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EFFECT OF SOAKING, GERMINATION AND AUTOCLAVING ON SELECTED NUTRIENTS OF RAPESEED

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Effect of soaking, germination and autoclaving on selected vitamins and other nutrients of rapeseed, was studied. Soaking at ambient conditions slightly increased protein, fat and niacin contents; decreased free fatty acid and riboflavin contents while ascorbic acid was not affected. Germination of seeds slightly increased the total protein, but significantly increased the vitamins while the total fat was reduced. Initial values of ascorbic acid, riboflavin and niacin were 6.95 (fresh weight), 0.62 and 21.1 mg/100gm respectively. The highest value of ascorbic acid, 82.9 mg/100gm (fresh weight) was observed after 2 days of germination while the highest values of riboflavin, 3.18 mg/100gm and niacin 28.57 mg/100gm (dry weight) were found after 4 and 6 days of germination respectively. Autoclaving at 121° and 15 PSI decreased riboflavin and niacin contents to 0.48 and 12.64 mg/100gm respectively. Free fatty acid increased from 0.59 to 2.02% whereas protein and fat value were little affected by autoclaving.

Key words: Rapeseed, Processing, Nutrition.

Introduction

Although primarily grown for its high oil content (40-45%) rapeseed provides a meal containing 36-40% protein, the quality of which is well suited for use as a component of animal feedstuffs. Its use is, however, limited by the presence of antinutritional factors such as glucosinolates, erucic acid, phytic acid and fibre levels [1,2]. Currently single zero, double zero and even tripple zero rapeseed varieties have been developed through plant breeding. Inspite of these achievements, growing of cultivars with high content of antinutritional factors will continue due to their high yields. In order to eliminate or decrease the damaging effects of these harmful biochemical factors, several processing treatments have been suggested [3-6]. Germination and autoclaving procedures are rather simple and economical. Effect of germination and soaking in increasing the nutrive value of several seed grain has been tested [6]. However, little attempt has been made to study this effect in rapeseed. Autoclaving has been used to detoxify the meals [5], however, its effect on other nutrients has not been studied., The objective of this study was to determine the influence of soaking/germination and autoclaving on nutrient content of rapeseed.

Materials and Methods

Rapeseed *(Brassica napus)* variety, Westar, was obtained from the Mutation Breeding Section of NIFA, Peshawar. The cultivar had been grown under standard agronomic practices. Seeds were soaked in tap water (2 ml/gm) for 24 hrs and then allowed to germinate for 6 days at room temperature (35±4°) in dark in containers lined with filter paper. The seeds were rinsed once a day with water to prevent any microbial growth. Except for ascorbic acid, the samples were oven dried at 50° for 24 hrs, ground to pass through a 20 mesh sieve and kept in a refrigerator. The ground samples were analyzed for protein, fat, free fatty acids, riboflavin and niacin after 24 hrs soaking and after 1, 2, 3, 4, 5, and 6 days of germination. In the second experiment, soaked seeds (2 ml water/gm seed) were autoclaved for 5, 10, 15, 20, 25 and 30 mins. under 15 lb pressure at 121°. The samples were oven dried and ground as before.

Moisture, protein, fat, free fatty acid, riboflavin and niacin were determined according to the methods outlined by the American Association of Cereal Chemistry [7]. For the analysis of ascorbic acid, 5 gm of fresh samples were taken at the end of each sampling interval. Ascorbic acid was determined using 2,6-dichlorophenolindophenol dye by titration [8]. For biochemical analysis triplicate determinations were made in each case and the resultant standard mean deviations were, dry matter 1.35, protein 0.53, fat 0.43, free fatty acids 0.55, niacin 0.94, riboflavin 0.03 and ascorbic acid 1.8%. The data were analysed statistically by the analysis of variance using LSD and the means were separated using DMR test on the MSTAT system [9].

