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The Effectiveness of Tibetan Yoga toward Estrogen Hormone Levels: A Community-Based Randomized Controlled Trial

Natsupa Archong[1], Samlee Plianbangchang, M.D.,Dr.P.H.[2]*
[1]Ph.D. Student in Public Health, College of Public Health Sciences, Chulalongkorn University, Thailand
[2]Distinguished Scholar, College of Public Health Sciences, Chulalongkorn University, Thailand
*Corresponding author: Samlee Plianbangchang, M.D., Dr.P.H. Email address: samleep40 @ gmail.com

***Abstract*—** *The purposes of this study are threefold 1) to assess changes in estrogen level of the intervention group and the control group before and after the intervention program. 2) to compare the estrogen level of the participants in the intervention group and control group after the intervention 3) to examine the retention of estrogen level of the intervention group after the intervention was over. The Tibetan yoga practice was used as an intervention program. A community-based randomized controlled trial, two group pre–test post-test design was organized with Thai perimenopausal women living in Moo 9, Lahan community in Bangbuatong District of Nonthaburi Province. The independent t-test and repeated measure ANOVA were employed in data analysis. The result revealed that the mean value of serum estradiol of the participants in both groups after attending the experiment was higher than before. The estrogen's mean values of the intervention group were found significantly higher than the control group after the intervention in week 12. The level of estrogen in the intervention group still retain after four weeks of the intervention (week 16) with a significantly higher mean value of the estrogen level compared to the control group.*

Keywords— *Tibetan yoga, estrogen, estradiol, perimenopause, menopause*.

I. INTRODUCTION

Estrogen is known as a type of sex hormones which plays the significant roles in female reproductive and non-reproductive systems. The functions of which encompassed a role to enable the transformation of a girl to a woman. [1] Estrogen also plays an important part in controlling the menstrual cycle and childbearing. [2] Moreover, its functions affect the brain (including mood), bones, heart, skin, and other tissues. [3] Therefore, it can be said that estrogen has had the roles in almost all cells in the body.

The estrogen hormone is naturally produced by fat cells and the adrenal gland at the beginning of puberty.[4] However, estrogen will decrease when the women get older. In perimenopause and menopause women, an insufficient level of estrogen has resulted in many menopausal symptoms such as hot flashes, excessive sweating, a terrible cold, fainting, or dizziness. [5] Due to these undesirable symptoms, many women have looked for treatments that can lessen or cure unwanted manifests.[6]

So far, yoga has been used as a treatment to promote better health.[7] Since many researchers revealed that yoga helps lessen or cure various disease symptoms such as asthma, high blood pressure, hypertension, and obesity.[8] Besides, It is found that yoga practice can help control hormones in menopausal women.[9, 10]

A considerable number of researches have revealed the effect of yoga practice on estrogen hormone. For instance, a study conducted by [9] Chattha & Raghuram (2008) indicated that yoga helped to promote hormone and endocrine systems in menopausal women. Afonso, Kozasa, Dinah, Leite, Tufik, and Hachul (2016) [11] conducted a case study to examine if Yoga increased serum estrogen levels in postmenopausal women. The result revealed that after four months of Yoga practice the participants exhibited a significant increase in estrogen level.

Nayak, Kamath, Kumar & Rao (2014) [12] aimed to study the effect of yoga on female sex hormone level in perimenopausal women. This experimental study indicated that both serum estrogen and progesterone levels were found to increase in the yoga group after yogic intervention. From the mentioned studies it can be said that yoga practice can help increase the estrogen level in perimenopause and menopause women.

Tibetan yoga is a type of yoga practice based upon the Buddhist religion. [13] Alike other yoga practices, it encourages the union of body, mind, and spirit. This yoga practice comprises 5 simples poses called the "5 Rites" which can be performed easily.[14]

Tibetan yoga has been reported by practitioners, medical professionals, and yoga instructors that it helped the practitioners to relieve joint pain and stiffness, improving their strength and coordination, improving blood circulation, reduced anxiety, having better sleep, and enhance a youthful appearance. [15]

Despite its benefits, the researchers that studied the effect of Tibetan yoga on the estrogen level in perimenopause women is scared. Therefore, this study was conducted to 1) assess changes in estrogen hormone of the intervention group and the control group before and after the intervention program. 2) compare the estrogen level of the participants in the intervention group and control group after the intervention. 3) examine the retention of estrogen hormone of the intervention group after the intervention was over.

