

Nutritional Changes of Common Oat (*Avena sativa*) and Naked Oat (*Avena nuda* L.) during Germination

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AIMS and BACKGROUND

The aim of this study was the evaluation of nutritional factor changes in common oat and naked oat during grain germination. The basic food components as well as minor nutrients were determined. The analyses included determination of dry matter, ash, proteins, dietary fibre, fat, amino acids, minerals and vitamins.

The practice of germination is traditionally widely used to improve the nutritional value of grains. In comparison to the seeds, sprouts were recognized to have a better quality of protein, a higher content of polyunsaturated fatty acids, an increased bioavailability of essential minerals and a higher content of vitamins and dietary fibre. A large number of negatively valued components in the seed (e.g. phytic acid, trypsin-inhibitor, hemagglutinins, saponins, bloating substances) decline with increasing time of germination.

Existing documentation revealed the cardiovascular benefit of oat consumption due to lowering LDL cholesterol levels. Number of observational and human studies indicates that oat can impact such heart disease risk factor as diabetes, obesity and hypertension. The increased interest of consumers in natural sources of nutritionally important factors and extension of crop diversity leads to the production and utilization of naked oat. Naked oat is higher in essential amino acids content than wheat or barley. It has lower content of dietary fibre and higher oil content than wheat, barley or common oat. Dietary fibre of naked oat contains soluble fibre beta -glucans that are considered to be important prebiotics.

METHODOLOGY

Material

Common oat (*Avena sativa*) var. Auron and naked oat (*Avena nuda*) var. Abel – harvest 2003, obtained from Research Institute of Crop Production, Prague.

Germination – soaking and swelling in tap water for 3 hrs
 germination for 8 days, 20°C, artificial lighting, no humidity regulation, washing once a day

Samples taken after 4, 6 and 8 days of germination, subjected to grinding and homogenization

Methods

Dry matter – gravimetric method, drying to constant weight at 105 °C

Ash – dry ashing at 520 °C

Fat – extraction after acidic hydrolysis

Proteins – Kjeldahl method

Amino acids – ion-exchange HPLC with postcolumn derivatization

Dietary fibre – AOAC enzymgravimetric method

Vitamin B1 – HPLC after dephosphorylation and derivatization to thiochrome

Vitamin B2 – fluorimetric method after dephosphorylation and derivatization to lumiflavine

Vitamin B6 – microbiological assay with *Saccharomyces uvarum* ATCC 9080

Niacin – microbiological assay with *Lactobacillus plantarum* ATCC 8014

Pantothenic acid – microbiological assay with *Lactobacillus plantarum* ATCC 8014

Vitamin C – titrimetric determination with 2,6-dichlorophenolindophenol

Carotenoids – spectrophotometric method after saponification and extraction

Vitamin E – HPLC after saponification and extraction of unsaponifiables

Minerals – flame AAS after dry ashing

Phosphorus – spectrophotometric method after dry ashing

RESULTS

Nutrient composition of dry and germinated oat grains

Analyte	Naked oat Abel				Common oat Auron			
	Dry grain	Germination (days)			Dry grain	Germination (days)		
		4	6	8		4	6	8
Dry matter (g/100g)	96.8	43.5	32.2	27.1	95.9	28.7	20.1	20.5
Ash (g/100g DM)	1.8	2.1	1.8	2.1	3.3	3.6	3.0	2.5
Fat (g/100g DM)	9.6	7.8	9.0	8.9	8.4	6.5	5.0	5.1
Proteins (g/100g DM)	11.6	14.5	15.0	13.6	11.9	15.1	13.0	12.6
Dietary fibre (g/100g DM)	8.6	13.2	22.2	26.8	14.5	19.2	29.8	35.1

Vitamin content (mg/100g DM) in dry grains of naked oat and common oat

	Vit. B1	Vit. B2	Niacin	Pant.acid	Vit. B6	Vit. C	Carotenoids	Vit. E
Abel	0.51	0.15	1.25	0.95	0.19	<0.1	0.18	1.66
Auron	0.30	0.07	0.68	0.57	0.18	<0.1	0.16	1.32

