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# TRAINING PROGRAM FOR SPECIFIC ENDURANCE AND ITS EFFECTS ON BLOOD MEASUREMENTS, BLOOD PROTEINS, IMMUNE SYSTEM ACTIVITY, AND 800 M PERFORMANCE

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## ABSTRACT

**Background.** Middle-distance running, particularly the 800-meter event, demands a balance of aerobic and anaerobic capacities, alongside optimal physiological resilience. Training programs that incorporate special endurance exercises are considered essential for improving both performance and physiological adaptations, including immune system function. **Objectives.** This study aimed to examine the effects of a researcher-designed training program, based on special endurance exercises, on blood measurements, blood proteins, immune activity, and athletic achievement in the 800-meter race. **Method.** An experimental design with a one-group pre-test and post-test approach was employed. The training program was implemented over a defined period during 2024–2025. Pre- and post-measurements were conducted to evaluate immune variables, blood indicators, and 800-meter performance times. The training sessions were delivered under controlled conditions to minimize external influences and ensure standardized assessments. **Results.** The findings revealed significant improvements in immune system efficiency and favorable changes in blood-related variables after the intervention. Moreover, the training program contributed to enhanced performance, as shown by a substantial reduction in the 800-meter completion time. **Conclusion.** The specialized endurance training program effectively enhanced both physiological health indicators and athletic achievement in middle-distance runners. This study provides empirical evidence supporting the integration of structured special endurance exercises into training regimens to improve competitive performance while simultaneously promoting immune system function and overall athlete health.

**Keywords;** special endurance, blood measurements, blood proteins, immune activity, 800 m run.

## A. INTRODUCTION

The practice of sports activity plays a significant role in disease prevention by strengthening the immune system through changes in metabolic and inflammatory pathways, which can affect the human body from time to time (Christiani et al., 2021). Moderate and regular exercises, whether qualitative or quantitative, particularly those characterized by strength and intensity, have a positive impact on white blood cells and overall immune function. Physical activity has also been shown to prevent atherosclerosis and other serious diseases by enhancing metabolic processes that combat inflammation, thereby reducing disease risks (Borges et al., 2022). As scientific interest in sports immunology has increased, researchers have begun to explore how the athlete's body protects itself from illness during training and competition, focusing on immune cells such as white blood cells and their components.

This area of study is particularly relevant during the pre-competition stage—a critical training period aimed at achieving peak performance—which requires a balance between high training loads and adequate preparation (Fiľo & Janoušek, 2022). Managing this phase is essential for maintaining an athlete's physical form and avoiding overtraining, which is often associated with weakened immunity and a higher risk of disease or injury (Jabbar et al., 2025). Physical exertion increases the body's need for oxygen, which is met by enhancing cardiac output and boosting blood flow to active muscles. This process stimulates the release of catecholamines and glucocorticoids, which mobilize white blood cells from various reservoirs, increasing their count in the bloodstream.

These changes positively influence immune function by raising levels of lymphocytes and granulocytes and improving conditions like VDR deficiency (Fikret & Leyla, 2020). Additionally, exercise helps combat chronic inflammation, improves mood, and has a direct impact on circulatory and respiratory systems, particularly through special endurance exercises that activate hormones, enzymes, and essential immune and muscle cells (Hortobágyi et al., 2022). Exercise also alters cardiovascular disease risk by modifying fat and glucose metabolism and reducing inflammation, thereby increasing the secretion of beneficial proteins that sustain muscle function during physical activity (Van der Woude et al., 2022). While many physiological studies have focused on the effects of exertion on the circulatory, respiratory, and musculoskeletal systems, research into its impact on the immune system remains limited.

To date, few have explored how physical exertion during the pre-competition phase affects immune blood components. Thus, the present study aims to fill this gap by investigating the effect of special endurance training on immune activity, blood proteins, and athletic performance during this critical period. The study focuses on six 800-meter runners from Zubair Club, with research activities conducted at Zubair Club Stadium, Al-Bayan Laboratory, and Zubair General Hospital from October 1, 2024, to January 5, 2025. The research aims to develop specialized endurance exercises, assess changes in blood measurements, immune proteins, immune system function, and performance, and compare pre- and post-test results.

