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## Aerobic versus resistive training on selected hematological parameters in elderly

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Aging is related to a wide assortment of changes, incorporating alterations in blood profile: immunological and hematological functions are down-regulated. Some studies have shown that different exercise ways can enhance the hematological parameters. The present study was designed to compare the effect of aerobic versus resistive training on selected hematological parameters in elderly. Forty male and female elderly subjects, with age, ranges from 65-75 years were selected and randomly divided into two groups of 20 subjects. Group (A) participated in moderate aerobic training (walking on the treadmill) and Group (B) (participated in a progressive resistive training program. Both resistance and aerobic training were performed three sessions /week for 8 weeks. There was no significant difference between both groups in the mean age ( $p = 0.95$ ). Also, there was no significant difference in sex distribution between groups ( $p = 0.75$ ). Both groups showed a significant decrease in BMI and a significant increase in Hb post-treatment compared with that pretreatment ( $p > 0.01$ ), while there was no significant change in WBCs, RBCs, PLT between pre and post-treatment ( $p < 0.05$ ). There was no significant difference between both groups in BMI, WBCs, RBCs, PLT and Hb pre-treatment and also post-treatment ( $p > 0.05$ ). It was concluded that both endurance and resistance exercises showed a significant decrease in BMI and a significant increase in Hb post-treatment compared with that pre-treatment. These results indicate that both endurance and resistance exercises has a beneficial effect on hematological parameters

**Keywords:** Elderly; Aerobic training; Resistive training; Hematological parameters.

### INTRODUCTION

Aging cannot be considered as a disease; however, the danger of building up disease is increased as a component of age. Age changes the biochemical composition of tissues; the capacity to keep up homeostasis in adjusting to stressors decreases, and liability to be diseased increases with age. (Padalia et al., 2014).

It has been proposed that physical activity limit and reverse the age-related changes and enhance hematological parameters. Changes in blood hematological parameters are related to aerobic exercise, for example, an increase in

hemoglobin or platelet number and decrease in hematocrit in young and old people. Moreover, it was showed that moderate aerobic exercise has a large effect on immune response. (Bobeuf et al., 2009). It was demonstrated that both resistance and endurance exercise has a good consequence on hematological parameters, and they are suitable and non-medication approaches to prevent and decrease the frequency of cardiovascular disorders in male obese adolescents (Mogharnasi et al., 2014). Another study on young people reported an increase in leukocytes count with a various difference

between subpopulation of leukocytes (neutrophils, lymphocytes, and monocytes) after acute resistance exercise (Ramel et al., 2003). Nevertheless, the impact of long-term resistance training on hematological blood parameters in older adults stays obscure (Bobeuf et al., 2009). Therefore, the objective of the current study was to compare the effect of aerobic versus resistive training on selected hematological parameters in elderly. To help old aged subjects to apply either aerobic or resistance training as an appropriate regimen that helps elderly to enhance their quality of life by preserving immune function.

## MATERIALS AND METHODS

### SUBJECTS:

Forty elderly subjects (sedentary, non-smoker, non-alcoholic, without major physical incapacity, no medication that could influence hematological parameters, no hormonal replacement therapy for women), their age ranged from 65-75 years with a BMI (25- 30) Kg/m<sup>2</sup>. They were selected from Hedaya Barakat elderly home. A consent form was taken from all subjects who participated in this study after explaining its aim. Subjects were divided randomly into two groups equal in number. Group (A) participated in moderate aerobic training (walking on a treadmill) and Group (B) participated in a progressive resistive training program. Both resistance and aerobic training were performed three sessions /week for 8 weeks. The study was approved by ethical committee of Faculty of physical therapy, Cairo University, Egypt, with Approval No. P.T.REC/012/001268

### Study procedures

firstly Weight and height of all subjects were measured and after explanations of nature and goals of the study, a consent form was taken from all subjects who participated in this study then all subjects were instructed to keep the same scheme of training and dieting before throughout the trial and a 12-hours fasting blood samples was taken before starting program to measure the hematological parameter (Hb, RBCs, WBCs and platelet), finally Subjects were assigned into one of 2 groups: (1) aerobic training and (2) resistance training.

