

# Measurement of Fetomaternal Outcome in Patients with Sepsis in Pregnancy

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**Keywords:** Sepsis, Maternal Sepsis, Fetomaternal Outcome, Pregnancy.

## Abstract

**Objective:** This research aims to assess the outcomes for both the fetus and the mother in cases where sepsis occurs during pregnancy.

**Materials & Methods:** This research, spanning from January 2021 to January 2022 at our institution, encompassed a one-year duration. It involved the inclusion of 120 pregnant females who experienced sepsis at any point during their gravid period, irrespective of the need for hospitalization. The primary goal was to assess the outcomes for both the fetus and the mother among these gravid patients.

**Results:** A total of 120 females presenting symptoms of sepsis, such as fever, were assessed for Fetomaternal outcomes. Among them, approximately 100 patients required hospitalization

leading to the delivery of the baby, while the remaining twenty underwent follow-up through outpatient visits until delivery. These patients exhibited diverse causes for sepsis, with 70 (58.33%) experiencing sepsis due to PPRM (pre-term premature rupture of membranes), 25 (20.83%) developing sepsis from UTI, and 15 (12.5%) contracting sepsis as a result of pulmonary infection. Additionally, nine (7.5%) patients encountered sepsis from GIT infection, and one (0.08%) experienced stillbirth.

**Conclusion:** Sepsis during pregnancy presents a grave medical concern, carrying substantial risks for both the expectant mother and the growing fetus. This condition represents a potentially life-threatening reaction to an infection, capable of

causing organ failure and mortality unless promptly identified and addressed.

## **INTRODUCTION:**

Pregnancy, a transformative journey marked by physiological changes and intricate interplay between the maternal and fetal systems, is a period of heightened vulnerability to various health challenges [1]. Among these, sepsis emerges as a critical concern, posing a substantial threat to both maternal and fetal well-being. Sepsis, characterized by a dysregulated host response to infection leading to life-threatening organ dysfunction, presents unique challenges when it occurs during pregnancy [2]. The intricate dance between the maternal immune response and the delicate environment supporting fetal development underscores the importance of understanding and measuring fetomaternal outcomes in cases of sepsis during pregnancy [3].

Maternal health is a cornerstone of successful pregnancy outcomes, and sepsis introduces a complex dimension to this delicate balance [4]. Sepsis during pregnancy is often associated with increased morbidity and mortality for both the mother and the fetus. The physiological changes inherent to pregnancy, such as altered immune responses and increased cardiovascular demands, can complicate the diagnosis and management of sepsis [5]. Moreover, the potential for rapid deterioration necessitates a nuanced approach to monitoring and intervention [6].

The primary objective of this exploration is to delve into the intricate web of fetomaternal outcomes in patients grappling with sepsis during pregnancy [7]. By comprehensively examining the existing literature, clinical studies, and emerging research in this realm, we aim to shed light on the multifaceted dimensions of this medical challenge [8]. This investigation pursues to contribute to present knowledge base, offering understandings that can inform clinical practice, enhance patient care, and ultimately improve outcomes for both mothers and their unborn children [9].

Understanding the impact of sepsis on maternal health is paramount. Sepsis can lead to a cascade of events, including organ failure, disseminated intravascular coagulation, and hemodynamic instability, all of which can significantly impact maternal mortality rates [10]. Monitoring maternal parameters, such as vital signs, laboratory markers, and organ function, becomes crucial in guiding timely and appropriate interventions. The challenge lies in discerning the nuanced changes in these parameters specific to the pregnant state and adapting management strategies accordingly [11-12].

Equally crucial is the evaluation of fetal outcomes in the context of maternal sepsis. The developing fetus is intricately connected to the maternal environment, relying on a shared circulatory system and immune milieu. Sepsis can disrupt these delicate connections, leading to adverse fetal outcomes ranging from preterm birth and intrauterine growth restriction to stillbirth [26-45]. Understanding the mechanisms through which sepsis influences fetal health is imperative for tailoring interventions that not only safeguard maternal well-being but also optimize outcomes for the unborn child.

