

Comparison of VO₂ Max between Natural and Surgical Postmenopausal Women

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ABSTRACT

Background: Menopause means permanent cessation of menstruation at the end of the reproductive life due to loss of ovarian follicular activity. Menopause is associated with a decrease in 17 β -estradiol production in lungs, which are associated with increased systematic inflammation in the lungs. Women undergoing natural menopause differ dramatically from women experiencing surgical menopause. VO₂ MAX refers to the highest value of oxygen consumption measure during a graded exercise test. The highest oxygen consumption value often occurs in the last minute of exercise.

Objective: To compare VO₂ max in natural and surgical postmenopausal women using the Queen's college step test.

Method: 30 subjects were selected with Normal BMI aged between 45 -55years. 15 subjects were women with natural menopause and 15 were women with surgical menopause. VO₂ MAX was calculated using Queen's College Step Test. Subjects were instructed to step up and down on the platform (16.25 inch) at the rate of 22 steps per minute. Subjects were asked to step using a four-cadence, 'up-up-down-down' for 3 minutes. Estimation of VO₂ MAX can be calculated from the test results using the formula (McArdle et al.1972) Women: VO₂ Max(ml/kg/min) = 65.81 - (0.1847 x heart rate (bpm)).

Result: Statistical analysis showed that there is a significant difference of VO₂ MAX in natural and surgical postmenopausal women

Conclusion: Thus our study concluded that there is significant difference of VO₂ max in natural and surgical postmenopausal women where VO₂ MAX is more affected in women with surgical menopause then compare to natural menopause.

Keywords: VO₂ MAX, Natural Menopause, Surgical Menopause, Queen's College Step Test, Oxygen Consumption.

INTRODUCTION

Menopause means permanent cessation of menstruation at the end of the reproductive life due to loss of ovarian follicular activity. It is the point of time when last and final menstruation occurs. The age of menopause ranges between 45-55years. Post menopause is the phase of life that comes after the menopause. ^[1]

SYMPTOMS OF MENOPAUSE:

-Hot flashes
-Relaxation of pelvic muscles

-Thinning, loss of elasticity and wrinkling of skin

.-Vaginal dryness which is due to estradiol deficiency

-Cardiac effect i.e. risk of ischemic heart disease, coronary artery disease, strokes are increased.

-Psychological changes: anxiety, headache, insomnia, irritability, depression.

-Osteoporosis and fracture

-Sexual dysfunction which may be due psychological changes (depression and anxiety) as well as genitourinary system. ^[1]

Primary organ changes in postmenopausal women are:

- Shrinking of ovaries size
- Fallopian tube atrophy
- Uterus becomes smaller
- Vulva atrophy^[1]

Women undergoing natural menopause differ dramatically from women experiencing surgical menopause. In most cases women experiencing natural menopause have a gradual onset of ovarian hormone deficiency after prolonged intermittent and unpredictable ovarian function, inherent in the physiology of the process. Women who develop surgical menopause experience more severe and more frequent menopausal symptoms than women who experience natural menopause. Multiple studies have reported a heightened cardiovascular disease risk among women who developed surgical menopause compared to women with natural menopause.^[2]

VO₂ MAX refers to the highest value of oxygen consumption measure during a graded exercise test. The highest oxygen consumption value often occurs in the last minute of exercise.^[3]

Factors affecting maximal oxygen consumption:

- Gender: Women have a lower VO₂ max than men. This is primarily due to physiology. The amount of blood that heart can pump partially determines VO₂ 2max. Blood pumping is a function of the length of the stroke of the valves, the type of fibers in the heart muscle and the size of the heart. Men, who are generally physically larger than women, have larger hearts that pump more blood. They also have larger lungs to take in more oxygen.
- Age:-VO₂ max declines steadily after age 25 at a rate of about 1% per year, so at age 55 it averages about 27% below values reported for 20 years old VO₂ max declined at an accelerated rate during aging.
- Mode of exercise: Since oxygen is ultimately consumed in the muscle during exercise, it generally reflects variations in the quantity of muscle mass activated.

