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Mineral profile of soyflour obtained from germinated and dried soybeans

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Abstract

In the present study an attempt was made to assess the effect of germination on the mineral content of soyflour. Two varieties of soybean viz. Shivalik and Punjab No-1 were allowed to germinate for 36 and 48 hours at room temperature followed by drying of the grains at room temperature and under controlled conditions at 70±5^{0}C. The dried grains were milled to flour fineness. A significant increase in the calcium, phosphorus, iron, sodium and magnesium content was observed with increase in germination time. The drying temperatures also had a significant effect on these minerals. Between the two varieties, the samples obtained from Shivalik variety had significantly higher value for calcium, magnesium and manganese contents whereas the phosphorus, iron and sodium contents were higher of soybean flour obtained from Punjab No-1.

Key words: Mineral profile, Punjab No-1, Shivalik, germination, drying, soybean.

Introduction

Mineral starvation is one of the biggest problems in India and people suffer from phosphorus, calcium and iron deficiencies. Soybean, also known as miracle or wonder bean is a nutrient stock. It contains appreciable amounts of minerals and its mineral profile is relatively superior to other pulses (Singh *et al.*, 1977; Kumar and Kapoor, 1984). Besides a good source of dietary fiber it contains calcium, zinc, iron, magnesium, phosphate and many B- complex vitamins. According to FAO/WHO soy protein quality is equivalent to that of most animal protein with a level of lysine far exceeding human requirements. It contains as high as 40-45 per cent protein and it is increasingly consumed for economical and nutritional reasons (Henley *et al.*, 1993 and Garcia *et al.*, 1997). Germination has been reported to cause a desirable change on the nutritional value of the legume. It not only improves the nutritional value but also decreases the anti- nutritional factors. So, an attempt was made to analyze the effect of germination, drying temperatures and varieties of soybean on the mineral contents of processed soy flour.

Materials and Methods

Soybeans: Samples of soybean varieties Shivalik and Punjab No-1 were procured from the Department of Plant Breeding and Genetics, CSK HPKV, Palampur.

Germination of Soybean seeds: The sound and mature grains of soybean were washed and soaked for 6 hours in water (1:5 w/v). The soaked grains were washed thoroughly and excess of water was drained off and soaked samples were further divided in to four lots. Two lots of each variety were incubated for 36 hours and other two for 48 hours and when the requisite incubation was over, two lots (one from each variety) were dried at room

temperature and other two lots, (one from each variety) were dried at 70 ±5°C in a tray drier (Fig.1). Thereafter, the samples were stored in metal bins to equilibrate the moisture for further use in the investigation. The soybean obtained after giving germination and drying treatments were dehulled and milled for flour fineness.

Mineral estimation: The organic matter in the sample (0.5g) was wet digested with diacid mixture (Piper, 1966). The volume was made to 50 ml. The digested samples were analyzed for iron, magnesium and manganese contents using Atomic Absorption Spectrophotometer. Calcium and sodium present in digested samples were determined by using flame photometer. The colourimetric method was used for determining phosphorus content in the digested samples (Fisher, 1971). The data collected on various parameters were statistically analyzed using standard technique of analysis of variance.

