

Single Nucleotide Polymorphism (SNP) rs2229569 with L Selectin Gene Expression in Iraqi Female during *in vitro* Fertilization Program.

Raghad Hameed Rashid , Asmaa M. Salih Almohaidi* , Alia Hussain Ali 

Department of Biology, College of Science for Women, University of Baghdad, Baghdad, Iraq.

*Corresponding Author.

Received 31/03/2023, Revised 14/08/2023, Accepted 16/08/2023, Published Online First 20/02/2024



© 2022 The Author(s). Published by College of Science for Women, University of Baghdad.

This is an Open Access article distributed under the terms of the [Creative Commons Attribution 4.0 International License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Infertility is recognized as one of the leading reproductive health problems in various regions of the world. In vitro fertilization (IVF) is one of the most effective treatments for infertility. In the current research, the role of the selectin -L (*SELL*) gene, especially the rs2229569 polymorphism, has been determined in terms of implantation and expression level. This work involved 67 females who underwent an in vitro fertilization cycle, divided into two major groups: the implantation failure female group and the implantation success female group. Blood samples were collected from the females. After DNA extraction from blood sample then amplification by polymerase chain reaction, samples were sent for sequence analyses. The SNP rs2229569 was detected and that recorded three genotypes. The failure group had a deviation from H.W.E., and the success group was in agreement with H.W.E. law according to Chi square values ($X^2 = 11.60, 1.58$). Significant differences in the failure group refers to the effects of infertility in the study population. Odds ratio of rs2229569 showed that the T allele was (2.09), so T allele may be considered a risk allele for the failure implantation. Finally, the *SELL* gene expression had a downregulation in female with failed implantation compared to female in successful implantation groups.

Keywords: Gene expression, Gene polymorphism rs2229569, Infertility, In vitro Fertilization, Selectin L.

Introduction

Infertility is a common problem and unique medical condition with important psychologic, economic, demographic, and medical implications ¹. It involves a couple rather than a single individual. Infertility is defined as the inability to achieve a clinical pregnancy after trying for 12 months with regular, unprotected sexual activity ². Primary infertility affects women who have never had a baby, while secondary infertility affects women who have already given birth at least once³. Recent research has found that 15% of married couples around the world are at increased risk of poor

reproductive health and mental health due to infertility and invasive treatments ⁴.

Many factors, including hormones, prostaglandins, and adhesion molecules, work together to regulate the intricate crosstalk between the endometrium and the blastocyst necessary for successful implantation^{5,6}. Adhesion molecules are a class of membrane-associated glycoproteins found on the surface of cells that play key roles in cellular processes such as recognition, adhesion, migration, and differentiation⁷. Different structural and functional properties categorize them into four

groups: cadherins, integrins, selectins, and immunoglobulin (Ig)-like proteins⁸. In various inflammatory factors the level of soluble platelet selectin, as one of the cell adhesion molecules, is increased⁹. When the endometrium is most receptive to embryo implantation, it is called the "window of implantation," and it occurs during the mid-luteal phase in humans^{10, 11}. In vitro fertilization (IVF) is a way to help women get pregnant when their fallopian tubes are damaged or blocked¹². During the window of implantation, the endometrium expresses several genes that enable the process of implantation to occur, such as selectins¹³.

The selectins, which include P-selectin, L-selectin, and E-selectin¹⁴, are a family of cell adhesion molecules. The *SELL* gene that encodes the L-

Materials and Methods

Study Design

The study consisted of 67 women under IVF cycle divided into two major groups including 41 implantation failure female group and 26 implantation success females group. Their age range was 18-44 years, from Rooh ALhayat Center for IVF, AL Farah Center for IVF and AL Nada Center for IVF in Baghdad, Iraq.

Collection of Blood Samples:

Following an hour after embryo transfer, the blood samples were drawn from each female (success 26 and failure 41 females) as two ml of blood was added directly into an EDTA containing tube for genotyping study. 250 µL added to 750 µL of GENEZOL for gene expression.