II. REVIEW OF LITERATURES

This study was conducted based upon the review of literatures as follows:

Natsupa Archong and Samlee Plianbangchang, "The Effectiveness of Tibetan Yoga toward Estrogen Hormone Levels: A Community-Based Randomized Controlled Trial," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 3, Issue 11, pp. 16-23, 2021.

A. Estrogen hormone and its physical and psychological effect on female

Estrogen is known as one of the female sex hormones which play the vital roles in both reproductive and non-reproductive systems. Estrogen hormone is responsible for female physical features and reproduction in a way that enables the transformation of a girl to a woman.[16] This stage of life is called puberty. [17]This transformation includes the growth of the breasts, pubic and underarm hair, and the start of menstrual cycles.[18] Estrogen hormone is also important for childbearing.[19] Besides, it has an effect on the brain (including mood), bones, heart, skin, and other tissues. [20] Therefore, it can be said that estrogen has a place in almost all cells in the body. Its effect can be observed from the tissues of the woman whose estrogen hormone decreased due to menopause.

Estrogen is produced by the cells of the ovaries in the female body. This hormone is divided produced estrogen into 3 sub-hormones: [21]

1. Estradiol (E2) is a hormone in women. Most are created from ovarian cells.
2. Estrone (E1) is a hormone made up of substances contained in progesterone. Estrones play a prominent role after menopause. This means when estradiol is no longer formed from ovarian cells.
3. Estriol (E3) is a hormone that is created when the placenta is stimulated due to pregnancy. Therefore, estriol may be used as an indicator of the condition of the fetus.

In this study, the blood samples of the participants (perimenopause woman) were tested to measure estradiol levels. This sub-estrogen hormone can be found in women who haven't reach the stage of menopause yet.[22] While estrone can be found in the woman after menopause and estriol can be detected in pregnant women only. [23]

B. Perimenopause

Perimenopause, or the menopausal transition, refers to the period when the physiological and psychological changes occur to indicate progress toward a woman's final menstrual period (FMP) [24]

The perimenopause period begins with the emergence of menstrual irregularities and continues until a woman reaches menopause. The early stage of perimenopause begins with skipped menstrual cycles from time to time.[25] The second stage is identified by more frequent menstrual irregularity. The absence of menstruation cycles may last over 60 days and up to 12 months.[26] Twelve or more months of amenorrhea indicates the final menstruation period in a woman [27]

When entering menopause, the body and mood will change due to the lack of estrogen. Some premenopausal women may not have symptoms. Or have few symptoms while some people have severe symptoms or some people may lead to estrogen deficiency for many years, which affects the quality of life. [28]

Many women who experienced perimenopause and menopause period felt discomfort and tried to find some treats to lessen or cure that symptom. One of those treatments is Yoga. [29] Generally, yoga practice contends the posture (asana), breath control (pranayama), and meditation (dhyana). [30] Regularly practicing yoga is shown to have some degree of improvement on the menopause symptoms such as hot flashes and sweating during night time [30]

C. Yoga and the Estrogen hormone level.

Yoga has been known as a treatment to promote better health. Many pieces of research revealed that yoga can help lessen or cure various disease symptoms such as asthma, high blood pressure (hypertension), and obesity. Moreover, It is found that yoga practice can help control hormones in menopausal women. [11]

According to Chattha, Raghuram, Venkatram, & Hongasandra (2008) [9] yoga helped to promote hormone and endocrine systems in menopausal women, enabling the working mechanism of the endocrine system to be normal and reproductive organ became healthier. Moreover, a considerable number of studies have encouraged menopausal women to exercise with yoga since yoga practice can help lessen the symptoms of menopausal hot flashes, night sweats, anxiety, sleep problems and enhance better memory. Practicing yoga for 8 weeks will affect the nervous system by controlling emotional symptoms in menopausal women.[31]

Afonso, Kozasa, Dinah, Leite, Tufik, and Hachul (2016)[7] conducted a case study of two postmenopausal women to examine if Yoga increased serum estrogen levels in postmenopausal women. This research was approved by the Committee of Ethics in Research of the Universidade Federal de Sa˜o Paulo (CEP 0408/07). The result revealed that after 4 months of Yoga practice. The participants exhibited an abnormal increase in estrogen (E2) Moreover, their quality of life was improved. The aforementioned studies are pieces of evidence that yoga can be an alternative tool in promoting estrogen levels in perimenopause or menopause women to lessen their undesirable symptoms during that period.

