DOI: http://dx.doi.org/10.21088/ijpn.2347.7083.5317.1

ORIGINAL ARTICLE

The Effect of Soy Flour Consumption on Gonadotropins in Postmenopausal Women

Deviga Thirunavukkarasu*, Menda Balachandrarao Naidu**

*Tutor, All India Institute of Medical Sciences, (AIIMS), Basni Industrial Area, Phase-2, Jodhpur, Rajesthan 342005, India. **Associate Professor, Department of Biochemistry, Greater Eastern Medical School and Hospital, Ragoul, Srikakulam District, Andhra Pradesh 532001, India.

Abstract

Soy is being considered as possible alternatives to hormone replacement therapy in postmenopausal period. This study was undertaken to evaluate the effect of two different quantity of soy flour on gonadotropins in post-menopausal women. The study was done in 75 postmenopausal women. These women were randomly divided into 3 groups (n=25). The study group I was given soy flour 25gm/day and the study group II was given soy flour 45g/day and the control group was given wheat flour 52 gm/day. Fasting blood samples were analyzed for serum Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH) at the beginning of therapy, 4 and 12 weeks after initiation of therapy. The hormone changes were analyzed statistically by using one-way repeated measure ANOVA and one-way ANOVA. The result showed that in control group the FSH and LH hormones level significant increased ($p<0.001$) over time. Whereas, in soy groups, serum LH and FSH levels were significantly decreased ($p<0.001$) over time. It indicated that daily intakes of soy flour either 25g or 45g may decrease the LH and FSH hormones. More so, those in 45g soy flour intake. In addition, the result observed that no correlation between the luteinizing hormone and follicular stimulating hormone in control group as well in soy groups.

Keywords: Luteinizing Hormone (LH); Follicle-Stimulating Hormone (FSH); Gonadotropins.

Introduction

Menopause is the phase in a woman's life when the menstruation ends. It is a universal and unalterable part of the whole aging process as it involves in woman's reproductive system. Most often, it is natural, the body change that mostly occurs between ages 45 to 55 yrs. Menopause is diagnosed after 12 months of amenorrhea and is characterized by a numerous of symptoms. The clinical symptoms usually begin with the changes in menses, followed by vasomotor and uro-genital symptoms such as vaginal dryness, paresthesia, night sweating and dyspareunia. These symptoms occur over a period leading up to menopause and following menopause (Butler L, et al. 2011, Santoro N, et al. 2011).

Generally, the ovaries are the source of estrogen and progesterone, the two important hormones that control the reproductive system, including the menstrual cycle and fertility in women (Wendy N Jefferson, 2010). During menopause, the number of ovarian follicles declines and the ovaries become less responsive to the two other hormones involved in reproduction—Luteinizing Hormone and Follicle-Stimulating Hormone. As the ovaries age and release fewer hormones, FSH and LH can no longer perform their usual functions to regulate the estrogen, progesterone, and testosterone. These inevitable changes in the hormones and natural decline of

Reprint Request: Deviga Thirunavukkarasu, Tutor, All India Institute of Medical Sciences, (AIIMS), Basni Industrial Area, Phase-2, Jodhpur, Rajesthan 342005, India.
E-mail: deviga.thirush@gmail.com

RECEIVED ON 12.07.2017, **ACCEPTED ON** 17.08.2017

estrogen levels during menopause can significantly affect the women's health (Butler L, et al. 2011) Estrogen depletion, often leads to physical and psychological symptoms (Loingcope C, et al. 1996) and women are put at an increased risk for cardiovascular issues, strokes, low bone mineral density, osteopenia and osteoporosis. (Kannel WB, et al.1976). Besides, gonadotropin secretion increases dramatically following menopause; in this follicle-stimulating hormone levels are higher than luteinizing hormone levels. The FSH rise precedes the LH rise, and FSH is the diagnostic marker for menopause (Santoro N, et al. 2011).