## Exercise protocol.

### Aerobic training Group (A):

participated in moderate aerobic training -walking on a treadmill) model:YY>9028D made in china with input voltage AC220-240 v/50-60 HZ )three sessions/week for 8 weeks, intensity was calculated by Karvonen formula:

$$\text{Exercise heart rate} = [(A-B) \times \text{desired intensity}] + B$$

[A represents maximum heart rate (220-age) and B for resting heart rate (average of three measurements)] (Mogharnasi et al., 2014). The desired intensity will be at 50-70%. Heart rate was measured by pulse-meter to detect pulse rate before exercise (Resting HR). During session heart rate will be monitored by pulse-meter to keep the training heart rate within the pre-calculated value for each subject. Each session began with Warming up for 10 minutes with stretching motions, walking then continuous running at a constant rate for 20 minutes. At the end of the session, cooling down was performed in form of slow running and stretching motions for 10 minutes to reduce the heart rate and body temperature .

### Resistive training Group B:

was participated in resistive training program Three times per week for 8 weeks (Mogharnasi et al., 2014). 3 sets of 8 repetitions with **Intensity:** at 40 to 60%. Of 1- RM (The 1-RM test was determined as the maximal resistance that could be moved through the full range of motion once for each exercise tested). Each session began with **Warming up** for 10 minutes through stretching motions then the **active phase:** 20 minutes resistance exercise, progressive resistance training program –that will be as follow: straight leg raising, knee extension, hip abduction, shoulder flexion, shoulder abduction. **1<sup>st</sup> week:** at first session we determined the maximal weight could be lifted correctly in a single repetition, for last two session of the week, subjects worked at 40% for three sets. **2<sup>nd</sup>-4<sup>th</sup> week:** intensity was increased gradually to reach the intended intensity. At the end of the session **cooling down** was performed for 5 minutes in form of stretching movements to reduce the heart rate and body temperature. After 48 hours from finishing the program, a 12-hour fasting blood sample was collected again for all subjects in both groups

**Statistical analysis:**

Descriptive statistics and t-test were conducted for comparison of the mean age between both groups. Chi-squared test was conducted for comparison of sex distribution between groups, Changes in BMI, WBCs, RBCs, PLT and Hb between pre and post-treatment in each group were compared using Paired t-test and between groups using unpaired t-test. The level of significance for all statistical tests was set at  $p < 0.05$ . All statistical measures were performed through the statistical package for social studies (SPSS) version 19 for windows.

**RESULTS****Subject characteristics:**

Table (1) showed the mean  $\pm$  SD age of group A and B. There was no significant

difference between both groups in terms of age, BMI and sex distribution. Both groups showed a significant decrease in BMI

**Effect of treatment on BMI, WBCs, RBCs, PLT and Hb:**

Both groups showed a significant decrease in BMI and a significant increase in Hb post treatment compared with that of pre-treatment ( $p < 0.01$ ), and there was no significant change in WBCs, RBCs, PLT between pre and post treatment within group ( $p > 0.05$ ). While there was no significant difference between both groups in BMI, WBCs, RBCs, PLT and Hb pre-treatment and also post treatment ( $p > 0.05$ ). (Table 2), and demonstrated in figures (1, 2, 3 and 4).

**Table (1): Comparison of subject characteristics between group A and B**

	$\bar{x} \pm SD$		MD	t- value	p-value
	Group A	Group B			
Age (years)	68.35 $\pm$ 3.31	68.3 $\pm$ 2.29	0.05	0.05	0.95*
Males/females	10/10	9/11		( $\chi^2 = 1$ )	0.75*

$\bar{x}$ , Mean; SD, Standard deviation; MD, Mean difference;  $\chi^2$ , Chi squared value; p value, Probability value; \*, Non-significant.

**Table (2): Mean BMI, WBCs, RBCs, PLT and Hb pre and post treatment in group A and B:**

	Group A			Group B			Between groups	
	Pre	Post	P value	Pre	Post	P value	Pre	Post
	$\bar{x} \pm SD$	$\bar{x} \pm SD$		$\bar{x} \pm SD$	$\bar{x} \pm SD$		P value	P value
BMI (kg/m <sup>2</sup> )	27.65 $\pm$ 1.34	26.71 $\pm$ 1.37	0.001**	27.6 $\pm$ 1.45	27.37 $\pm$ 1.55	0.01**	0.89*	0.16*
WBCs (10 <sup>9</sup> /L)	5.92 $\pm$ 1.5	5.69 $\pm$ 1.16	0.29*	6.55 $\pm$ 1.36	6.26 $\pm$ 1.05	0.17*	0.17*	0.11*
RBCs (10 <sup>12</sup> /L)	4.72 $\pm$ 0.41	4.75 $\pm$ 0.35	0.55*	4.66 $\pm$ 0.31	4.7 $\pm$ 0.32	0.44*	0.64*	0.68*
PLT (10 <sup>9</sup> /L)	303.05 $\pm$ 84.95	314.05 $\pm$ 77.58	0.24*	298.95 $\pm$ 67.83	312.45 $\pm$ 56.65	0.15*	0.86*	0.94*
Hb (g/dl)	13.45 $\pm$ 1.13	13.77 $\pm$ 1.24	0.001**	13.47 $\pm$ 0.8	13.69 $\pm$ 0.88	0.01**	0.94*	0.81*

