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Evaluation of biological value of wheat sprout: fat content, fatty acid composition

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ABSTRACT

During our research work fatty acid content of the wheat and wheat sprout was investigated during the germination. It was found that both the saturated and unsaturated fatty acids hardly changed during the germination. The most important saturated fatty acid of the sprout investigated by us is palmitic acid, amount of which hardly changed or even increased during germination. Oleic acid and linoleic acid were present in the highest concentration among the unsaturated fatty acids in the sprout investigated. The concentration of oleic acid remained unchanged during the germination period, and the same applies to linoleic acid. Based on our investigation it can be stated that most of the fatty acids hardly changed during the germination, and there was no verifiable tendency.
(Keywords: sprout, chemical changes during germination, fat content, fatty acid composition)

INTRODUCTION

Sprouting is a natural biological process that every higher plants exhibit, during which the seed at rest starts to grow under favourable environmental conditions (appropriate moisture content, temperature, oxygene) and a new plant develops. Germination can lead to the development of such functional foods that have a positive effect on the human organism and that help in maintaining the health (*Sangronis and Machado,* 2007).

The sprouts fulfill the requirements of the modern nutritional science for whole-food. Researches found that the sprouts are a good source of ascorbic acid, riboflavin, choline, thiamin, tocopherol and pantothenic acid (*Lintschinger et al.,* 1997).

Urbano et al. (2005) examined the protein digestibility of various sprouts and bioavailability of the minerals, *Gill et al.* (2004) the relationship between the consumption of vegetables and the prevention of cancer, and *Clarke et al.* (2008) the effeciency of the sulforaphane content of different sprouts in cancer prevention. *Kim et al.* (2004) examined the change in fatty acid composition due to sprouting. It was established that majority of fatty acids of buckwheat is unsaturated ones, out of which linoleic acid can be found in the highest amount. *Tokiko and Koji* (2006) examining fat content and fatty acid composition of various sprouts established that the fat content ranged between 0.4 and 1.6%. In the course of fatty acid content analysis it was found that linolenic acid was present in the highest concentration, 23% in case of buckwheat, 48% in the soybean, 47.7% in the clover and 40.6% in the pea.

Studying the literature, we found no more data on the change in fat content and fatty acid composition during sprouting. Because of the above we started our investigation relating to fatty acid composition of wheat sprout and the changes in the fatty acid composition due to germination. During our work we determined the fatty acid composition of wheat sprout and its change in the function of germination time.

MATERIALS AND METHODS

The examined samples, germination

Commercially obtainable organic wheat were obtained. The seeds were washed in 0.1% H_2O_2 for 1 min then soaked in distilled water for 24 hrs. After the 24 hrs elapsed, the seeds were placed into germination bowls, and germinated at 20 ºC in a Memmert 200 incubator. They were rinsed twice a day with distilled water and samples were taken in every 24 hrs. According to the domestic practice and international recommendations wheat was germinated for 3 days. After germination the sprouts were washed with distilled water, dried at 60 ºC, then stored frozen at -10 ºC until the analyses.

Determination of fat content and fatty acid composition

Crude fat content of the sprouts were determined in a Soxhlet extractor after extraction with diethylether according to the Hungarian Standard (HS 6830/19-79). Determination of the fatty acid composition was performed using a Varian 3800 gas chromatograph. Results were given as fatty acid methyl ester relative weight%.

RESULTS AND DISCUSSION

Table 1 shows crude fat content of the starting seed and the sprout. Results were given in weight% on air dry matter basis.

Table 1

Crude fat content of the wheat seed and wheat sprout

Number	Description	Crude fat content (%) (on air dry-matter basis)
1	Wheat seed	1.7
2	Wheat sprout, day 3	1.7

In case of wheat no change was experienced between seed and sprout. *Table 2* shows fatty acid composition of wheat seed and wheat sprout.