Genomic DNA Extraction and Genotyping:

DNA was isolated using 2 mL of whole blood collected in tubes of EDTA using a purification kit for the genomic DNA (Geneaid). The amplification of DNA represented in fragment of exon 5 region of *SELL* gene (forward and reverse). Then the polymorphism of the *SELL* gene was detected using the PCR-sequencing method. PCR amplifications were detected in a total volume of 25 µL consisted of 5 µL genomic DNA (30 to 53.3 µg/mL), 13 µL D.W., 5µL master mix [1 U DNA polymerase, 1000 µM dNTP , Reaction Buffer with 1.5 mM MgCl₂(1 x)] and 1 µL of each primer as follow L selectin

selectin protein in humans is located in a tandem arrangement with other members of the family on the long arm of chromosome 1 (1q24.2). L-selectin consists of nine exons and eight introns (<https://www.ncbi.nlm.nih.gov/>)¹⁵. The surface of vascular endothelial cells express adhesion molecules, enabling leukocytes in adhering to other tissues in that region¹⁶. The binding of *SELL*, expressed by the trophoblast, to oligosaccharide based ligands expressed by the endometrium¹⁷ is critical for the initial attachment of an embryo to the endometrium. Thus, L-selectin-ligand interactions in the uterus may serve as a link in the chain leading to the essential first attachment for implantation¹⁸. According to previous information, the present study has been designed to evaluate the relation between *SELL* gene and IVF outcome.

forward (10 pmole / µl) were 5'-TTTGAATCCTAGCCCTGCCAC-3'; and reverse (10 pmole / µl) were 5'-AAGCCCCAGAGTAATGCTTGA -3' both primers were designed by second author used primer designing tool in NCBI. The program of PCR were shown in **Table1**. The 832bp PCR fragment was confirmed to be present after separation on a 1% agarose gel with ethidium bromide staining. The sequencing technique was used to identify the *SELL* gene polymorphism.

Table 1. The PCR program of *SELL*

No	Step	Temperature °C	Time	No of cycle
1	Initial denaturation	94	5 min	1
2	Denaturation	94	45 sec	
3	Annealing	58	45 sec	35
4	Extension	72	2 min	
5	Final extension	72	5 min	1

DNA Sequencin

After amplification, the PCR products were analyzed of exon 5 region for *SELL* gene (forward and reverse) of all failure and success implantation group. The 61 samples (35 failure group and 26 success group) were sent to Macrogen Corporation



– Korea for sequencing by using automated DNA sequence Macrogen.

Real Time -PCR (RT-PCR)

250 µL of blood was added to 750 µL of GENEZol and used for gene expression. RNA was isolated using the GENZolTM TriRNA Pure Kit, and then RNA was converted to complementary DNA (cDNA) using the Accu PowerRRT RocketScriptTM PreMix Kit from Bioneer, Korea, and Oligo dT20 as primer. *SELL* gene expression was detected by real-time PCR (RT-PCR). This technique was carried out by a dye that used the real-time fluorescence of a cDNA binding dye (SYBR Green) to measure cDNA amplification. L-selectin Primer for Real time PCR was forward TGA TTC AGT GTG AGC CTT TG and reverse CTT GAC AGG TTG GTT CTG¹⁹. The required volume of each component was 25 µL: (5 µL SYPER Green), 13 µL nuclease-free water, 1 µL of

each forward and reverse primer, and 5 µL cDNA. The absolute target quantities were calculated using the human reference gene (junctional cadherin complex regulator) (JHY). The primer of reference gene was forward GTCCAGGGTATTACAGGCAA and reverse TCAGGAATCAGCCCCAGACG were designed by present study . The threshold cycle was used to quantitatively measure the levels of gene expression 20.

Statistical Analysis

The results of genomic DNA amplification were analyzed using BioEdit software. Online Hardy-Weinberg equilibrium H.W.E. Calculator to test whether the observed genotype was applied with H.W.E. WINPEPI software was used to calculate the significance and odds ratios of genotyping and allele frequencies of the studied genes.

Results

The present study examined the *SELL* gene polymorphism by sequencing method in infertile female who underwent IVF programs, including failure and success implantation groups. Sanger's sequencing was performed on the samples of amplified PCR-products for exon5 on *SELL* gene. The sequences were blast to a reference sequence of *SELL* gene in the National Center for Biotechnology Information (NCBI) (www.ncbi.nlm.nih.gov) as shown in **Fig. 1** and **Fig. 2**, and the samples analyzed by BIO Edit as shown in **Fig. 3**.

