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ASSESSMENT OF ANTIOXIDANT CAPACITY OF NOVICE STUDENT-ATHLETES PERFORMING MODERATE INTENSITY EXERCISE

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ABSTRACT

This research study aims to assess the Antioxidant Capacity of Novice student-athletes Performing Moderate Intensity Exercise. Thirty participants (N = 30), aged 18 to 30, were recruited from the Department of Sports Sciences and Physical Education at the University of the Punjab, Lahore, Pakistan. Similarly, they were randomly placed into two groups, i.e. experimental group (EG) and control group (CG). Each group comprised fifteen (15) subjects. Written informed consent was obtained from all the

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subjects. A self-made exercise protocol comprised of twelve weeks of different exercises, such as moderate intensity, was applied to the experimental group (EG) as per the study protocol. Antioxidant Capacity of participants was calculated through the Ferric Reducing Antioxidant Power (FRAP) Assay. The pre- and post-test data were processed through a statistical package for the social sciences, and thus, appropriate statistical tools were applied according to parametric data. Based on the analysis, the study concluded that low-intensity exercise has a significant impact on the antioxidant capacity of the participants.

Key words: Antioxidant Capacity, Moderate Intensity Exercise, Novice Students Athletes.

INTRODUCTION

According to Heart et al. (2016), the blood redox state is significant in the cell functions. Similarly, the blood redox state shows the reduction or oxidation in a cell. The most crucial redox systems are glutathione (reduced/ oxidized glutathione), thioredoxin reduced/oxidized, and nicotinamide adenine dinucleotide phosphate. According to Ifeanyi (2018), a cell contains free radicals. Similarly, Edmondson (2014) stated that mitochondria produce hydrogen peroxide (H_2O_2). The cell's metabolic process forms the antioxidant and reactive oxygen species (Ivanova & Yankova, 2013).

The byproduct of oxygen/nitrogen consists of non-radical and radical reactive species. Oxidative stress (OS) is usually used for oxidative damage (Finkler et al., 2014). Smoking, drinking, and an irregular diet increase oxidative stress.

The oxidative stress indicators are patenting in blood and urine. Among these indicators, blood is considered the most dominant indicator of oxidative stress (Lorenzano et al., 2019). Vollaard et al. (2005) indicated that exercise produces antioxidants and reactive oxygen species.

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Bouayed and Bohn (2010) state that an antioxidant system protects the cells from reactive species, which can be Endogenous, like Bilirubin and uric Acid and Exogenous, like Tocopherols and ascorbate. In moderate exercise, we can talk comfortably (O'Donovan et al., 2010). According to Fogarty et al. (2011), moderate exercise is good for each person, but exhaustive exercise produces free radicals, which can damage oxidative protein. Moderate training and an energetic routine of life are helpful for the prevention of oxidative stress and several diseases (cardiovascular disorders, type II diabetes) (Teixeira-Lemos et al., 2011). Moderate-intensity exercise is beneficial in such ways, decreases oxidative stress, deduces inflammatory cytokines, Improves cardiac function and reduces blood pressure (Booth et al., 2012).

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METHODS AND MATERIALS

The below procedures were adopted by the researcher to reach at certain findings and conclusion

Research Design

Due to close concern with exercise and its effects on the antioxidant system, an experimental research design was used by the researcher..

Setting

The study was carried out within the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan, between 1st January 30th 2023 to March 2023. The exercise sessions and data collection processes were carried out under controlled conditions within the department's facilities.

Study Participants

The participants of the study were recruited from the Department of Sports Sciences and Physical Education, University of the Punjab, Lahore, Pakistan.

Subject Size

The sample size of the study was calculated using G*Power statistical software to ensure adequate power to detect significant differences between groups. A total of Thirty (N=30) aged 18 to 30 participants were randomly placed into two groups i.e. experimental group (EG) and the control group (CG). Each group was comprised of fifteen (15) subjects.

Bias

The research made all possible efforts to minimize bias by randomizing participants into groups, standardizing the exercise protocol, and using validated laboratory techniques for plasma measurement. Potential confounders, such as salt consumption, medication use, and physical positioning during sampling, were controlled as per protocol.

Instruments and Instrumentations

A self-made exercise protocol comprised of twelve weeks of different exercises such as moderate intensity was applied to the experimental group (EG) as per the study protocol. The Ferric Reducing Antioxidant Power (FRAP) Assay test measured the Antioxidant Capacity through the blood sample. A 5ml blood sample was collected from all subjects to evaluate the Antioxidant Capacity. Each blood sample was marked with identification codes according to the code of each group.