In the wheat sprout the fatty acids being present in the highest concentration are palmitic acid, linoleic acid and oleic acid. Out of the saturated fatty acids palmitic acid is present in 33.5% in the wheat sprout which value is higher than that for the wheat seed (31.2%). Accordingly due to the germination the concentration of palmitic acid increased. The value for stearic acid decreased from 1.9% in the seed to 1.2% in the wheat sprout. Out of the saturated fatty acids beyond the mentioned ones also undecanoic acid (1.7% in the wheat seed and also in the sprout), lauric acid (0.1% in both of the samples), tridecanoic acid (0.7% in the seed and the sprout), myristic acid (0.8% in the wheat seed and 0.5% in the wheat sprout), pentadecanoic acid (0.3% in both samples), arachidic acid (0.3% in the seed and 0.2% in the sprout) and behenic acid (1.2% in both samples) could be detected in the samples.

Table 2

Fatty acid composition of wheat seed and wheat sprout

Fatty acid		Wheat seed	Wheat sprout, Day 3
		Fatty acid methyl ester %	
Undecanoic acid	11:0	1.7	1.7
Lauric acid	12:0	0.1	0.1
Tridecanoic acid	13:0	0.7	0.7
Myristic acid	14:0	0.8	0.5
Pentadecanoic acid	15:0	0.3	0.3
Palmitic acid	16:0	31.2	33.5
Stearic acid	18:0	1.9	1.2
Oleic acid	18:1	10.7	7.8
Linoleic acid	18:2	25.6	27.3
Arachidic acid	20:0	0.3	0.2
Eicosenoic acid	20:1	0.9	0.4
α-Linolenic acid	18:3n3	2.0	2.5
Behenic acid	22:0	1.2	1.2
Eicosatrienoic acid	20:3n6	1.4	1.5
Eicosatrienoic acid	20:3n3	2.3	0.2

Out of the monounsaturated fatty acids oleic acid is present in the highest concentration, its value decreased from 10.7% in the wheat seed to 7.8% due to germination. In the samples also eicosenoic acid could be detected: 0.9% in the wheat seed and 0.4% in the wheat sprout.

Out of the polyunsaturated fatty acids linoleic acid was present in the highest concentration, with 25.6% in the starting wheat seed and increasing to 27.3% in the sprout. In the samples also α-linolenic acid (2.0% in the wheat seed and 2.5% in the sprout) and eicosatrienoic acid (C20:3n6): (1.4% in the wheat seed and 1.5% in the wheat sprout), (20:3n3): (2.3% in the wheat seed, 0.2% in the sprout) were detectable.

By the analysis of the fatty acid composition of wheat sprout, we established that by far no such radical changes occurred during the germination as reported by *Kim et al*. (2004), and *Tokiko and Koji* (2006). Calculating on dry-matter basis the crude fat content of the sprouted plant either did not change or decreased during the sprouting.

Regarding the fatty acid composition, concentration of palmitic acid, the saturated fatty acid being present in the highest concentration, increased in case of wheat or did not change during the germination. Similar change can be reported in case of stearic acid, and we cannot give a definite answer to how the stearic acid content changed during the germination. It is very probable that either the stearic acid content or palmitic acid content does not suffer a substantial change due to the germination.

We can formulate almost similar tendencies in case of unsaturated fatty acids. In case of wheat sprout the amount of oleic acid decreased somewhat. The amount of linoleic acid remains practically unchanged in the germination period. The other polyunsaturated fatty acids occur in such a small concentration, that even the tendency of the changes is difficult to follow.

Summarized, it can be established that some of the saturated fatty acids decrease minimally, others remain unchange. Out of the unsaturated fatty acids oleic acid and linoleic acid practically hardly changes. From our investigations we can conclude that in case of the wheat sprout the germination process hardly affected the fatty acid composition of the fat of the wheat plant, consequently the biological value of the fat. We cannot confirm the results found in the literature reporting that due to the germination the amount of the saturated fatty acids considerably decreases and the amount of the polyunsaturated essential fatty acids considerably increases.

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