

## Effectiveness of an Aerobic Training Program on some Physiological Variables and Social Acceptance among Females (40-50 years)

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**Abstract:** The current research aims to design an aerobic exercises program and identify its effects on: Physiological variables (pulse – blood pressure – fat percentage – muscles – bones – water – basic metabolic rate BMR – active metabolic rate AMR) for women (40-50 years) - 5HIAA concentrations in urine for women (40-50 years) - Responses to social acceptance scale for women (40-50 years) - Differences between measurements of all mentioned variables for women (40-50 years). The researcher used the experimental approach (one-group design) with pre- and post-measurements. The researcher purposefully chose (10) women (40-50 years) who are newly participating in sport for health. Results indicated that: 1- The aerobic exercises program induced several physiological adaptive processes that can be measured after 6-8 weeks with no less than 25 minutes per session (3 times per week). 2-Regular aerobic exercises have positive effects on improving the function of heart and this decreases heart rate 3- Aerobic exercises program decreased body fats through burning more calories and this decreases weight. In addition, it has positive effects on bone and muscle mass. This protects women in this critical age from osteoporosis although improvements did not reach calibration values. 4- Regular aerobic exercises decrease BMR and AMR due to energy saving in normal life. 5- Aerobic exercises program increased serotonin levels in the brain and this increase urine concentrations of 5HIAA which in turn has positive effects on mood. 6- Regular aerobic exercises improved responses to social acceptance scale and decreases vulnerability to depression due to increased levels of serotonin.

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**Key Words:** Serotonin – aerobic exercises – physiological response – social acceptance

### 1. Introduction and Research Problem:

Performance of aerobic exercises requires maximum force for a prolonged period of time. Aerobic power is the main objective of physical fitness programs for health and disease prevention in addition to improving female body structure and distribution of fats. It is a physical quality that can be improved for athletes and non-athletes as well (Abd El-Fattah & Nasr El-Din 2003; Chaouloff, 1997).

Hormones play a major role in human mental health. Sport has positive effects on hormonal secretion for hormones that decrease stress, anxiety, insomnia...etc. depression, with all its various degrees, is a common disease that sports participation may affect positively. It is a hard-to-diagnose disease but physiological changes accompanying depression are quite obvious on the cellular level as these biochemical changes affect neurons and are possibly due to genetic factors. When neuron cycle activity decreases, some brain functions suffer disorders including appetite, sleep, sexual desire and memory. Hormonal disorders in some glands may cause hyperstimulation which in turn lead to depression (Abd El-Fattah 2003; Blomstrand 2001; Gomes et al. 2001).

Social acceptance is a basic human need. It means that every individual needs to be socially accepted and respected from others. The sports field affects social and psychological aspects of human life as sport is a preventive measure for health protection with all its positive effects on emotional aspects and mood. For years, different moods and behavioral patterns were subjects for psychology more than biology. But recent years revealed the biological origins of psychological processes and behavior. Functional causes of mental diseases may be due to imbalance of neurotransmitters secretion including serotonin or 5-hydroxytryptamine (5-HT) (Mahmoud, I. 2006: 351; Abd El-Fattah, A. 2003; Dwyer & Flynn 2002).

Serotonin is a neurotransmitter produced in the brain from tryptophan, a basic monoamine. Serotonin suppresses transmission of neuro-signals. Therefore, increased concentration of serotonin is related to sleep and fatigue. It has an effective role in treating anxiety and depression (Blomstrand, et al.198.; Bianchi et al 1997, Meeusen & Placentini 2003).

Recent studies indicated that decreased serotonin levels can cause depression. Therefore, it is used in treating psychological disorders like anxiety, depression, obsessive compulsive and schizophrenia.

In addition, serotonin is used in treating obesity, hypertension, insomnia and migraine. As a neurotransmitter, serotonin is responsible for several body functions including physical and motor activity and cardio-pulmonary system. It also affects other psychological behaviors like eating, aggression and sleep (Abd El-Fattah, A. 2003, Abd El-Kawy, A. 1995, Meeusen & Placentini 2003, Stenfors et al 2004).

Several studies indicated that lack of serotonin leads to depression in women between 40 and 50 years (Darweesh & Berekaa 2000; Harzawy 2004, Faheem 2004).