Ethical Consideration

Written informed consent was obtained from all the subjects. In addition, all the protocols of the study were approved by the ethical and review board of the University of the Punjab, Lahore Pakistan (NO.D/373/FIMS).

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Study Variables

The primary variable of interest was the Moderate Intensity exercise and Antioxidants Capacity. Other variables included demographic factors (age, weight, and height) and the exercise protocol adherence for the EG.

Quantitative Variables

The primary quantitative variable was antioxidants capacity measured in unit mole per litre ($\mu\text{mole/L}$) thus the normal value of antioxidants used for the assessment according to a standard ferric reducing assay kit. Factors antioxidants capacity, such as dietary salt intake, pregnancy, and diurnal variations, were documented for consistency.

Data Analysis

The pre and post-test results were processed through a statistical package (SPSS, Version 26) for social sciences, and similarly, suitable statistical tools were applied.

RESULTS AND DATA ANALYSIS

Descriptive of Anthropometric measurements and Antioxidant Capacity of 30 participants before and after treatments

Variables	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Age (years)	10.0	18.0	28.0	20.71	1.8497	3.421
Weight (Kg)	34.00	48.00	82.00	65.30	6.27090	39.324
Height (feet)	.90	5.10	6.00	5.57	.21989	.048
FRAP ($\mu\text{mol/L}$) Pretest	24.00	134.00	158.00	144.07	5.94129	35.299
FRAP ($\mu\text{mol/L}$) Posttest	120.00	80.00	200.00	135.50	36.67325	1344.927

Abbreviation: FRAP = Ferric Reducing Antioxidant Power

Table indicates descriptive statistics of anthropometric measurements, blood redox state and its allied parameters of 30 participants before and after treatments. The descriptive statistics include each variable's range, minimum, maximum, mean, standard deviation, and variance. For the age variable, the mean age of the participants was 20.711 years, with a standard deviation of 1.8497 and a range of 10.0 to 28.0 years. For the weight variable, the mean weight was 65.30 Kg with a standard deviation of 6.27090 and a range of 34.00 to 82.00 Kg. For the height variable, the mean height was 5.5727 feet with a standard deviation of 0.21989 and a range of 0.90 to 6.00 feet.

For the FRAP variable, the mean pretest FRAP was 144.0667 $\mu\text{mol/L}$ with a standard deviation of 5.94129 and a range of 24.00 to 158.00 $\mu\text{mol/L}$. The mean post-test was 135.5000 $\mu\text{mol/L}$ with a standard deviation of 36.67325 and a range of 80.00 to 200.00 $\mu\text{mol/L}$.

Mean difference between Moderate intensity Exercise Group (MIE-G) and Control Group (CG) FRAP ($\mu\text{mol/L}$) After the Treatment

	Groups	N	Mean	Std. Deviation	Std. Error Mean
FRAP ($\mu\text{mol/L}$) Post test	MIE-G	15	193.7333	5.33809	1.37829
	CG	15	140.6667	2.99205	.77254

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
FRAP	EVA	5.84	.02	33.586	28	.000	53.06667	1.58003	49.83011	56.30322
	EVNA			33.586	22.007	.000	53.06667	1.58003	49.78993	56.34340

The results of the above tables show a comparison in terms of antioxidant capacity in the treatment group compared to a CG. Table provides the mean and standard deviation for each variable for the EG and CG, along with the standard error mean.

Table presents the independent samples t-test results to determine whether significant differences exist between the two groups for each variable. Levene's test for equality of variances is also provided to assess the assumption of equal variances for the t-test. For FRAP, the t-test indicates a significant difference between the two groups ($t(28) = 33.586$, $p < .001$), with the EG having a significantly higher mean FRAP level ($M = 193.7333 \mu\text{mol/L}$) than the control group ($M = 140.6667 \mu\text{mol/L}$). The Equal variances assumption was violated, so the t-test with EVNA was used.

In summary, the study found that EG significantly increased FRAP levels compared to the CG.

Pre and Post-test differences of Moderate Intensity Exercise Group (EG) in FRAP ($\mu\text{mol/L}$).