Recently, soy is placing a significant role in the part of menopausal management. Soy is high in isoflavones (phytoestrogen) and the Phytoestrogens are chemicals found in plants that work like estrogens in the human body. A recent study on phytoestrogens (soy, berries, wine, grains, and nuts) has shown they may help menopausal symptoms for women early in menopause (Chen G, et al. 2007). Similarly, the intake of soy protein in excess (>100 mg soy isoflavones/d) can lead to lowered ovarian function as determined by lower circulating levels of hormones, with the most common finding being lowered gonadotropin levels (Wendy N. Jefferson, 2010). The present study was undertaken to determine the effect of soy flour intake in decreasing the LH, FSH level in postmenopausal women.

Material and Methods

Participants

Women aged 40-60 years, either surgically or naturally attained menopause were included. Besides, the individual who was having a history of medical illnesses like heart disease, kidney or liver diseases, diabetes, thyroid disease, gastrointestinal disease and malignant disease were excluded. In addition, women who were taking lipid-lowering drugs or corticosteroids also excluded from the study.

Study Methods

A true experimental research design of 3 groups with one pre-test and two post-tests research designs and simple random technique was used to select the samples for this study. Control group (n=25) received wheat flour 52g/day daily, Study group I (n=25) received soy flour 25 g/day daily and study group II (n=25) received soy flour 45 g/day daily. All subjects received flour in the form of dosa for 12 weeks. The soy dosa prepared with soy flour, water, the little salt, coriander leaves and chilies. In 25g soy flour, dosa contains the proportions of genistein, diazedein, and glycetine are 41.2 mg, 5.34 mg, 6.45 and in soy flour 45g, dosa contains genistein, diazedein, and glycetine are 69.4 mg, 8.05 mg, and 9.54 mg respectively. Subjects asked to maintain a balanced diet throughout the study period. The participants instructed not to change their habitual physical activity level during the study period.

In the present study, a structured interview schedule was used to assess the demographic variables of the samples. The subjects were undergone for routine clinical examination including breast examination. Serum LH and FSH were measured by ELISA using commercial kits. The hormone test was carried out at the beginning (0 week), mid (6th week) and end of the study (12th week) of supplementation.

Statistical Analysis

The data were analyzed and graphs plotted by using the Sigma Plot (Systat, USA). Data were presented in the form of mean and S.E. Within the group and between the groups' effects on blood pressure were measured by using paired t-test and one-way ANOVA respectively. Similarly, within the group and between the groups' effects on glycemic parameters were measured by using one-way repeated measure ANOVA and one-way ANOVA respectively. The Student Neuman Keul test was also used for multiple comparisons between the groups. The significance level was considered equal when the p-value is < 0.05.

Results

Figure 1 shows the bar chart of the effect of soy flour intake on luteinizing hormone in postmenopausal women. The bar chart shows, mean, standard error. The mean and S.E value of control group pre-test, post-test1, and post-test2 were 38.32±0.75, 39.12±0.80, 40.24±0.85 respectively. The data were analyzed by one-way repeated measure analysis of variance. It was statistically significant ($P<0.001$). The Student Neuman Keul multiple comparisons showed that significant differences between the pre-test, post-test1, and post-test2. It infers that hormonal levels increased over time in the control group. The mean and S.E value of 25g soy group pre-test, post-test1, and post-test2 were 38.68±1.10, 37.72±1.16, 36.32±1.05 respectively. It was found to be significant ($P<0.001$). The multiple comparisons showed that pre-test, post-test1 and post-test 2 was significantly differing from each

other. The mean and S.E value of 45g soy group pre-test, post-test1, and post-test2 were 38.12±1.033, 36.84±0.867, 35.96±0.65 respectively. It was statistically significant (P<0.001). The multiple comparisons showed that pre-test, post-test1, and post-test2 were significantly differing from each other. It infers that 25g, as well as 45 g soy group, significantly decreased the hormonal levels over time.

