13. Effect of drying method on the chemical properties of local soy flour

by Arinda Lironika

Submission date: 16-Mar-2023 11:12AM (UTC+0700)
Submission ID: 2038307385
File name: Suryana_2022_IOP_Conf._Ser.__Earth_Environ._Sci._980_012030.pdf (555.24K)
Word count: 2826
Character count: 14699

Effect of drying method on the chemical properties of local soy flour

Effect of drying method on the chemical properties of local soy flour

A L Suryana [1], N M Rosiana [1*] and Z Olivia [1]

[1] Clinical Nutrition Study Program, Health Department, Politeknik Negeri Jember, Jalan Mastrip Kotak Pos 164 Jember 68101, Indonesia

[*] email: nita.maria.r@polije.ac.id

Abstract. Soybean is a good source of protein because the nutrition value of soybean protein is equivalent to animal protein. Soy foods have been generally proven to prevent chronic disease, such as antiobesity, antihypertensive, immunity regulation, cholesterol-lowering, lipid-lowering, anticarcinogenic and antioxidant. Moreover, soy food also decreases the prevalence of stunting in toddlers. Soybean in the form of flour can make it easier to process into food, but soy has a bad smell that they don't like. This aroma can be reduced by heating treatment such as the drying method. So this study aimed to determine the effect of the drying method on the chemical content of soybean flour. Four methods to dry the soybean are sun drying, oven drying at 50o C, oven drying at 70o C hours, and oven drying at 100o C. After drying, the soybeans are roasted for 2 minutes with medium heat. The result shows the drying method affects the moisture, protein, fat, ash, and carbohydrate of soybean flour. Oven drying at 50oC for 3 hours is recommended to use as the best method to produce soy flour due to its nutritional value and has better aroma, sweet taste, light color, and good nutritional value.

1. Introduction

The soybean, soya bean or more famous with soybean, is a species of legume from East Asia. Traditional food uses of soybeans are soy milk, tofu, tempeh, soy sauce, natto, miso, oncom, etc. Soybean is a source of nutrition due to its amazing chemical properties. Between cereal and other legumes, soybean has the highest protein content. Raw dried soybean contains 40,4% protein, higher than dried mungbean (22,9%), kidney bean (22,1%), beef (18,8%), sesame seed (19,3%), and corn (9,8%) [1]. Soybean protein can be separated from other components and is called isolate soybean protein (ISP). Soybean protein is used as an alternative protein to increase the nutritional composition of various food such as beverage powders, cheeses, salad dressings, infant formulas, bars, pasta, meat analogs, bread, nondairy creamers, frozen desserts, and breakfast cereals [2]. In food, soybean proteins function as an emulsifying agent, foaming agent, gelling agent replacement of eggs, hydration, oil absorption, solubility, and film properties [3–7]. Soybean protein does not only affect the sensory properties of the product but also affects human health such as lower chronic diseases such as cardiovascular disease, obesity, type II diabetes, immune disorders, and cancers [8].

Other important components discovered in soybeans are polysaccharides, oligosaccharides, phospholipids, minerals, vitamins, and isoflavones. Soybean polysaccharides have antioxidant activity and are composed of mannose, galactose, arabinose, rhamnose, glucose, and galacturonic acid. Soybean polysaccharides also have considerable protective effects against CCl4-induced liver damage and prevent obesity and metabolic syndrome in mice [9,10]. The main active ingredient of phospholipids in

soybeans is 1,2-di-linoleoyl-phosphatidylcholine (DLPC). Soybean phospholipids influenced membrane-dependent cellular functions and showed antioxidant, antiinflammatory, anti-fibrotic, apoptosis-modulating, regenerative, membrane-repairing and -protective, cell-signaling and receptor-influencing, as well as lipid-regulating effects in intoxication models with chemicals or drugs [11]. The vitamin and mineral content in soybeans includes calcium, phosphor, iron, sodium, potassium, zink, thiamin, riboflavin, and niacin [1]. Soybean flour has 250,33 mg/100g phenol, 476,67 mg/100g flavonoids and antioxidant activity as IC_{50} is 18,60 [12].

