Effect Of Aerobic Exercise On Preventing Hyperuricemic Complications After Menopause

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ABSTRACT

Background: It is generally believed that elevated serum uric acid is more common in women after menopause. There are many serious complications are associated with increased serum uric acid such as gout, metabolic syndrome, renal calculi and cardiovascular problems. **Purpose:** The aim of this study is to determine the effect of aerobic exercise on preventing post menopausalhyperuricemic complications. **Subjects and Methods:** Forty female patients, have elevated serum uric acid levels were selected randomly from Outpatient clinic of Department of Rheumatology and Rehabilitation in El Kasr El-Einy , Cairo University, their ages ranged from 50 to 65 years old and their body mass index (BMI) didn`t exceed 30kg/m2. The participants were assigned into two groups of equal number. **Group (A)** (20 patients) treated by aerobic exercise 3 sessions per week and diet modification for 8 weeks and **group (B)** (20 patients) treated by diet modification only, for 8 weeks. All subjects in both groups were assessed through serum uric acid level testand visual analogue scale (VAS) to measure pain intensity before and after treatment. **Results:** It was revealedintensily that there was a statistically significant improvement in serum uric acid level and pain in group (A) than group (B) post treatment. **Conclusion:** The effect of aerobic exercise along with diet modification was more effective in reducing serum uric acid level and pain intensity than diet modification only in postmenopausal hyperuricemicwomen.

Keywords: Aerobic exercise - Hyperuricemic complications - Menopause.

Introduction

Hyperuricemia is an abnormally high level of uric acid in the blood. In the pH conditions of body fluid, uric acid exists largely as urate, the ion form. The amount of urate in the body depends on the balance between the amount of purines eaten in food, the amount of uratesynthesised within the body (e.g., through cell turnover), and the amount of urate that is excreted in urine or through the gastrointestinal tract **(Al-Ashkar and Feyrouz, 2014).**

High plasma uric acid (UA) is a prerequisite for gout and is also associated with the metabolic syndrome and risk factors for cardiovascular diseases **(Kim et al., 2009).**

Many factors contribute to hyperuricemia, including genetics, insulin resistance, iron overload, hypertension, hypothyroidism, hyperthyroidism, renal insufficiency, obesity, diet, use of diuretics (e.g. thiazides, loop diuretics), and consumption of excess alcoholic beverages. Of these, alcohol consumption is the most important **(Sam et al., 2010).**

Reproductive events which occur over the life-span of women are expected to influence hormonal levels, especially estrogen levels. Estrogens have an impact on the renal tubular handling of uric acid and therefore are possibly explaining the underlying relation between some reproductive parameters and uric acid levels, suggesting that premenopausal levels of estrogen in women cause a greater renal clearance of uric acid **(Sumino et al., 2012).**

There were significant benefits of the exercise regimen such as improved exercise tolerance as judged by falling rated perceived exertion (RPE) scores for the same achieved exercise and broad improvements in the quality of life and health. The quality of life improvements are of interest in view of evidence that the psychological benefits of exercise may be an important contributor to the accompanying physical improvements in health **(Kosmadakis et al., 2011).**

Subjects

This study was carried out on forty female patients had elevated serum uric acid levels, were selected randomly from Outpatient clinic of Department of Rheumatology and Rehabilitation in El Kasr El-Einy, Cairo University. This study was conducted from September 2018 to January 2019.

Inclusion criteria:

1- All patients had elevated uric acid levels ≥6.0 mg/dL.
2- Their age was ranged from 50-65 years old.
3- Females only after menopause.
4- Females suffered from musculoskeletal pain only without swelling or redness especially in small joints without response to traditional treatment.

5- Body mass index was less than 30kg/m^2.

Exclusion criteria:

1- Patients suffered from one or more of post menopausalhyperuricemic complications.
2- Patients on specific hormonal medications.
3- Patients who had history of kidney disease such as chronic kidney disease or microalbuminuria.
4- Uncooperative patients or patients unable to perform exercise regularly.

Design of the study:

1- Group A (study group):

This group was consisted of 20 patients with hyperuricemia. They were participated in an aerobic exercise in the form of walking on a treadmill 3times/week and each session was last for 45 minutes with dietary modification for 8weeks.