This exploration also recognizes the gaps in current knowledge and emphasizes the need for refined methodologies in measuring fetomaternal outcomes in cases of sepsis during pregnancy [13]. Integrating advanced diagnostic tools, such as imaging modalities and biomarker assessments, can offer a more comprehensive understanding of the dynamic changes occurring in both maternal and fetal compartments. Moreover, collaborative efforts between obstetricians, infectious disease specialists, and critical care teams are essential for developing cohesive and effective management strategies [14]. The measurement of fetomaternal outcomes in patients with sepsis during pregnancy represents a critical frontier in maternal-fetal medicine. This exploration aims to navigate this complex landscape, unraveling the intricacies of sepsis's impact on both maternal and fetal health. By advancing our understanding of these dynamics, we aspire to pave

the way for targeted interventions, improved clinical guidelines, and ultimately, enhanced outcomes for mothers and their precious unborn children [15].

**MATERIALS & METHODS:**

Our current research was led at our institution from May 2022 to April 2023 over a one-year period. This research involved a total of 120 pregnant females who experienced sepsis during their gravid period, with the possibility of requiring hospitalization. The primary objective was to assess the outcomes for both the fetus and the mother in these gravid patients.

Prior to commencing study, explicit informed consent was gained from all applicants, and ethical approval was secured from institution’s ethical review committee. Pregnant women presenting at the hospital emergency or outpatient department

with suspected sepsis, indicated by symptoms such as high-grade fever or vaginal discharge, were documented. Thorough history and physical examinations were conducted, and the participants were closely monitored for Fetomaternal outcomes.

**RESULTS:**

A total of 120 women presenting with sepsis symptoms, specifically fever, underwent assessment for Fetomaternal outcomes. The participants’ ages ranged from 19 to 52 years, with a mean age of 35 years. The body mass index (BMI) of all pregnant women fell within the range of 27.5 to 30.4 kg/m<sup>2</sup>. Among these, approximately 100 patients required hospitalization, leading to subsequent childbirth, while the remaining twenty continued follow-up through outpatient visits until delivery. Further details are summarized in Table 1.

**Table 1: summarizing basic details of patients (n=120):**

Factor	Number	Percentage
Age	19-52 yrs.	100%
BMI	28.6-31.5kg/m <sup>2</sup>	-----
Hospitalization needed	99	80.30%
OPD visits	21	19.70%

**Graph 1: Providing details on patients requiring hospital admission and those opting for outpatient department (OPD) visits.**

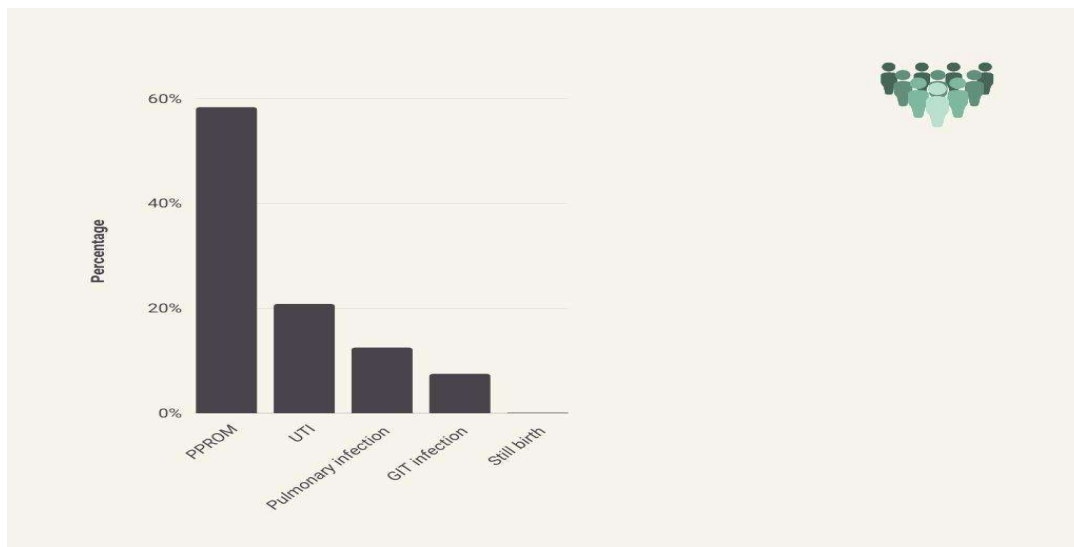


Various causes of sepsis were observed in these individuals. The majority, comprising approximately 58.33%, had sepsis attributed to pre-term premature rupture of membranes (PPROM). Another 20.83% developed sepsis due to urinary tract infections (UTI), while 12.5% experienced