The pre-test, post-test1, post-test 2 of control, 25g soy group and 45g soy group were analyzed by one-way analysis of variance. The pre-test of control, 25g, and 45g of soy flour group were not statistically significant (P=0.919). The post-test1 of control, 25g, and 45g of soy flour group were also not statistically significant (P=0.242). The post-test2 of control, 25g, and 45g soy flour group were statistically significant (P<0.001). Follow up, comparison indicated that 45g soy flour significant when compared with control group. It infers that at 12 weeks of 45g soy flour intake was effectively decreased the luteinizing hormone.

Figure 2 shows the bar chart of the effect of soy flour intake on the follicular stimulating hormone in post-menopausal women. The bar chart shows, mean, standard error. The mean and S.E value of control group pre-test, post-test1, and post-test2 were 50.56±0.96, 51.68±0.98, 53.16±1.15 respectively. It was statistically significant (P<0.001). The Student

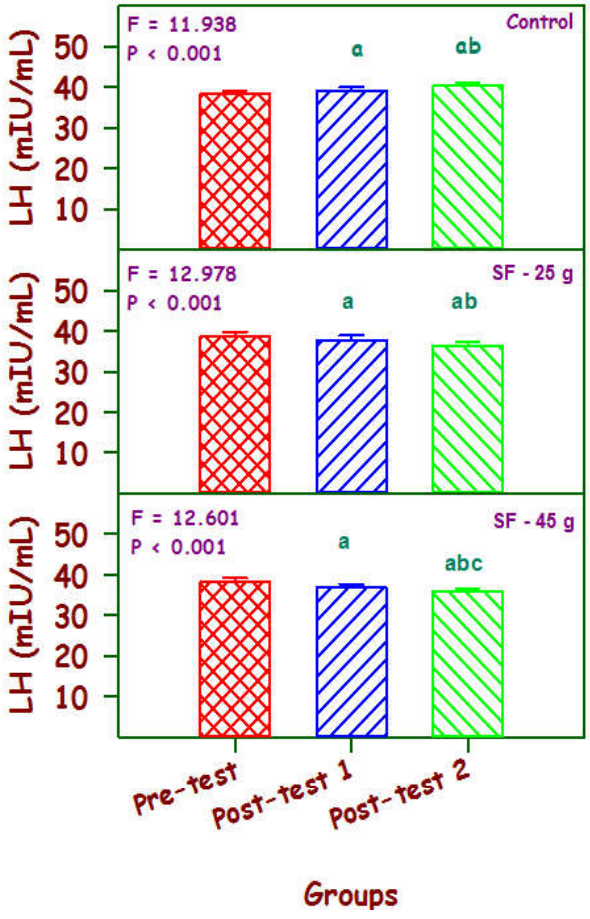

Fig. 1: Effect of soya flour (SF), 25g and 4 g compared with control on luteinising hormone (LH) level in post-menopausal women. Post-test 1 is 6 weeks and post-test 2 is 12 weeks. Values are mean ± SE (n = 25 each). The F and P values are by one way repeated measures ANOVA of the control, SF-25g and SF-45g. a = Statistically significant from pre-test to the post-tests. b = Statistically significant from post-test 1 to post-test 2.The F and P values by one-way ANOVA for Pre-test groups are 0.085, 0.919 respectively, post-test 1 are 1.448, 0.242 respectively, and post-test 2 are 7.554, < 0.001 respectively. c = Statistically significant from the respective control and d = Statistically significant from SF-25g to SF-45g.