2- Group B (control group):

This group was consisted of twenty patients with hyperuricemia. They were received dietary modifications only three times per week for 8 weeks.

Diet modification: use vitamin C, root vegetables low in purine such as potatoes, lotus root and sweet potatoes, dairy products, high fiber food and restrict red meat, fish and poultry, sugar-sweetened soft, drinks caffeine and alcohols for both groups A&B.

Methods

A) Evaluation methods:

1. Serum uric acid level: a sample of blood was used to assess the level of uric acid in the blood for both groups A&B before and after treatment.

2. Weight and height scale:a universal height and weight scale will be used to determine the subjects' height and weight to calculate the body mass index for all participants before the study for the two groups.

3. Visual analogue scale: will be used to measure the level of pain for both groups A&B before and after treatment.

B) Treatment methods:

1-Aerobic exercise:

Moderate aerobic exercise was applied in addition with diet modification once daily three times / week for 45 minutes for all patients participated in group (A) in the form of walking on a treadmill. Before starting aerobic exercise, every patient was instructed briefly and clearly about the nature of exercise and its effect in order to gain their confidence and cooperation of all through the period of this study (8 weeks).

Exercise session for the study group consisted of:

(1) Warm-up phase: The patient started the exercise session with warm-up exercise at a speed of 0.5 mph for 5min to allow for conditioning of the body for the exercise. Thereafter, the speed was increased to 2 mph for 3min, after that the speed was increased in increments of 1.0 mph every 2min until the participant reached level 14–75% effort of Borg scale effort.

(2) Training phase: The patient walked at the level of speed obtained, she reached level 14–75% effort of Borg scale effort (somewhat hard) for 30–35min.

(3) Cooling down phase: Afterward, the speed was decreased to 0.5 mph and the session was terminated with cooling down for 5min as warming up.

2-Diet:

Diet modification: purine restricted dietthrough using vitamin C, root vegetables low in purine such as potatoes, lotus root and sweet potatoes, dairy products, high fiber food, drinking water excessively and restrict red meat, fish and poultry, sugar-sweetened soft, drinks caffeine and alcohols for both groups A&B.

Statistical analysis

Descriptive statistical analysis was used for data collection to calculate means and standard deviations. Differential statistical analysis was used in form of 2x2 Mixed MANOVA test to compare the tested variables of interest at different measuring periods at both groups. With the initial alpha level set at 0.05.

Results

1- Physical characteristics of the patients in both groups:

The current study was conducted on 40 hyperuricemic females. They were assigned into two equal groups. Control group (Group A) consisted of 20 participants with mean age, body mass, height and BMI values 53.7±1.83 years, 73±3.9 kg, 1.63±0.03 m and 27.29±1.16 kg/m^2 respectively. Study group (Group B) consisted of 20 participants with mean age, body mass,

height and BMI values 54.05±1.84 years, 75.15±3.53 kg, 1.63±0.02 m and 28.2±1.12 kg/m^2 respectively. As indicated by the independent t test, there were no significant differences (p>0.05) in the mean values of age, body mass, height and BMI between both tested groups (Table 1).

Table (1): Physical characteristics of participants in both groups.

Items	Control group	Study group	Comparison		S
	Mean ± SD	Mean ± SD	t-value	P-value	
Age (years)	53.7±1.83	54.05±1.84	-0.60	0552	NS
Body mass (Kg)	73±3.9	75.15±3.53	-1.806	0.079	NS
Height (m)	1.63±0.03	1.63±0.02	0.262	0.795	NS
BMI (kg/m^2)	27.29±1.16	28.2±1.12	-2.481	0.05	NS

***SD: standard deviation, P: probability, S: significance, NS: non-significant**

***1. Serum uric acid*:**

1-Within groups:

As presented in table (2), within group's comparison the mean ± SD values of Serum uric acid in the "pre" and "post" tests were 6.95±0.40 and 6.08±0.58 respectively in the control group. Multiple pairwise comparison tests (Post hoc tests) revealed that there was significant reduction of Serum uric acid at post treatment in compare to pre-treatment (P-value =0.0001*). While, the mean ± SD values of Serum uric acid in the "pre" and "post" tests were 6.82 ±0.46 and 3.55 ±0.3 respectively the study group. Multiple pairwise comparison tests (Post hoc tests) revealed that there was significant reduction of Serum uric acid at post treatment in compare to pre-treatment (P-value =0.0001*).