Various nutrients can be obtained from soybeans that are processed into functional foods. Soy flour can be processed into snack bars containing up to 12, 55% fiber [13]. Soybeans are turned into flour to make it easier to use them as food ingredients such as nuggets, brownies, food bars, cookies [14–18]. In the process of making flour using a drying process which greatly affects the functional properties of the product. Comparably drying methods such as microwave, vacuum and freeze drying, sun drying and oven drying methods are the most preferenced food processing technology in developing societies. The drying process uses low energy so it is cheap and suitable for the agricultural environment with limited resources like in Indonesia. The food drying process purposes to dehydrate the fresh produce, so it can be stored at minimum moisture content which extends the shelf life of the products [19]. Soybean flour in the market generally has a beany flavor, so it needed a flour processing process that can reduce this aroma. So, the purpose of this study was to determine the effect of the drying process on the proximate content of soybean flour.

2. Materials and Methods

2.1. Materials

Local soybeans (*Glycine max*) are purchased from Jember local market with the characteristics of whole seeds, uniform size, yellowish color, not broken. Soybeans flour-making equipment includes an oven, blender, and 80 mesh sieve. 600g soybeans, wash thoroughly with water flow. Then drain. Furthermore, there are 4 treatments for drying, that are open sun drying, oven drying at 50°C, 70°C, 100°C. The ambient conditions for open sun drying were a dry season, without rain, and an average temperature of around 30-33°C. After drying, dry soybeans roasted at low heat for 2 minutes. Grind soybeans with a blender until they become fine flour and then sieve with an 80 mesh sieve. Soybean flour was stored in a dry and airtight place.

2.2. Analysis

The samples were analyzed for proximate analysis based on the AOAC standard [20]. Moisture determination used the oven drying method. Protein content analysis used the Kjeldahl method. Fat analysis used the soxhlet method. Ashing determination used dry method with muffle at 600°C. Carbohydrates by different. This analysis was done in duplicate. Organoleptic observations were carried out by 3 trained panelists with aroma and taste parameters using descriptive methods.

2.3. Statistics analysis

All experiments used a completely random design. The results were shown as mean values with standard deviations. Statistical analysis used ANOVA ($\alpha = 0,05$) and Duncan's post hoc test.

3. Result and Discussion

Drying process using sun drying and oven. The temperature of the oven for drying is 50°C, 70°C, and 100°C. In the traditional method, soybeans are directly exposed to the sun by spreading the beans on a mat. Oven drying is the easiest method to dry a product because of almost doesn't need particular equipment. This method is faster than sun drying. But oven drying has a limited capacity. Home electric oven usually has limited capacity, between 9-60 L. A home electric oven can be used as a drying method for small-scale proses or the home industry.

The drying process is very time-dependent. Sun-drying method for 12 hours, oven drying at 50°C for 3 hours, oven drying at 70°C for 2,5 hours, and oven drying at 100°C for 1 hour. When the drying temperature is increased, the drying time is shorter. The results of the proximate analysis of soybean flour can be seen in Table 1.

Table 1. Proximate characteristics of soybean flour

Parameter	Sun-drying	Oven drying		
		50°C	70°C	100°C
Moisture (%)	9,15 ± 0,08^{d}	8,87 ± 0,08^{c}	8,68 ± 0,03^{b}	8,52 ± 0,03^{a}
Protein content (%)	37,56 ± 0,05^{a}	37,76 ± 0,03^{b}	37,89 ± 0,09^{c}	38,09 ± 0,06^{d}
Fat content (%)	19,21 ± 0,04^{a}	19,37 ± 0,03^{b}	19,45 ±0,03^{c}	19,59 ± 0,05^{d}
Ash content (%)	3,76 ± 0,76^{a}	3,91 ± 0,03^{b}	3,97 ± 0,02^{bc}	4,05 ± 0,02^{c}
Carbohydrate (%)	30,32 ± 0,07^{c}	30,08 ± 0,49^{b}	30,00 ± 0,08^{b}	29,74 ± 0,15^{a}

The same lowercase notation in the same line showed no significant difference at the 95% (Duncan test, $p<0.05$)

Based on Table 1 the method of drying has a significant effect on the moisture, protein, fat, ash, and carbohydrate of soybean flour. The moisture content of the flour is between 8,52-9,15%. The sun-drying method has the highest moisture content and the oven drying at 100°C has the lowest moisture content. The moisture content of the dried product varies depending on the type of commodity and the drying method. The sun-drying method gives 9,5-12,5% moisture content for germinated brown rice flour and 10,00% for waxy maize starch has 10,00% moisture content with the same method [21,22]. Meanwhile, the oven drying method provides a moisture content of coconut flour between 3,42-5,70% at 70°C for 4-5 hours [23]. First, the drying process removes free moisture on the surface of the food product. Then it removes bound moisture in the inside or matrix of the food product until the lowest moisture is reached. It involves heat and mass transfer operations together [24].