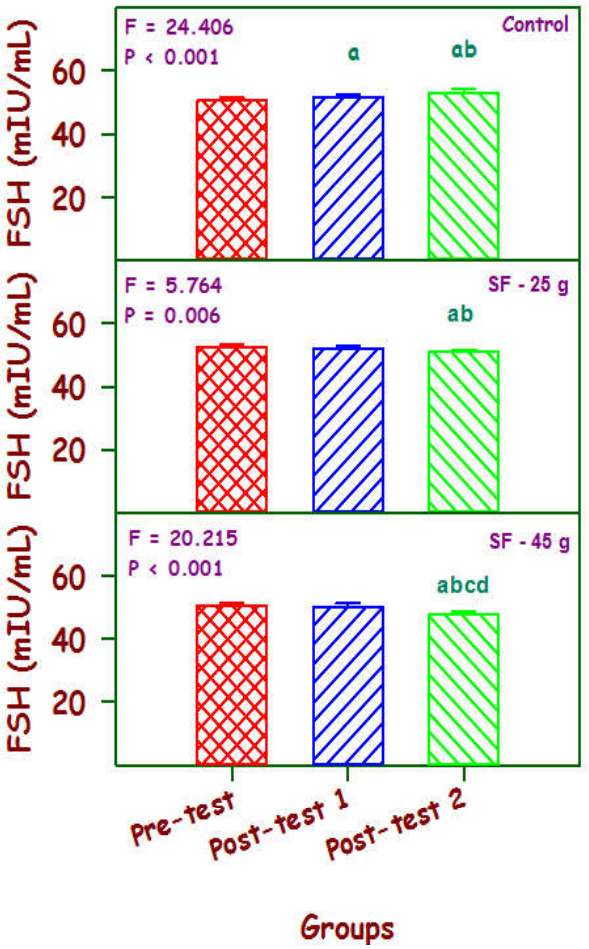

Fig. 2: Effect of soya flour (SF), 25g and 45g compared with control on follicular stimulating hormone (FSH) level in post-menopausal women. Post-test 1 is 6 weeks and post-test 2 is 12 weeks. Values are mean + SE (n = 25 each). The F and P values are by one way repeated measures ANOVA of the control, SF-25g and SF-45g. a = Statistically significant from pre-test to the post-tests. b = Statistically significant from post-test 1 to post-test 2.The F and P values by one-way ANOVA for Pre-test groups are 2.028, 0.139 respectively, post-test 1 are 1.144, 0.324 respectively, and post-test 2 are 7.947, < 0.001 respectively. c = Statistically significant from the respective control and d = Statistically significant from SF-25g to SF-45g.

Neuman Keul multiple comparisons showed that significant differences between the pre-test, post-test 1, and post-test 2. But, it infers that there was the significant rise in FSH over time. The mean and S.E value of 25g soy group pre-test, post-test 1, post- test 2 were 52.68±0.66, 52.24±0.84, 50.88±0.81 respectively. It was statistically significant (P=0.006). The multiple comparisons showed that the post-test 2 significantly differ from pre-test and post-test 1. The mean and S.E value of 45g soy group pre-test, post-test 1, and post-test 2 were 50.72±0.84, 50.24±1.06, 47.76±0.89 respectively.

It was also statistically significant (P<0.001). The multiple comparisons showed that post- test 2 significantly differ from pre-test and post-test 1. It infers that 25g, as well as 45g soy flour intake for 12 weeks, was effectively decreased the follicular stimulating hormone.

The pre-test, post-test 1, post-test 2 of control, 25g soy group and 45g soy group were analyzed by one-way analysis of variance. The pre-test of control, 25g, and 45g of soy flour group were not significant (P=0.139). The post-test1 of control, 25g, and 45g of soy flour group were also not significant (P=0.324). The post-test 2 of control, 25g, and 45g soy flour group were statistically significant (P<0.001). Follow up; the comparison indicated that 45g soy group significant when compared with the control group as well as 25g soy group. It infers that 45g soy flour intake decreased the follicular stimulating hormone.