$\bar{x}$ , Mean; SD, standard deviation; p-value, level of significance; \* Non-significant; \*\* Significant

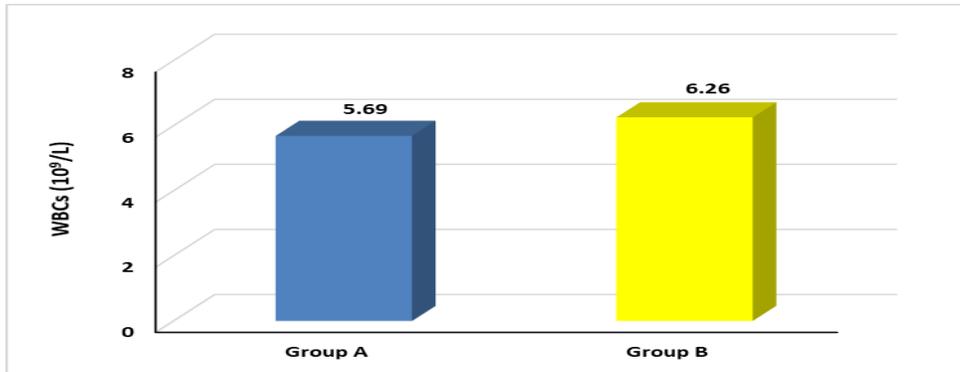


Figure (1). Post treatment mean values of WBCs of the group A and B.

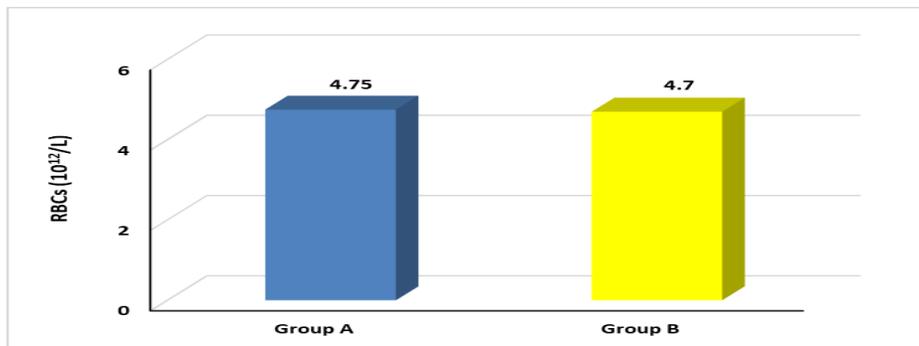


Figure (2). Post treatment mean values of RBCs of the group A and B.

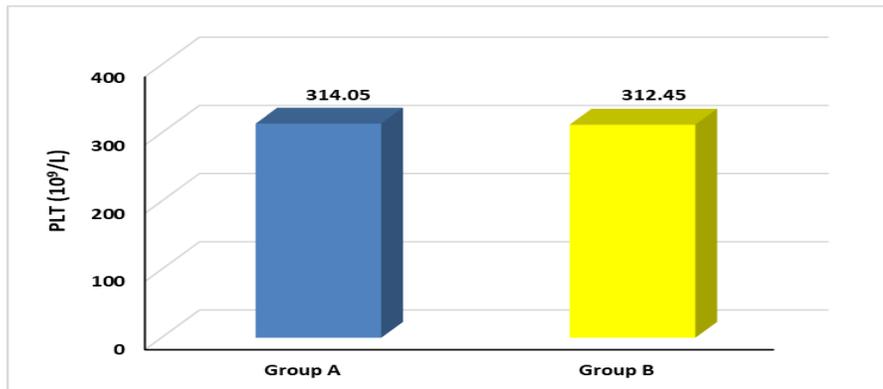


Figure (3). Post treatment mean values of PLT of the group A and B.