sepsis from pulmonary infections. Gastrointestinal (GIT) infections led to sepsis in 7.5% of the patients. One individual, accounting for 0.08%, faced stillbirth and necessitated ICU admission due to severe sepsis.

**Table 2: Reasons for development of sepsis:**

Cause of sepsis	Number	Percentage
PPROM	80	67.38%
UTI	24	19.80%
Pulmonary infection	16	14.62%



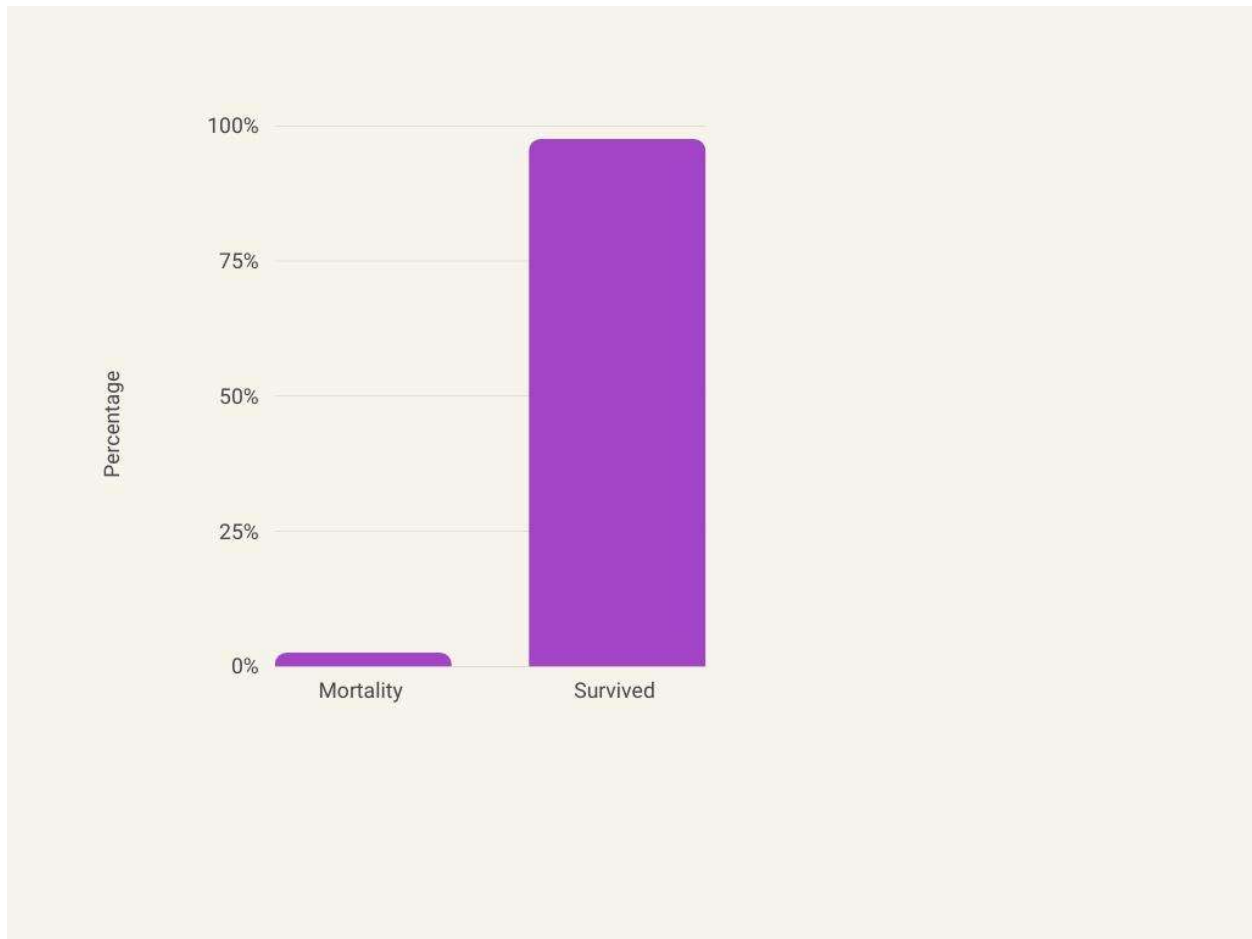
**Graph 2: Individuals who experienced sepsis arising from various factors.**

