

Tofu and Tempeh, the Mostly Sources of Phytoestrogens

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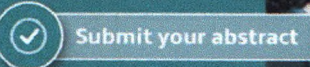
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Tofu and Tempeh, the Mostly Sources of Phytoestrogens in Minangkabau Premenopausal Women Ethnicity

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Abstract. Phytoestrogens are estrogen-like substances that come from outside the body, especially from plants. Phytoestrogens can bind to estrogen receptors, causing estrogen-like effects. Consumption of phytoestrogens in premenopausal women may help estrogen function due to decreased production. This study aims to determine the source of phytoestrogens consumed by Minangkabau ethnic premenopausal women. This study used a cross-sectional design conducted on 127 premenopausal women in Padang City, West Sumatra. Data on the intake of source food ingredients were taken through guided interviews using a semiquantitative-food frequent questionnaire (SQ_FFQ). According to the United States Department of Agriculture (USDA) guidelines, the amount of phytoestrogen intake is calculated manually. The study results show five groups of food ingredients containing phytoestrogens most consumed by premenopausal women of Minangkabau ethnicity. It were tofu (97.62 grams/day); fish (70.7 grams/day); oranges (35.36 grams/day); potatoes (34 grams/day), and tempeh (23.3 grams/day). Meanwhile, most food sources of phytoestrogens are tofu (containing 19.26 mg of phytoestrogens / day), tempeh (15.6 mg / day), pure soybean milk (0.04 mg / day) and fish (0.1 mg / day). It can be concluded that tofu and tempeh are food sources of phytoestrogens that are mostly consumed by premenopausal women of Minangkabau ethnicity in Padang City.

Keywords: Menopausal, phytoestrogen, Source, Tofu, Tempeh

1. Introduction

Premenopause is included in the terminology of the menopausal transition, which is characterized by changes in the menstrual cycle. There is a change in the menstrual cycle length for seven days or more in the early stages of premenopause [1]. In premenopause, there is a decrease in estrogen production by ovarian follicles. This condition causes various symptoms in premenopause, including vasomotor symptoms. Hot flushes occur in 22 - 74% of postmenopausal women. Flushes are triggered by a slight increase in body temperature leading to peripheral vasodilation, sweating of the face, neck, and sternal area. These symptoms are more severe in premenopause than in menopause [2]



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Estrogen is a steroid hormone that is synthesized from cholesterol. Estrogen is secreted by the ovaries, placenta, adipose tissue, testes, and adrenal glands. In menopausal women, estrogen biosynthesis in the ovaries decreases, which results in a decrease in the amount of estrogen in the circulation [3].

Phytoestrogens are estrogen-like compounds derived from plants, which are structurally similar in shape to 17 β -estradiol [4,5]. The largest sources of phytoestrogens are isoflavones found in soybeans and their processed products. Phytoestrogen levels in pure soybeans are higher than those that have been processed due to differences in bioavailability. Asian people consume more soybeans than Europeans and Americans [6,7,8]. There is no definite data about the source of phytoestrogens consumed by Minangkabau ethnic, especially premenopausal women. This study aims to determine the source of phytoestrogens consumed by Minangkabau ethnic premenopausal women.

2. Materials and Methods

This study used a cross-sectional design. The study was conducted in the city of Padang, West Sumatra, Indonesia, in 2018. A total of 127 respondents consisting of premenopausal women of the Minangkabau ethnicity participated in the research. The Minangkabau ethnic group is a tribe originating from West Sumatra. In this study, the Minangkabau ethnic boundaries were if the two lineages above were original Minangkabau people. There was no marriage with another ethnicity.

Data on the intake of source food ingredients were taken through guided interviews using a semiquantitative-food frequent questionnaire (SQ_FFQ). Interviews were conducted by trained enumerators. According to the United States Department of Agriculture (USDA) guidelines, the total phytoestrogen content was calculated manually.

The data was presented in tabular form and analyzed the most food sources of phytoestrogens consumed by respondents. This research has received approval from the ethical committee of the medical faculty of Andalas University with registration number 279 / KEP / FK / 2017.

3. Result and Discussion

We interviewed and calculated of the amount of phytoestrogen content in source food ingredients from FFQ data. Then, we obtained the order of phytoestrogen source food ingredients, as shown in the table below.

Table 1. Phytoestrogen source food ingredients consumed by Minangkabau ethnic premenopausal women

No	Sources Food Ingredients	Total Intake of Sources Food Ingredients (grams/day)	Amount of Phytoestrogens Intake (mg/d)
1	Tofu	97.614	19,26
2	Tempeh	24.389	15,56
3	Pure Soy Milk	5,617	0,441
4	Potato	34,608	0,325
5	Meats	14,563	0,277
6	Fish	70,770	0,190
7	Chicken	26,556	0,146
8	Tea	109.421	0,050
9	Peanuts	1,155	0,042
10	Green beans	4,610	0,020
11	Orange	35,359	0,007
12	Cheese	0,029	0,002
13	Shrimp	1,018	0,001

In the table 1, we can see that premenopausal women of Minangkabau ethnicity most consume five groups of food ingredients containing phytoestrogens. Its were tofu, tempeh, pure soy milk, potatoes, and meats. Meanwhile, most food sources of phytoestrogens are tofu (containing 19.26 mg of phytoestrogens / day), tempeh (15.6 mg / day), pure soybean milk (0.4 mg / day) and potato (0.3 mg / day).