2- Between groups:

Considering the effect of the tested group (first independent variable) on Serum uric acid, Multiple pairwise comparison tests (Post hoc tests) revealed that the mean values of the "pre" test between both groups showed no significant differences with (P=0.349). As well as, multiple pairwise comparison tests (Post hoc tests) revealed that there was significant difference of the mean values of the "post" test between both groups with (p=0.0001*) and this significant reduction in favor to study group.

Table (2): Mean ±SD and p values of Serum uric acid pre and post-test at both groups.

Serum uric acid	Pre test	Post test	MD	% of change	p- value
	Mean± SD	Mean± SD			
Control group	6.95±0.40	6.08±0.58	0.87	12.51	0.0001*
Study group	6.82 ±0.46	3.55 ±0.3	3.27	47.9	0.0001*
MD	0.13	2.53			
p- value	0.349	0.0001*			

*Significant level is set at alpha level <0.05 SD: standard deviation
MD: Mean difference p-value: probability value

2. VAS:

1-Within groups:

As presented in table (3), within group's comparison the mean ± SD values of VAS in the "pre" and "post" tests were 7.25±0.94 and 5.95 ±0.99 respectively in the control group. Multiple pairwise comparison tests (Post hoc tests) revealed that there was significant reduction of VAS at post treatment in compare to pre-treatment (P-value =0.0001*). While, the mean ± SD values of VAS in the "pre" and "post" tests were 67.05 ±0.94 and 3.15±0.74 respectively the study group. Multiple pairwise comparison tests (Post hoc tests) revealed that there was significant reduction of VAS at post treatment in compare to pre-treatment (P-value =0.0001*).

2- Between groups:

Considering the effect of the tested group (first independent variable) on VAS, Multiple pairwise comparison tests (Post hoc tests) revealed that the mean values of the "pre" test between both groups showed no significant differences with (P=0.5). As well as, multiple pairwise comparison tests (Post hoc tests) revealed that there was significant difference of the mean values of the "post" test between both groups with (p=0.0001*) and this significant reduction in favor to study group.

Table (3): Mean ±SD and p values of VAS pre and post-test at both groups.

VAS	Pre test	Post test	MD	% of change	p- value
	Mean± SD	Mean± SD			
Control group	7.25±0.94	5.95 ±0.99	1.33	18.3	0.0001*
Study group	7.05 ±0.94	3.15±0.74	3.9	55.3	0.0001*
MD	0.2	2.8			
p- value	0.5	0.0001*			

*Significant level is set at alpha level <0.05 SD: standard deviation
MD: Mean difference p-value: probability value

Discussion

The aim of this study was to evaluate the effect of aerobic exercise on preventing hyperuricemic complications after menopause.

Forty female patients, have elevated serum uric acid levels, was selected randomly from Outpatient clinic of Department of Rheumatology and Rehabilitation in Al Kasr El-Einy , Cairo University – Egypt. The patients were divided randomly into two equal groups (A&B). Group (A) was consisted of twenty patients with hyperuricemia. They were received aerobic exercise in the form of walking on a treadmill 3times/week and each session will last for 45 minutes with dietary modification of low purine for 8weeks. Group (B) wasconsisted of twenty patients with hyperuricemia. They were received dietary modifications only three times per week for 8 weeks.

Serum uric acid level through a sample of blood was used to assess the level of uric acid in the blood and visual analogue scale was used to measure the level of pain for both groups A&B before and after treatment.

The result of the present study revealed that there was a significant improvement in serum uric acid, and visual analogue scale in post treatment in compared with that in pre treatment in groupA (study group) while there was a significant improvement in serum uric acid and visual analogue scale in post treatment in compared with that in pre treatment in groupB (control group), while the improvement in group A more than in group B with accurate statistical index and these results were approved by ***Casas et al., 2014***through study conducted to test blood purines which stated that when doing physical exercises (especially the long term aerobic physical training), ATP turnover is accelerated which thereby reduces uric acid production ideally.