Among the 120 patients, ten infants were born through low birth weight, and three individuals (2.6%) did not survive.

**Table 3: Outcome of maternal-fetal conditions among pregnant individuals with sepsis (sample size: 120):**

Outcome	Number	Percentage
Survived	116	96.6%
Death of both mother and fetus	04	3.4%

**Graph 3: out of n= 120, mortality rate was 2.5% while the survival rate from sepsis was 97.5%**



Out of 120 participants, 97.5% fully recovered from sepsis. Despite 11 infants being of low birth weight, they managed to survive.

#### **DISCUSSION:**

Sepsis is possibly very life-threatening disease that arises once body's immune system reacts overwhelmingly to an infection, leading to widespread inflammation [14]. It is often termed systemic inflammatory response syndrome (SIRS) triggered by infection. Maternal infections, primarily pneumonia and reproductive system infections, are the most common causes [15]. Lung inflammation is more prevalent during childbirth, while infections related to vaginal delivery and

medical procedures occur more frequently after giving birth [16]. Streptococcal infections progress to septic shock more rapidly than those caused by other organisms. Postpartum women face a significantly higher risk of group A streptococcal infection, emphasizing the importance of early recognition to reduce maternal deaths from sepsis [17].

Initiating broad-spectrum antibiotics within sixty minutes of suspected sepsis, prior to obtaining culture findings, is crucial. Infections of the reproductive system often involve various microorganisms, with group A streptococcus and E. coli frequently associated with serious infections [18]. The toxins released by group A streptococcus

may lead to rapid deterioration and streptococcal toxic shock [19]. In the current research, 120 females through sepsis signs were assessed for Fetomaternal outcomes, with a focus on different reasons for sepsis, including PPRM, UTI, pulmonary infection, GIT infection, and stillbirth [20].

The survival rate stands at 97.5%, while the mortality rate is 2.5%. Sepsis is frequently encountered during pregnancy due to its susceptibility. If not promptly addressed, sepsis may advance to serious sepsis or septic shock—more critical conditions that may inflict damage on multiple organs [21]. Characteristic indicators and manifestations of sepsis contain fever, increased heart rate, swift breathing, disorientation, diminished urine production, low blood pressure, and overall weakness [22]. Although established diagnostic criteria for maternal sepsis and septic shock could globally alleviate impact on maternal well-being, the absence of consensus among medical practitioners poses challenges to identification and treatment [23].

Identifying sepsis during pregnancy and the postpartum period poses challenges, and establishing a diagnostic scale across diverse obstetric populations can enhance care, especially in resource-constrained nations [24]. Enhancements in collaborative management of maternal sepsis, beginning with prompt identification of dangerous aspects, could greatly enhance the well-being of both mothers and infants [25].

### CONCLUSION:

Sepsis during pregnancy presents a grave medical concern, carrying substantial risks for both expectant mother and developing fetus. It constitutes the possibly life-threatening reaction to infection, capable of causing organ failure and mortality unless promptly identified and addressed.

