

The Erythrocyte Sedimentation Rate in Type 1 Diabetes Mellitus

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Abstract

Objective: This study aimed to investigate the comparison of the Erythrocyte Sedimentation Rate (ESR) levels in patients with type 1 diabetes mellitus (T1DM) rather than the standard ESR rate as the reference.

Materials and Methods: In this analytical cross-sectional study 80 individuals with T1DM under 14 years of age were selected from Diabetes Research Center from 2021-2022. Sampling was done by available methods. Demographic information such as age, gender, HbA1c, and ESR level was recorded. The collected data were entered into SPSS v.22 software. Pearson correlation was used for association and t-test was used for comparing means. A significance level of $P < 0.05$ was considered.

Results: thirty three (41.2%) were male and 47 (58.8%) were female. The mean (\pm SD) age was 9.50 (\pm 0.414) years. The mean (\pm SD) ESR in the studied samples was 11.60(\pm 6.475), which had a significant difference with the ESR value of 10 ($P= 0.031$). Moreover, the ESR of both groups of studied boys -and girls was significantly higher than the standard upper limit of the society ($P= 0.0001$). Additionally, ESR had a statistical relationship with HbA1c ($P= 0.016$) and no significant relationship with age ($P= 0.730$).

Conclusion: ESR levels in children with T1D were significantly elevated, indicating systemic inflammation. ESR also showed a statistical relationship with HbA1c levels, suggesting its potential as a valuable marker for disease activity and management in T1D patients.


Keywords: Type 1 diabetes, Erythrocyte sedimentation rate, Inflammation

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Introduction

Type 1 diabetes (T1D), is characterized by the immune-mediated destruction of insulin-producing beta cells in the pancreas (1-4). Although the autoimmune nature of the disease is widely acknowledged, the exact trigger that initiates this immune attack remains uncertain. The pathogenesis of T1D involves a complex interplay between genetic susceptibility and environmental factors, leading to the development of autoimmunity against pancreatic islet cells (5,6). While the precise origins of T1D are elusive, recent research suggests a potential connection between systemic inflammation and the disease's pathophysiology (7-9).

One vital laboratory test in the realm of inflammation is the erythrocyte sedimentation rate (ESR), which measures the rate at which red blood cells settle in anticoagulated blood over a specified timeframe (10). While ESR is a non-specific marker of inflammation, elevated levels of ESR can indicate the presence of systemic inflammation, which is associated with various diseases, including autoimmune disorders (11,12). In such conditions, heightened ESR levels serve as indicators of systemic inflammation and prove invaluable in assessing disease activity, tracking treatment responses, and predicting the risk of complications (13).

Evidence suggests that inflammation plays a critical role in the pathogenesis of T1D. Inflammatory responses, particularly those triggered by viral infections, can contribute to the autoimmune attack on pancreatic beta cells (14). As inflammation escalates, ESR levels may rise, potentially providing a clue to the autoimmune processes at play (15-19).

While ESR can serve as an indicator of inflammation in the body, its role in the onset or progression of T1D remains less clear. Understanding the relationship between ESR and T1D could have important clinical implications (19). To shed light on this connection, we conducted a study aimed at investigating the comparison of the ESR levels

in patients with T1D rather than the standard ESR rate as a reference.

Material and methods

This was an analytical cross-sectional study conducted at the Diabetes Research Center. By convenience sampling method, a total of 80 children younger than 14 years with T1D were included in 2021-2022.

The exclusion criteria were as follows: (1) patients who had experienced fever or recent infections within the past 3 weeks; (2) patients with malignant tumors; and (3) patients with inflammatory disease.

Demographic information such as age, gender, and ESR level were recorded.

Scientific Accuracy and Data Reliability

The upper limit of normal ESR values for participants was calculated by the following formulas (20):

$$\text{ESR (male)} = \text{age} / 2$$

$$\text{ESR (female)} = (\text{age} + 10) / 2$$

Based on the Westergren method, the maximum standard value for the ESR for children is 10 mm/hr (21). So, the means of these ESR values were compared to reference levels of ESR 10 and the normal ESR levels for females and males in the general population.

Statistical analysis

The collected data were analyzed using the SPSS v.22 software. Descriptive analysis was performed to determine the prevalence of certain variables. Pearson correlation was used to evaluate association and a t-test was used for comparing means. A significance level of $P < 0.05$ was considered statistically significant.

Ethical considerations

This study was approved by the Institutional Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

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Results

Of the patients included in the study, 33 (41.2%) were male, 47 (58.8%) were female and the mean (\pm standard deviation) age was 9.50 (\pm 0.41) years. Moreover, the mean (\pm SD) HbA1c and ESR of the participants were 9.30 (\pm 0.20) and 11.60 (\pm 0.73) respectively.

Comparing the mean and standard deviation of ESR in the participants with the maximum standard value for the ESR (ESR=10) showed the average ESR in the studied samples was 11.60(\pm 6.47), which had a statistically significant difference with the ESR value of 10 ($P= 0.03$).