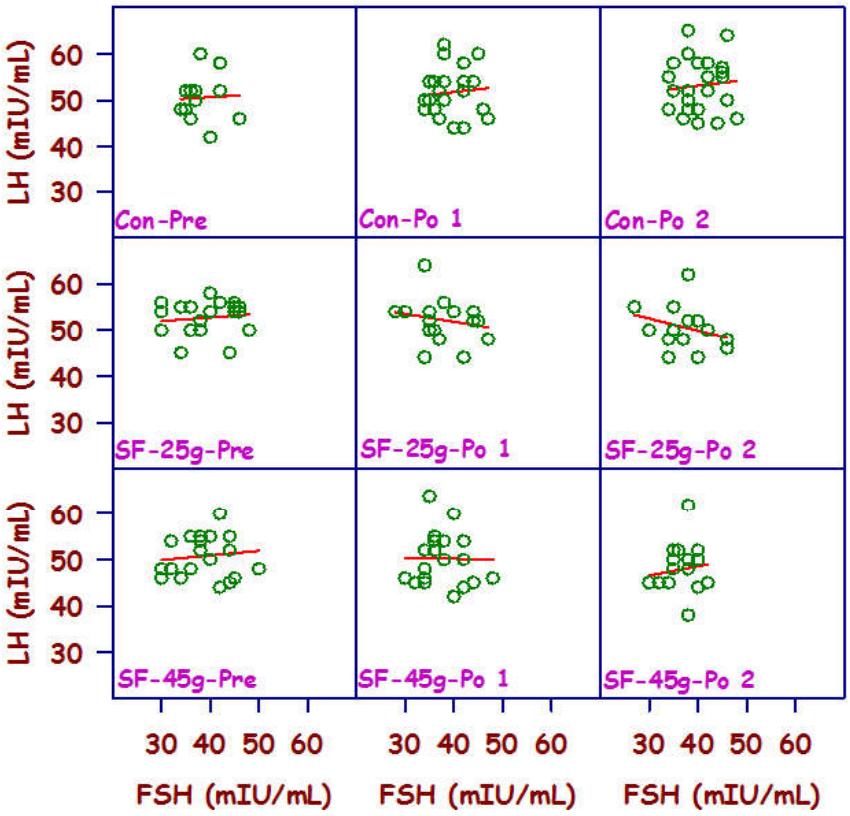

Fig. 3: Correlation of luteinising hormone (LH) level and follicular stimulating hormone (FSH) level in post-menopausal women in control (Con) and soya flour (SF) 25 g and 45 g.
Pre = pre-test, Po 1 = post-test 1 (6 weeks) and Po 2 = post-test 2 (12 weeks).
n = 25. The correlation coefficient (r value) and P value are given in Table 1.

Table 1: Correlation of luteinising hormone level and follicular stimulating hormone level in post-menopausal women in control, and soya flour 25g and 45g. n = 25.

S. No.	Group	Pre-test	Post-test 1	Post-test 2
1	Control	r = 0.049	r = 0.095	r = 0.094
		P = 0.815	P = 0.650	P = 0.654
2	Soya flour 25 g	r = 0.132	r = - 0.238	r = - 0.342
		P = 0.529	P = 0.253	P = 0.094
3	Soya flour 45 g	r = 0.123	r = - 0.016	r = 0.144
		P = 0.558	P = 0.938	P = 0.491

The control, 25g and 45g soy group statistical inferences are given in Table 1. Figure 3 shows the scatter diagram of the correlation between the luteinizing hormone and follicular stimulating hormone in post-menopausal women. It indicates that there is no correlation exists between the luteinizing hormone and follicular stimulating hormone in control group as well in soy groups.

Discussion

The present study was observed that in control group the FSH and LH hormones level significantly increased over time. Whereas, in soy groups, the levels of serum LH and FSH were significantly decreased over time. It infers that daily intakes of soy flour either 25g or 45g may decrease the LH and FSH hormones. More so, those in 45g soy flour intake.

There have been several recent symposiums and studies that examined the effect of intake of soy-rich foods on circulating levels of hormones in adult women. A symposium on soy and prevention of disease reviewed seven studies with intakes of 32–200 mg of isoflavones/day (Kurzer MS, 2002). The summary from this symposium showed a decrease in mid-cycle gonadotropins, trends for increased cycle length, and lower estradiol, progesterone, and serum hormone binding globulin following soy intake. This is similar to the present study result.