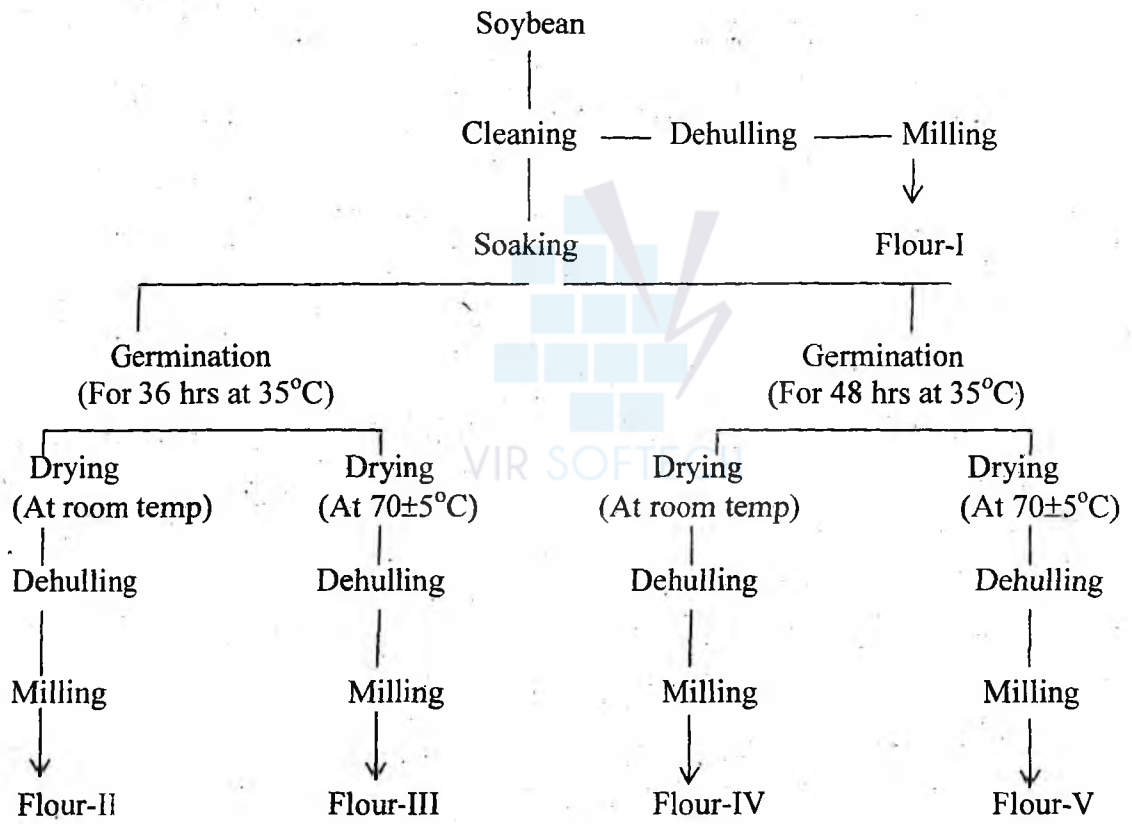


Figure 1. Flow chart for the preparation of soybean flours

Results and Discussion

Effect of germination on the calcium, phosphorus, iron, sodium, magnesium and manganese contents of soybean flour is presented in table1. The calcium, phosphorus and magnesium contents of soybean increased with increase in germination time. The calcium content increased from 66.73mg/100g to 90.30

and 91.24 mg/100g and the phosphorus content increased from 583.02 mg/100g to iron content of raw soybean flour was 10.84 which increased significantly to 13.78 mg/100g after 48 hours of germination. Similarly, the sodium and magnesium contents of the soybean flour also varied significantly with germination. However, the increase in the values of calcium, phosphorus and manganese was non-significant with germination.

The data pertaining to the effect of drying temperature on the mineral content of soybean flour is presented in table 2. As is evident from the data the drying temperatures 590.19 and 591.50 mg/100g after 36 and 48 hours of germination, respectively. The mean had non-significant effect on the mineral profile of the soybean flour. The mean values of calcium, phosphorus, iron, sodium and magnesium were 92.32, 593.00, 13.44, 127.45 and 359.15 mg/100g, respectively for samples dried at 70±5^{0}C whereas the corresponding values for samples dried at room temperature were 89.23, 588.69, 12.96, 119.09 and 351.17 mg/100g, respectively. The samples dried at 70±5^{0}C temperature had better retention of minerals as compared to samples dried at room temperature.

Table 1. Mean values of minerals (mg/100g) of soybean flour as affected by germination

Minerals	Germination time (Hrs)				
	0	36	48	Mean	CD(P≤0.05)
Calcium	66.73	90.30	91.24	82.74	NS
Phosphorus	583.02	590.19	591.50	588.23	NS
Iron	10.84	12.62	13.78	12.41	0.52
Sodium	93.85	125.83	120.91	113.46	14.40
Magnesium	374.48	338.75	371.56	361.59	21.30
Manganese	3.78	2.88	2.97	3.21	NS

Table 2. Mean values of minerals (mg/100g) of soybean flour as affected by drying temperature

Minerals	Drying temperature			
	Low*	High**	Mean	CD(P≤0.05)
Calcium	89.23	92.32	90.76	NS
Phosphorus	588.69	593.00	590.84	NS
Iron	12.96	13.44	13.20	NS
Sodium	119.09	127.45	123.27	NS
Magnesium	351.17	359.15	355.16	NS
Manganese	2.97	2.86	2.92	NS

* Room temperature, **70±5^{0}C

Between the two varieties, the samples obtained from Shivalik variety had significantly higher value for calcium, magnesium and manganese contents (98.79, 423.26 and 3.75 mg/100g respectively) whereas the phosphorus, iron and sodium contents of soybean flour obtained from Punjab No-1 were 606.59, 12.28 and 126.03 mg/100g respectively (Table 3). It can be concluded from the study that germination had a beneficial effect on the mineral contents of soybean samples. The increase in some minerals viz. iron, sodium and magnesium was significantly higher whereas for minerals

Table 3. Mean values of minerals (mg/100g) of soybean flour as affected by variety of soybean

Minerals	Variety			
	Shivalik	Punjab No-1	Mean	CD(P≤0.05)
Calcium	98.79	80.06	89.42	14.86
Phosphorus	571.12	606.59	588.85	0.31
Iron	11.80	12.28	12.41	0.48
Sodium	100.89	126.03	113.46	NS
Magnesium	423.26	299.90	361.59	17.15
Manganese	3.75	2.66	3.21	0.20

like calcium, phosphorus and manganese this increase was non-significant. Germination is a simple, inexpensive technology which can be carried out very easily at household level. The effect of germination of soybean grains on the mineral content varies greatly with the germination conditions, seed varieties or cultivars and analytical methods. Apart from reducing anti-nutritional factors, it increases the biological availability of the minerals and certain other nutrients.

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