From this table, we can also see that the consumption of tofu is much greater than tempeh (with a ratio of about 4 to 1), but its phytoestrogen content is only slightly higher. This shows that actually, the phytoestrogens content is much higher in tempeh (0.63 mg/grams tempeh) than tofu (0.19 mg/grams tofu). Tofu may be preferred because of its softer texture. Besides that, the processing of beans into tofu also affects the phytoestrogen content.

Previous studies found an average consumption of isoflavones of around 118.9 ± 98.6 mg per week or about 17.1 mg/day [9]. Sources of phytoestrogens are tofu, tempeh, soybeans, and tolo beans. This study used a case-control design for 180 Minangkabau and 180 Javanese menopausal women by grouping the amount of phytoestrogen intake before menopause according to the age of menopause. From these results, it can be seen that, in general, the consumption of isoflavone sources is higher in Javanese than in Minang tribes. This is because in the Javanese tribe, consuming tofu and tempeh has been a culture for a long time. Almost all age groups can consume tofu and tempeh, both as a side dish and snack.

Different results of phytoestrogens intake caused by the difference in data collection years, so there has been an increase in the consumption of food sources of isoflavones, especially tofu and tempeh, throughout Indonesia, including in West Sumatra. It is estimated that consumption will increase by around 2.1% per year in 2015 [10], and 7.97% per year in 2018. According to data from the Central Statistics Agency (BPS), the consumption of soybeans, tofu, and tempeh in Indonesia is 0.27 kg/capita/week in 2015, increasing to 0.5 kg/capita/week in 2017. The use of soybeans as a food ingredient in Indonesia around 83.7%, mainly in the form of tempeh and tofu with a consumption level of 14.13 kg/capita/year, 14.7% for soy sauce and tauco, and the rest for soy milk, sprouts, and others [11].

The intake of phytoestrogens in this study is lower than the consumption of phytoestrogens in Japanese society, reaching 200 mg/day [12]. This difference is caused by differences in phytoestrogens' content in food sources of phytoestrogens consumed by the community, namely soybeans. Indonesian soybeans contain 30.37-221.97 mg/100-gram isoflavones, almost the same as the isoflavones in soybeans from the United States and Croatia. However, the isoflavone content is lower than several soybean genotypes from China, Japan, and Brazil, which contain more than 447.5 mg / 100 g of seeds. The difference in isoflavone content mentioned above is caused by differences in varieties/genotypes, including nutrients in each environment for growth, cultivation, and post-harvest handling [13].

The processing of food ingredients containing phytoestrogens also affects the phytoestrogen content in it. In this case, steamed food ingredients lose fewer isoflavones compared to boiling or fried. For example, boiled tempeh will lose 13.3% isoflavones. This amount is smaller if the tempeh is boiled (loss of 18.2%) or fried (loss of isoflavones 39.15%). The bioavailability and pharmacokinetics of isoflavones are influenced by the texture of the source food material or the form of food consumed. Liquid food is absorbed more quickly and has a higher concentration in plasma than solid food. In the form of aglycones, isoflavones are absorbed faster than in the conjugated form of glucosides [14].

Isoflavones found in soybeans are in the form of a complex mixture of glucoside conjugates. Then it is hydrolyzed in the digestive tract by the intestinal mucosa with the help of β -glucosidase bacteria to become aglycon, genistein, and daidzein. Aglycon can be absorbed directly or metabolized by the microflora in the large intestine into an active metabolite in the form of equol and an inactive metabolite O-desmethylanagolensin (ODMA). Lignans are converted to secoisolaricisnol-diglucoside (SDG), and coumestans are converted to coumestrol. These phytoestrogens' effect is influenced by the rate of absorption and metabolism in the body [2].

Phytoestrogens have many health benefits. Phytoestrogens play a role in reproductive health, cardiovascular, skin health, bones, and others [15]. Phytoestrogens can also suppress clinical symptoms of menopause caused by decreased production of endogenous estrogens, such as hot flashes, vasomotor symptoms, vaginal atrophy. The administration of 100 mg isoflavones per day in postmenopausal women can reduce vasomotor symptoms. The advantage of this phytoestrogen is that it does not harm the breast and endometrium. Phytoestrogens also do not increase clotting risk in postmenopausal women. This makes phytoestrogens a safe alternative supplement to hormone replacement therapy [2, 4, 16, 17].

4. Conclusions

Tofu and tempeh are food sources of phytoestrogens that are mostly consumed by premenopausal women of Minangkabau ethnicity in Padang City

5. Conflicts of Interest

There is no conflict of interest in this study.

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