On the other hand, neurons in the brain and spinal cord that have decreased concentrations of 5-Hydroxy Indol Acetic Acid (5HIAA), a biproduct of serotonin metabolism in urine, is an important biomarker of depression, insomnia, obsessions and anxiety as 5HIAA concentrations in urine indicate the increase or decrease of serotonin in brain (Okasha 2000, 2004; Abu Srea & Mahmoud 2007, Bianchiet et al 1997; Victor and Donald 1994; Blomstrand2001; Gomes et al. 2001).

Sports training and aerobic exercise till fatigue increases serotonin concentrations in the brain and this is what anti-depressive drug try to do. Sports participation help preventing depression and therefore improving mood and emotional and psychological status of non-athlete participants, especially women in this critical age (Abd El-Fattah, A. 2003, Rateb, O. 2004; Heshmat & Shalaby 2003; Chaouloff, 1997).

Accordingly, this research is trying to use sport to improve health conditions for women in this critical

age as a preventive treatment for some contemporary diseases and hypokinetic syndromes through an aerobic exercises program and identifying its effects on 5HIAA concentrations in urine and its relation to some psychological behaviors like social acceptance. Recent years revealed the potentials of applied physiology in establishing objective indicators for measuring functional abilities of vital body systems related to psychological behaviors especially in women.

#### **Aims:**

The current research aims to design an aerobic exercises program and identify its effects on:

- Physiological variables (pulse – blood pressure – fat percentage – muscles – bones – water – basic metabolic rate BMR – active metabolic rate AMR) for women (40-50 years).
- 5HIAA concentrations in urine for women (40-50 years).
- Responses to social acceptance scale for women (40-50 years).
- Differences between measurements of all mentioned variables for women (40-50 years).

## **2. Methods:**

### **Approach:**

The researcher used the experimental approach (one-group design) with pre- and post-measurements.

### **Participants:**

The researcher purposefully chose (10) women (40-50 years) who are newly participating in sport for health.

**Table (1): Characteristics of participants (n=10)**

Variables	Mean	SD	Squewness
Age	43.80	3.5839	1.199
Height	159.10	6.0818	0.020
Weight	71.70	10.3821	0.349

Table (1) indicated that that squewness values ranged between ( $\pm 3$ ) and this indicates homogeneity of sample.

### **Criteria for choosing participants:**

- They are all between 40 and 50 years.
- They are all beginners in sports participation.
- Written consent on involvement in the study.
- Not following particular nutrition program.
- Free of any diseases of physiological disorders.

### **Data collection instruments:**

- Data recording forms.
- A restameter for measuring heights.

- Blood pressure monitor (Beurer medical BC 08).

- Body composition monitor (Beurer BF 100 body Complete).

- Urine sampling kit:

- Dry sterile plastic tubes with tight cover.
- Closed sterile plastic package for tubes.
- Ice box.

- Psychological scales:

- Social Acceptance Scale: 33 positive items corrected on a (yes/no) scale with (yes=1) and (no=0) (Desouky 2004).

- Social Desirability Scale (Allawy 1998).

The recommended Exercises Program:

The recommended aerobic exercises program aims to identify the effects of sports participation on women health as seen in some physiological variables, 5HIAA concentrations in urine and responses to social acceptance scale. The researcher followed the following steps:

- Review of literature.
  - Content analysis for similar programs.
  - Assuring suitability of exercises to age group.
  - Assuring the program will fulfill its objectives.
  - Considering progression from easy to hard.
- Program principles:
- The program includes (24) units (3 units per week).
  - Each unit is between (20 – 60) minutes.
  - Warmup for (10) minutes including walking and (4-5) stretches.
  - Progressive aerobic exercises as a main part.
  - Cool down for (10) minutes including walking and (4-5) stretches.
  - The program concentrates on aerobic work
- Abd El-Fattah, A. (1999), quoting Hannaford et al, Dayne et al, Sexton et al, Roth & Holmes and

Mecan & Holmes, indicated that exercises should be initiated for (8-12) times per week with duration of (20-60) minutes (3-5 units per week). The researcher chose to initiate the program for (8) weeks (3 units per week).

Pilot study:

The researcher performed a pilot study on a pilot sample (n=5) from the same research community and outside the main sample to:

- Verify the suitability of exercises (number of exercises – volume – intensity – rest) for this age group.
- Verify the validity of training places and instruments.