Homo sapiens selectin L (SELL), RefSeqGene on chromosome 1

Sequence ID: [NG_016132.1](#) Length: 28038 Number of Matches: 1

Range 1: 11992 to 12135 GenBank Graphics				
Score	Expect	Identities	Gaps	Strand
259 bits(140)	8e-67	143/144(99%)	1/144(0%)	Plus/Plus
Query 12	TGGACTGTACTCACCTTTGGG-AACTTCAGCTCACAGTGTGCCCTCAGCTGCT			
Sbjct 11992	TGGACTGTACTCACCTTTGGGAACTTCAGCTCACAGTGTGCCCTCAGCTGCT			
Query 71	CTGAAGGAACAAACTTAACCTGGGATTGAAGAAACCAACCTGTGGACCATTTGGAAACTGGT			
Sbjct 12052	CTGAAGGAACAAACTTAACCTGGGATTGAAGAAACCAACCTGTGGACCATTTGGAAACTGGT			
Query 131	CATCTCCAGAACCAACCTGTCAAG 154			
Sbjct 12112	CATCTCCAGAACCAACCTGTCAAG 12135			

Figure1. A representative sequence alignment of *SELL* at exon 5 amplification results with NCBI Blast. Arrow is for normal homozygous genotype rs2229569.

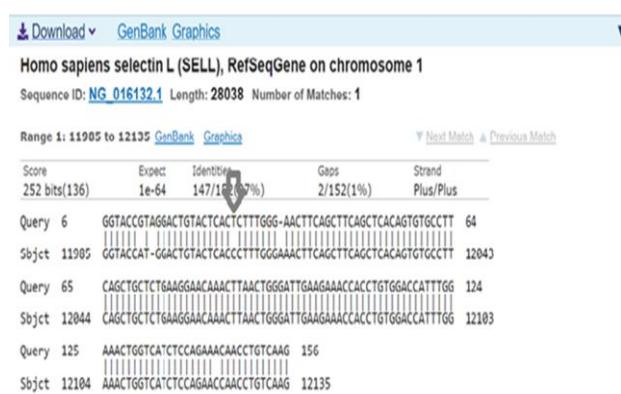
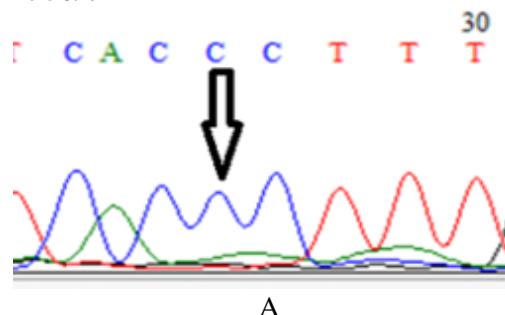


Figure2. A representative sequence alignment of *SELL* at exon 5 amplification results with NCBI Blast. Arrow is for heterozygote genotype of rs2229569.



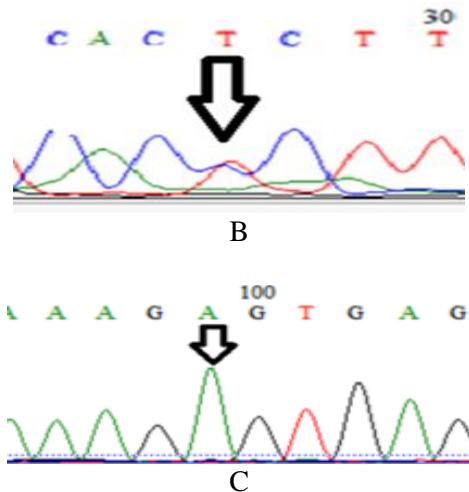


Figure 3. A and B and C shows the sequence of DNA samples of the rs2229569 analyzed by BIO Edit software. In A, the normal homozygote genotype C\|C. B, the heterozygote C\|T and C, the mutant homozygote TT genotype.

The frequency of genotypes and alleles of the SNP of *SELL* T>C rs2229569 using H.W.E were shown in **Table 2**. The results in **Table 2**. Showed significantly higher ($P > 0.05$) of genotypes frequency for failure implantation group but showed non-significant in success group. This indicates that the failure group had deviation from H.W.E while success group agreed with H.W.E. The Expected frequencies: CC homozygous genotype recorded 21.61vs.20.35, while the heterozygous genotype CT had expected frequency 11.79vs 5.31and TT genotype had 1.61vs. 0.35 as expected frequency

among two study groups at receptively. Homozygote genotype CC was more frequent in both groups failure and Success group (25+21=46) which made it common genotype in Iraqi female population.