Additionally, Based on Table 1, the mean of the upper limit of normal ESR value in the examined boys was calculated at 5.46 \pm (1.60) which was remarkably different from the mean of the ESR level blood test in examined boys (9.81 \pm (6.24)). Moreover, the mean blood level of ESR in the examined girls was 12.85 (\pm 6.40), which was significantly higher than the calculated average of the upper normal limit of their ESR level (9.24 (\pm 1.86)).

As shown in Table 2, there was a significant relationship between HbA1C and ESR ($P= 0.016$). However, no significant relationship between HbA1c and age was observed in participants ($P= 0.730$).

Conclusion

ESR levels in T1D patients reflect the presence of systemic inflammation, which plays a significant role in disease progression.

Monitoring ESR levels can provide valuable insights into disease activity, risk stratification, and personalized treatment approaches. By understanding the link between systemic inflammation and T1D, healthcare professionals can improve patient outcomes and develop targeted interventions to minimize the long-term complications associated with the disease. With continued advancements in our understanding of the pathophysiology of T1D, ESR may become an integral part of comprehensive management strategies for individuals with T1D.

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Conflict of Interest

All authors interpret that they have no conflict of interest.

Authors' contributions

F.B and M.O. design the study. N.N developed the original idea and the protocol. Material preparation and data collection were performed by F.B, and S.P. Data analysis was performed by N.N. The first draft of the manuscript was written by F.B. and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Table 1. Comparison of ESR in participants relative to the upper limit of normal ESR value

Variable	Mean (\pm SD)	P-value	Mean (\pm SD)	P-value
ESR	Normal boy society	5.46 (\pm 1.60)	9.24 (\pm 1.86)	0.0001
	Studied boy society	9.81 (\pm 6.24)		
	Normal girl society	9.24 (\pm 1.86)	12.85 (\pm 6.40)	0.0001
	Studied girl society	12.85 (\pm 6.40)		

Table 2. Correlation analysis between the studied variables

Variable	Age	HbA1c
HbA1c	Pearson r	0.170
	P-value	0.133
ESR	Pearson r	-0.040
	Significant	0.730
		0.271
		0.016