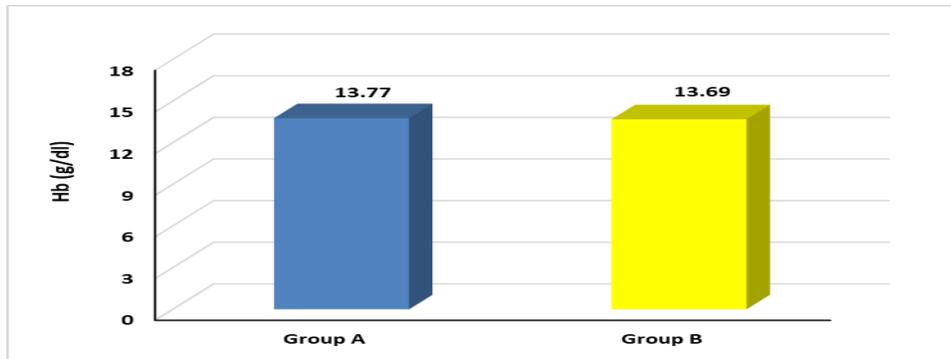


Figure (4). Post treatment mean values of Hb of the group A and B.

## DISCUSSION

The purpose of this study was to compare the effect of aerobic versus resistive training on selected hematological parameters in elderly.

Forty elderly subjects participated in this study. Subjects were divided into two groups, equal in numbers. The first group was the group A who received aerobic training and the second group was the group B who received the resistive training program. Data obtained from both groups regarding body mass index (BMI), white blood cells count (WBCs), red blood cells count (RBCs), platelet count (PLT) and hemoglobin (Hb) were statistically analyzed and compared.

The results of the present study showed that 8 weeks of resistance and endurance exercises do not make a significant difference in WBC (White Blood Cells). These results agreed with results declared by Mogharnasi et al., 2014, and Ghanbari-Niaki and Mohammadi, 2010. Mogharnasi et al., 2014, examined the effects of two months of endurance and resistance training on hematological parameters in obese male students and concluded that two months of exercise has no impact on WBC. Ghanbari-Niaki and Mohammadi (2010) studied the impact of four-week anaerobic exercises on the hematologic changes in thirty young kick boxers male showed that there was no impact on WBC.

However, this result is inconsistent with the findings of Neves, et al., (2014) and Arazi et al., (2012). Neves, et al., (2014) examined the impact of high, low exercise intensity on leukocytes count in nine healthy, active young males the results showed a greater increase in the leukocyte count after high-intensity exercise. Arazi et al., (2012) studied the impact of Circuit resistance training included ten stations, three sets with twenty

seconds for each station on hematological parameters in 24 athlete male, subjects were randomly divided into three groups including three low, moderate and high intensities, results demonstrated a significant increase WBC in the high-intensity group.

Study findings showed that 8 weeks of resistance and endurance exercises do not make a significant difference in RBC (red blood cell counts), these results supported the results achieved by Kostrzewa-Nowak D et al., (2015), and Bobeuf et al., (2009). Kostrzewa-Nowak Det al., (2015) studied the effect of a 12-week-long aerobic training program on complete blood count in Thirty-four young women and showed that no significant change in RBCs count. Also, Bobeuf et al., (2009) examined the effects of resistance training on hematological blood markers in twenty-nine older individuals and concluded that a 6-month resistance program in healthy older individuals seems to have no significant effects on RBCs.

However, the result is inconsistent with the findings of Arazi et al., (2012) and Arazi, Damirchi, and Mostafaloo (2011). Arazi et al., (2012) studied the effect of Circuit resistance training program included ten stations, three sets with twenty seconds for each station on hematological parameters in 24 athlete male students. Subjects were randomly divided into three groups including three low, moderate and high intensities, results showed a significant increase RBC in low, moderate and high-intensity group. Arazi, Damirchi, and Mostafaloo (2011) investigated the effect of two bouts of selected concurrent endurance and resistance exercises (for 90 minutes in the morning and afternoon bouts) on hematological parameters in eight male students, blood samples were obtained before, immediately

after and three hours after the exercise and the results indicated that RBCs decreased significantly three hours after exercise.

Ahmadizad and El-Sayed, 2005 found that after an acute resistance exercise there were transient changes in blood viscosity assuming that this change could be ascribed to the hemo concentration. It was demonstrated that an increase in red blood cell concentration results from decreased plasma volume, because, the viscosity of the plasma increased immediately after exercise and returned to normal at the end of the recovery period .