Comparison of the frequencies of allele and Genotype of *SELL* gene polymorphism (rs2229569 T>C) between failure and success groups was shown in Table 3. The present data in Table3 showed that the genotypes (CC, CT, TT) recorded different between groups. Frequency of homozygous genotype CC in success group (80.77%) was higher than in failure group (71.42%), while the heterozygous genotype CT was (15.38%) in success group and (14.29%) in failure group. Homozygous TT genotype was higher in failure group (14.29%) than in success groups (3.85%). According to odds ratio TT recorded 4.17 therefore TT genotype may be considered an etiological fraction with positive association with failure of IVF while other genotype CC and CT may be protective genotype with odds ratio 0.6 and 0.9. The frequency of C allele was (78.57%)in the failure group, while in the success group was (88.46%). The frequency of T allele was (21.43%) in the failure group while in the success group was (11.54%). Moreover, T allele could have recorded odds ratio 2.09 which make it risky factor with positive association with failure implantation while C allele was protective 0.48 with negative association with the failure implantation.

Table 2. Frequencies of genotypes and allele of the SNP of *SELL* T>C rs2229569 in exon 5 using H.W.E

<i>SELL</i> rs2229569T>C Genotype		CC	CT	TT	C	T	χ^2	P-value
Failure implantation	Observed no(%)	25 71.42%	5 14.29%	5 14.29%	0.78	0.22		
Female (35)	Expected no(%).	21.61	11.79	1.61			11.60	0.003**
		61.73%	33.67%	4.6%				
Success implantation	Observed no(%)	21 80.77%	4 15.38%	1 3.85%	0.88	0.12		
Female(26)	Expected no(%)	20.35 78.26%	5.31 20.41%	0.35 1.33%			1.58	0.50NS
		75.40% 0.555 NS	14.76% 0.738 NS	9.84% 0.102 NS				
Total Observed (%)								
P value								

* ($P \leq 0.01$) significant, ** ($P \leq 0.01$) highly significant, NS: Non-Significant.

Table 3. Comparison of the genotype and allele frequencies of L-selectin gene polymorphism (rs2229569 T>C) between failure and success groups

SELL polymorphism rs2229569T>C	Frequencies (%)		Odds Ratio	Etiological or Preventive Fraction%	Fisher's exact probability	CI 95%
	failure group (n=35)	success group (n=26)				
CC	25 (71.42%)	21 (80.77%)	0.6	40.05	0.5	0.16to 2.03
CT	5 (14.29%)	4(15.38%)	0.92	8.3	0.8	0.21to 4.25
TT	5(14.29%)	1 (3.85 %)	4.17	76.0	0.1	0.52to 80.82
Alleles Distribution						
C	55(78.57%)	46 (88.46%)	0.48	52.2	0.2	0.16to 1.32
T	15 (21.43%)	6(11.54%)	2.09	52.2	0.1	0.76to 6.26

CI: confidence intervals

Results of Real Time PCR of SELL

Sixty-one 61 female underwent IVF included 35 failure group implantation,26 success group selected for L selectin gene expression. Quantitative real-time PCR was validated and performed. *SELL* gene expression was quantified into two groups: the failure group and the success group with used the reference gene (*JHY*). As shown in **Table 4**, the mean ct of selectin L gene for the failure, and

success group were respectively (18.62, and 18.11), while the means of Ct for (*JHY*) gene expression for the failure, and success were respectively (26.37and 26.71). The present study result shows that the fold change in *SELL* was down regulation in the failure group (0.56 ± 0.17) while upregulation in the success group was (1.00 ± 0.00) and significant difference in the fold gene expression between these two groups.

Table 4. Comparison between Failure and Success folding of SELL gene

Study Group	Mean ct of SELL	Mean ct of JHY	Mean Δ ct	Mean ct of calibrator	Δ Δ ct	2-Δct	Experimental group\success group	Fold gene expression mean±Std
Failure group	18.62	26.37	-7.75	7.2	-14.95	31651.8	31651.8\57052.4	$0.56 \pm 0.17^*$
Success group	18.11	26.71	-8.6	7.2	-15.8	57052.4	57052.4\57052.4	1.00 ± 0.00

* (P<0.01) significant, ** (P<0.01) highly significant, NS: Non-Significant.