The researcher hypothesizes that special endurance training will positively impact the physiological systems of athletes, with expected improvements in immune function and athletic achievement. Blood is defined here as a connective tissue responsible for nutrient transport and waste removal (Musallam, 2001), while white blood cells are immune components that protect the body from germs, including various types such as neutrophils and lymphocytes (Musallam, 2001). Immunoglobulins are antibodies that combat foreign substances, including types like IgM, IgG, and IgA (Breaux et al., 2021), while cellular immunity involves immune responses driven by specialized cells such as macrophages (2022), and humoral immunity refers to antibody-mediated responses targeting bacterial infections (Borges et al., 2022).

## B. METHOD

*Participant*

The research sample consisted of six (6) advanced-category athletes specializing in the 800-meter run, deliberately selected from Al-Zubair Sports Club and officially registered with the Iraqi Central Athletics Federation for the 2024–2025 season. The selection criteria included similarity in training age, biological age, and performance level to ensure homogeneity. Table 1 presents the morphological characteristics of the participants, showing consistency in data distribution, as evidenced by torsion coefficient values within ±3.



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**Table 1.** Shows The Morphological Measurements Of The Research Sample

| Variables | Measurement unit | Mean | Median | Standard deviation | Torsion coefficient |
|---|---|---|---|---|---|
| Age | Year | 21 | 21 | 0.894 | 0.000 |
| Height | cm. | 180.33 | 180 | 2.2422 | 1.825 |
| Training age | Year | 4.33 | 4 | 0.516 | 0.968 |
| Achievement 800 m | Min. | 1.59 | 1.795 | 0.2264 | -0.001 |

Table (1) shows the arithmetic mean, standard deviation, median and torsion coefficient between (±3), which indicates the homogeneity of the sample.

**Table 2.** Shows The Arithmetic Mean, Standard Deviation and Torsion Coefficient Of Blood and Immune System Variables For The Research Sample Before The Training Program

| Variables | Measurement unit | Mean | Median | Standard deviation | Torsion coefficient |
|---|---|---|---|---|---|
| white blood cells | Ml | 4.67 | 5.00 | .516 | -.968 |
| Red blood cells | Ml | 4.273 | 4.150 | 0.307 | 2.022 |
| Hemoglobin | di/g | 11.17 | 11.00 | .753 | -.313 |
| Platelets | Ml | 219.67 | 220.00 | .516 | -.968 |
| Limo Fusite | % | 21.33 | 21.00 | .516 | .968 |
| Nitrophil | % | 30.50 | 30.50 | .548 | 0.000 |
| Isophil | % | 5.67 | 5.50 | .816 | .857 |
| IgG | di/mg | 1127.50 | 1127.50 | 7.583 | .774 |
| IGE | m/kiu | 11.33 | 11.00 | .516 | .968 |
| IGA | di/mg | 171.67 | 171.50 | 1.862 | 1.281 |

Table (2) shows that the torsion coefficient in the measurements of blood and immunity variables represented in some components of blood (variables under research) ranged between (2.022, 0.742) receded between (±3), which indicates the homogeneity of the sample members in the variables under research.

*Study organization*

An exploratory study was conducted on September 25, 2024, using two athletes outside the research sample at Al-Zubair Sports Stadium in Basra. The objective was to identify potential implementation issues, train assistants, test devices, and introduce procedures to the athletes. Following the pilot, pre-tests were carried out on September 28, 2024, involving blood withdrawal for lab analysis and physical performance assessments including a 300-meter run (speed endurance), 10 squat jumps (strength endurance), and a 600-meter run (performance endurance). Blood was drawn again after the 800-meter race test to monitor immune response.

The training program, designed by the researcher, was implemented over 12 weeks (October 4, 2024 – January 6, 2025), totaling 36 training sessions (3 per week). It was divided into three phases: general preparation (4 weeks), special preparation (4 weeks), and pre-competition (4 weeks). Each training unit lasted between 60 to 90 minutes. Training methods included high-intensity interval training (HIIT), repetitive training, and Fartlek, with a 3:1 load-to-recovery structure. The post-tests, conducted on January 7, 2025, followed the exact protocol as the pre-tests for consistency and comparison.

*Statistical Analysis*

To analyze the data and evaluate the effect of the training program, the researcher applied several statistical techniques, including the arithmetic mean, median, standard deviation, torsion coefficient, and the t-test (both calculated and tabular). The mean, median, and standard deviation were employed to provide descriptive summaries of the data, offering insights into central tendencies and variability within the sample. The torsion coefficient was utilized to verify the normality and homogeneity of the data distribution, thereby ensuring the validity of subsequent analyses. To assess the significance of differences between pre-test and post-test results, a paired t-test was conducted. This test enabled the identification of statistically significant changes in performance outcomes, blood parameters, and immune function attributable to the training intervention.

