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Serum serotonin response to aerobic exercise verus *phoenix*

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Abstract : Back ground and Purpose: Aerobic training and *Phoenix* (dates) for elderly subjects with mild depression can alter the level of serum serotonin either by increasing its synthesis or increasing its uptake by the serotonergic receptors. This alteration of the serum serotonin level improves the subject's depression symptoms on the geriatric depression scale with a return to the normal scores. The effects of 24 weeks aerobic exercise and date consumption on the serum serotonin level and on subjects' score on the geriatric depression scale were studied. **Patients and methodology:** one hundred men and women with mild depression aged 60-70 years old referred from the psychiatric out clinic of Elobour Medical Center were included. They were randomly assigned into two equal groups, Group (I) participated in a specialized program of date consumption in form of eating three dates daily one before each meal by one hour, group (II) participated in a program of aerobic exercise in form of walking on a computerized treadmill for about twenty minutes (active phase), 5-10 min warming up and 5-10 min cooling down three times per week with a target heart rate of 60-75%of MHR. The study was conducted at PT department of Elobour medical centre one of the Health ministry medical centres.The serum serotonin levels and subjects scores on the geriatric depression scale were measured for all subjects in the two groups at the beginning of the study and after twenty four weeks.
The results: The results of this study revealed a significant increase in the serum serotonin level in Group (I) with a percent of improvement of 75.77%, a significant decrease of the serum serotonin level in group (II) with a percent of improvement of 38.9% and a significant decrease (improvement) of the patients score on the geriatric depression scale in both groups with no significant difference.
Conclusion: It can be concluded that both aerobic exercise and *Phoenix* can produce a significant improvement for patients with mild depression.
Key words: serum serotonin, aerobic exercise, *Phoenix.*

Introduction

Feeling down from time to time is a normal part of life, but when emotions such as hopelessness and despair take hold and just won't go away, that could be depression. Depression makes it tough to function and enjoy life like once did. Just getting through the day can be overwhelming; some people describe depression as "living in a black hole". An estimated 350 million people of all ages experience symptoms of depression and about 13 percent of Americans take antidepressants a figure that jumps to 25 percent for women in their 40s and 50s [1].

Serotonin is a hormone used as both a neurotransmitter by the central nervous system and a vasoconstrictor by the vascular system. Serotonin is synthesized by the brain from the amino acid L-tryptophan and is then stored in various areas of the body, including the intestinal wall, blood platelets, pineal gland and brain. Serotonin has direct and indirect effects on a large number of psychological and physiological functions, including mood, appetite, sleep, memory, learning, temperature control, sexual behavior and social behavior. Despite the debate on the exact cause, researchers do agree that low serotonin is somehow connected to such psychological problems as depression, anxiety, seasonal affective disorder, and obsessive-compulsive disorder [2].

The synthesis of serotonin decreases with age. This decrease is related to the drop of the enzyme tryptophan hydroxylase activity in the raphes nuclei resulting in alterations of this neurotransmitter concentration. In contrast, it was reported that the exercise is an important factor for the uptake and metabolism of the serotonin and could play an important role as a possible anti-depressive agent [3].

L-tryptophan works best when combined with carbs. Carbs trigger the body to secrete insulin, which uses up other amino acids in the blood stream first, leaving more L-tryptophan to sedate. The best foods for this job are dates they're high in carbs and have a fair amount of L-tryptophan [4].

Dates *(Phoenix dactylifera*) contain a higher percentage of protein than other type of fruits. They contain 2.3-5.6% protein, whereas apples, oranges, bananas, and grapes contain 0.3%, 0.7%, 1.0% and 1.0%, respectively. Twenty-three different amino acids have been found in the proteins of dates. Many of these are not present in the most popular fruits such as tryptophan (the pecurser of serotonin) which is mainly found in dates in about 100mg/100g dry date [5].

One study investigated the effects of an 8-wk aerobic training program on the serum levels of serotonin and in the changes in the symptoms of depression in elderly women. This study demonstrated that 8-wk with 5 d.wk-1 of moderate and progressive aerobic training emphasizing walking can safely cause significant reduction in the serum levels of serotonin (this can be interpreted by increasing serotonin uptake by serotonirgic receptors in the CNS) and improve the symptoms of depression in elderly women [6].