Discussion

This study analyzed the L selectin gene polymorphism with expression level during an in vitro fertilization program for rs2229569 in exon five of the *SELL* gene. The failure implantation group showed deviations from H.W.E. in all genotypes. Significant differences in the failure group refer to the effects of infertility in the study population, in which infertility in the failure group leads to a deviate from HWE, and *SELL* gene polymorphism may be considered a factor related to infertility. Other Iraqi studies have emphasized that the *SELL* gene may play a role in type 2 diabetes mellitus in the Iraqi population²¹. Therefore, it is possible that *SELL* defects contribute to implantation failures and infertility.

The present study found that the genotypes of *SELL* gene non-significantly varied between failure and success group.TT genotype which could be considered an etiological genotype, while CC could be a protective allele related to success of implantation according to odds ratio. The rs2229569 T allele was most common among the failure group. This allele was present in about 21.43 % in failure group, but only 11.54% in the success group, according to Fisher's probability (2.09) may be consider etiological allele and could be related with the failure of implantation. This observation may highlight the role of the *SELL* polymorphism in IVF outcome. A different studies emphasize that different genes are associated with infertility and



endometriosis one of them is *SELL*²²⁻²⁴. The present study agrees with study in Iran that showed E-Selectin mutant genotype frequency was significantly higher in Coronary Patients pathogenesis²⁵. The polymorphism of *SELL* in present study results from transition amino acid proline to serine, this genetic variant determines synthesis of protein with other amino acid serine; this leads to a change in the effectiveness of protein domain 1.

The results of the present study showed that *SELL* gene expression was downregulated in the failure groups (0.56) compared with the success groups (1.00) according to fold gene value. These findings demonstrate that downregulation of *SELL* gene expression may be associated with failure of embryo implantation. The present study agrees with other studies about Iraqi females showing that downregulation of Integrin Beta3 gene expression

was associated with implantation failure^{26,27}. Another study demonstrated that the level of L-selectin ligand was significantly more available in pregnant female²⁸. Another local study shows that *SELE* gene probability is associated with development of breast cancer²⁹. It is well known that selectins play crucial roles during implantation as the primary adhesion molecules at the maternal-fetal interface^{30, 31}. Higher rates of embryo implantation and successful pregnancies have been linked to higher levels of L-selectin ligand in the secretory endometrium, suggesting a role for L-selectin ligand in facilitating endometrial receptivity and mediating the maternal-fetal interface³²⁻³⁵. All these studies goes with the present study also emphasized a finding that there are many factors effect on IVF outcome and L selectin could be one of them. In order to improve this conclusion another studies with large sample requires.

Conclusion

In conclusion, this study demonstrates that the TT genotype and T allele of rs2229569 may be associated with the failure of implantation therefore it may be considering as the risky allele in female

Acknowledgment

We appreciate the kind assistance and cooperation of the medical staff at Nuclear Medicine Hospital, Medical City in Baghdad.

Authors' Declaration

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are ours. Furthermore, any Figures and images, that are not ours, have been included with the necessary permission for re-publication, which is attached to the manuscript.

under IVF program. In addition, the present study shows that downregulation of *SELL* gene expression may be associated with the failure of embryo implantation.

- Authors sign on ethical consideration's approval. The study included human participants and was approved by the ethics committees of the intended hospitals. Participants gave their free, informed consent to take part in this research.
- Ethical Clearance: The project was approved by the local ethical committee in University of Baghdad.

Authors' Contribution Statement

A. M. S. A designed the whole project and primers following the research work, analyzed data and wrote the manuscript. R. H. R. collected the

samples and writing the draft of the manuscript. A. H. A. read the physiological part. All authors read and approved the final manuscript.

Journal Declaration:

Dr. Asmaa M. Salih Almohaidi is an Editor for the journal but did not participate in the peer review

process other than as an author. The authors declare no other conflict of interest.



