc. can be used to improve the availability of starch, protein and

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minerals (Begum *et al.*, 2003; Chaudhary, 2011 and Munoz-Insa *et al.*, 2011). These techniques lower the antinutritional factors and improve the nutritive value of oat grains for its diversified utilization among masses. As different oat varieties contained different nutritional properties and very few data is available on these varieties of oats, so this research work was carried out with the objective to assess the antinutritional factors and mineral content of different varieties of oat.

METHODOLOGY

Seed samples of five oat varieties namely HJ-8, HFO-114, OS-6, OS-346 and Kent were procured in a single lot from the Forage Section of the Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. The grain samples were cleaned, made free of dust, dirt and foreign materials. Half of the seed samples were ground in an electric grinding mill and stored in plastic containers at room temperature for further analysis.

Antinutritional factors :

Phytic acid was determined by using the method of Davies and Reid (1979) and polyphenols were extracted by the method of Singh and Jambunathan (1981).

Total minerals :

Total minerals *i.e.* calcium, iron, magnesium and zinc in acid digested samples were determined by Atomic Absorption Spectrophotometer (Lindsey and Norwell, 1969). Whereas, phosphorus was determined colorimetrically (Chen *et al*., 1956). *In vitro* availability of minerals, iron in the samples were extracted according to method of Rao and Prabhavathi (1978) and Calcium and zinc were extracted by the method of Kim and Zemel (1986).

Statistical Analysis :

The data were statistically analyzed for analysis of variance to determine the critical difference (CD) among different varieties (Sheoran and Pannu,1999).

OBSERVATIONS AND ASSESSMENT

Phytic acid content of five oat samples significantly varied from 112.80 to 137.33 mg/100g the highest being observed in OS-6 variety and lowest in OS-346 variety. Among the five oat varieties, variety OS-6 exhibited maximum amount of polyphenols (231.80 mg/100g) and OS-346 contained minimum (203.60 mg/100g) amount of polyphenols (Table 1). Significant differences were observed in phytic acid and polyphenols content of five oat varieties. Gupta and Brar (2015) also reported 124. 6 mg/100 g of phytic acid and 227.80 mg/100 g of polyphenols in oat flour which are in agreement with the present results. Other workers also reported similar results (Czerwin Ski *et al*., 2004 and Ragaee *et al.*, 2011).

Calcium content of five oat varieties varied from 51.16 to 54.83 mg/100g, respectively, the highest (54.83 mg/100g) being observed for OS-346 variety and lowest (51.16 mg/100g) for variety HFO-114. Non- significant differences were observed between varieties such as HJ-8 vs OS-346, HFO-114 vs OS-6, kent vs OS-6 and OS-346 vs HJ-8. Calcium content of var. OS-346 differed significantly ($P \leq 0.05$) from varieties Kent, OS-6 and HFO-114 whereas differed non-significantly from var. HJ-8. Phosphorus content was found to be highest (522.73 mg/100g) in OS-346 variety and lowest (514.40 mg/100g) in Kent variety. Variety HJ-8 vs OS-346 exhibited non-significant differences whereas all other varieties differed significantly in their phosphorus content. Magnesium content ranged from 173.00 to 177.23 mg/100g, respectively among the five oat varieties. Kent and HFO-114 varieties exhibited lowest whereas variety OS-346 exhibited highest magnesium content. Non-significant differences were observed in magnesium content of varieties such as HJ-8 vs OS-6 and OS-346, HFO-114 vs Kent. Iron content of five oat varieties ranged from 3.96 to 4.80 mg/100g, respectively. Highest (4.80 mg/100g) was observed in var. OS-346 and lowest (3.95 mg/100g) was in var. HFO-114. Iron content of var. HJ-8, HFO-114, OS-6 and OS-346 differed significantly ($P \leq 0.05$) from each other. Whereas non-significant difference was observed in iron content of var.OS-6 and Kent (Table 2).

Table 1 : Antinutritional factors (mg/100g) of different oat varieties (on dry matter basis)

Varieties	Phytic acid	Polyphenols
HJ-8	132.50±3.37	219.76 ± 3.69
HFO-114	126.50±3.19	212.76 ± 1.32
OS-6	137.33±1.80	231.80 ± 2.50
OS-346	112.80±4.07	203.60±4.09
Kent	120.73±1.52	209.20±1.93
C.D. ($P \leq 0.05$)	2.78	2.23

Values are mean ± SE of three independent determinations

Table 2 : Total mineral content (mg/100g) of different oat varieties (on dry matter basis)

Varieties	Calcium	Phosphorus	Magnesium	Iron	Zinc
HJ-8	53.63±0.75	521.90±2.63	175.96±1.59	4.62±0.03	4.08±0.05
HFO-114	50.76±0.46	517.66±2.16	173.00±2.57	3.95±0.04	3.83±0.06
OS-6	51.73±0.52	519.96±2.54	176.30±1.23	4.12±0.01	3.97±0.02
OS-346	54.83±0.24	522.73±1.70	177.23±2.94	4.80±0.01	4.10±0.08
Kent	51.16±0.72	514.40±3.11	173.00±2.03	4.20±0.24	3.98±0.03
CD (P≤0.05)	1.82	1.59	2.00	0.36	0.14

Values are mean ± SE of three independent determinations

Table 3: Available minerals (%) of different oat varieties (on dry matter basis)

Varieties	Calcium	Iron	Zinc
HJ-8	43.73±1.27	34.20±0.70	32.25±0.76
HFO-114	45.13±1.35	36.60± 0.43	32.47±0.25
OS-6	42.80±1.88	30.96±0.87	31.56± 0.46
OS-346	49.16±2.55	40.70±0.63	35.82±0.24
Kent	46.56±0.93	38.62±0.62	33.98±0.54
C.D. (P≤0.05)	1.57	1.44	0.58

Values are mean ± SE of three independent determinations

Zinc content of five oat varieties varied from 3.83 to 4.10 mg/100g, respectively. Highest (4.10 mg/100g) being observed for var. OS-346 and lowest (3.83 mg/100g) being observed for var. HFO-114. Zinc content of variety HJ-8 and OS-346 differed non-significantly whereas zinc content of other varieties differed significantly (P≤0.05). Narwal and Dahiya (2015) also reported similar contents of calcium, iron and zinc (52.06, 4.66 and 3.96 mg/100g) in oat flour, respectively. Other workers also reported similar results of calcium, phosphorus, magnesium, iron and zinc content in different oat varieties. (Maboodurrahman and Birari, 2015 and Sangwan *et al*., 2014).

In vitro availability of calcium of different oat varieties varied from 42.80 to 49.16 per cent, respectively, the highest (49.16%) being observed for OS-346 variety and the lowest (42.80%) in OS-6 variety. These two varieties differed significantly in *in vitro* availability of calcium than other varieties. Varieties HJ-8 vs HFO-114 and OS-6 and var. HFO-114 vs Kent was found to be statistically non-significant from each other in their *in vitro* calcium availability.

In vitro availability of iron ranged from 30.96 to 40.70 per cent, respectively which differed significantly among the five varieties. Among the five oat varieties, OS-6 variety exhibited minimum (30.96%) in *vitro* availability of iron and OS-346 variety showed maximum (40.70%) *in vitro* availability of iron. *In vitro* availability of iron of five oat varieties differed significantly. *In vitro* availability of zinc varied from 31.56 to 35.82 per cent, with variety OS-6 had lowest (31.56%) and variety OS-346 exhibited highest (35.82 %) in *vitro* availability of zinc. These results are in agreement with those reported by Narwal and Dhaiya (2015) in oat grains (Table 3).

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