Results and Discussion

The effect of soaking and germination on protein, fat and free fatty acids is shown in Table 1. Fat contents increased due to soaking. However, statisticaly insignificant increase in the protein and decrease in the free fatty acids, were observed. There was a net increase in the protein as a result of germination. The increase in total protein is not considered in fact the real one but merely the result of concentrating effect due to disolution of soluble nutrients during soaking, oxidation and consumption of the other classes in the germination process. Fat content increased (from 39.00 to 41.93%) while free fatty acids decreased (from 0.63 to 0.59%) after 24 hrs soaking and

TABLE 1. EFFECT OF SOAKING AND GERMINATION ON SELECTED NUTRIENTS OF RAPESEED.

Treatment	Dry matter %	Protein %	Fatt %	Free fatty acids%
Untreated- control	96.69	23.17b	39.00b	0.63e
Soaking-24 hrs	96.73	24.49ab	41.93a	0.59e
Germination-days				
1	97.28	24.80ab	38.87 bc	0.41e
2	96.88	24.88ab	38.33c	2.73e
3	96.11	25.26ab	33.19d	6.69d
4	95.84	26.74a	22.92e	10.62c
5	96.08	25.15ab	18.59f	21.44b
6	94.99	25.65ab	17.60g	29.34a

Means (of triplicate determinations) in the same column followed by different letters are significantly different (P≤0.01).

the later decreased further to 0.44% after a day germination. Germination resulted in a continuous decrease in fat upto 17.60% and an increase in free fatty acid content reaching to maximum value of 29.34% after 6 days. Our results were in partial agreement with those of Thompson and Serraino [6] who reported 6 and 4% increase in fat and protein respectively in rapeseed after two days germination. They also reported continuous rise in free fatty acids, 10% increase in protein content and 46% loss of fat with advanced stages of germination. Sattar *et al.* [10] reported an increase in protein and fat content from 9.6 and 4.36% to maximum values of 14.0 and 5.80% respectively after 4 days of germination in corn. They noted a slight decrease in these values when germination was further continued. Similar changes have been reported by Hassium and Fields in corn [11], Bressani [12] and Sathe *et al.* [13] in beans. On the contrary, Rahman [14] reported little effect of germination on protein and other extract but a substantial increase in reducing sugars and free fatty acids.

Initially ascorbic acid, riboflavin and niacin contents of seeds were 6.95, 0.62 and 21.18 mg/100gm respectively. Influence of germination on ascorbic acid, riboflavin and niacin contents is shown in Figs. 1 and 2. The effect of initial soaking for 24 hrs was also studied. It was found that native contents of ascorbic acids and riboflavin were not affected by this treatment. However, niacin content increased from original value of 21.18 to 25.07 mg/100gm after 24 hrs soaking. After one day germination niacin contrary to riboflavin dropped considerably but ascorbic acid significantly increased. Germination upto 6 days resulted in the multiple increases in all the vitamins. The highest values were observed after 6, 4 and 2 days of germination for niacin, riboflavin and ascorbic acid, respectively. Riboflavin decreased significantly (P≤ 0.01) after 5 and 6 days of germination while ascorbic acid started decreasing after 3 days of germination. Effect of germination on the vitamin content of cereals and legumes is well docu-

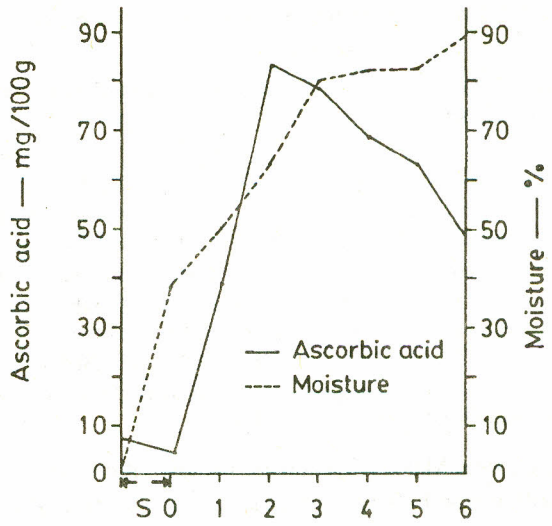

Fig. 1. Effect of soaking and germination on ascorbic acid content of rapeseed.