The researcher applied the first week of the program to the pilot sample from 26-3-2016 to 30-3-2016 and results indicated that:

- Load variables (number of exercises – volume – intensity – rest) were identified.
- Training and measurement dates were set.
- Training hall and instruments proved valid.

As for Social Acceptance Scale, the researcher compared it with Social Desirability Scale as seen in table (2).

**Table (2): Differences in pilot sample responses to the two scales (n=5)**

Scale	Mean	SD	(t)	P
Social desirability	18.11	4.88	*5.12	0.001
Social acceptance	10.55	1.80		

Table (2) indicated statistically significant differences between the two scales. This clearly shows that both scales are distinct and only measure what they are meant to.

#### Main study:

Application of the program:

The recommended aerobic exercises program was applied to the main sample (n=10) from 2-4-2016 to 15-6-2016 for (8) weeks (3 units per week) with total of (24) training units.

Pre-measurements:

Pre-measurements were taken on 1-4-2016 according to the following order:

- Physiological variables (blood pressure – pulse – BMI).
- 5HIAA concentrations in urine before the first unit.
- 5HIAA concentrations in urine after the first unit.
- Social acceptance scale.

Instructions for urine sampling:

- All participants should refrain from consuming and caffeinated drinks (tea – coffee – cola) for at least 12 hours before sampling.

- Drinking water is allowed.
- Each tube is labeled by the participant name and sampling time.

- A mark should be drawn on the plastic cup from outside indicating the amount of urine sampled then samples are transferred to tubes and unwanted amount should be discharged.

Post-measurement:

Post-measurements were taken on 17-6-2016, following the same protocol of pre-measurements.

#### Statistical treatment:

- Descriptive statistics.
- Wilcoxon coefficient (Z).
- Difference significance (t test).

### 3. Results:

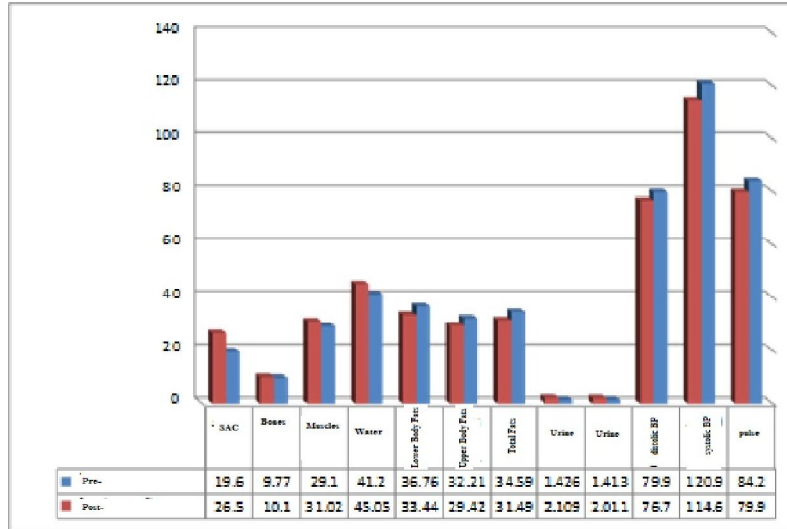


Fig. 1: means of physiological measurements (n=10)

Fig. 1 showed means of some physiological variables (pulse – blood pressure – BMI – fat percentage – muscles – bones – water) for participants (n=10)

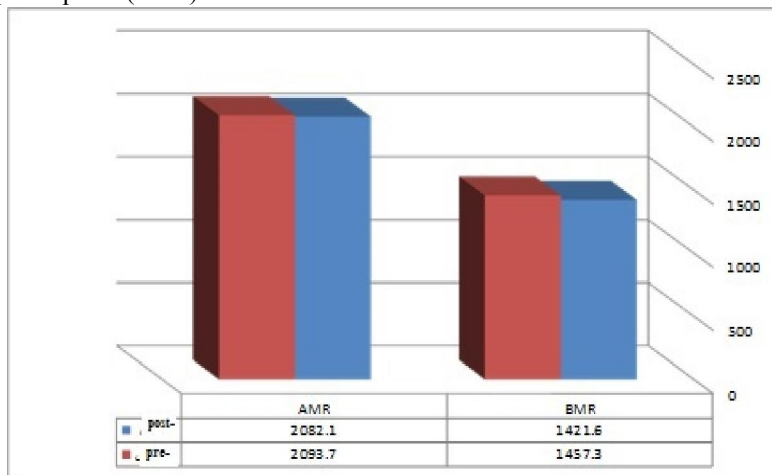


Fig.2: means of BMR and AMR values (n=10)

