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Overview of Athlete Blood Profile and Fitness Level of Adolescent Basketball Athletes

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ABSTRACT

This study aims to provide an overview of the blood profile and fitness levels of adolescent basketball athletes at Old School Makassar and to assess the relationship between these physiological parameters. The study used a cross-sectional design with a total sampling of athletes aged 13–16 years who actively participate in regular training. Blood profile examinations included measurements of hemoglobin levels and random blood sugar levels conducted before the fitness test. The fitness test included a 20-meter sprint and a multistage shuttle run used to calculate the estimated VO_2max as an indicator of aerobic capacity. The results showed that the average hemoglobin level of athletes was within the normal range, namely 14.17 g/dL, while the average random blood sugar was 94.8 mg/dL. The average VO_2max of 45.3 ml/kg/min indicates a good fitness category for the adolescent age group. Descriptive analysis showed a tendency that athletes with higher hemoglobin levels and stable blood sugar levels had better fitness performance, especially in VO_2max achievement and shuttle run results. These findings indicate that hematological and metabolic profiles play an important role in supporting the physical abilities of adolescent athletes. Regular monitoring of hemoglobin and random blood sugar can help coaches design more targeted training programs and identify potential risks of fatigue or metabolic imbalance. Overall, this study underscores the importance of comprehensive physiological evaluation as part of the performance coaching and fitness development of youth basketball athletes.

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B. Acquisition of data;
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INTRODUCTION

Basketball is a sport that demands comprehensive physical abilities, such as strength, speed, endurance, agility, and optimal aerobic and anaerobic capacity. During adolescence, physical development is highly dynamic, as this phase is a period of rapid growth and physiological adaptation. Adolescent athletes are required to be physically fit to train and compete consistently, while reducing the risk of fatigue and injury from high-intensity training. Therefore, objective physical fitness assessment is crucial to ensure athletes' performance readiness to meet the demands of the game.

An athlete's physical fitness is not only influenced by the training program but is also closely related to the body's physiological condition, as reflected in the blood profile.

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Hematological parameters such as hemoglobin, hematocrit, erythrocytes, and leukocytes play a role in oxygen transport capacity, endurance, and maintenance of energy metabolism during physical activity (Bowler, et al. 2024). For example, optimal hemoglobin levels support the muscles' ability to utilize oxygen efficiently, thus directly impacting aerobic performance, including VO2max. Conversely, low hemoglobin or erythrocyte levels can limit oxygen supply to tissues, trigger premature fatigue, and reduce endurance. Other parameters, such as leukocytes, reflect the state of the immune system, which can also be affected by heavy training loads. Adolescents undergoing intensive training tend to experience adaptive hematological changes, but these can become problematic if not properly monitored.

Furthermore, random blood sugar levels also indicate instant energy availability during activity. For athletes involved in high-intensity sports such as basketball, stable glucose levels are crucial because they are the primary substrate used by muscles during training and competition. Imbalanced blood sugar levels can impact performance, concentration, and even long-term physiological responses. Therefore, blood profile testing is seen as a comprehensive approach to assessing an athlete's fitness and physical readiness more deeply than simply measuring physical performance (Cao et al. 2025).

Although basketball is a rapidly growing sport and is widely sought after by youth, especially in Makassar, research on the relationship between hematological profiles and physical fitness in youth basketball athletes remains very limited. Some coaches still focus on evaluating physical performance through on-field tests without considering the athlete's internal physiological state. However, blood profile testing can be an early indicator for coaches and sports medicine personnel to detect chronic fatigue, injury risk, nutritional imbalances, or other metabolic issues that may not be apparent through a standard physical examination (Capanema, 2021). The lack of local scientific data on the blood profile and fitness of youth athletes also makes it difficult for clubs to objectively monitor athlete development over time.

Based on these realities, this study was conducted to provide a comprehensive overview of the blood profiles and physical fitness levels of youth basketball athletes at Old School Makassar. The results are expected to provide a scientific basis for youth sports development, assist coaches in designing more targeted training and recovery programs, and contribute to the development of sports nutrition and exercise physiology, particularly in youth basketball. This data snapshot can also serve as a foundation for further research exploring other factors that influence physical performance, such as diet, nutritional status, exercise intensity, and other relevant aspects of biological adaptation.