-Body size and composition

-Temperature: Outside air temperature can affect VO₂ max, oxygen consumption is more at warmer temperatures

-Stroke volume

VO₂ max is dependent on transport of oxygen, the oxygen binding capacity, cardiac function, oxygen extraction capabilities and muscular oxidative potential.^[3]

The two methods of VO₂ assessments

-Direct: VO₂ max is measured directly by Benedict Rosh apparatus.

-Indirect: VO₂ max is measured indirectly by sub maximal and maximal tests.

Sub maximal test include 6min walk test 3min walk test, Queen's College step test, Harvard step test.^[4]

Step test is convenient for both indoor and outdoor settings and for use with either one person or multiple people. Step test come in many types and perhaps one of the most popular is the Queen's college step test. Queen's college step test is an established method to evaluate cardio-respiratory fitness. Stepping requires no elaborate or expensive equipment no calibration and can be easily administered.^[5] Stepping test is one the most widely used field test for estimating VO₂ max. Previous study done show that Queen's college step test is a valid test for measuring VO₂ max compared to six-minute walk test.^[6]

MATERIALS AND METHODS

The study was a comparative study where 30 females were selected using convenient sampling. Inclusion criteria: Women who were willing to participate and women between 45 to 55 years of age with 2 to 3 years postmenopausal. Exclusion criteria: Obesity, Hormone replacement therapy, acute respiratory and cardiovascular disease, History of smoking, Acute musculoskeletal injury, Women on any other exercise program, Psychiatric illness. Prior to starting the study a written informed consent was taken from the subject in language best understood by them. Materials used were Stopwatch,

metronome, weighing machine, sphygmomanometer, pulse oximeter, chair, pen and paper.



Fig. 1: Queen's college step stool of 16.25 inches (41.3cm) height



Fig. 2: Apparatus used in the study.

PROCEDURE

30 subjects were selected based on inclusion and exclusion criteria. Group A: 15 women with natural menopause 2 to 3 year postmenopausal with age group 45 to 55 year old) Group B: 15 women with surgical menopause 2 to 3 year postmenopausal with age group 45 to 55 year old. Prior to starting the study a written informed consent was taken from the subject in language best understood by them. The need of the study and methodology was explained to the subjects.

Demographic data of the subject which include (Name, Age, Gender,) was taken and BMI is calculated Subjects were assessed on the basis of Queen's College Step Test which is safe and a useful tool in predicting VO₂ MAX. The subjects were shown a demonstration of the test to be performed.-Prior to the study the subject was asked not to have any heavy meal. Before starting the test the blood pressure, respiratory rate and pulse rate were taken. Subjects were instructed to step up and down on the platform (16.25 inch) at the rate of 22 steps per minute. Subjects are to step using a four-cadence, 'up-up-down-down' for 3 minutes. As the subject steps up and down a metronome is maintained. - Multiplied this 15 seconds reading by 4 which will give the beats per minute (bpm) value to be used in the calculation below. -Estimation of VO₂ MAX can be calculated from the test results, using the formula (McArdle et al 1972) Men: VO₂ MAX (ml/kg/min) =111.33-(0.42×heart rate bpm Women: VO₂ Max(ml/kg/min) = 65.81 - (0.1847 x heart rate (bpm)

Normal Values of VO₂ max in Female

Age	Poor	Fair	Average	Good	Excellent
≤29	≤23.9	24-30.9	31-38.9	39-48.9	≥49
30-39	≤19.9	20-27.9	28-36.9	37-44.9	≥45
40-49	≤16.9	17-24.9	25-34.9	35-41.9	≥42
50-59	≤14.9	15-21.9	22-33.9	34-39.9	≥40
60-69	≤12.9	13-20.9	21-32.9	33-36.9	≥37

Statistical Analysis

Collected data was entered in Microsoft Excel and Graph pad prism 8.3.1 was used for the data analysis. Normality of the data was tested for both the group using Kolmogorov-Smirnov test. As the data passed the normality test for both the group statistical analysis was done using parametric test i.e. unpaired t-test.