Soybean flour had 37,56-38,09% of protein, 2,76% of ash and 29,74-30,32% of carbohydrate. Proximate content on the sun drying method was lower than oven drying. Drying methods, temperatures, and time had a significant effect on the nutritional components of products. Usually, protein and fat decreased as increased drying temperature whereas ash and carbohydrate increased as increased drying temperature [24]. Proteins and fats have been hydrolyzed by heat. But based on Table 1, protein and fat increased significantly with drying temperature. This showed that the drying temperature did not hydrolyze the protein and fat. Decreased water content caused an increase in protein and fat content in soybean flour.

Table 2. Organoleptic characteristics of soybean flour

Parameter	Organoleptic characteristics
Sun-drying	Beany flavors strong, not sweet taste, yellowish color
Oven drying at 50°C	Beany flavors not too strong, sweet taste and aroma, yellowish color
Oven drying at 60°C	Beany flavors not too strong, not sweet taste, sweet aroma yellowish color
Oven drying at 70°C	Beany flavors were little smell, the smell was gone, darker yellow color

Generally, soybean flour had beany flavors that decrease panelist preference when it was made into a product (Table 2). After drying, soybean roasted for a moment to decrease the beany flavors. The result showed that the soybean flour that was roasted after the drying process has low beany flavors and sweet flavors and sweet taste appears. Oven drying at 50° C for 3 hours was recommended to use as the

best method to produce soybean flour due to better its aroma, sweet taste, light color, and good nutritional value. This result was suitable with soymilk that the bean has been roasted before. Roasting soybeans improved sensory characteristics by decreasing the beany flavors, increasing sweet taste, and roasted flavor [25].

4. Conclusion

In developing societies, using the sun to dry soybeans is easy to use. However, there are obstacles such as inconsistent weather. Oven drying is an alternative even though its capacity is limited and more expensive. The research result shows that this method of drying has a significant effect on the moisture, protein, fat, ash, and carbohydrate of soybean flour. The roasted process after drying decreases beany flavor and increases sweet taste and light color.

5. Acknowledgment

Special thanks to DIPA Politeknik Negeri Jember for funding this research.