D. Tibetan Yoga

Tibetan yoga is a union of body, mind, spirit, and is based on Buddhism. Tibetan yoga comprises 5 simples poses as called the "5 Rites" which have been developed over the centuries in 5 Temple of Tibet. (Unraveling the Mystery of Tibetan Yoga Practices., 2019).[14] These five rites are presented in figure 1- 5.

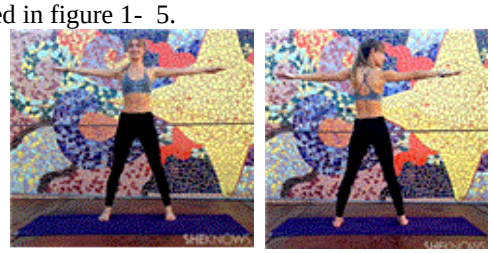

Fig. 1. Rite 1: Tibetan spin

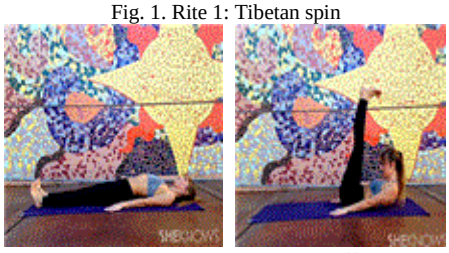

Fig. 2. Rite 2: Prone to upward staff pose

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Fig. 3. Rite 3: Rabbit to camel pose

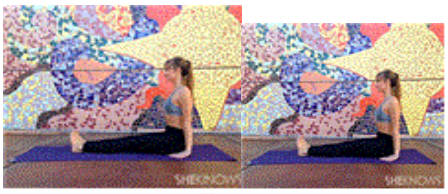

Fig. 4. Rite 4: Staff to upward plank pose

Fig. 5. Upward dog to downward pose

As observed from figure 1-5 the 5 rites of Tibetan yoga are simple and can be performed easily. Moreover, this practice has been reported by practitioners, medical professionals and yoga instructors that Tibetan Yoga helped the practitioners to relief from joint pain and stiffness, improving their strength and coordination, improving blood circulation, reduced anxiety, having a better sleep and enhance a youthful appearance. [15] Despite it remarkable benefit the study However very few researches have studied about the benefit of this practice. Moreover, the study about its effect on estrogen hormone of the practitioners which inspired the author to conduct this study.

III. METHODOLOGY

A community-based randomized controlled trial, two group pre-test post-test design was organized with Thai perimenopausal women living in Moo 9, Lahan community in Bangbuatong District of Nonthaburi Province between 1st August 2020 and 30th November 2020 to assess the effect of Tibetan Yoga on the level of Estrogen.

A. Research participants

The population of this study was three hundred thirty-two Thai perimenopausal women who lived in Moo 9, Lahan community in Bangbuatong District of Nonthaburi Province, aged between 45 and 55 years. An appropriate number of the participants for this experiment was calculated by the *G*Power* program configuring the effect size at 0.80 and type I error at 0.05 (Kaewpitool, 2012). [32]

The t-test statistic was employed to determine the mean difference between the two groups, The analysis result yield the number of participants per group was 26 and 52 as a whole. However, the participant's number was added up to 64. to prevent dropout during the experiment. The 64 participants were randomly placed into two groups, namely the intervention group and the control group. With 32 participants for each one.

The inclusion criteria of this study designated that the 1) research participants had the climacteric symptoms score greater than 15. The assessment was executed through the Climacteric Symptoms Assessment Form for screening. 2) They must not have amenorrhea in the last consecutive 12 months. 3) They must have no history of diabetes, high blood pressure, and heart disease, and 4) They must haven't been in a systemic exercise program or been in yoga programs in the past 6 months. Moreover, 4) the participants in the intervention group must be able to attend the intervention program for at least 10 weeks accounting for 80% of the total intervention period.

While, this experiment has excluded the perimenopausal women with a history of knee or spine surgery, hysterectomy or endometrial ablation, any type/form of hormone replacement therapy, or currently taking any type of supplements (vitamins, phytoestrogens, etc.).

The research participants were randomly placed into two groups, which are the intervention group and the control group, with 32 subjects each. Using t-test to determine the differences of the baseline the characteristics of the two groups. It was found that there were no statistically significant differences in any baseline characteristics between the two groups as shown in the table 1. This indicated the similarity of the intervention and control group in this study.