A large review of 47 studies (11 pre-, 35 post-, and 1 peri-menopausal women) showed in pre-menopausal women, meta-analysis suggested that soy or isoflavone consumption did not affect primary outcomes estradiol, estrone or SHBG concentrations, but significantly reduced secondary outcomes FSH and LH [by approximately 20% using standardized mean difference, P=0.01 and 0.05, respectively (Hopper L, et al. 2009). In another study conducted in premenopausal women showed decreases in LH and FSH following 64 or 128 mg/d isoflavones over 3 menstrual cycles (Duncan A M, et al. 1999). The present study result also revealed the effect of soy in decreasing the gonadotropins.

Baird DD, et al. (1995) showed no effect on FSH, LH, estradiol or SHBG in 191 post-menopausal women exposed to a dietary intervention of soy foods that total 165 mg of total isoflavones/day for 4 weeks (17). Maskarinec G, et al. (2004) showed that 2 servings/d of soy (50 mg isoflavones) caused no difference in serum hormone levels. In the present study, the result was controversial to the above study findings. However, exposure to much higher levels of soy may lead to reductions in hormone levels, particularly the gonadotropins, LH and FSH (Wendy N. Jefferson, 2010). In the present study results stated that daily intake of 25g or 45g soy flour for 12 weeks significantly decreased the luteinizing hormone and follicular stimulating hormone in post-menopausal women.

References

1. Butler L, Santoro N. The reproductive endocrinology of the menopausal transition. Steroids. 2011;76(7): 627-35.
2. Santoro N, Randolph JF. Reproductive hormones and the menopause transition. Obstet Gynecol Clin North Am. 2011;38(3):455-66.
3. Wendy N. Jefferson. Adult Ovarian Function Can Be Affected by High Levels of Soy. J Nutr. 2010; 140(12): 2322S–2325S.
4. Butler L, Santoro N. The reproductive endocrinology of the menopausal transition. Steroids. 2011;76(7):627-35.
5. Longcope C, Crawford S, Mc Kinlay S. Endogenous estrogens: relationship between estrone, estradiol, non-protein bound estradiol and hot flashes and lipids. Menopause. 1996;3:77-84.
6. Kannel WB, Hjortland MC, Mc Namara PM, Gordon T. Menopause and risk of cardiovascular disease: The Framingham study. Ann Intern Med. 1976;85(4):447-52.
7. Cheng G, Wilczek B, Warner M, Gustafsson JA, Landgren BM. Isoflavone treatment for acute menopausal symptoms. Menopause. 2007;14(3):468-73.
8. Kurzer MS. Hormonal effects of soy in premenopausal women and men. J Nutr. 2002;132(3): 570S-573S.
9. Hooper L, Ryder JJ, Kurzer MS, Lampe JW, Messina MJ, Phipps WR, Cassidy A. Effects of soy protein and isoflavones on circulating hormone concentrations in pre- and post-menopausal women: a systematic review and meta-analysis. Hum Reprod Update. 2009;15(4):423-40.
10. Duncan AM, Merz BE, Xu X, Nagel TC, Phipps WR, Kurzer MS. Soy isoflavones exert modest hormonal effects in premenopausal women. J Clin Endocrinol Metab. 1999;84(1):192-7.
11. Baird DD, Umbach DM, Lansdell L, Hughes CL, Setchell KD, Weinberg CR, Haney AF, Wilcox AJ, Mclachlan JA. Dietary intervention study to assess estrogenicity of dietary soy among postmenopausal women. J Clin Endocrinol Metab. 1995;80(5):1685-90.
12. Maskarinec G, Takata Y, Franke AA, Williams AE, Murphy SP. A 2-year soy intervention in premenopausal women does not change mammographic densities. J Nutr. 2004;134(11):3089-94.