### REFERENCES:

1. Lao, M., Dai, P., Luo, G., Yang, X., Peng, M., Chen, Y., ... & Chen, D. (2023). Pregnancy outcomes in patients receiving assisted reproductive therapy with systemic lupus erythematosus: a multi-center retrospective study. *Arthritis research & therapy*, 25(1), 1-10.
2. D'Antonio, F., Pagani, G., Buca, D., & Khalil, A. (2023). Monkeypox infection in pregnancy: a systematic review and metaanalysis. *American journal of obstetrics & gynecology MFM*, 5(1), 100747.
3. Burden, C. A., Smith, G. C., Sovio, U., Clayton, G. L., & Fraser, A. (2023). Maternal hemoglobin levels and adverse pregnancy outcomes: individual patient data analysis from 2 prospective UK pregnancy cohorts. *The American Journal of Clinical Nutrition*, 117(3), 616-624.
4. Kitada, A., Nakai, T., Fukui, S., Rokutanda, R., Okada, M., Kusaoi, M., ... & Tamura, N. (2023). Safety of tacrolimus use during pregnancy and related pregnancy outcomes in patients with systemic lupus erythematosus: A retrospective single-center analysis in Japan. *Lupus*, 32(3), 352-362.
5. Cai, Q. Y., Yang, Y., Ruan, L. L., Wang, D. D., Cui, H. L., Yang, S., ... & Liu, T. H. (2023). Effects of COVID-19 home quarantine on pregnancy outcomes of patients with gestational diabetes mellitus: a retrospective cohort study. *The Journal of Maternal-Fetal & Neonatal Medicine*, 36(1), 2193284.
6. Oğlak, S. C., Ölmez, F., & Tunç, Ş. (2022). Evaluation of antepartum factors for predicting the risk of emergency cesarean delivery in pregnancies complicated with placenta previa. *Ochsner Journal*, 22(2), 146-153.

7. Wang, J., Wang, D., Zhang, X., Liu, Y., Yang, Q., & Zhang, N. (2022). The effect of prophylactic uterine artery embolization on reproductive outcomes in patients with cesarean scar pregnancy: a propensity score-matched study. *Archives of Gynecology and Obstetrics*, 1-9.
8. Early, M. L., Eke, A. C., Gemmill, A., Lanzkron, S., & Pecker, L. H. (2023). Severe maternal morbidity and mortality in sickle cell disease in the National Inpatient Sample, 2012-2018. *JAMA Network Open*, 6(2), e2254552-e2254552.
9. Goncu Ayhan, S., Turgut, E., Oluklu, D., Ozden Tokalioglu, E., Menekse Beser, D., Moraloglu Tekin, O., & Sahin, D. (2022). Influence of Covid-19 infection on fetal thymus size after recovery. *Journal of Perinatal Medicine*, 50(2), 139-143.
10. Martínez-Varea, A., Satorres, E., Florez, S., Domenech, J., Desco-Blay, J., Monfort-Pitarch, S., ... & Diago-Almela, V. (2022). Comparison of Maternal-Fetal Outcomes among Unvaccinated and Vaccinated Pregnant Women with COVID-19. *Journal of Personalized Medicine*, 12(12), 2008.
11. Turgut, E., Sakcak, B., Uyan Hendem, D., Oluklu, D., Goncu Ayhan, S., & Sahin, D. (2022). Decreased fetal cardiac output in pregnant women with severe SARS-Cov-2 infection. *Echocardiography*, 39(6), 803-810.
12. Li, H. T., Zhang, S. X., Zhang, J. Q., Cheng, T., Liu, Y., Liu, H. Q., ... & Chen, J. W. (2022). A decreased number of circulating regulatory T cells is associated with adverse pregnancy outcomes in patients with systemic lupus erythematosus. *Immunity, Inflammation and Disease*, 10(12), e731.
13. Can, E., Oğlak, S. C., & Ölmez, F. (2022). Maternal and neonatal outcomes of expectantly managed pregnancies with previable preterm premature rupture of membranes. *Journal of Obstetrics and Gynaecology Research*, 48(7), 1740-1749.
14. Bourgioti, C., Nikolaidou, M., Theodora, M., Zafeiropoulou, K., Daskalakis, G., Fotopoulos, S., ... & Mouloupoulos, L. (2022). 199 Enhanced intraplacental fetal vasculature on prenatal placental mri may predict clinical outcome in patients at high risk for placenta accreta spectrum disorders. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 270, e73-e74.
15. Kielaitė, D., & Paliulyte, V. (2022). Parvovirus (B19) Infection during Pregnancy: Possible Effect on the Course of Pregnancy and Rare Fetal Outcomes. A Case Report and Literature Review. *Medicina*, 58(5), 664.
16. Arruda Correia, M. L., Peixoto Filho, F. M., Gomes Júnior, S. C., & Peixoto, M. V. M. (2023). Effects of intra-abdominal hypertension on maternal-fetal outcomes in term pregnant women: A systematic review. *PLoS One*, 18(6), e0280869.
17. Hughes, B. L., Sandoval, G. J., Metz, T. D., Clifton, R. G., Grobman, W. A., Saade, G. R., ... & Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. (2023). First-or second-trimester SARS-CoV-2 infection and subsequent pregnancy outcomes. *American journal of obstetrics and gynecology*, 228(2), 226-e1.
18. Khalil, A., Samara, A., O'Brien, P., Morris, E., Draycott, T., Lees, C., & Ladhani, S. (2022). Monkeypox and pregnancy: what do obstetricians need to know?. *Ultrasound Obstet Gynecol*, 60(1), 22-27.
19. Vimercati, A., De Nola, R., Trerotoli, P., Metta, M. E., Cazzato, G., Resta, L., ... & Cicinelli, E. (2022). COVID-19 infection in pregnancy: obstetrical risk factors and

