

EFFECT OF SPORTS ON SOME HEMATOLOGICAL PARAMETERS IN STUDENTS OF SARHAD UNIVERSITY PESHAWAR

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Abstract

This study investigates the influence of sports activities on specific hematological parameters among students at Sarhad University Peshawar. The research encompasses red blood cell count, hemoglobin levels, white blood cell count, platelet count, weight, duration of exercise, and the type of sports played by 20 participating students. The findings reveal that different combinations of exercise duration, weight, and sports participation have varying impacts on hematological profiles. For instance, students engaged in cricket, football, and badminton exhibit differential hematological responses based on their weight and the duration of exercise. Similarly, variations in red blood cell count, hemoglobin levels, white blood cell count, and platelet count are observed within the study group.

INTRODUCTION

Studies investigating hematological adaptations in cricket players have shown significant changes in red blood cell count, hemoglobin concentration, and hematocrit levels due to the physically demanding nature of the sport (Banerjee, 2016; Saxena & Saxena, 2019).

Football, being a highly dynamic and intermittent sport, has also been found to impact hematological parameters. Research has revealed alterations in red blood cell indices, white blood cell count, and platelet aggregation in football players, possibly due to the combination of aerobic and anaerobic demands during matches and training sessions (Ghani *et al.*, 2021; Mohr *et al.*, 2016).

Regular participation in sports and physical activity has been acknowledged for its numerous health benefits, including improvements in cardiovascular fitness, musculoskeletal strength, and overall well-being (Warburton *et al.*, 2006). In recent years, there has been a growing interest in exploring the influence of sports on various physiological systems, including the hematological system (Moniz *et al.*, 2005). Hematological parameters, which involve the study of blood components and their functions, play a crucial role in maintaining homeostasis and optimal performance (Ernst, 2012). Understanding how sports impact hematological parameters is vital for athletes, coaches, and

healthcare professionals involved in sports medicine (Banfi *et al.*, 2006).

This review aims to explore the current literature and provide a comprehensive overview of the effect of sports on select hematological parameters. To ensure a systematic approach, the review will focus on key hematological parameters commonly assessed in sports-related research, including red blood cell count (RBC), hemoglobin concentration (Hb), hematocrit (Hct), white blood cell count (WBC), platelet count, and iron metabolism markers (Peeling *et al.*, 2014). It is important to note that the influence of sports on hematological parameters can be both acute, occurring immediately during or after exercise, as well as chronic, resulting from long-term training adaptations (Fallon *et al.*, 2001).

In examining the effect of sports on RBC count, Hb, and Hct, research has suggested that regular physical activity, particularly endurance training, may lead to physiological adaptations such as increased erythropoiesis, enhanced oxygen-carrying capacity, and improved aerobic performance (Millet *et al.*, 2012). However, factors such as altitude, hydration status, and the use of performance-enhancing substances can also influence these hematological parameters (Moniz *et al.*, 2005).

Furthermore, the impact of sports on WBC count and platelet count warrants investigation. Exercise has been shown to induce a transient increase in WBC count, attributed to the release of stress hormones, inflammatory cytokines, and tissue damage associated with exercise-induced muscle micro trauma (Peeling *et al.*, 2014). Platelet count, on the other hand, is generally unaffected by acute exercise, but chronic exercise training may elicit alterations in platelet function and aggregation, potentially affecting coagulation and thrombotic risk (Banfi *et al.*, 2006).

Finally, iron metabolism markers, including serum ferritin, transferrin, and iron saturation, are of interest due to the high prevalence of iron deficiency in athletes, particularly in endurance sports (Moniz *et al.*, 2005). Understanding the effect of sports on iron metabolism is crucial for identifying athletes at risk of iron deficiency

anemia and implementing appropriate interventions to optimize performance and overall health (Peeling *et al.*, 2014).

The study of hematological parameters in athletes has gained significant attention due to its potential implications for performance, recovery, and overall health (Eichner *et al.*, 2013). Hematological adaptations to exercise have been observed across various athletic populations, including endurance runners (Banfi *et al.*, 2006), cyclists (Santos *et al.*, 2016), and soccer players (Aebersold *et al.*, 2021).

Understanding the effect of different sports and exercise modalities on hematological parameters is crucial for tailoring training programs and optimizing athletic performance (Boushel *et al.*, 2014). The demands of high-intensity interval training (HIIT) on hematological parameters, such as red blood cell count and hemoglobin concentration, have been explored in studies involving both trained and untrained individuals (Brocherie *et al.*, 2019; Siahkoughian *et al.*, 2014).