References

1. Namdar A, Naghizadeh MM, Zamani M, Yaghmaei F, Sameni MH. Quality of life and general health of infertile women. *healthcare.* 2017; 15(1): 1-7. <https://doi.org/10.1186/s12955-017-0712-y>.
2. Sirait BI, Reviani N, Udjung GI. Factors Affecting Infertility in Women of Reproductive Age in the IVF Programme. *Int. J. Trop. Dis. Health.* 2023; 44(1): 65-75. <https://doi.org/10.9734/ijtdh%2F2023%2Fv44i11386>.
3. Greil AL, Slauson-Blevins K, McQuillan J. The experience of infertility: a review of recent literature *Sociol Health Illn.* 2010; 32(1): 140-62. <https://doi.org/10.1111/j.1467-9566.2009.01213.x>.
4. Zaami S, Driul L, Sansone M, Scatena E, Andersson KL, Marinelli E. ART innovations: fostering women's psychophysical health between bioethics precepts and human rights. In *Healthcare.* 2021; 9 (11) :1486. <https://doi.org/10.3390/healthcare9111486>.
5. Su RW, Fazleabas AT. Regulation of Implantation and Establishment of Pregnancy in Mammals. 6th ed. USA: Springer Cham, 2015. Chapter 10, Implantation and establishment of pregnancy in human and nonhuman primates; p.189-213. https://doi.org/10.1007/978-3-319-15856-3_10.
6. Massimiani M, Lacconi V, La Civita F, Ticconi C, Rago R, Campagnolo L. Molecular signaling regulating endometrium–blastocyst crosstalk. *Int J Mol Sci.* 2019; 21(1): 23. <https://doi.org/10.3390/ijms21010023>.
7. Darvishi B, Boroumandieh S, Majidzadeh-A K, Salehi M, Jafari F, Farahmand L. The role of activated leukocyte cell adhesion molecule (ALCAM) in cancer progression, invasion, metastasis and recurrence: A novel cancer stem cell marker and tumor-specific prognosticmarker. *Exp.J.Mol.Pathol.*2020; 115:104443. <https://doi.org/10.1016/j.yexmp.2020.104443>.
8. Homrich M, Gotthard I, Wobst H, Diestel S. Cell adhesion molecules and ubiquitination—functions and significance. *Biology.* 2015; 5(1): 1. <https://doi.org/10.3390/biology5010001>.
9. AL-Maini EH, Ali SI. The correlation between serum levels of soluble platelet-selectin in preeclampsia with & without intrauterine growth retardation versus normal pregnancy. *J.Fac Med Baghdad.* 2017; 59(1): 36-41. <https://doi.org/10.32007/jfacmedbagdad.591156>.
10. Sehring J, Beltsos A, Jeelani R. Human implantation: The complex interplay between endometrial receptivity, inflammation, and the microbiome. *Placenta.* 2022; 117: 179-86. <https://doi.org/10.1016/j.placenta.2021.12.015>.
11. Ashary N, Tiwari A, Modi D. Embryo implantation: war in times of love. *Gen. Comp. J Endocrinol.* 2018; 159(2): 1188-98. <https://doi.org/10.1210/en.2017-03082>.
12. Dai W, Ma L, Cao Y, Wu D, Yu T, Zhai J. In vitro fertilization outcome in women with endometrial tuberculosis and tubal tuberculosis. *Gynecol Endocrinol.* 2020; 36(9): 819-23. <https://doi.org/10.1080/09513590.2019.1702639>.
13. Ochoa-Bernal MA, Fazleabas AT. Physiologic events of embryo implantation and decidualization in human and non-human primates. *Int J Mol Sci.* 2020; 21(6): 1973. <https://doi.org/10.3390/ijms21061973>.
14. Zhong M, Huang J, Wu Z, Chan KG, Wang L, Li J, et al. Potential Roles of Selectins in Periodontal Diseases and Associated Systemic Diseases: Could They Be Targets for Immunotherapy? *Int J Mol.* 2022; 23(22): 14280. <https://doi.org/10.3390/ijms232214280>.
15. National Center for Biotechnology Information(<https://www.ncbi.nlm.nih.gov/>).
16. Almohaidi AMS, Salman IN, Kaduhm RM. Study ABO/Rh system with Endothelial Inflammatory Factors in Iraqi Arab Female with Diabetes Mellitus Type II. *Baghdad Sci J.* 2014; 11(1): 93-102. <https://doi.org/10.21123/bsj.2014.11.1.93-102>.
17. Lai TH, Chang FW, Lin JJ, Ling QD. Gene expression of human endometrial L-selectin ligand in relation to the phases of the natural menstrual cycle. *Sci Rep.* 2018; 8(1): 1443. <https://doi.org/10.1038/s41598-018-19911-z>.
18. Foulk RA, Zdravkovic T, Genbacev O, Prakobphol A. Expression of L-selectin ligand MECA-79 as a predictive marker of human uterine receptivity. *J Assist Reprod Genet.* 2007 Jul; 24: 316-21. <https://doi.org/10.1007/s10815-007-9151-8>.
19. Jozefczuk J, Adjaye J. Quantitative real-time PCR-based analysis of gene expression. *Methods Enzymol.* 2011; 500: 99-109. Academic Press. <https://doi.org/10.1016/B978-0-12-385118-5.00006-2>.
20. Wei YS, Lan Y, Meng LQ, Nong LG. The association of L-selectin polymorphisms with L-selectin serum levels and risk of ischemic stroke. *J Thromb.* 2011; 32: 110-5. <https://doi.org/10.1007/s11239-011-0587-4>.
21. Al KA, Almohaidi AMS. Polymorphism variation of l-selectin the pro213ser (rs2229569) in Iraqi Arab patient with type2 diabetes mellitus (T2DM). *Iraqi journal of biotechnology.* 2017; 16(3):1-8. <https://doi.org/10.25258/ijpqa.v9i01.11358>.
22. Zakariya BF, Almohaidi AMS, Şimşek SA, Kamal AM, Al-Dabbagh WH, Al-Waysi SA. The whole wheat effect and refined with E-selectin