Paired Samples Statistics				
	Mean	N	Std. Deviation	Std. Error Mean
FRAP ($\mu\text{mol/L}$) Pre test	151.4000	15	4.32270	1.11612
Pair 1 FRAP ($\mu\text{mol/L}$) Post test	193.7333	15	5.33809	1.37829

Paired Samples Correlations				
	N	Correlation	Sig.	
Pair 1 FRAP ($\mu\text{mol/L}$) Pretest & FRAP ($\mu\text{mol/L}$) Post test	15	.008	.977	

Paired Samples Test									
		Paired Differences				T	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	FRAP (μmol/L)								
	Pretest - FRAP (μmol/L)	-42.33333	6.84175	1.76653	-46.12217	-38.54450	-23.964	14	.000
	Post test								

Table presents the results of pre-and post-test differences in FRAP ($\mu\text{mol/L}$) of the EG. Paired Samples Statistics: For FRAP, the mean value increased from 151.4 $\mu\text{mol/L}$ in the pre-test to 193.7 $\mu\text{mol/L}$ in the post-test, indicating a significant difference ($p < .001$). Paired Samples Correlations: For FRAP, there was no significant correlation between pre-test and post-test values ($r = .008$, $p = .977$). Paired Samples T Test: The pre and post-test differences were significant for FRAP ($t = -23.964$, $p < .001$).

In summary, the results suggest EG increases (FRAP).

Pre and Post-test differences of the Control Group (CG) in FRAP ($\mu\text{mol/L}$).

Paired Samples Statistics

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		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FRAP (μmol/L) Pre test	140.8000	15	3.29935	.85189
	FRAP (μmol/L) Post test	140.6667	15	2.99205	.77254

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	FRAP (μmol/L) Pretest & FRAP (μmol/L) Post test	15	.868	.000

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	FRAP (μmol/L) Pre test - FRAP (μmol/L) Post test	.13333	1.64172	.42389	-.77582	1.04249	.315	.758

Table shows the pre and post-test differences of the CG in FRAP (μmol/L). The analysis involves three variables, each including a particular biomarker's pre-test and post-test values. The paired samples statistics show each variable's mean, standard deviation, and standard error mean in the pre-test and post-test. For the FRAP biomarker, the mean values were 140.80 μmol/L in the pre-test and 140.67 μmol/L in the post-test, indicating a slight decrease in antioxidant capacity.

The paired samples t-test evaluates the significance of the differences between the pre and post-test values for biomarker. For FRAP, the mean difference was 0.13 μmol/L, with a standard deviation of 1.64 and a standard error mean of 0.42. The confidence interval of the difference includes zero, suggesting no significant change in antioxidant capacity between the pre-test and post-test.

The results suggest no significant changes in the CG's FRAP.

DISCUSSION

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Based on the analysis, the study moderate-intensity exercise, has a significant impact on Antioxidant Capacity as measured through Frap (FRAP ($p < .001$)). There were no significant differences between the EG and CG; this finding is supported by Khan et al. (2019); the quality of blood life increases with the help of moderate-intensity exercises, which reduces muscle fatigue and health-related problems due to the oxidative damage of the cells in the human body. The same result was drawn by Debevec et al. (2017), who found that moderate intensity helps reduce oxidative stress by maintaining the balance between antioxidants and ROS, termed the blood redox state. Exercise with moderate intensity increases antioxidant enzymatic activities.

In addition, using nutritional supplementations strengthens the antioxidant system and thus helps balance the blood redox state (Shamsnia et al., 2022). Researchers found that exercise dramatically contributes to liver health. Researchers observed that age is a central point in sports support since progression in age diminishes one's capacity to get through natural pressure, working limits, physical wellness, strength, perseverance and oxygen take-up. Another study observed that university students are mostly between 21 and 25 years old (Comeaux, 2011).

STRENGTHS AND WEAKNESSES OF THE STUDY

The research utilized a quantitative exploration approach, showing the review's solidarity; additionally, in light of anthropometric qualities, for example, Age, sex/gender and body mass, the subjects were enlisted and analyzed, which demonstrated the speculation of the research. In like manner, there were a few shortcomings of the study, for example, it was completed among male competitors and just activity interventions were used on moderate intensity without dietary supplementation. These shortcomings might give new knowledge to the scientists to complete such examinations with new anthropometric characteristics of subjects and different activity qualities.

CONCLUSION

Based on data analysis and findings, the researcher concluded that exercise with moderate intensity significantly alters the Antioxidant Capacity of Participants.

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