Our results are supported by ***Banfi et al., 2012*** who found that physical exercise is known to induce metabolic changes intensifying catabolic processes. Thus, the uric acid concentration is one of the most important biochemical parameters indicating changes in purine nucleotides distribution.

Our results are in agreement with ***Meyer and Meister, 2011***who stated that aerobic exercise affected the UA plasma concentration in female football players. It decreased significantly after the exercise post-exercise as well as during recovery in comparison to the measurements pre exercise in this studied group. A significant decrease in the uric acid level in female football players during the entire training season was also found by Meyer and Meister.

Data in this report of ***Hedrington and Davis, 2015***also suggested that exercise may help controlling uric acid and serum lipids and alleviating gastroesophageal reflux. A large number of reports also confirm that exercise may help to control hypoglycemia and hyperlipidemia.

The results also in agreement with ***Aucella et al., 2015*** who stated that exercise is beneficial in ameliorating cardiovascular risk factors such as hypertension, dyslipidemia, hyperglycemia,

hyperuricemia, obesity, inflammation, and oxidative stress. Moreover, it has been reported that inactivity is associated with the development of major chronic kidney disease precursors, including albuminuria, reduced glomerular filtration rate, and initiates diabetes.

Our results are supported by ***Tang et al., 2017*** whostated that the reduction in serum uric acid from the DASH diet was greater among participants with a baseline SUA ≥6 mg/dL; over half the participants achieved a SUA <6 mg/dL by 30 days. These findings provide a meaningful timeline for health professionals and patients initiating the DASH diet to lower serum uric acid.

Conclusion

Aerobic exercise along with diet modification was more effective in reducing serum uric acid level, pain intensity than diet modification only in postmenopausal hyperuricemic women.

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المستخلص العربي

أظهرت الدراسات أن ارتفاع حمض اليوريك في الدم هو أكثر شيوعا في النساء بعد انقطاع الطمث.هناك العديد من المضاعفات الخطيرة المرتبطة بزيادة حمض اليوريك في الدم مثل النقرس ، ومتلازمة التمثيل الغذائي ، وحساسية الكلى ومشاكل القلب والأوعية الدموية.الهدف من هذه الدراسة هو تحديد تأثير التمرينات الهوائية على الوقاية من مضاعفات زيادة نسبة حمض اليوريك في الدم في مرحلة ما بعد انقطاع الطمث أم لا. تم اختيار أربعين مريضة ، لديهن ارتفاع بمستويات حمض اليوريك في الدم بشكل عشوائي من العيادات الخارجية بقسم أمراض الروماتيزم و التأهيل في القصر العيني ، جامعة القاهرة ، تراوحت أعمارهن بين ٥٠ و٦٥ سنة ومؤشر كتلة الجسم لديهنلا يتجاوز ٣٠ كجم/ م^{٢} . تم تعيين المشاركين في مجموعتين من العدد المتساوي.المجموعة (أ) (٢٠ مريضة) يعالجون بالتمارين الهوائية ٣ جلسات في الأسبوع وتعديل النظامالغذائي لمدة ٨ أسابيع والمجموعة (ب) (٢٠ مريضة) يعالجون بتعديل النظام الغذائي فقط ، لمدة ٨ أسابيع. تم تقييم جميع المواد في كلا المجموعتين من خلال اختبار مستوى حمض اليوريك في الدم و استخدام مقياس التماثلية البصريةلقياس وتقييم شدة الألم قبل وبعد العلاج. تم الكشف عن وجود تحسن ذو دلالة إحصائية في مستوى حمض اليوريك في الدم والألم في المجموعة (أ) عن المجموعة (ب). وهكذا يمكن ان نستخلص أن تأثير التمارين الرياضية مع تعديل النظام الغذائي أكثر فعالية في خفض مستوى حمض اليوريك في الدم وشدة الألم من تعديل النظام الغذائي فقط في مرضى فرط حمض اليوريك في الدم بعد انقطاع الطمث.

الكلمات الدالة: التمارين الهوائية - مضاعفات ارتفاع حمض اليوريك في الدم - انقطاع الطمث.