- polymorphism on breast cancer. *Analytical Science & Technology*. 2022; 35(4): 161-8. <https://doi.org/10.5806/AST.2022.35.4.161>.
23. Alzubadiy MW, Almohaidi AMS, Sultan AA, Abdulhameed LQ. Evaluation of E-selectin rs 5367 C/T Polymorphism in Iraqi Diabetic Foot patients. In *Journal of Physics: Conference Series* 2019; 1294 (6): 06 2021. IOP Publishing. <https://doi.org/10.1088/1742-6596/1294/6/062021>.
24. Cho SB. Molecular Mechanisms of Endometriosis Revealed Using Omics Data. *Biomedicines* 2023; 1(11) 2-19. <https://doi.org/10.3390/biomedicines11082210>.
25. Rayat S, Ramezanidoraki N, Kazemi N, Mohammad HM, Falah M, Zardadi S and Morovvati S. Association study between polymorphisms in MIA3, SELE, SMAD3 and CETP genes and coronary artery disease in an Iranian population. *BMC Cardiovascular Disorders* 2022; 22(298) 1-9. <https://doi.org/10.1186/s12872-022-02695-6>.
26. Yousif RA, Almohaidi AMS, Al-Musawi BJ. Assessment of ITGB3 gene expression and hormonal status in infertile female undergoing an in vitro fertilization protocol. *HIV Nurs.* 2023; 23(1): 770-8. <https://doi.org/10.31838/hiv23.01.130>.
27. Elnaggar A, Farag AH, Gaber ME, Hafeez MA, Ali MS, Atef AM. AlphaVBeta3 Integrin expression within uterine endometrium in unexplained infertility: a prospective cohort study. *BMC Women's Health.* 2017; 17(1): 1-9. <https://doi.org/10.1186/s12905-017-0438-3>.
28. Wang B, Sheng JZ, He RH, Qian YL, Jin F, Huang HF. High expression of l-selectin ligand in secretory endometrium is associated with better endometrial receptivity and facilitates embryo implantation in human being. *Am J Reprod Immunol.* 2008; 60(2): 127-34. <https://doi.org/10.1111/j.1600-0897.2008.00604.x>.
29. Zakariya BF, Almohaidi AMS, Şimşek SA, Al-Waysi SA, Al-Dabbagh WH, Kamal AM. The relationship of E-26 selectin single nucleotide polymorphisms with breast cancer in Iraqi Arab women. *Genomics Inform.* 2022; 20(4). <https://doi.org/10.5808/gi.22042>.
30. Achache H, Revel A. Endometrial receptivity markers, the journey to successful embryo implantation. *Hum Reprod Update.* 2006; 12(6): 731-46. <https://doi.org/10.1093/humupd/dml004>.
31. Miller D, Motomura K, Garcia-Flores V, Romero R, Gomez-Lopez N. Innate lymphoid cells in the maternal and fetal compartments. *Front Immunol.* 2018; 9: 2396. <https://doi.org/10.3389/fimmu.2018.02396>.
32. Wang B, Sheng JZ, He RH, Qian YL, Jin F, Huang HF. High expression of l-selectin ligand in secretory endometrium is associated with better endometrial receptivity and facilitates embryo implantation in human being. *Am J Reprod Immunol.* 2008; 60(2): 12734. <https://doi.org/10.1111/j.1600-0897.2008.00604.x>.
33. Pina Carvalho LF, Hui CY, Agarwal A. Endometriosis and infertility: biomarkers affecting implantation rate. *J Obstet Gynaecol.* 2013; 8(5): 467-73. <https://doi.org/10.1586/17474108.2013.825456>.
34. Feng Y, Ma Z, Deng L, Yao B, Xiong Y, Wu Y, Wang L, Ma Q, and Ma F. Role of selectins and their ligands in human implantation stage. *Glycobiolog.* 2017; 27(5) 385-391. <https://doi.org/10.1093/glycob/cwx009>.
35. Vazgiourakis Vm, Zervou2 Mi, Papageorgiou L, Chaniotis D, Spandidos Da, Vlachakis D, Eliopoulos E and Goulielmos2 Ga. Association of endometriosis with cardiovascular disease: Genetic aspects. *International Journal of Molecular Medicine.* 2023; 51(29) 1-16. <https://doi.org/10.3892/ijmm.2023.5232>.
36. Ersuz R, Karapinar O S, Doğan S. Comparison of Serum Levels of Cell Adhesion Molecules (E-selectin, P-selectin, Icam-1, Vcam-1, Lrg-1) in Placental Invasion and Adhesion Anomalies With Patients With Vaginal Delivery and Former Cesarean. Research Square; 2-19. <https://doi.org/10.21203/rs.3.rs-2059755/v1>