References

- Entezari Z, Injinari N, Vakili M, Namiranian N. Identification of Factors Related to Sexual Dysfunction in Type 2 Diabetic Women. *Iranian journal of diabetes and obesity*. 2023, 15(2): 66-72.
- Asadollahi S, Hadizadeh M, Namiranian N, Kalantar SM, Firoozabadi AD, Injinari N. Misexpression of LINC01410, FOSL1, and MAFB in peripheral blood mononuclear cells associated with diabetic nephropathy. *Gene*. 2023;862:147265.
- Syed FZ. Type 1 diabetes mellitus. *Annals of internal medicine*. 2022;175(3):ITC33-48.
- Injinari N, Ghoshouni H, Mehrabbeik A, Namiranian N, Ghadiri-Anari A, Azizi R. Comparison of Diabetic Ketoacidosis Characteristics During-and Before the COVID-19 Pandemic. *International Journal of Endocrinology and Metabolism*. 2023;21(3):134882.
- Gallen I. Type 1 diabetes: clinical management of the athlete. Springer Science & Business Media; 2012.
- Ordooei M, Niknafs Z, Mehrabbeik A, Namiranian N. Mental and Social Health Status and its Association With Glycosylated Hemoglobin Level in Adolescents Aged 12-18 Years With Type 1 Diabetes. *Disease and Diagnosis*. 2022;11(2):54-7.
- Tsalamandris S, Antonopoulos AS, Oikonomou E, Papamikroulis GA, Vogiatzi G, Papaioannou S, et al. The role of inflammation in diabetes: current concepts and future perspectives. *European cardiology review*. 2019;14(1):50.
- Cabrera SM, Henschel AM, Hessner MJ. Innate inflammation in type 1 diabetes. *Translational Research*. 2016;167(1):214-27.
- Ordooei M, Karimi M, Akbarian E, Rasoulizadeh Z. Diabetic ketoacidosis in children before and during COVID-19 pandemic: a cross-sectional study. *International Journal of Endocrinology and Metabolism*. 2023;21(2).
- Tishkowski K, Gupta V. Erythrocyte sedimentation rate. 2020;638–46. <http://europepmc.org/books/NBK557485>
- Lapić I, Padoan A, Bozzato D, Plebani M. Erythrocyte sedimentation rate and C-reactive protein in acute inflammation: meta-analysis of diagnostic accuracy studies. *American journal of clinical pathology*. 2020;153(1):14-29.
- Khaleghi F, Namiranian N, Ansari K, Mansouri M, Injinari N, Aghaeimeybodi F. Relationship between Severity of Primary Lung Involvement with Erythrocyte Sedimentation Rate and Lactate Dehydrogenase in Patients with COVID-19 in Yazd. *Journal of Advances in Medical and Biomedical Research*. 2022;30(140):215-22.
- Daniels LM, Tosh PK, Fiala JA, Schleck CD, Mandrekar JN, Beckman TJ. Extremely elevated erythrocyte sedimentation rates: associations with Patients' diagnoses, demographic characteristics, and comorbidities. *InMayo Clinic Proceedings*. 2017;92(11):1636–43.
- Alkaabi J, Sharma C, Yasin J, Afandi B, Beshyah SA, Almazrouei R, et al. Relationship between lipid profile, inflammatory and endothelial dysfunction biomarkers, and type 1 diabetes mellitus: A case-control study. *American journal of translational research*. 2022;14(7):4838.
- Korcowski B, Kowalczyk JR, Bijak M, Rusin J. Concentration of procalcitonin and C-reactive protein in serum and erythrocyte sedimentation rate in active autoimmune diseases in children. *Polski Merkuriusz Lekarski: Organ Polskiego Towarzystwa Lekarskiego*. 2003;15(86):155-7.
- Guo S, Wang M, Yu Y, Yang Y, Zeng F, Sun F, et al. The association of erythrocyte sedimentation rate, high-sensitivity C-reactive protein and diabetic kidney disease in patients with type 2 diabetes. *BMC Endocrine Disorders*. 2020;20:1-8.
- van Asten SA, Jupiter DC, Mithani M, La Fontaine J, Davis KE, Lavery LA. Erythrocyte sedimentation rate and C-reactive protein to monitor treatment outcomes in diabetic foot osteomyelitis. *International wound journal*. 2017;14(1):142-8.
- Mottaghi T, Khorvash F, Khorvash F, Maracy M, Kheirrollahi M, Askari G. Association between BMI and inflammation among diabetic polyneuropathy patients. *International Journal of Preventive Medicine*. 2019;10(1):212.
- Wang Y, Yang P, Yan Z, Liu Z, Ma Q, Zhang Z, et al. The relationship between erythrocytes and diabetes mellitus. *Journal of Diabetes Research*. 2021;2021(1):6656062.
- Bartholomew's Hospital S, Ecla L. Simple rule for calculating normal erythrocyte sedimentation rate. *Br Med J*. 1983;286(6361):266.
- Pagana KD, Pagana TJ, Pagana TN. *Mosby's Diagnostic & Laboratory Test Reference*. 14th edn St. Louis, Mo: Elsevier. 2019.
- Gomes MB, Cobas RA, Nunes E, Castro-Faria-Neto HC, da Matta MF, Neves R, et al. Plasma PAF-acetylhydrolase activity, inflammatory markers and susceptibility of LDL to in vitro oxidation in patients with type 1 diabetes mellitus. *Diabetes research and clinical practice*. 2009;85(1):61-8.
- Satis S. New inflammatory marker associated with disease activity in rheumatoid arthritis: the systemic immune-inflammation index. *Current Health Sciences Journal*. 2021;47(4):553.
- Dariya B, Chalikonda G, Srivani G, Alam A, Nagaraju GP. Pathophysiology, etiology, epidemiology of type 1 diabetes and computational

- approaches for immune targets and therapy. *Critical Reviews™ in Immunology*. 2019;39(4):239-265.
25. Buschard K. The etiology and pathogenesis of type 1 diabetes—A personal, non-systematic review of possible causes, and interventions. *Frontiers in Endocrinology*. 2022;13:876470.
 26. Zorena K, Michalska M, Kurpas M, Jaskulak M, Murawska A, Rostami S. Environmental factors and the risk of developing type 1 diabetes-old disease and new data. *Biology*. 2022;11(4):608.
 27. Blagov AV, Summerhill VI, Sukhorukov VN, Popov MA, Grechko AV, Orekhov AN. Type 1 diabetes mellitus: Inflammation, mitophagy, and mitochondrial function. *Mitochondrion*. 2023;72:11–21.
 28. Rogovskii V. Immune tolerance as the physiologic counterpart of chronic inflammation. *Frontiers in Immunology*. 2020;11:2061.
 29. Stanislavovich Rogovskii V. The linkage between inflammation and immune tolerance: interfering with inflammation in cancer. *Current cancer drug targets*. 2017;17(4):325-32.
 30. Bikramjit P, Raveender N, Sudipta P. The importance of HbA1C and erythrocyte sedimentation rate as prognostic factors in predicting the outcome of diabetic foot ulcer disease. *International Journal of Advances in Medicine*. 2017;4(1):137-42.
 31. Burlaka I. Analysis of apoptotic, clinical, and laboratory parameters in type 1 diabetes and early diabetic nephropathy: clustering and potential groups evaluation for additional therapeutic interventions. *Journal of Clinical Research in Pediatric Endocrinology*. 2022;14(3):313.