

# THE CHANGES IN NUTRITION VALUE, PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITIES OF SOYBEANS (*Glycine max* L.) DUE TO GERMINATION

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## Introduction

Germination is a simple and not expensive process and effective in improving the quality of nuts. Germination can cause changes in nutrient content due to aerobic respiration and biochemical metabolism. Tian *et al.*, (2010) have conducted research on oat seeds germination. The study proved that germination is able to improve the quality of nutrients seeds. Germination can increase protein digestibility of red bean (Wisaniyasa *et al.*, 2017). Germination is also able to increase phenolic components up to 450% in *L. campestris* seeds (Martinez, 2012). Until now there have been no studies examining changes in nutrition, phenolic compounds and antioxidant activity of soybeans due to germination.

## Research Methods

Soybean germination was carried out for 48 hours, because in general the functional properties of the best nuts after 48 hours of germination. After germination, analysis of nutrient content, phenolic compounds and antioxidant activity was carried out. The study was repeated for 3 (three) times. The procedure for making sprouts was as follows: soybeans are sorted, washed in running water, soaked for 8 hours then germinated in a plastic basket container and covered with banana leaves. Germinated for 48 hours at room temperature and without light. The number of nuts each treatment was 150 g with a thickness of 1 cm. Every treatment was sprinkled with water 10 ml every 12 hours. The result of study were tested by T-test (Gomez and Gomez, 1995).

## Results and Discussion

Table 1. Moisture, ash, protein, fat and carbohydrate content of soybeans, before and after germination (% bb)

Parameters	Before Germination (soybean)	After Germination (soybean sprout)	T-test
Moisture content (%)	7,04 ± 0,02	47,46 ± 0,005	**
Ash content (%)	4,22 ± 0,04	1,93 ± 0,06	**
Protein content (%)	30,95 ± 2,64	32,25 ± 2,26	*
Fat content (%)	7,52 ± 0,43	4,46 ± 0,71	**
Carbohydrate content (%)	50,27 ± 2,99	13,89 ± 3,01	**
Flavonoid content (%)	1,19 ± 0,10	2,11 ± 0,19	*
Total Fenol (%)	35,99 ± 0,16	39,45 ± 0,33	**
Antioksidant activity (ppm)	776,07 ± 21,35	932,86 ± 53,81	*

Note : \* = significant effect, \*\* = very significant effect

### Moisture and Ash content

Soybean moisture content was 7.04%, while soybean sprout moisture content was 47.46%. This is caused before the germination process, the beans are soaked for 8 hours. Immersion causes the imbibition process or the entry of water into the material. The immersion aims to increase the activity of enzymes in nuts. In addition, the sprinkling of water process when 24 hours of germination causes increase the water content of the sprouts produced. The soybean ash content before germination was 4.22%, while after germination process decreased to 1.93%. Ash content is a component of all minerals contained in food. The decrease in ash content caused by minerals are used for growth process..

### Protein Content

The soybean protein content was 30,95% whereas soybean sprout protein content was 32,25%. Increased levels of soybean sprout protein may be due to the process of hydrolysis during germination, which is the breakdown of proteins into amino acids. The formation of these amino acids cause increased protein content as total N of soybean sprout (Wisaniyasa and Suter, 2016).

### Fat and Carbohydrate Content

Soybean fat content was 7.52%, while soybean sprout fat content was 4.46%. The decrease in fat content was caused by fat being a food reserve that was converted into energy during the germination process. Soybean carbohydrate content was 50.27%, while soybean sprout carbohydrate content was 13.89%. The decrease in carbohydrate content caused by carbohydrates are used as a source of energy during the germination process.

### Flavonoid content

During germination soybean flavonoid content increased from 1.19 to 2.11 mg QE / 100. Increased flavonoids may be caused by the formation of isoflavones. Isoflavones, which are compounds classified as flavonoids. It's function as antioxidants.

### Total Fenol

The germination process in soybeans is able to increase the total phenol which is from 35.99 to 39.45 mg GAE /100g. Increased of total phenol may be due to an increase in isoflavone compounds in soybean sprouts. Isoflavones include flavonoids. Flavonoid compounds are part of phenol compounds. Flavonoids are phenol compounds found in almost all plants.

### Antioxidant activity

The antioxidant activity of soybeans was 776.07 ppm, while the antioxidant activity of soybeans sprout was 932.86 ppm. Increased antioxidant activity in soybean sprouts, probably caused by increased compounds capable of antioxidants such as vitamin A and E. Soy contains antioxidant compounds such as vitamin E, A, provitamin A, vitamin C and isoflavones. This is supported by the results of this study, where flavonoid levels of soybean sprouts are higher than soybeans.

## Conclusion

1. Germination changes nutrient composition of soybean ie: moisture, ash, protein, fat, carbohydrates, flavonoids, total phenols content and antioxidant activity..
2. The germination process increases the moisture content, protein, flavonoids, total phenol and antioxidant activity, while reducing ash, fat and carbohydrate content.

## Thank You Note

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