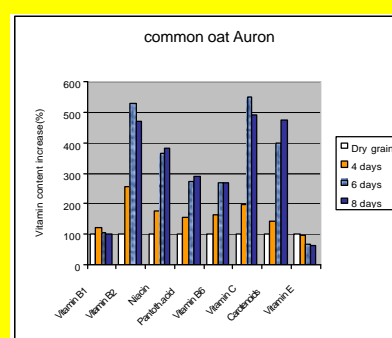
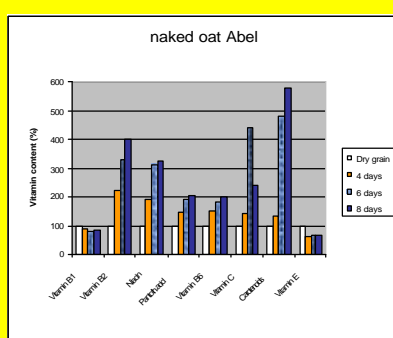
Mineral content (mg/100g DM) in dry grains of naked oat and common oat

	K	Ca	Mg	P	Zn	Fe	Cu	Mn
Abel	321	63	118	395	2.8	3.5	0.43	4.3
Auron	575	99	139	502	2.1	4.1	0.40	3.9

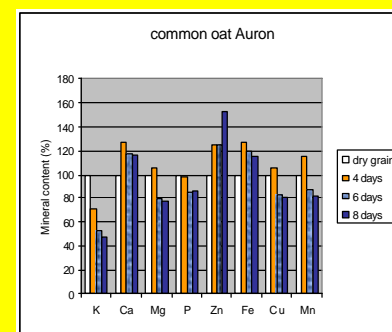
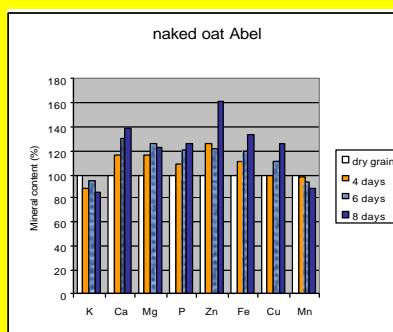
Chemical score of essential amino acids in naked oat and common oat

Amino acid	Naked oat Abel			Common oat Auron		
	Dry grain	Germination (days)		Dry grain	Germination (days)	
		6	8		6	8
Thr	0.660	0.597	0.673	0.848	0.612	0.624
Val	0.739	0.661	0.687	0.912	0.696	0.694
Met	0.672	0.647	0.628	0.502	0.282	0.312
Ile	0.575	1.040	1.003	0.814	0.535	0.545
Leu	0.673	0.365	0.369	1.125	0.677	0.708
Phe	0.950	0.737	0.709	1.170	0.648	0.687
Lys	0.516	0.583	0.681	0.605	0.696	0.786

Vitamin changes during oat germination



Mineral changes during oat germination



CONCLUSION

After 8 days of germination of common oat Auron and naked oat Abel the following changes were observed:

- Dry matter decreased to 27.1% in naked oat and to 20.5% in common oat.
- Protein content in dry matter increased by 17% in naked oat and by 6% in common oat. Methionine was found to be the limiting amino acid. The chemical score of essential amino acids decreased during germination (with exception of lysine).
- Fat content in dry matter decreased by 7% in naked oat and by 40% in common oat.
- Dietary fibre content in dry matter increased by 212% in naked oat and by 142% in common oat. Content of vitamin B2, niacin, pantothenic acid, vitamin B6, vitamin C and carotenoids in dry matter increased by 300, 220, 106, 100, 140 and 478% resp. in naked oat and by 371, 282, 188, 172, 388 and 375% resp. in common oat. No significant changes were found in vitamin B1 content, vitamin E content showed slight decrease.
- Increase of Ca, Mg, P, Zn, Fe and Cu content in dry matter was between 23.7 and 60.7% of original value in naked oat. Only Ca, Zn and Fe content increased above original level (14.6-52.4%) in common oat. Contents of K and Mn were reduced in both tested oats.
- During germination of both common and naked oats positive nutritional changes occur. Dietary fibre, protein, some vitamin and mineral levels are increased. Germinated naked oat with lower vitamin increase but higher original content represents better source of vitamins than germinated common oat. Mineral contents of germinated common and naked oats are comparable.