## C. RESULTS AND DISCUSSION

### Results

It is clear from Table (3) that the significant differences between physical measurements and achievement under research before and after the implementation of the training program, as the standard deviations after the implementation of the training program are less than they were before the implementation of the program, and this is a preliminary indicator that there is an impact of the program on the development of physical qualities under research and achievement (200 m ran jumping 400 m running 800 m achievement) and to test the statistical significance test was used test (T) as shown in the table above.

The descriptive results in Table 3 indicate notable improvements in physical performance variables after the application of the special endurance training program. In the

800-meter run test, participants' mean performance time decreased from 1.59 minutes in the pre-test to 1.56 minutes in the post-test, with a significant t-value (6.892) exceeding the tabular value (2.776), confirming a meaningful improvement in endurance performance. Similarly, the 200-meter jumping run demonstrated progress, as the mean time improved from 52.0 seconds to 41.0 seconds post-program, indicating enhanced speed endurance. Furthermore, the 400-meter run test showed substantial gains, with performance times improving from 60.7 seconds to 54.8 seconds. The calculated t-value (34.785) confirmed the statistical significance of this change, highlighting the effectiveness of the training program in developing strength endurance. Overall, these findings emphasize that the specialized endurance training program successfully improved endurance, speed, and strength components, which collectively contributed to better overall performance in the 800-meter event.

**Table 3.** Results of performance endurance, speed endurance, strength endurance, and completion (800).

| Variables | Test | | Mean | Median | standard deviation | (T) calculated value | (T) tabular value | Sig. level |
|---|---|---|---|---|---|---|---|---|
| Physical tests | 800 m run | Pre | 1.59min | 2 | 1.17 | 6.892 | 2.776 | Sig. |
| | | Post | 1.56min | 1.925 | 0.0225 | | | |
| | 200 m jumping run | Pre | 52.0sec | 2 | 0.632 | 2.201 | | Sig. |
| | | Post | 41.0sec | 1.925 | 0.632 | | | |
| | 400m run | Pre | 60.7sec | 60 | 1.387 | 34.785 | | Sig. |
| | | Post | 54.8sec | 53 | 0.516 | | | |

**Table 4.** Descriptive Results of Blood, Blood Protein, and Immunity Measurements Before and After for Research Samples

| Variables | Measurement unit | Pre-program mean | St.d | Post-program mean | St.d | Sig. value | Calculated t | Tabular t | Sig. level |
|---|---|---|---|---|---|---|---|---|---|
| white blood cells | Ml | 4.67 | .516 | 5.67 | .632 | .012 | -3.873 | 2.776 | Sig. |
| Red blood cells | Ml | 4.298 | 0.176 | 5.285 | 1.751 | .012- | -3 .876 | 2.776 | Sig. |
| Hemoglobin | di/g | 11.17 | .753 | 13.83 | 1.179 | .014 | -3 .037 | 2.776 | Sig. |
| Platelets | Ml | 219.67 | .516 | 255.00 | 5.477 | .000 | -15. 732 | 2.776 | Sig. |
| Limo Fusite | % | 21.33 | .516 | 31.17 | 0.983 | .000 | -16 .364 | 2.776 | Sig. |
| Nitrophil | % | 30.50 | .548 | 51.33 | 1.966 | .000 | -27 .812 | 2.776 | Sig. |
| Isophil | % | 5.67 | .816 | 9.67 | .516 | .000 | -10 .954 | 2.776 | Sig. |
| IgG | di/mg | 1127.50 | 7.583 | 1453.33 | 4.082 | .000 | -82 .247 | 2.776 | Sig. |
| IGE | m/kiu | 11.33 | .516 | 21.83 | 2.229 | .000 | -11 .864 | 2.776 | Sig. |
| IGA | di/mg | 171.67 | 1.862 | 255.83 | 3.764 | .000 | -43 .020 | 2.776 | Sig. |