In addition to aerobic activities, investigations have also focused on the impact of resistance training on hematological parameters, particularly in terms of muscle damage-induced changes in white blood cell count and platelet function (Clarkson & Hubal, 2002; Karabulut *et al.*, 2017).

In conclusion, investigating the effect of sports on hematological parameters provides valuable insights into the physiological adaptations and potential health implications associated with physical activity. By comprehensively examining the available literature, this review aims to enhance our understanding of how sports influence hematological parameters and provide a foundation for future research (Banfi *et al.*, 2006). Ultimately, this knowledge can contribute to the development of evidence-based guidelines and strategies to optimize athletic performance, prevent adverse health effects, and promote overall well-being among athletes (Warburton *et al.*, 2006).

METHODOLOGY

Study design

The said study was conducted at Khyber Teaching Hospital, of Peshawar and Sarhad University of Science and Information Technology, Peshawar, KP, Pakistan.

Inclusive Criteria

1. Students of Sarhad University was included in the study.
2. Only those students included who were playing football and cricket.

Exclusive Criteria

1. Students other than Sarhad University were excluded.
2. Students playing games other than cricket and football.

Sample Collection and Processing

A total of 20 students were included in the study from Sarhad University of Science and Information Technology, Peshawar from March 2023 to June 2023. The students were briefed about the research study through a written consent research performed followed by 5cc of blood through a sterilized syringe in EDTA Tube.

Processing of samples

Requirement;

Various materials like Blood samples of the patient in EDTA Tube, 5 cc syringe, Alcohol pad, Tourniquet and Sysmex Analyzer.

Process

The following process were applied,

1. 5 cc blood was taken aseptically from each student in EDTA Tube.

2. After mixing the blood sample thoroughly, it was transported to Pathology Laboratory of Khyber Teaching Hospital Peshawar.

3. Special care was taken to ensure that the blood samples reached the laboratory in a safe condition from sunlight and heat.

4. Blood sample were evaluated with the help of sysmex machine of Roche Company for testing hematology parameters.

RESULTS

Weight of Students, Duration of Exercise and Red Blood Cells Count

According to weight and duration of exercise (Table 4.1) revealed that among 20 students, the red blood cells count was 4.6 to 5.0, among them 5 students exercised for 1 to 2 hours and 3 students exercised for 2 to 4 hours and their weight was 55 to 65 kg. Among 20 students, the red blood cells count was 4.6 to 5.0, among them 5 students exercised for 1 to 2 hours and 1 student exercised for 2 to 4 hours and their weight was 66 to 75 kg. Among 20 students, the red blood cells count was 4.6 to 5.0, among them only 2 students exercised for 2 to 4 hours and their weight was 76 to 85 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them 1 student exercised for 2 to 4 hours and his weight was 56 to 65 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student exercised for 1 to 2 and 1 student exercised for 2 to 4 hours and their weight was 66 to 75 kg. Only 1 student exercised for 2 to 4 hours and his weight was 76 to 85 kg.

Effect of weight and exercise on red blood cell count

RBC count			Duration of exercise		Total
			1-2 hours	2-4 hours	
4.60-5.40 (10 *6/ul)	Weight	56 - 65 kg	5	3	8
		66 - 75 kg	5	1	6
		76 -85 kg	0	2	2
	Total		10	6	16
5.41 - 6.21 (10*6/ul)	Weight	56 - 65 kg	0	1	1
		66 - 75 kg	1	1	2
		76 -85 kg	0	1	1
	Total		1	3	4
Total	Weight	56 - 65 kg	5	4	9
		66 - 75 kg	6	2	8
		76 -85 kg	0	3	3
	Total		11	9	20

Weight of Students, Type of Sports and Red Blood Cells Count

According to weight and type of sports (Table 4.2) revealed that among 20 students, the red blood cells count was 4.6 to 5.0, among them 5 students were playing cricket, 2 were playing football and only 1 was playing badminton and their weight was 56 to 65 kg. Among 20 students, the red blood cells count was 4.6 to 5.0, among them 5 students were playing cricket and 1 was playing football and their weight was 66 to 75 kg. Among 20 students, the red blood cells count

was 4.6 to 5.0, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student was playing cricket and his weight was 76 to 85 kg.