The results showed that 8 weeks of resistance and endurance exercises do not make a significant difference in the platelet count, the results of this study came in support with results shown by Kostrzewa-Nowak D et al., (2015) and Bobeuf et al., (2009). Kostrzewa-Nowak Det al., (2015) studied the effect of a 12-week-long aerobic training programme on complete blood count in thirty-four young women aged and showed that No significant change in platelet count. Bobeuf et al., (2009), examined the effects of resistance training on hematological blood markers in older individuals and concluded that a 6-month resistance program in healthy older individuals seems to have no significant effects on platelet counts.

However, the result is inconsistent with the findings of Arazi, Damirchi, and Mostafaloo (2011) and Ghanbari-Niaki and Mohammadi (2010). Arazi, Damirchi, and Mostafaloo (2011) investigated the effect of two bouts of selected concurrent endurance and resistance exercises (for 90 minutes in the morning and afternoon bouts) on hematological parameters in eight male students Blood samples were obtained before, immediately after and three hours after the exercise, findings indicate that platelet counts increased significantly immediately after exercise .Ghanbari-Niaki and Mohammadi (2010) studied effect of four- week anaerobic exercises on the hematologic changes in thirty young male kick boxers and found significant increase in platelets (PLT)

The findings of the study also showed that 8 weeks of resistance and endurance exercises caused significant increase in hemoglobin (Hb) in endurance and resistance groups. This result came in line with the findings of Mogharnasi et al., (2014) and Arazi et al., (2012). Mogharnasi et al., 2014 studied the effect of two months of endurance and resistance training on lipid profiles, heart rate, and hematological parameters in

obese male students, demonstrated that two months of resistance and endurance exercises significantly increased Hb. Arazi *et al.* (2012) studied the response of hematological parameters to different intensities (low, medium, and high) of a resistance circle exercise in male athlete students and found that resistance circle exercise caused significant increase in Hb in both medium-intensity and high-intensity groups .

On the other hand, result is inconsistent with the findings of Kostrzewa-Nowak D et al.,(2015) and Mousavizadeh, Ebrahimi, and Nikbakht (2009). Kostrzewa-Nowak D et al.,(2015) studied the effect of 12-week-long aerobic training program on complete blood count in Thirty-four young women aged and showed that No significant change in HB . Also, Mousavizadeh, Ebrahimi, and Nikbakht (2009) studied the effect of eight weeks of aerobic training including 40-minute running twice a week on hematological parameters in female students and the results showed decrease in hemoglobin. so, we concluded that the duration of 8 weeks and the intensity of exercise in the present study seems to be enough to cause significant changes in hemoglobin.

The findings of the study also showed that 8 weeks of resistance and endurance exercises caused a significant decrease in BMI in both endurance and resistance groups. This result came in line with the findings of Habibzadeh and Rahmaninia (2011). Habibzadeh and Rahmaninia (2011) studied the effect of two months of walking exercise on body mass index and lipid profile in Twenty untrained obese (BMI>30) girls, the results showed that the body mass index decreased significantly . It has been demonstrated that the endocrine system of the body, can utilize fatty acids as fuel to increase lipolysis during exercise, by increasing the level of epinephrine, norepinephrine, growth hormone and cortisol. (Mogharnasi et al., 2014)

On the other hand, result is inconsistent with the findings of Bobeuf et al., (2009), who examined the effect of resistance training on hematological blood markers in older individuals and noticed the BMI of subjects before and after the training .The results showed that a 6-month resistance program in healthy older individuals seems to increase the BMI from  $27.2 \pm 2.7$  to  $27.4 \pm 3.0$ . This difference between the effect of our study and the study made by Bobeuf et al., (2009) on BMI may be due to the difference in characteristics of subjects, duration and intensity of exercise.

## CONCLUSION

From the results of the current study, it was concluded that both endurance and resistance exercises showed a significant decrease in BMI and a significant increase in Hb post-treatment compared with that of pre-treatment. These results indicate that both endurance and resistance exercises has a beneficial effect on hematological parameters and should be recommended in old aged persons , as both exercises can be considered to limit and reverse the age-related changes and enhance hematological parameters

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

## ACKNOWLEDGEMENT

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## AUTHOR CONTRIBUTIONS

MAM designed and performed the experiments and also wrote the manuscript.HME, AAH and SAF performed *continuous guidance and suggestions* during the performance of experiments, data analysis and reviewed the manuscript. All authors read and approved the final version.

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