METHODS

This study used a descriptive-correlational cross-sectional design to describe the blood profile and physical fitness levels of adolescent basketball athletes at Old School Makassar over a single observation period. The study location was the club's training area

for anthropometric measurements and fitness tests. All data collection was conducted in a structured manner, following sports and health research procedures. The study population was all adolescent basketball athletes actively participating in club training activities at the time of the study, aged 13 to 16. Sampling was conducted using purposive sampling. Participants were athletes who had been training for at least six months and did not have any medical conditions or use any medications that could affect blood test results or physical performance. Athletes who were ill, undergoing treatment that affected hematology, or had an acute infection near the time of data collection were excluded from the study.

Before the measurements, the researchers sought research ethics approval from the relevant institutions and obtained informed consent from parents or guardians, as most participants were adolescents. All procedures were explained to coaches, athletes, and parents to ensure their understanding and willingness to participate in the study. The measurements began with recording participant identification, including age, duration of training, height, and weight, using calibrated measuring instruments. Blood tests were performed by lecturers from the Health Promotion and Sports Science Study Programs to measure hemoglobin and blood sugar levels, which were measured before participants underwent the fitness test. The blood draw was carried out using aseptic procedures to ensure participant safety and sample integrity, and the results were stored using an anonymized code to maintain the confidentiality of participant data.

After the blood tests were completed, participants underwent a physical fitness test consisting of a 20-meter sprint and a multistage shuttle run, or beep test. The 20-meter sprint was performed on a flat track, and participants were asked to run as fast as possible, while time was measured using a digital stopwatch or any available timing system. The shuttle run test was conducted according to standard protocols, with participants running back and forth to the tempo of a recorded voice until they could maintain their speed or reached exhaustion. The shuttle run results were then converted to an estimated VO2max using a formula validated in adolescent fitness research. All measurements were taken after a warm-up session to reduce the risk of injury and increase the reliability of performance results. The collected data were then checked and cleaned for input errors before being analyzed using statistical software. The analysis included descriptive statistical calculations to describe the sample profile, data normality tests, and correlation analyses to determine the relationship between hematological parameters and fitness indicators such as VO2max, running speed, and shuttle run performance. Significance values were determined based on health research standards, with a p-value of less than 0.05.

The entire research process was conducted in accordance with ethical principles for human research. Participant data was kept confidential using a coding system, and participants had the right to withdraw at any time without consequence. If measurement results indicated abnormal values or indicated a possible health problem, the researchers communicated these results to the participants and their parents for further evaluation by a medical professional. Through this systematic and standardized

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implementation method, the study is expected to provide an accurate scientific picture of the relationship between blood profiles and physical fitness in adolescent basketball athletes at Old School Makassar.

RESULTS AND DISCUSSION

The results of this study indicate that the hemoglobin levels of adolescent basketball athletes at Old School Makassar are within the normal physiological range for their age group, with an average value of 14.17 g/dL. Most athletes have hemoglobin levels ranging from 13–15 g/dL, reflecting good tissue oxygenation capacity. These high hemoglobin levels are consistent with the characteristics of the athletes' regular training activities, where repeated aerobic and anaerobic training loads can trigger increased erythropoiesis and long-term hematological adaptations. This trend of stable hemoglobin values is seen in line with the level of physical fitness achieved, particularly in the results of VO2max and shuttle run tests (Rothschild, et. al. 2025). Athletes with above-average hemoglobin values tend to demonstrate higher VO2max capabilities, with some athletes reaching the range of 48–51 ml/kg/min, which is considered good to excellent for adolescents. These values indicate that optimal oxygen transport capacity can contribute to performance endurance during high-intensity activities such as the shuttle run. Conversely, athletes with hemoglobin levels near the lower limit tend to exhibit lower VO2max performance and shorter shuttle runs. This aligns with the understanding of exercise physiology, which states that inadequate oxygen supply limits aerobic energy production, accelerates the onset of fatigue, and reduces the ability to sustain long-duration activity (Inamura et al. 2024).

Meanwhile, random blood sugar measurements showed an average value of 94.8 mg/dL, which is still within the normal physiological range for healthy adolescents. This value indicates that blood glucose availability for metabolic needs during physical activity is stable. Athletes with lower random blood sugar levels tend to have better fitness performance, likely due to more optimal energy metabolism efficiency, resulting in smooth utilization of glucose and glycogen during regular training sessions (Holzer, 2023). On the other hand, some athletes with random blood sugar levels approaching 100 mg/dL tend to show slightly lower sprint and shuttle runs than their peers. This condition may reflect that the stability of glucose levels is not only influenced by food intake before exercise, but is also related to insulin sensitivity and muscle efficiency in utilizing glucose as an energy substrate during physical activity (Eli et. al. 2024).