Table Effect of weight and Type of sports on red blood cell count

			Cricket	Football	Badminton	Total
4.60 - 5.40 (10 *6/ul)	Weight	56 - 65 kg	5	2	1	8
		66 - 75 kg	5	1	0	6
		76 -85 kg	2	0	0	2
	Total		12	3	1	16
5.41 - 6.21 (10*6/ul)	Weight	56 - 65 kg	1	0	0	1
		66 - 75 kg	2	0	0	2
		76 -85 kg	1	0	0	1
	Total		4	0	0	4
Total	Weight	56 - 65 kg	6	2	1	9
		66 - 75 kg	7	1	0	8
		76 -85 kg	3	0	0	3
	Total		16	3	1	20

Weight of Students, Type of Sports and Hemoglobin Level

According to weight and type of sports (Table 4.3) revealed that among 20 students, the hemoglobin was 13.3 to 15.3 gm/dL, among them 5 students were playing cricket and 2 were playing football and only 1 was playing badminton and their weight was 56 to 65 kg. Among 20 students, the hemoglobin was 13.3 to 15.3 gm/dL, among them 5 students were playing cricket and 1 was playing football and their weight was 66 to 75 kg. Among 20 students,

the hemoglobin was 13.3 to 15.3 gm/dL, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student was playing cricket and his weight was 76 to 85 kg.

Table Effect of weight and Type of sports on Hemoglobin Level

Hemoglobin			Cricket	Football	Badminton	Total
13.3 - 15.3 g/dl	Weight	56 - 65 kg	5	2	1	8
		66 - 75 kg	5	1	0	6
		76 - 85 kg	2	0	0	2
	Total		10	12	3	1
15.4 - 17.4 g/dl	Weight	56 - 65 kg	1	0	0	1
		66 - 75 kg	2	0	0	2
		76 - 85 kg	1	0	0	1
	Total		6	4	0	0
Total	Weight	56 - 65 kg	6	2	1	9
		66 - 75 kg	7	1	0	8
		76 - 85 kg	3	0	0	3
	Total		16	3	1	20

Weight of Students, Duration of Exercise and Hemoglobin Level

According to weight and duration of exercise (Table 4.4) revealed that among 20 students, the hemoglobin was 13.3 to 15.3 gm/dL, among them 5 students exercised for 1 to 2 hours and 3 students exercised for 2 to 4 hours and their weight was 55 to 65 kg. Among 20 students, the hemoglobin was 13.3 to 15.3 gm/dL, among them 5 students exercised for 1 to 2 hours and 1 students exercised for 2 to 4 hours and his weight was 66 to 75 kg. Among 20 students, the hemoglobin was 13.3 to 15.3 gm/dL, among

them only 2 students exercised for 2 to 4 hours and their weight was 76 to 85 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them 1 student exercised for 2 to 4 hours and his weight was 56 to 65 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them 1 student exercised for 1 to 2 hours and 1 students exercised for 2 to 4 hours and his weight was 66 to 75 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student exercised for 2 to 4 hours and his weight was 76 to 85 kg.

Effect of weight and duration of exercise on hemoglobin level

HB			Duration of exercise		Total
			1 - 2 hours	2 - 4 hours	
13.3 - 15.3 g/dl	Weight	56 - 65 kg	5	3	8
		66 - 75 kg	5	1	6
		76 - 85 kg	0	2	2
	Total		10	6	6
15.4 - 17.4 g/dl	Weight	56 - 65 kg	0	1	1
		66 - 75 kg	1	1	2
		76 - 85 kg	0	1	1
	Total		1	3	4
Total	Weight	56 - 65 kg	5	4	9
		66 - 75 kg	6	2	8
		76 - 85 kg	0	3	3
	Total		16	4	20

Effect of weight and type of sports on white blood cells count

According to weight and type of sports (Table 4.5) revealed that among 20 students, the wbc count was 5000 to 9000, among them 5 students were playing cricket and 2 were playing football and only 1 was playing badminton and their weight was 56 to 65 kg. Among 20 students, the WBC count was 5000 to 9000, among them 5 students were playing cricket and 1 was playing

football and their weight was 66 to 75 kg. Among 20 students, the WBC count was 5000 to 9000, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 2 students were playing cricket and their weight was 66 to 75 kg.