تعدد الأشكال للقاعدة المفردة rs2229569 مع التعبير الجيني للسلكتين L في الإناث العراقيات اثناء برنامج الأخصاب خارج الجسم الحي

رغد حميد رشيد ، أسماء محمد صالح المهيدى ، عالية حسين على

قسم علوم الحياة، كلية العلوم للبنات، جامعة بغداد، بغداد ، العراق.

الخلاصة

يُعرف العقم بأنه أحد مشاكل الصحة الإنجابية الرائدة في مناطق مختلفة من العالم. يعتبر الإخصاب في المختبر أحد أكثر علاجات العقم فعالية. في الدراسة الحالية ، تم تحديد دور جين *SELL* ، وخاصة تعدد الأشكال rs2229569 ، من حيث الانغراس ومستوى التعبير. اشتملت الدراسة على 67 أنثى خضعت لدوره إخصاب في المختبر ، مقسمة إلى مجموعتين رئيسيتين: مجموعة الإناث التي فشلت عملية الزيز ومجموعة الإناث الناجحة في عملية الزيز. تم جمع عينات الدم من مجموعة الإناث. بعد استخلاص الدنا من الدم وتضخيم الحمض النووي عن طريق تفاعل البلمرة المتسلسل ، تم إرسال العينات لتحليل التسلسل ، وتم تحديد SNP rs2229569 التي اظهرت ثلاثة أنماط وراثية. كانت مجموعة الفشل منحرفة عن H.W.E. وكانت مجموعة النجاح في اتفاق مع H.W.E. وفقاً لقيم مربع كاي ($\chi^2 = 11.60$ ، $P = 1.58$) ، تشير الفروق المعنوية في مجموعة الفشل إلى تأثير العقم في مجتمع الدراسة. تُظهر نسبة الأرجحية لـ rs2229569 أنAllele T كان (2.09) ، لذلك قد يمثل Allele T المخاطرة لعملية فشل الزيز. أخيراً ، أظهر جين *SELL* مستوى تعبيراً منخفضاً لدى الإناث المصابة بفشل الزيز مقارنة بالإناث في مجموعات الزيز الناجحة.

الكلمات المفتاحية: التعبير الجيني، تعدد الأشكال للقاعدة الواحدة rs2229569، العقم، الأخصاب في المختبر، سلكتين L.