B Research Instrument

The research tools employed in this study are;

1. The Climacteric Symptom Assessment Form of the Bureau of Reproductive Health, Department of Health under the Ministry of Public Health Thailand was used for screening and recruiting the participants in the study.
2. The participant' socio-demographic record form was used to record the socio-demographic characteristics of the participants.
3. The record form for change in estrogen hormone level was used to record the Estrogen level of the participants within the intervention group and the control group during the experiment.

C Laboratory examination

1. Specimen and Collection medium

Six ml blood was collected from each participant in both the intervention and control group using SYRINGE 21 G x1 "1/2 in blood collection tubes without anticoagulant (red stopper).

2 Handling

The blood samples were sent to the laboratory within 2 hours after collection and inspection.

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The estradiol serum which is a component of estrogen hormone was measured to represent the estrogen hormone level in the participants.

TABLE 1. The differences in the Characteristics between the intervention group and the control group

Baseline Characteristics	Intervention group (n=32) N(%)	Control group (n=32) N(%)	P-value
Age (year)			0.578*
45-50 year	22 (68.8%)	24 (75%)	
51-55 year	10 (31.3%)	8 (25%)	
Mean ± SD	48.81 ± 3.66	48.22 ± 3.02	0.482**
Status			0.496*
single	4 (12.5%)	2 (6.3%)	
marries	22 (68.8%)	19 (59.4%)	
Divorced/Separate	3 (9.4%)	5 (15.6%)	
Widow	3 (9.4%)	6 (18.8%)	
Baseline Charecteristic	**Intervention group (n=32) N(%)**	**Control group (n=32) N(%)**	**P-value**
Education			0.559*
Primary	3 (9.4%)	4 (12.5%)	
secondary	16 (50%)	17 (53.1%)	
Diploma/Certificate	8 (25%)	4 (12.5%)	
Bachelor	2 (6.3%)	5 (15.6%)	
Higher than bachelor	3 (9.4%)	2 (6.3%)	
Income			0.825*
Less than 10,000 bath	13 (40.6%)	13 (40.6%)	
10,001-20,000 bath	13 (40.6%)	14 (43.8%)	
20,001-30,000 bath	4 (12.5%)	2 (6.3%)	
More than 30,000 bath	2 (6.3%)	3 (9.4%)	
tobacco use			0.351*
Yes	8 (25%)	5 (15.6%)	
No	24 (75%)	27 (84.4%)	
Health problems or pain			0.2*
Yes	8 (25%)	4 (12.5%)	
No	24 (75%)	28 (87.5%)	
Height (CENTIMETERS) Mean ± SD.	166.98 ± 2.93	166.87 ± 2.57	0.874*
Weigh (KILOGRAMS) Mean ± SD.	58.85 ± 3.39	59.38 ± 2.5	0.484**
BMI Mean ± SD.	21.04 ± 1.03	21.27 ± 0.7	0.319**

D. Research procedure and flow of the participants

The Tibetan yoga practice was used as an intervention program in this study. The experiment contended four phases as follows:

Phase 1: Baseline measurement (week 0)

The blood samples were collected from the participants in both the intervention and the control group to measure estrogen levels. Socio-demographic information was also collected from the participants and were screened for climacteric symptoms using the Climacteric Symptoms Assessment Form of the Bureau of Reproductive Health, Ministry of Public Health Thailand.

Phase 2: The Intervention Program started (week 1)

The second phase began at week 1. Whereas the intervention group received the usual care and the Tibetan Yoga practice. While the control group received only the usual care.

The intervention group would practice yoga together as demonstrated and advised by the licensed yoga expert and was performed thrice a week (Monday, Wednesday, and Friday) at 17:30 hours for 45 minutes to 1 hour per session in a public park located in the study site.

Phase 3: First Follow-up (week 12)

After the intervention was over in week 12. The blood samples were collected from the participants in both groups to measure their estrogen level. The intervention was ended this week but the experiment continued until week 16.

Phase 4: Endpoint (week 16)

The experiment was ended in week 16. (4 weeks after the intervention finished) The blood samples were collected to determine estrogen level in the participants of both groups to examine the estrogen level of the participants in both groups after the intervention finished. These four phases procedures are illustrated in figure 6.