Effect of weight and type of sports on white blood cells count

WBC count			Type of sports?			Total
			Cricket	Football	Badminton	
5.0 - 9.0 (10 ³ /ul)	Weight	56 - 65 kg	5	2	1	8
		66 - 75 kg	5	1	0	6
		76 - 85 kg	2	0	0	2
	Total		12	3	1	16
9.1 - 13.0 (10 ³ /ul)	Weight	56 - 65 kg	1	0	0	1
		66 - 75 kg	2	0	0	2
	Total		3	0	0	3
Total	Weight	56 - 65 kg	4	0	0	4
		66 - 75 kg	6	2	1	9
		76 - 85 kg	7	1	0	8
	Total		16	3	1	20

Effect of weight and duration of exercise on white blood cell count

According to weight and duration of exercise (Table 4.6) revealed that among 20 students, the

wbc count was 5000 to 9000, among them 5 students were exercised for 1 to 2 hours and 1 was exercised for 2 to 4 hours and their weight was 56 to 65 kg. Among 20 students, the WBC

count was 5000 to 9000, among them 5 students were exercised for 1 to 2 hours and 1 was exercised for 2 to 4 hours and their weight was 66 to 75 kg. Among 20 students, the WBC count was 5000 to 9000, among them only 3 students were exercised for 2 to 4 hours and their weight was 76 to 85 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 3

student were exercised for 2 to 4 hours and their weight were 56 to 65 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 1 students was exercised for 1 to 2 hours and his weight was 66 to 75 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 1 student was exercised for 2 to 4 hours and his weight was 66 to 75 kg.

Effect of weight and duration of exercise on white blood cell count

WBC count			Duration of exercise		Total
			1 - 2 hours	2 - 4 hours	
5.0 - 9.0 ($10^3/\text{ul}$)	Weight	56 - 65 kg	5	1	6
		66 - 75 kg	5	1	6
		76 - 85 kg	0	3	3
	Total		10	5	15
9.1 - 13.0 ($10^3/\text{ul}$)	Weight	56 - 65 kg	0	3	3
		66 - 75 kg	1	1	2
	Total		1	4	5
Total	Weight	56 - 65 kg	5	4	9
		66 - 75 kg	6	2	8
		76 - 85 kg	0	3	3
	Total		11	9	20

Effect of weight and type of sports on platelets count

According to weight and type of sports (Table 4.7) revealed that among 20 students, the platelet count was 1 lakh 61 thousand to 2 lakh 40 thousand, among them 5 students were playing cricket, 2 were playing football and only 1 was playing badminton and their weight was 56 to 65 kg. Among 20 students, the platelet count was 1 lakh 61 thousand to 2 lakh 40 thousand, among them 5 students were playing cricket and 1 was playing football and their weight was 66 to 75 kg. Among 20 students, the platelet count was 1 lakh

61 thousand to 2 lakh 40 thousand, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 3 student was playing cricket and his weight was 76 to 85 kg.

Effect of weight and type of sports on platelets count

Platelets count			Type of sports?			Total
			Cricket	Football	Badminton	
161 - 240 (10*3/ul)	Weight	56 - 65 kg	5	2	1	8
		66 - 75 kg	5	1	0	6
		76 -85 kg	2	0	0	2
	Total		8	12	3	1
241 - 320 (10*3/ul)	Weight	56 - 65 kg	1	0	0	1
		66 - 75 kg	2	0	0	2
		76 -85 kg	3	0	0	3
	Total		8	4	0	0
Total	Weight	56 - 65 kg	6	2	1	9
		66 - 75 kg	7	1	0	8
		76 -85 kg	16	3	1	20
	Total		16	5	2	1

Effect of weight and duration of sports on platelets count

According to weight and duration of exercise (Table 4.8) revealed that among 20 students, the platelet count was 1 lakh 61 thousand to 2 lakh 40 thousand, among them 5 students were exercised for 1 to 2 hours and 1 was exercised for 2 to 4 hours and their weight was 56 to 65 kg. Among 20 students, the WBC count was 1 lakh 61 thousand to 2 lakh 40 thousand, among them 5 students were exercised for 1 to 2 hours and 1 was exercised for 2 to 4 hours and their weight was 66 to 75 kg. Among 20 students, the WBC count was 1 lakh 61 thousand to 2 lakh 40

thousand, among them only 3 students were exercised for 2 to 4 hours and their weight was 76 to 85 kg. Among 20 students, the platelet count was 1 lakh 61 thousand to 2 lakh 40 thousand, among them only 3 student were exercised for 2 to 4 hours and their weight were 56 to 65 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 1 students was exercised for 1 to 2 hours and his weight was 56 to 65 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 1 student was exercised for 2 to 4 hours and his weight was 66 to 75 kg.