RESULT

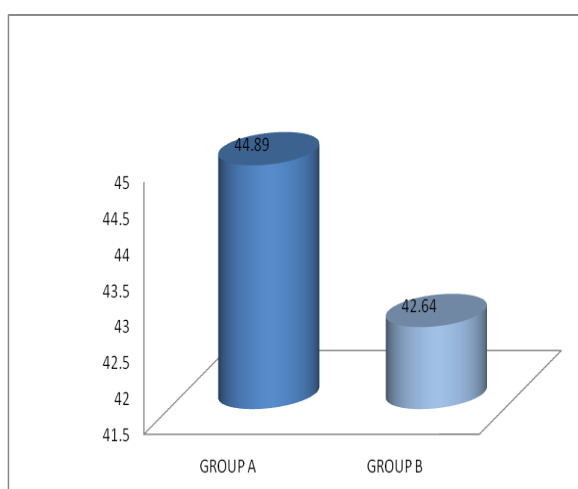
The result of unpaired t-test showed that there was a statistically significant difference in of Vo₂ max in natural and surgical postmenopausal women. Where VO₂ MAX is more affected in women with

surgical menopause then compare to natural menopause (p<0.0001)

Table 1: Demographic data of subjects:

Gender	Female
Age	45-55 Mean=50.13333 Standard Deviation:3.870524
Sample size	30 15-Natural Menopause 15-Surgical Menopause

-The Graph shows that VO₂ MAX is significantly higher in women with natural menopause then compared to women with surgical menopause.



Group A- Natural menopause
Group B- Surgical menopause

DISCUSSION

Menopause means permanent cessation of menstruation at the end of the reproductive life due to loss of ovarian follicular activity. Women undergoing natural menopause differs dramatically from women experiencing surgical menopause. In most cases women experiencing natural menopause have a gradual onset of ovarian hormone deficiency after prolonged intermittent and unpredictable ovarian function, inherent in the physiology of the process. [1]

The aim of the study was to compare VO₂ max between natural and surgical postmenopausal women in age group of 45 to 55 years. The sample consisted of 30 subjects. 15 with natural menopause and 15 with surgical menopause. Queen’s college step test was used to assess VO₂MAX. As

the Data passed the normality test unpaired t test was used for statistical analysis.

The result of the study showed that there was a significance difference of vo₂ max between natural and surgical postmenopausal women. p<0.0001. Where VO₂MAX is more affected in women with surgical menopause then compared to women with natural menopause

Menopause is associated with a decrease in 17β-estradiol production in lungs, which are associated with increased systematic inflammation in the lungs .These finding point towards a possible association between menopause and increased lung function decline Postmenopausal women face a higher risk of heart disease as estrogen protect women from heart disease before menopausal. [2] Menopause is associated with accelerated lung function decline.

-Triebner K, et al (2016) conducted a study whether menopause is associated with lung function decline by assessing FVC and FEV1. Menopausal status was associated with accelerated lung function decline. The study concluded lung function declined more rapidly among transitional and postmenopausal women, in particular for FVC, beyond the expected age change. Also the study concluded lung function declined more rapidly among transitional and postmenopausal women, in particular for FVC, beyond the expected age change.

Women who develop surgical menopause experience more severe and more frequent menopausal symptoms than women who experience natural menopause. Multiple studies have reported a heightened cardiovascular disease risk among women who developed surgical menopause compared to women with natural menopause. [2]

P.Gnanavel et al conducted a study of comparison of VO₂ max in pre and postmenopausal women where women with surgical menopause were excluded and this study showed that postmenopausal women had lower VO₂ max than premenopausal women. Hence, this study was an attempt to

compare VO₂ max in natural and surgical postmenopausal women.

The main limitation of the study was that it was performed on small size and since it was unaccustomed activity it might have affected the result of our study.

Since menopause is associated with lung function decline and has a higher risk of heart disease and since the female having acute respiratory and cardiovascular disease were excluded from the present study so further studies can be done to assess the extent to which VO₂ MAX is affected in this female.

CONCLUSION

Thus, our study concluded that there is significance difference of VO₂ max in natural and surgical postmenopausal women. Where VO₂ MAX is more affected in women with surgical menopause then compare to natural menopause.

Clinical Implication:

As we found that VO₂ MAX is affected more in women with surgical menopause then compare to women with natural menopause so we should take consideration that we must work on lung function more specifically in women who underwent surgical menopause.

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