The results presented in Table 4 demonstrate significant improvements in blood measurements, blood proteins, and immune indicators following the implementation of the special endurance training program. White blood cell counts increased from a pre-program mean of 4.67 ml to 5.67 ml post-program, while red blood cells also rose from 4.298 ml to 5.285 ml, both reaching statistical significance ($p < 0.05$). Hemoglobin levels showed a marked improvement, rising from 11.17 g/dl before training to 13.83 g/dl after the intervention. Platelet counts also increased substantially, from 219.67 ml to 255.00 ml. In terms of immune parameters, lymphocyte percentages rose from 21.33% to 31.17%, neutrophil counts increased from 30.50% to 51.33%, and isophil percentages improved from 5.67% to 9.67%. Furthermore, immunoglobulin concentrations recorded significant enhancements, with IgG increasing from 1127.50 mg/dl to 1453.33 mg/dl, IgE from 11.33 m/kiu to 21.83 m/kiu, and IgA from 171.67 mg/dl to 255.83 mg/dl. The calculated t-values for all variables exceeded the tabular t-value (2.776), confirming the statistical significance of the differences. Collectively, these findings highlight the positive impact of the training program on hematological parameters, blood protein levels, and immune system activity among the participants.

**Discussion**

The results presented in Table 4 clearly demonstrate significant differences in the mean values, standard deviations, and p-values of the examined variables before and after the training program. The calculated $t$-values, when compared with the significance level of 0.05, confirmed that the differences in blood measurements, blood proteins, and immune system indicators were statistically significant in favor of the post-test results (Miguel et al., 2021). These findings highlight the positive physiological adaptations elicited by the specialized endurance training program.

The researcher attributes these positive outcomes to the structure and quality of the training program, which was carefully designed based on prior expertise as a former Iraqi athletics champion and coach for Smouha Club, the University of Basra, and the Iraqi national team. The application of scientifically grounded training methods, particularly those targeting aerobic-lactic and anaerobic endurance, appears to have contributed to the observed improvements (Liao et al., 2021).

In addition, careful consideration of training load dynamics—including intensity, volume, and recovery—played a vital role in ensuring progressive overload and adaptation. The program also incorporated the principle of individual differences, which facilitated



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personalized adjustments for athletes. These elements collectively fostered functional adaptation and enhanced both physiological efficiency and performance outcomes (Hortobágyi et al., 2022). Ultimately, the use of purposeful, specialized training contributes to advanced results by enabling athletes to achieve peak performance in their respective events (Schneider et al., 2018).

Furthermore, endurance—particularly speed endurance—was shown to be a fundamental component of performance for middle-distance runners, such as those competing in the 800 meters. Developing this capacity allows athletes to maintain technical execution and efficiency throughout the race without experiencing premature fatigue, thereby improving competitive outcomes (Sonchan et al., 2017).

Despite the promising findings, this study is not without limitations. First, the research employed a one-group pre-test and post-test design without a control group, which may limit the ability to attribute improvements solely to the training intervention. Second, the relatively small sample size reduces the generalizability of the results. Third, potential confounding factors such as nutrition, psychological stress, and recovery outside of the training program were not controlled, which may have influenced some physiological outcomes. Finally, the study was limited to a specific group of middle-distance runners, meaning that the results may not be fully applicable to athletes from other sports or performance levels. Future studies should incorporate larger, more diverse samples and control groups to strengthen the validity and applicability of the findings.

## D. CONCLUSION

In light of the research objectives, hypotheses, results, and statistical analyses, several conclusions can be drawn. First, the specialized endurance training program designed on sound scientific principles significantly enhanced the efficiency of the immune system among 800-meter runners. Second, the structured application of aerobic, lactic, and anaerobic exercises contributed to positive morphological adaptations in neutrophil cells. Third, the training program effectively improved athletic achievement, as demonstrated by reduced completion times in the 800-meter event. Collectively, these findings confirm that properly designed endurance training programs can simultaneously promote physiological health and optimize performance outcomes in middle-distance runners. Based on the findings, the researcher proposes several recommendations. Continuous and periodic medical follow-ups are essential to monitor vital organ functions and ensure athlete well-being. Regular physical activity should be emphasized as a means to enhance general health, particularly immune system efficiency. Future applications of this training approach should be extended to different sports and contexts to verify its broader effectiveness. Stronger collaboration between medical professionals and sports practitioners is necessary to raise the overall standard of athletic performance in Iraq. Moreover, physiological analyses should be incorporated as reliable tools for assessing public health and guiding athlete selection. Finally, further research should investigate the relationship between immune system function and performance progression across various sporting disciplines.

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## F. AUTHOR CONTRIBUTION STATEMENT

IFB takes full responsibility for the authenticity of the manuscript and the content of this research.

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