Effect of weight and duration of sports on platelets count

Platelets count			Duration of exercise		Total
			1-2 hours	2-4 hours	
161 - 240 (10*3/ul)	Weight	56 - 65 kg	5	1	6
		66 - 75 kg	5	1	6
		76 -85 kg	0	3	3
	Total		10	5	15
241 - 320 (10*3/ul)	Weight	56 - 65 kg	0	3	3
		66 - 75 kg	1	1	2
	Total		1	4	5
Total	Weight	56 - 65 kg	5	4	9
		66 - 75 kg	6	2	8
		76 -85 kg	0	3	3
Total		11	9	20	

DISCUSSION

The findings of this study shed light on the impact of sports activities on various hematological parameters among students at Sarhad University Peshawar. These results can be contextualized and compared with previous research on a similar topic to gain a broader understanding of the relationship between sports participation and hematological profiles. Several studies have explored the effects of sports on hematological parameters in various populations, providing valuable insights that can be compared to the current findings.

Among 20 students, the red blood cells count was 5.41 to 6.21, among them 1 student exercised for 2 to 4 hours and his weight was 56 to 65 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student exercised for 1 to 2 and 1 student exercised for 2 to 4 hours and their weight was 66 to 75 kg. Only 1 student exercised for 2 to 4 hours and his weight was 76 to 85 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the red blood cells count was 5.41 to 6.21, among them only 1 student was playing cricket and his weight was 76 to 85 kg.

(Koc *et al.*, 2012) found as a result of his study, the increase in RBC values that were found significant.

Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student was playing cricket and his weight was 76 to 85 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them 1 student exercised for 2 to 4 hours and his weight was 56 to 65 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them 1 student exercised for

1 to 2 hours and 1 student exercised for 2 to 4 hours and his weight was 66 to 75 kg. Among 20 students, the hemoglobin was 15.4 to 17.4 gm/dL, among them only 1 student exercised for 2 to 4 hours and his weight was 76 to 85 kg.

(Habibie *et al.*, 2023) conducted a similar study, the results of the research conducted shows differences in the effect of training methods on the cardiovascular endurance of Unsil United soccer players in 2022. The 10 minutes cardio workout training method has better cardiovascular results. There is a difference in the effect of high and low normal hemoglobin levels on football UKM players in 2022. The results of the two training methods impacted increasing hemoglobin. There is an increase in hemoglobin that significantly increases cardiovascular results, and there is also something that is not very significant but has a high impact.

Among 20 students, the WBC count was 9100 to 13000, among them only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 3 student were exercised for 2 to 4 hours and their weight were 56 to 65 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 1 students was exercised for 1 to 2 hours and his weight was 66 to 75 kg. Among 20 students, the WBC count was 9100 to 13000, among them only 1 student was exercised for 2 to 4 hours and his weight was 66 to 75 kg.

(Koc *et al.*, 2018) findings showed that athletes participating in the long-term regular exercise have the high level of the concentration of red blood cells subtypes and the low level of the concentration of white blood cells subtypes when compared to their sedentary peers. Because their hematologic values remain within the reference range for healthy people, these differences do not pose any serious clinical problems for athletes.

Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them

only 1 student was playing cricket and his weight was 56 to 65 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 2 students were playing cricket and their weight was 66 to 75 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 3 student was playing cricket and his weight was 76 to 85 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 1 students was exercised for 1 to 2 hours and his weight was 56 to 65 kg. Among 20 students, the platelet count was 2 lakh 41 thousand to 3 lakh 20 thousand, among them only 1 student was exercised for 2 to 4 hours and his weight was 66 to 75 kg.

(Garai *et al.*, 2017) found that platelet counts increases with strenuous exercise and decrease with moderate type of exercise. The average healthy size of platelets may change in human from different part of the world.

Conclusions

In conclusion, the current study contributes valuable insights into the effect of sports on hematological parameters in students at Sarhad University Peshawar. While these findings align with some previous research, they also underscore the complexity of the relationship between sports participation, exercise duration, weight, and hematological profiles. Understanding these nuances is critical for developing personalized training programs and health management strategies for athletes and students.

Further research in this area should explore the long-term effects of sports on hematological parameters and consider additional factors such as dietary habits, hydration status, and the level of physical intensity in different sports. Such studies can provide a more comprehensive understanding of the hematological responses to sports activities, contributing to improved athlete health and performance.

Recommendations

1. Tailored training programs
2. Regular hematological monitoring
3. Nutritional guidance

4. Hydration strategies
5. Rest and recovery
6. Long term health monitoring and further research
7. Collaboration with Healthcare Professionals and health education

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