Fig.2 showed means of basic metabolic rate (BMR) and active metabolic rate (AMR) of participants (n=10)

Table (3): Difference significance between pre- and post-measurements of physiological variables (n=10)

Variables	Trend	Number	Ranks mean	Ranks sum	(Z)	P
Weight (KG)	-	7	4.79	33.50	*2.20	0.027
	+	1	2.50	2.50		
	=	2				
Pulse (BPM)	-	7	4.00	28.00	*2.37	0.018
	+	0	0.00	0.00		
	=	3				
Systolic blood pressure (mm/hg)	-	4	3.50	14.00	1.75	0.080
	+	1	1.00	1.00		
	=	5				
Diastolic blood pressure (mm/hg)	-	7	5.14	36.00	1.60	0.108
	+	2	4.50	9.00		
	=	1				

Table (3) indicated statistically significant differences between pre- and post-measurements of physiological variables except for systolic/diastolic blood pressure, in favor of post-measurements.

**Table (4): Difference significance between pre- and post-measurements of Body Composition Variables (n=10)**

Variables	Trend	Number	Ranks mean	Ranks sum	(Z)	P
Total body fats	-	8	6.38	51.00	*2.39	0.017
	+	2	2.00	4.00		
	=	0				
Upper body fats	-	8	4.50	36.00	*2.52	0.012
	+	0	0.00	0.00		
	=	2				
Lower body fats	-	8	6.25	50.00	*2.29	0.022
	+	2	2.50	5.00		
	=	0				
Water	-	0	0.00	0.00	*2.66	0.008
	+	9	5.00	45.00		
	=	1				
Muscles	-	0	0.00	0.00	*2.80	0.005
	+	10	5.50	55.00		
	=	0				
Bones	-	0	0.00	0.00	*2.53	0.011
	+	8	4.50	36.00		
	=	2				
BMR	-	0	0.00	0.00	*2.80	0.005
	+	10	5.50	55.00		
	=	0				
AMR	-	0	0.00	0.00	*2.81	0.005
	+	10	5.50	55.00		
	=	0				

Table (4) indicated statistically significant differences between pre- and post-measurements of body composition variables in favor of post-measurements.

**Table (5): Difference significance between pre- and post-measurements of 5HIAA Concentrations in Urine (n=10)**

Variables	Trend	Number	Ranks mean	Ranks sum	(Z)	P
Before unit (1) and after the program	-	0	0.00	0.00	*2.80	0.005
	+	10	5.50	55.00		
	=	0				

Table (5) indicated statistically significant differences between pre- and post-measurements of urine concentrations of 5HIAA (before unit 1 and after the program) in favor of post-measurements.

**Table (6): Difference significance between pre- and post-measurements of 5HIAA Concentrations in Urine (n=10)**

Variables	Trend	Number	Ranks mean	Ranks sum	(Z)	P
After unit (1) and after the program	-	1	2.00	2.00	*2.6	0.009
	+	9	5.89	55.00		
	=	0				

Table (6) indicated statistically significant differences between pre- and post-measurements of urine concentrations of 5HIAA (after unit 1 and after the program) in favor of post-measurements.

**Table (7): Difference significance between pre- and post-measurements of Social Acceptance Scale (n=10)**

Variables	Trend	Number	Ranks mean	Ranks sum	(Z)	P
Social acceptance	-	2	2.75	5.50	*2.25	0.024
	+	8	6.19	49.50		
	=	0				

Table (7) indicated statistically significant differences between pre- and post-measurements of social acceptance scale in favor of post-measurements.

#### 4. Discussion:

Table (3) indicated statistically significant differences between pre- and post-measurements of physiological variables except for systolic/diastolic blood pressure, in favor of post-measurements.

The researcher thinks that these improvements are due to the effects of the aerobic exercises program as it improved weight and pulse in addition to efficiency of the heart. This is consistent with Abd El-Fattah, A. (2003) who indicated that aerobic work decreases blood circulation at rest and this decreases heart rate by 5-10 BPM.