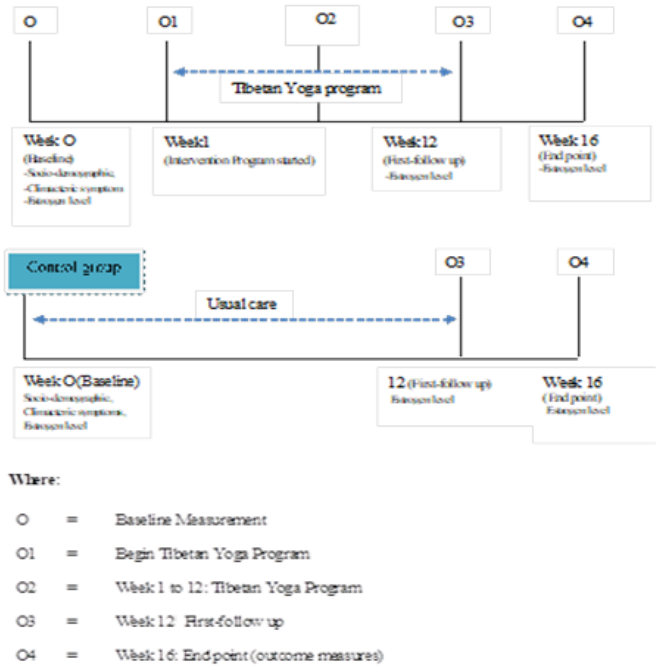

Fig. 6. Four phases of the research procedure

The flow of research participants was in accordance with the phases of research procedures as illustrated in figure 7.

E. Ethical Approval and Consent to participate

This research project has been received ethical approval from the research ethics review committee for research involving human research participants. Chulalongkorn University with the certificate of approval number 042/2563 dated February 18 2020 for not disclosed the research in the formation of the participants to the public on an individual basis, but will report the research results as public information. Research participants are allowed to refuse to answer all questions and can withdraw when not consenting most

importantly, this research has conducted experiments under the ethical principles and ethical principles of research in the nation in 2011 in all respects.

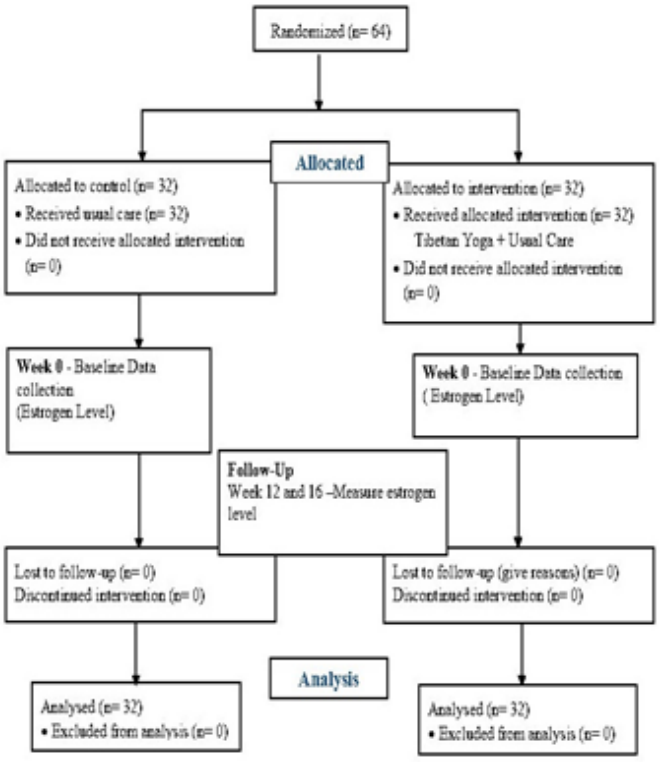

Fig. 7. Participant flow chart

IV. RESULT

The collected data were analyzed using the statistics such as, the independent t-test and the repeated measure ANOVA to answer the research objectives which are;

1. to assess changes in estrogen level of the intervention group and the control group before and after the intervention program.

The results showed the increase in the mean value of serum estradiol of the participants in both groups after attending the experiment as measured in week 12 and week 16. (see table 2)

TABLE 2. Mean of serum estradiol among the participants classified by groups.