Purpose of the study

The purpose of this study was to assess the serum serotonin response to aerobic exercise versus dates *(Phoenix dactylifera)*

Patients and Methodology:-

Patients:-

0ne hundred untrained aged 60 to 70 years men and women subjects with mild depression were encouraged to follow their habitual life style throughout the study period, They were randomly assigned into two groups; fifty patients (25 men, 25 women) for each. Both groups were under their medical treatment prescribed by the physician. All patients were diagnosed as having mild depression. Their **inclusion criteria** were as follow: elderly subject aged 60-70 years old with some of depression symptoms or occasional mood disturbance or can be brought to depression easily and has none of the exclusion criteria could be included in this study, while their **exclusion criteria were:** patient with orthopedic disorders impeding the ability to walk or exercise**,** cardiac diseases**,** any of hereditary or acquired thyroid disorder, smokers, alcohol drinkers and diabetic subjects.

Instrumentation:-Computerized treadmill, Sphygmomanometer and stethoscope, Weight & height scale: (Healthy scale 160 kg) to evaluate the height and weight. Kits and Tubes of blood sample.

Procedure:-

Evaluation procedure: After selection of the patients an informed consent was taken from all patients who accepted to participate in the study. Before starting the study all patients were informed about the nature, benefits and procedure of the study, The sample was randomly divided into two groups equal in number and sex, 50 for each group (25 men, 25 women); group I received a specialized program of date consumption, group II performed a specific program of aerobic exercise. Serum samples were obtained by venipuncture (arterial

cannula used in Larsen's study) and stored on ice. Concentration of serotonin was measured by a serstonin stripe in VIVAS champer. **Initial evaluation:** In form of estimation of the serum serotonin level and subject score on the geriatric depression scale. **Final evaluation** done after 24 weeks from starting the management program and in the same form as the initial evaluation. **Physician evaluation:** patients were screened by a specialized physician for the presence of any disease or drug that could interfere with the study treatment program and to go on the steps to deal with any possible hazards.

Experimental:

Estimation of total flavonoidal and total phenolic content of the fruit of *Phoenix dactylifera*.

A- Procedure:

1-quantitative estimation of total flavonoidal content of the fruit of Phoenix dactylifera as rutin equivalent [7]:

Total flavonoid content was determined in the 70% aqueous methanolic extract of the fruit of Phoenix dactylifera as rutin equivalent.

2-quantitative estimation of total phenolic content of the fruit of Phoenix dactylifera as gallic acid equeivalent [8]:

By applying modified folin-Ciocalteau method.

B- Results:

1-Total Phenolic content was 54.4 mg gallic acid equivalent/ 100gm of the dried extract.

2-total flavonoidal content was 11.2 mg rutin equivalent /100gm of the dried extract.

Management procedure:

(1) Each subject of group (I) ate three dates of the same type daily one before each meal by one hour.

(2) Each patient of the group (II) was trained according to the geriatric health promotion program of exercise with the following characteristics [9]:

- Frequency: 3-5 times / week for a period of six months.
- Intensity: training should begin at low levels and gradually increased to the training zone, or target heart rate (THR). The THR is 60% to 75% of the individual's maximal heart rate (MHR), which is 220 minus the age.
- Time: 20-40 minutes including warming up phase 5-10 min, active exercise phase 20 min, and cooling down phase 5-10 min.
- Type: walking exercise on a computerized treadmill**.**

- Results

- Subject characteristics:

Table (1) showed the mean ± SD (SE) age, weight, height, and BMI of group I and II. There was no significant difference between both groups in the mean age, weight, height, and BMI ($p > 0.05$).

Table (1): Comparison of mean age weight, height, and BMI between groups I and II:

	Group A	**Group B**		
	$\overline{X}$ **±SD(SE)**	$\overline{X}$ **±SD(SE)**	**t- value**	**p- value**
Age (years)	63.38 ± 2.23(0.31**)**	62.84 ± 1.77(0.25)	1.33	0.18*
Weight (kg)	98.54 ± 5.13(0.72)	98.82 ± 7.53(1.06)	-0.21	0.82*
Height (cm)	161.76 ± 5.55(0.78)	162.88 ± 9.53(1.34)	-0.71	0.47*
BMI (kg/m²)	37.8 ± 3.46(o.49**)**	37.96 ± 8.88(1.25)	-0.11	0.91*

x̄: **Mean, SD: Standard deviation, SE: standard error, t value: unpaired t value, p value: Probability value *:Non significant.**

-Comparison between groups:

Serotonin level

There was no significant difference between group I and II in mean serotonin level pre-treatment (p = 0.18). Comparison between group I and II post treatment revealed a significant increase in serotonin level in group I compared to group II (p = 0.0001). (Table 2, figure 1).

Geriatric depression scale

There was no significant difference between group I and II in median of geriatric depression scale pre-treatment (p = 0.19). Comparison between group I and II post treatment also revealed no significant difference in median of geriatric depression scale (p = 0.44). (Table 3, figure 2).