Table (4) indicated statistically significant differences between pre- and post-measurements of body composition variables (total; fats – upper body fats – lower body fats – water – bones – muscles – BMR – AMR) in favor of post-measurements. The researcher thinks that these improvements are due to the effects of the aerobic exercises program. Galen (2005) and Mahmoud et al (2008) agreed that aerobic exercises improve physical fitness of individuals as it enables them to use energy in amusing activity that relieves boredom and stimulates body systems.

According to these results, the researcher thinks that aerobic exercises programs based on scientific evidence prepared for women who participate in sport for health are very effective in improving physiological variables under investigation as it decreased body fats through using more calories in energy production and improved bone and muscle mass although these improvements did not reach the calibration values of the device. Ammar (2004) indicated that increasing body muscle mass leads to burning more calories during active work and rest and this leads to quick loss of obesity. ( Chaoulhoff, 1997).

In addition, the researcher thinks that aerobic exercises helped participants to consume more water and this increased rehydration. Mahmoud et al (2008) and Abd El-Fattah, A. (2003) indicated that participation in sport improves body composition and fat distribution for women in addition to increasing hydration.

Table (5) and (6) indicated statistically significant differences between pre- and post-measurements of urine concentrations of 5HIAA in favor of post-measurements. The researcher thinks that this is due to increased concentrations of serotonin in the brain. This is confirmed by the results of Abu Srea & Mahmoud (2007), Heshmat & Shalaby (2003), Bianchi et al (1997), Lehman et al (1995), Linda et al (1998) and Ito et al (1999) who indicated that prolonged physical activity increases concentrations of 5HIAA in urine and this leads to central fatigue after training. This means that the aerobic exercises program for (8) weeks increased serotonin concentrations in the brain and 5HIAA in urine.

Table (7) indicated statistically significant differences between pre- and post-measurements of social acceptance scale in favor of post-measurements. This is due to regular aerobic exercises as this type of exercises improves positive psychological status due to increased serotonin concentrations in the brain which in turn decreases the chance of feeling depressed.

This is consistent with Rateb & Khalifa (1998) and Rateb (2004) who indicated the positive effects of physical activity on increasing serotonin levels in the brain which leads to relaxation and rest. Serotonin helps individuals to get rid of stress in addition to improving sleep and decreasing insomnia and depression. Several studies indicated that physical activity is an excellent method for decreasing depression in patients with clinical diagnosis of depression. This is consistent with Grist (1999) who categorized individuals with depression into three groups according to the type of treatment:

- A group for running exercises (45 minutes for 3 times per week).
- Psychotherapy (10 minutes per session).
- Psychotherapy (unlimited period).

These results indicated that after (10) weeks, group (1) with running exercises showed significant decreases in depression symptoms compared with the two groups of psychotherapy.



Yamamoto et al (1997), Meeusen et al (2003), Abdullah, M. & Ali, M. (1999), Abd El-Fattah, A. (2003) and Heshmat & Shalaby (2003) indicated that serotonin is a major cause of central fatigue and increases the need for sleep. This decreases depression and insomnia. The increase of serotonin levels in the brain due to exhaustive training leads to good mental status after training and prevents depression.

The researcher thinks that the aerobic exercises program for untrained women increased 5HIAA concentrations in urine. This means that aerobic training increases serotonin levels in the brain and this improves social acceptance response.

### Conclusions:

1. The aerobic exercises program induced several physiological adaptive processes that can be measured after 6-8 weeks with no less than 25 minutes per session (3 times per week).

2. Regular aerobic exercises have positive effects on improving the function of heart and this decreases heart rate.

3. Aerobic exercises program decreased body fats through burning more calories and this decreases weight. In addition, it has positive effects on bone and muscle mass. This protects women in this critical age from osteoporosis although improvements did not reach calibration values.

4. Regular aerobic exercises decrease BMR and AMR due to energy saving in normal life.

5. Aerobic exercises program increased serotonin levels in the brain and this increase urine concentrations of 5HIAA which in turn has positive effects on mood.

6. Regular aerobic exercises improved responses to social acceptance scale and decreases vulnerability to depression due to increased levels of serotonin.

### Recommendations:

- Spreading sports participation culture among women due to its positive psychological and physiological effects.

- Encouraging women to participate in sport to decrease negative psychological and physiological effects of menstruation disorders.

- Studying the effects of serotonin on some psychological disorders like anxiety, depression and obsession through sports participation in addition to treating such disorders.

- Encouraging women to keep participating in sport so that body composition reaches international standards.

- Designing similar programs for bigger groups of women according to identified design criteria.

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