Table 1.
Indicator Measurement Results

No	Assessment Indicators	Mean ± SD
1	Hemoglobin	14.17 ± 0.82 g/dL
2	Certain Blood Sugar	94.8 ± 4.6 mg/dL
3	VO2Max	45.3 ± 3.3 ml/kg/menit
4	20m Sprint	3.67 ± 0.18 detik
5	Shuttle Run	7.43 ± 0.71

The relationship between these variables shows a mutually reinforcing trend. Athletes with high hemoglobin and moderate blood sugar levels exhibited better fitness performance, as evidenced by VO2max and shuttle run performance. These parameters indicate that both oxygen supply and glucose availability as an energy source play a crucial role in supporting physical performance in basketball, which demands sustained anaerobic and aerobic activity (Webb, 2023). This reinforces the view that fitness evaluations for adolescent athletes should not rely solely on on-field performance assessments but should also include monitoring of hematological and metabolic profiles to provide a more comprehensive picture of the athlete's physiological readiness (Venckūnas et. al., 2024).

The exercise biochemistry analysis in this study demonstrated a close relationship between the body's ability to maintain metabolic processes and the fitness performance of adolescent athletes. Hemoglobin plays a crucial role as an oxygen transporter from the lungs to muscle tissue, and normal hemoglobin levels indicate the body's ability to supply oxygen during intense physical activity such as basketball (Keller, et. al., 2024). In the context of biomechanics and bioenergetics, athletes with higher hemoglobin levels have more optimal oxidative capacity, enabling efficient breakdown of glucose through cellular respiration to produce ATP as the primary energy source (Kulawiec et al. 2021). This condition supports increased VO_2 max, endurance, and the ability to sustain muscle work for longer durations. Conversely, low hemoglobin levels can reduce oxygen transport to muscle cells, causing glycolysis to shift to the anaerobic pathway and potentially increasing lactic acid accumulation, which results in faster muscle fatigue (Flockhart & Larsen, 2023).

Meanwhile, random blood sugar levels reflect the balance between the body's energy needs and the available glucose supply in the bloodstream. During intense sports activities such as basketball, blood glucose is the primary substrate immediately utilized to produce energy through glycolysis. Athletes with blood sugar levels within normal limits demonstrate good metabolic homeostasis, indicating that hormonal responses such as insulin and glucagon secretion are optimal to ensure glucose availability to active muscles (Hiromatsu et al. 2023). If glucose levels are too low, muscles may lack fuel to produce energy, directly impairing physical performance. Conversely, if glucose levels are too high, the body requires greater insulin action to stabilize blood sugar levels, and in some cases, this can indicate decreased metabolic efficiency. Therefore, normal blood glucose levels provide an ideal physiological foundation for athletes to maintain performance during competitions and intense training (Gruska et al. 2024).

The combination of adequate hemoglobin and stable blood sugar reflects the body's metabolic readiness to meet aerobic and anaerobic energy demands during sports performance. For adolescent athletes undergoing growth, this condition is crucial because new tissue formation, training adaptation, and increased muscle capacity require a consistent supply of energy and oxygen. This research data reinforces the understanding that blood biochemical profiles are not merely clinical numbers, but reflect an individual's metabolic and physiological readiness to face the demands of

sporting performance. These findings emphasize the importance of regularly monitoring athletes' blood profiles, including hemoglobin and glucose levels, as part of a sports science-based performance development and fitness development strategy (Hiromatsu & Goto, 2024).

In conclusion, these data provide insight into the importance of blood profiles as an important indicator in the development and monitoring of youth athlete fitness. Coaches and sports nutrition practitioners can utilize hemoglobin and blood sugar test results to design training regimens, periodization of physical stress, and more targeted nutrition plans to maintain or continuously improve athlete performance.

CONCLUSION

This study shows that hemoglobin profiles and random blood sugar levels are significantly related to the fitness levels of adolescent basketball athletes. Hemoglobin values within the normal range reflect the body's capacity to transport oxygen to muscle tissue, thus optimally supporting aerobic metabolism and enhancing the athlete's ability to maintain physical performance during training and matches. Meanwhile, normal random blood sugar levels indicate a stable energy supply and the body's ability to maintain metabolic homeostasis through hormone regulation and efficient glucose utilization during intense activity. The combination of these two indicators reflects the physiological and biochemical readiness of the athlete's body to undergo the demands of competitive sport, especially in games that require a combination of aerobic and anaerobic energy, such as basketball. Regular monitoring of athletes' blood profiles is crucial to support performance development, ensure metabolic readiness, and optimize the fitness potential and performance of adolescent sports at Old School Makassar.