References

[1] Kementerian Kesehatan RI 2021 Data Komposisi Pangan Indonesia
[2] Thrane M, Paulsen P V., Orcutt M W and Krieger T M 2017 *Soy Protein: Impacts, Production, and Applications* (Elsevier Inc.)
[3] Nishinari K, Fang Y, Guo S and Phillips G O 2014 Soy proteins: A review on composition, aggregation and emulsification *Food Hydrocoll.* **39** 301–18
[4] Matsumiya K and Murray B S 2016 Soybean protein isolate gel particles as foaming and emulsifying agents *Food Hydrocoll.* **60** 206–15
[5] Sun D, Fan W, Xu Y and Wang L 2016 Functional Properties of Soy Protein Isolate and Its Application in Foods *Biotechnol. Med. Sci.* 630–6
[6] Lin M, Tay S H, Yang H, Yang B and Li H 2017 Replacement of eggs with soybean protein isolates and polysaccharides to prepare yellow cakes suitable for vegetarians *Food Chem.* **229** 663–73
[7] Zhang L, Chen F, Lai S, Wang H and Yang H 2018 Impact of soybean protein isolate-chitosan edible coating on the softening of apricot fruit during storage *Lwt* **96** 604–11
[8] Chatterjee C, Gleddie S and Xiao C W 2018 Soybean bioactive peptides and their functional properties *Nutrients* **10** 8–11
[9] Han L, Song H, Fu L, Li J, Yang L and Liu H 2021 Effect of extraction method on the chemical profiles and bioactivities of soybean hull polysaccharides *Food Sci. Nutr.* 1–11
[10] Lu Y, Zhao A, Wu Y, Zhao Y and Yang X 2019 Soybean soluble polysaccharides enhance bioavailability of genistein and its prevention against obesity and metabolic syndrome of mice with chronic high fat consumption *Food Funct.* **10** 4153–65
[11] Gundermann K J, Kuenker A, Kuntz E and Drożdzik M 2011 Activity of essential phospholipids (EPL) from soybean in liver diseases *Pharmacol. Reports* **63** 643–59
[12] Rosiana N M, Suryana A L and Olivia Z 2021 Polyphenol content and antioxidant activity of beverage from dragron fruit peel powder and soy powder *IOP Conf. Ser. Earth Environ. Sci.* **672**
[13] Cahyani W and Rosiana N M 2020 Kajian Pembuatan Snack BarTepung Gembili (Dioscorea Esculenta) Dan Tepung Kedelai (Glycine Max) Sebagai Makanan SelinganTinggi Serat *J. Kesehat.* **8** 1–9
[14] Simbolon M V T, Pato U and Restuhadi F 2016 Kajian Pembuatan Nugget dari Jantung Pisang dan Tepung Kedelai dengan Penambahan Ikan Gabus (Opiochepalus striatus) *J. Online Mhs. Fak. Pertan. Univ. Riau* **3** 1–15
[15] Eni W, Karimuna L and Isamu K T 2017 Pengaruh Formulasi Tepung Kedelai dan Tepung Tapioka Terhadap Karakteristik Organoleptik dan Nilai Gizi Nugget Ikan Kakap Putih (Lates carcarifer, Bloch) *J. Sains dan Teknol. Pangan* **2** 615–30

[16] Fibriafi R and Ismawati R 2018 Pengaruh Substitusi Tepung Kedelai, Tepung Bekatul Dan Tepung Rumput Laut (Gracilaria Sp) Terhadap Daya Terima, Zat Besi Dan Vitamin B12 Brownies *Media Gizi Indones.* **13** 12
[17] Jariyah, B.S E K and Pertiwi Y A 2017 Evaluation of Physicochemical Properties of Food bar from Composite Flour (Pedada, Taro and Soybeans) as an Emergency Food Alternative *J. Rekapangan* **11** 70-75.
[18] Jaya I K S 2016 Pengaruh Penambahan Tepung Kedelai Terhadap Cita Rasa Dan Kadar Air Cookies Ubi Jalar Ungu *J. Gizi Prima* **1** 37–9
[19] Mohammed S, Edna M and Siraj K 2020 The effect of traditional and improved solar drying methods on the sensory quality and nutritional composition of fruits: A case of mangoes and pineapples *Heliyon* **6** e04163
[20] AOAC 1995 *Official Method of Analysis of The Association Analitycal Chemist* (Whasington DC)
[21] Teixeira C S, Neves G A da R, Caliari M and Soares Júnior M S 2019 Waxy maize starch modified by sun-drying after spontaneous or backslopping fermentation *Int. J. Biol. Macromol.* **135** 553–9
[22] Cáceres P J, Peñas E, Martinez-Villaluenga C, Amigo L and Frias J 2017 Enhancement of biologically active compounds in germinated brown rice and the effect of sun-drying *J. Cereal Sci.* **73** 1–9
[23] Septiani S and Rousmaliana R 2019 Identifikasi Tepung Ampas Kelapa Terhadap Kadar Proksimat Menggunakan Metode Pengeringan Oven *J. Ilm. Kesehat.* **1** 18–31
[24] Babu A K, Kumaresan G, Raj V A A and Velraj R 2018 Review of leaf drying: Mechanism and influencing parameters, drying methods, nutrient preservation, and mathematical models *Renew. Sustain. Energy Rev.* **90** 536–56
[25] Navicha W, Hua Y, Masamba K G, Kong X and Zhang C 2018 Effect of soybean roasting on soymilk sensory properties *Br. Food J.* **120** 2832–42

Effect of drying method on the chemical properties of local soy flour

ORIGINALITY REPORT

15%	12%	14%	13%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Durban University of Technology Student Paper	6%
2	Submitted to Universitas Airlangga Student Paper	4%
3	www.scilit.net Internet Source	4%
4	Submitted to Universitas Indonesia Student Paper	2%

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		