Table (2):Comparison of serotonin level between group I and II pre and post treatment:

Serotonin (ng/ml)	**Group I**	**Group II**	**MD**	**t-value**	**p-value**
	x̄**±SD(SE)**	x̄**±SD(SE)**			
Pre treatment	154.52 ± 13.94(1.97)	158.32 ± 14.24(2.01)	-3.8	-1.34	0.18*
Post treatment	271.6 ± 3.1(0.43)	96.72 ± 12.14(1.71)	174.88	98.61	0.0001**

x̄: **Mean, SD: Standard deviation, MD: Mean difference, p value: Probability value *:Non significant,**: Significant.**

Table (3): Comparison of geriatric depression scale between group I and II pre and post treatment:

Geriatric depression scale	**Group I**	**Group II**	**U-value**	**p-value**
	Median	**Median**		
Pre treatment	17.5	17	1066	0.19*
Post treatment	3	2	1142	0.44*

U- value, Mann-Whitney test value; p-value, level of significance; * Non-significant.

- Comparison within group:

Results of group I:

There was a significant increase in serotonin level post treatment in group I compared with pre treatment (p = 0.0001). The percent of increase in serotonin level was 75.77%. (Table 4, figure 1).There was a significant decrease in geriatric depression scale score in group I post treatment compared with pre treatment (p = 0.0001). (Table 5, figure2).

Results of group II: There was a significant decrease in serotonin level post treatment in group II compared with pre treatment (p = 0.0001). The percent of decrease in serotonin level was 38.9%. (Table 4, figure 1).There was a significant decrease in geriatric depression scale score in group II post treatment compared with pre treatment (p = 0.0001). (Table 5, figure2).

Table (4):Comparison of serotonin level between pre and post treatment in group I and II:

Serotonin (ng/ml)	Pre treatment	Post treatment	MD	% o change	t-value	p-value
	x̄±SD(SE)	x̄±SD(SE)				
Group I	154.52 ± 13.94(1.97)	271.6± 3.1(0.43)	-117.08	75.77	-54.23	0.0001
Group II	158.32± 14.24(2.01)	96.72± 12.14(1.71)	61.6	38.9	26.78	0.0001

x̄: **Mean, SD: Standard deviation, SE: standard error, MD: Mean difference, p value: Probability value **:Significant,**

***: Non significant**

Table (5): Comparison of geriatric depression scale between pre and post treatment in group I and II:

Geriatric depression scale	Pre treatment	Post treatment	Z-value	p-value
	Median	Median		
Group I	17.5	3	6.17	0.0001**
Group II	17	2	6.17	0.0001**

Z-value: Wilcoxon signed ranks test value; p-value, level of significance; ** Significant

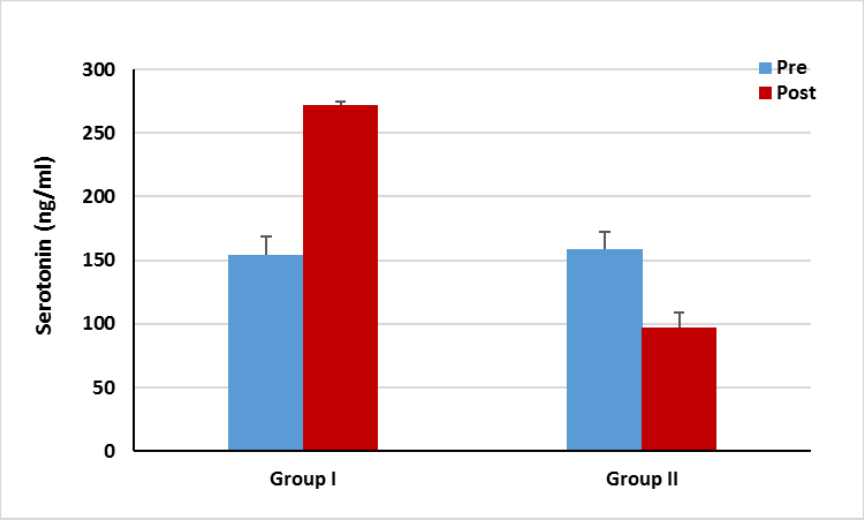
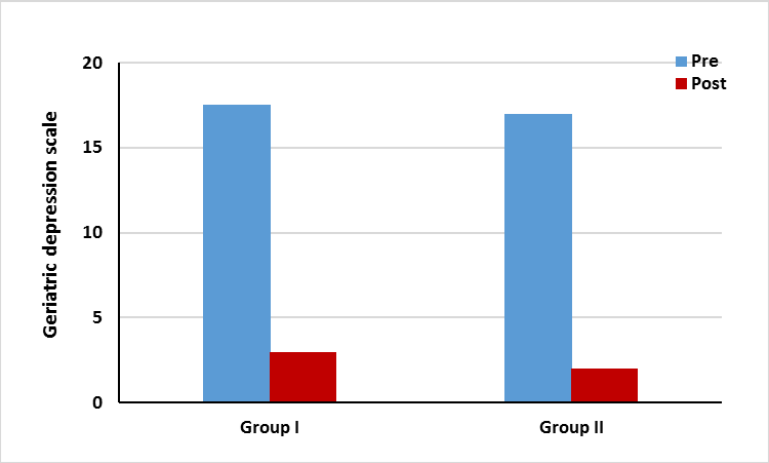