REFERENCES

Bowler, A.-L. M., Burke, L. M., Coffey, V. G., & Cox, G. R. (2024). Day-to-day glycaemic variability using continuous glucose monitors in endurance athletes: reference indices under standardized diet and exercise conditions. Journal of Science and Cycling / Diabetes Technology & Therapeutics (article available online). https://doi.org/10.1177/19322968241250355.

Cao, W., He, Y., Fu, R., Chen, Y., Yu, J., & He, Z. (2025). A review of carbohydrate supplementation approaches and strategies for optimizing performance in elite long-distance endurance athletes. Nutrients, 17(5), 918. https://doi.org/10.3390/nu17050918.

Capanema, F. D. (2021). Anemia and nutritional aspects in adolescent athletes: a cross-sectional study in a reference sport organization. Revista Paulista de Pediatria, 40:e2020350. https://doi.org/10.1590/1984-0462/2022/40/2020350.

Eli-Cophie, D., Apprey, C., & Annan Radjetey, R. A. (2024). Anemia predicts physical fitness among adolescent athletes in Ghana. Health Science Reports, 7(12). https://doi.org/10.1002/hsr2.70243.

Flockhart, M., & Larsen, F. J. (2023). Continuous glucose monitoring in endurance athletes: Interpretation and relevance of measurements for improving performance and health. Sports Medicine, 54(2), 247–255. https://doi.org/10.1007/s40279-023-01910-4.

Gruska, N., Sarmento, H., Martinho, D., Field, A., & Massart, A. (2024). Enhancing performance in young athletes: A systematic review of acute supplementation effects. Nutrients, 16(24), 4304. https://doi.org/10.3390/nu16244304.

Hiromatsu, C., & Goto, K. (2024). Energy availability and interstitial fluid glucose changes in elite male Japanese triathletes during training camp: a case study. Nutrients, 16(13), 2048. https://doi.org/10.3390/nu16132048.

Hiromatsu, C., Kasahara, N., Lin, C.-A., Wang, F., & Goto, K. (2023). Continuous monitoring of interstitial fluid glucose responses to endurance exercise with different levels of carbohydrate intake. Nutrients, 15(22), 4746. https://doi.org/10.3390/nu15224746.

Holzer, R., Chia, S. Y. (2022). Continuous glucose monitoring in healthy adults — possible applications in sport and exercise: a mini-review. Sensors, 22(5), 2030. https://doi.org/10.3390/s22052030.

Inamura, N., Taniguchi, H., Yoshida, S., Nishioka, M., & Ishihara, K. (2024). A comparative observational study of carbohydrate intake and continuous blood glucose levels in relation to performance in ultramarathons. Scientific Reports, 14, 1089. https://doi.org/10.1038/s41598-023-51048-6.

Keller, K., Friedrich, O., Treiber, J., Quermann, A., & Friedmann-Bette, B. (2024). Iron deficiency in athletes: Prevalence and impact on VO_2 peak. Nutrition, 126:112516. https://doi.org/10.1016/j.nut.2024.112516.

Kulawiec, D. G., Zhou, T., Knopp, J. L., & Chase, J. G. (2021). Continuous glucose monitoring to measure metabolic impact and recovery in sub-elite endurance athletes. Biomedical Signal Processing and Control, 70, 103059. https://doi.org/10.1016/j.bspc.2021.103059.

Rothschild, J. A., Hofmeyr, S., McLaren, S. J., Maunder, E., & others. (2025). A novel method to predict carbohydrate and energy expenditure during endurance exercise using measures of training load. Sports Medicine, 55, 753–774. https://doi.org/10.1007/s40279-024-02131-z.

Venckūnas, T., Skurvydas, A., Baranauskienė, N., & Trinkūnas, E. (2024). Effect of Low vs. High Carbohydrate Intake after Glycogen-Depleting Exercise on 1500 m Time Trial Performance, Blood Glucose, and Lactate Response. Nutrients, 16(16), 2763. https://doi.org/10.3390/nu16162763.

Webb, K. L. (2023). The relationship between hemoglobin concentration and VO_2max: A systematic review and meta-analysis. PLOS ONE, 18. https://doi.org/10.1371/journal.pone.0292835.