Serum estradiol	Intervention group (n=32) Mean ± SD.	Control group (n =32) Mean ± SD.
week 0	46.08 ± 8.7	48.07 ± 7.61
week 12	57.73 ± 9.11	49.88 ± 8.78
week 16	57.78 ± 9.04	50.09 ± 8.72

2. to compare the estrogen level of the participants in the intervention group and control group after the intervention

The independent t-test was employed to determine the significant difference in the mean value of serum estradiol between the intervention and the control group. The result revealed that the mean value of serum estradiol was non-significantly different at week 0 when the intervention hasn't started. (P-value = 0.335). However, the significant difference in the mean value of serum estradiol between the two groups was found in week12 (intervention period) and week 16 (4 weeks after the intervention finished) (P-value < 0.001) This result confirm that the intervention group had a significantly higher level of estrogen hormone level compare to the control group after they received the intervention program as presented in table 3.

Table 3 the differences in serum estrdiol of the participants in the intervention group and control group.

Serum estradiol	Mean difference	95% CI of difference lower	95% CI of difference upper	P-value
week 0	-1.98625	-6.07249	2.09999	0.335
week 12	7.84375	3.37265	12.31485	0.001
week 16	7.69094	3.25232	12.12955	0.001

3. to examine the retention of estrogen level of the intervention group after the intervention was over.

The repeated ANOVA was employed in the comparative analysis of changes in estrogen hormone's level of the intervention group four weeks after the intervention finished.

The assumption of this statistic, such as the normal distribution of the variables was determined by Kolmogorov-Smirnov test. The results revealed a normal distribution of serum estradiol in the participants (P-value = 0.20) as shown in figure 8.

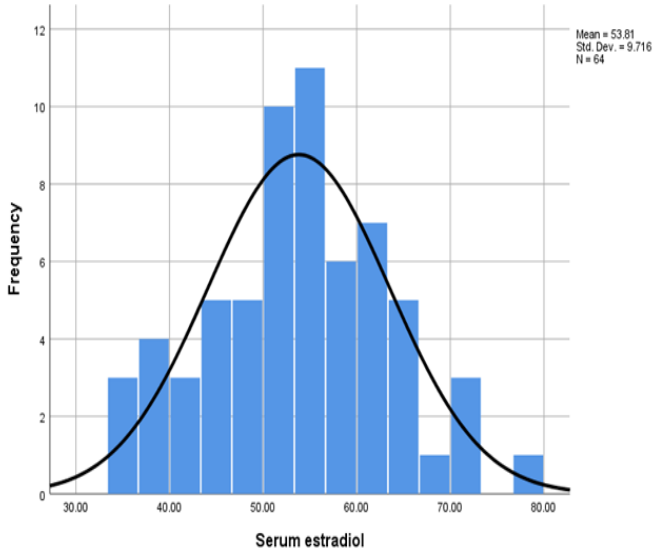

Fig. 8.The distribution of serum estradiol data

The homogeneity of variance was examined using Levene's test. The result showed that there was no significant difference in the variance of serum estradiol level among each week during the experiment. (P-value =0.686, 0.953 and 0.961 on week0, week12 and week16, respectively).

The test of compound symmetry for serum estradiol was exceeded, thus we analyzed the mean differences via Greenhouse-Geisser adjustment with the univariate test. Then, we computed the comparative analysis of the differences mean of serum estradiol among control and intervention group in

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week 0, week 12, and week 16 using the repeated measure ANOVA.[33]

The result showed significant differences in serum estradiol level at week 12 (the intervention finished) and week 16 (four weeks after the intervention finished. (F= 37.55, P-value < 0.001). (see table 4) The result is consistent with the statistics presented in table 2 which showed that the mean value of serum estradiol levels of the participants in both groups was increased at week 12 and week 16.

Moreover, it was found that there was an interaction between time*type (0.001). The result conveyed that there were significant differences in serum estradiol levels between the intervention group and control group during each measurement weeks (week 12 and week 16)as detailed in table 4

This finding is consistent with the statistics presented in table 3 which indicated the retention of the estrogen level of the participants in the intervention group after four weeks of the intervention (week 16) with a significantly higher mean value of the estrogen level compared to the control group.

Table 4 Comparison of serum estradiol among intervention and control groups at week0, week12 and week16 by repeated ANOVA

Source of variance	SS	df	MS	F	P-value
Time (Week)	1968.74	1.004	1960.32	72.83*	< 0.001
Time*Type	1014.934	1.004	1010.592	37.55*	< 0.001
error	1676.001	62.27	26.92		

SS = Sum Square; df = degree of freedom; MS = Mean square
*= Greenhouse-Geisser correction was used to reduce type I error

V. DISCUSSION

The randomized control trial pretest-posttest design was implemented in this study. Since this design has excellent internal validity due to the randomization the measurement of the effect size is less prone to bias.[34] The similarity of participant's baseline characteristics (age, status, education, income, health problem or pain, height, weight, BMI, serum estradiol) between the intervention and control group were test via the independent t-test. The result showed non-significant differences of all baseline characteristics between them. Therefore, the characteristics factors were controlled and the effect of the intervention would not be affected by the differences in the characteristics of the participants.