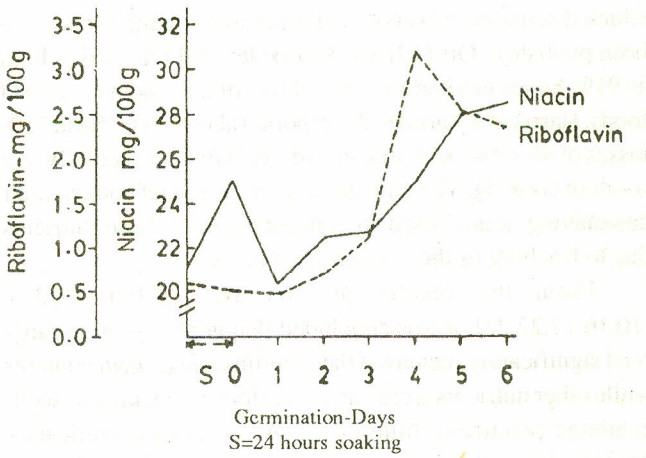

Fig. 2. Effect of soaking and germination on riboflavin and niacin content of rapeseed.

mented. Unlike other food grains and oilseeds, presence of considerable quantity of ascorbic acid in rapeseed is rather interesting. Hofsten [15] reported a 50 mg/100gm increase in vitamin-C and 100-300% increase in vitamin B-12 in mungbeans due to sprouting. Sattar *et al.* [10] reported highly significant increase in ascorbic acid and riboflavin contents after germination. Increase in the content of ascorbic acid and B-vitamins as a result of germination has also been reported earlier [14, 16-18].

Effect of autoclaving on rapeseed is shown in Table 2. The protein and fat contents slightly decreased after 5 mins autoclaving while further autoclaving upto 30mins significantly increased the protein content. Fat content followed the same pattern upto 20 mins but after 25 mins, the increase was not significant. Free fatty acids increased significantly after 5 mins. Riboflavin and niacin contents were adversely affected

TABLE 2. EFFECT OF AUTOCLAVING ON SELECTED NUTRIENTS OF RAPESEED.

Autoclaving time min.	Dry matter %	Protein %	Fat %	Free fatty acid%	Riboflavin mg/100gm	Niacin mg/100gm
0	96.69	23.17bc	39.00c	0.59d	0.62a	21.18a
5	97.49	23.06c	38.37c	0.94c	0.46d	15.51bcd
10	97.70	24.09ab	41.85a	1.04c	0.53bc	16.76bc
15	97.46	24.77a	41.48a	1.00c	0.55bc	15.52bc
20	96.75	24.02ab	40.85ab	1.77b	0.54bc	17.56b
25	97.14	24.47ab	39.62bc	1.66b	0.49cd	13.58cd
30	96.73	24.09ab	39.86bc	2.02a	0.48cd	12.64d

Mean (of triplicate determinations) in the same column followed by different letters are significantly different (P≤ 0.01).

by autoclaving. Maximum decrease in these vitamins (23.63% for riboflavin and 40.32% for niacin) was observed after 30 mins of autoclaving. Niacin was observed to be more sensitive to heat under pressure (autoclaving) than riboflavin. From initial value of 21.18 mg/100gm it decreased to level of 12.64 mg/100gm after 30 mins autoclaving. Several review articles which discuss the effect of heat processing on nutrients, have been published. Orr [19] and Schroeder [20] reported as high as 91% losses in vitamin B-6 and pantothenic acid in canned foods. Harris and Karmas [21] reported about 100, 75 and 75% losses of ascorbic acid, niacin and riboflavin respectively as a result of cooking. The increase in protein and fat content after autoclaving is attributed to concentration of these nutrients due to leaching of the soluble substances.

From the results of this and earlier studies [10,16,17,22,23], it was concluded that germination of rapeseed significantly increased the vitamins and protein contents while other nutrients were variably affected. Soaking of seeds exhibited practically little effect. Autoclaving significantly decreased the vitamins such as riboflavin and niacin. In view of these findings, possibility of fortifying cereals with sprouted rapeseed in order to improve the nutritional value of the poultry ration, seems worth investigating. It has already been established that soaking and sprouting of grains significantly lowers their antinutritional factors such as phytic acid and protein inhibitors [22-25].

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