Figure (1). Pre and post treatment mean values of serotonin of group I and II.



Figure(2). Pre and post treatment median values of geriatric depression scale of group I and II.

Discussion

The aim of this study was to investigate the serum serotonin response to aerobic exercise versus *Phoenix*.

In the present study it was found that there was a significant increase in the serum serotonin level in response to eating dates with a percentage of improvement of 75.77% this was associated with a significant decrease and improvement in the patient score on the geriatric depression scale.

This come in support with **Khadem et al., [10]** who studied the efficacy of dates in comparison with intramuscular oxytocin in the management of postpartum haemorrhage in modern obstetrics. It was performed on 62 women delivered in hospital. It was found that blood loss mean at the end of first hour after delivery were significantly different in dates and oxytocin groups (104 ml vs 141.6 ml, p=0.043), but in second and third hour were not significant, although the bleeding in dates was less. In whole three hours after delivery the blood loss mean in dates group was significantly less than the oxytocin group (162.5 ml vs 220.7, p=0.02). So it was concluded that usage of oral dates after delivery decreases bleeding more than intramuscular oxytocin and it's a good alternative in normal delivery**.**

This is also come in consistent with **Kathrin** [11] made a clinical trial in an attempt to compete kwashiorkor in Sanambele by offering an agricultural suggestion to the village of Sanambele, Mali, where a lack of tryptophan is putting the young citizens at risk of developing kwashiorkor. At the end of the study she suggested the farmers to grow date, sesame or chick peas with considering date as the first choice**.**

In the present study it was found that there was a significant decrease in the serum serotonin level with a percentage of change of 38.9% this was associated with a significant decrease and improvement in the patient score on the geriatric depression scale in response to the designed program of aerobic exercise

This supported by **Andersen et al.,** [12] that studied the Antidepressant effects of paroxetine (30 mg/day) versus clomipramine (150 mg/day) in Patients with major depressive disorder. After 1 week120 patients fulfilled the criterion of a Hamilton (17-item) score of ≥18 and started on active treatment for 6 weeks. Categorical response measures and group averages of rating scores showed a significant decrease in the plasma levels of serotonin in both groups and a significantly better therapeutic effect of clomipramine from the second week of treatment on**.**

And also come in consistent with **Wipfli et al.,[13]** in a Research that revealed that7-weeks of aerobic exercise is more effective than stretching exercise in reducing symptoms of depression and anxiety with a larger percentage decrease in serotonin in aerobic than the stretching group**.**

North et al., [14] reported that a Meta-analyses on exercise and depression have found effect sizes (ESs) ranging from 0.53 to 1.10, indicating that people who exercise show moderate to large reductions in depression.

And a small to moderate reductions in anxiety, with ESs ranging from 0.20 to 0.53.The results show strong support for exercise reducing anxiety and depression. Growing evidence also suggests that exercise can be effective as an adjunct treatment to drugs, and that exercise is an effective option for people who do not show remission of depressive symptoms with typical treatment**.**

Hemat et al.,[15] studied the effect of selected aerobic exercises on the depression in depressed female student aged 18 to 25. 20 female students with moderate levels of depression were selected by using Beck Depression Inventory (BDI). And divided into two experiamental and control groups randomly. afte. Results showed that the level of depression significantly decreased in the experimental group expressed by their score improvement**.**

Conclusion

The results of this study support the good effect of aerobic exercise and dates on the serum serotonin level. One of them increases the synthesis of serotonin (dates) while the other (aerobic exercise) enhances its uptake and utilization making it more available to sedate. So both of them can result in a significant improvement of patient's depressive symptoms on the geriatric depression scale with a return to the normal scores. This can greatly lower the risk and even treats the depression.

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