At week 0 the baseline characteristics of the participants including serum estradiol level were measured. The intervention program began at week 1 when the control group received only usual care and the intervention group was treated with the usual care and the Tibetan yoga practice. The first follow-up was done in week 12. The second one was executed in week 16.

The result indicates that the serum estradiol level of the participants in the intervention group, as well as the control group, had increased in week 12 and week 16. Since both groups received the usual care while the intervention group received the usual care and intervention program. However, the test indicated that the intervention group has a significantly higher mean value of estradiol compare to the control group in week 12 and week 16.

This result indicates that Tibetan yoga practice affects the estrogen level in a way that it helps increase the serum estradiol level of the perimenopause women in the intervention group. This finding is consistent with the study of Afonso, Kozasa, Dinah, Leite, Tufik, and Hachul (2016) conducted a case study to examine if Yoga increased serum estrogen levels in postmenopausal women The result revealed that after 4 months of Yoga practice. The participants exhibited an abnormal increase in estrogen.[7]

The repeated measurement ANOVA revealed significant differences in the mean value of the estradiol between the intervention group and control group in week 12 and week 16.

However, we have found that although the levels of estradiol of the participants in both groups were increased consecutively, the level of serum estradiol of the participants in the intervention group was significantly higher than those of the control group in week 16 which was four weeks after the intervention was finished. This conveys the retention of the estrogen hormone level after the Tibetan yoga practice.

This results indicates that Tibetan yoga practice has a significant effect on estrogen level in a way that it helps increase the estrogen hormone in the perimenopause women.

From this study it can be said that the Tibetan yoga practice can be used as an alternative treatment to increase estrogen level in the perimenopause women which may result in the lessen of the undesirable perimenopause symptoms. This study is consistent with the study of Chattha, Raghuram, Venkatram, & Hongasandra (2008). [9] which found that yoga helps promoting hormone and endocrine systems in menopausal women. This can lead to the lessen of the menopausal symptoms such as, hot flashes, night sweats, anxiety, and sleep problems.

VI. LIMITATION

The limitation of this study was the time by which the author has only four months to experimented. Therefore, only two measurements have been done. The longer time of intervention and follow-up may lead to additional results so that the study can provide a broader contribution to the academic society.

VII. RECOMMENDATION

From the limitation of this study, future researchers can organize a longer period of intervention and add more follow-up measurements. They can extend the scope of the study to examine the effect of Tibetan yoga on the quality of life of perimenopause or menopause women. Future research can examine the effect of other treatments such as "Tai chi" on estrogen hormone in perimenopause women.

VIII. CONCLUSION

This study aims to 1) assess changes of estrogen level in the intervention group and the control group before and after the intervention program. 2) to compare the estrogen level of the participants in the intervention group and control group after the intervention 3) to examine the retention of estrogen

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level of the intervention group after the intervention was over. Tibetan yoga was used as an intervention. The randomized control trial pretest-posttest design was implemented in this study. The baseline characteristics of the participants including serum estradiol level were measured at week 0. The intervention program began at week 1 when the control group received only usual care and the intervention group was treated with the usual care and the Tibetan yoga practice. The first follow-up was at week 12. And the final measurement was executed at week 16.

The result indicates that the serum estradiol level of the participants in the intervention group, as well as the control group, had increased in week 12 and week 16.

The result of the independent t-test signified a significantly higher mean value of serum estradiol in the intervention group compared to the control group in both week 12 and week 16.

The repeated measurement ANOVA revealed significant differences in the mean value of serum estradiol in the intervention group and control group from week 12 to week 16. The retention of serum estradiol in the intervention group was found in week 16 with a significantly higher mean value of serum estradiol compare to the control group.

ACKNOWLEDGMENT

The success of this study was due to the assistance of the research participants who devoted their valuable time to attend the experiment. Thanks to the headman of the community who facilitates us regarding the place of the experiment. We also thank our professional Tibetan yoga coach who dedicated her time to provide Tibetan yoga practice to the participants.

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