- neonatal outcomes—a monocentric, single-cohort study. *Vaccines*, 10(2), 166.
20. Piekos, S. N., Hwang, Y. M., Roper, R. T., Sorensen, T., Price, N. D., Hood, L., & Hadlock, J. J. (2023). Effect of COVID-19 vaccination and booster on maternal–fetal outcomes: a retrospective cohort study. *The Lancet Digital Health*, 5(9), e594-e606.
  21. Mappa, I., Pietrolucci, M. E., Pavjola, M., Maruotti, G., D'Antonio, F., & Rizzo, G. (2023). Fetal brain biometry and cortical development after maternal SARS-CoV-2 infection in pregnancy: A prospective case–control study. *Journal of Clinical Ultrasound*, 51(4), 639-643.
  22. Giuliani, F., Oros, D., Gunier, R. B., Deantoni, S., Rauch, S., Casale, R., ... & Villar, J. (2022). Effects of prenatal exposure to maternal COVID-19 and perinatal care on neonatal outcome: results from the INTERCOVID Multinational Cohort Study. *American journal of obstetrics and gynecology*, 227(3), 488-e1.
  23. Piekos, S. N., Hwang, Y. M., Roper, R. T., Sorensen, T., Price, N. D., Hood, L., & Hadlock, J. J. (2022). The effect of COVID-19 vaccination and booster on maternal-fetal outcomes: a retrospective multicenter cohort study. *medRxiv*, 2022-08.
  24. Eke, A. C., Mirochnick, M., & Lockman, S. (2023). Antiretroviral therapy and adverse pregnancy outcomes in people living with HIV. *New England Journal of Medicine*, 388(4), 344-356.
  25. David, A. L., & Spencer, R. N. (2022). Clinical Assessment of Fetal Well-Being and Fetal Safety Indicators. *The Journal of Clinical Pharmacology*, 62, S67-S78.
  26. Khan MI, Ashfaq F, Alsayegh AA, Hamouda A, Khatoon F, Altamimi TN, et al. Advanced glycation end product signaling and metabolic complications: Dietary approach. *World Journal of Diabetes* [Internet]. 2023 Jul 15;14(7):995–1012. Available from: <http://dx.doi.org/10.4239/wjd.v14.i7.995>
  27. Aladel A, Khatoon F, Khan MI, Alshewair A, Almutairi MG, Almutairi SO, et al. Evaluation of miRNA-143 and miRNA-145 Expression and Their Association with Vitamin-D Status Among Obese and Non-Obese Type-2 Diabetic Patients. *Journal of Multidisciplinary Healthcare* [Internet]. 2022 Dec;Volume 15:2979–90. Available from: <http://dx.doi.org/10.2147/jmdh.s391996>
  28. Kumar R, Khan MI, Ashfaq F, Alsayegh AA, Khatoon F, Altamimi TN, et al. Hesperidin Supplementation Improves Altered PON -1, LDL Oxidation, Inflammatory Response and Hepatic Function in an Experimental Rat Model of Hyperlipidemia. *Indian Journal of Clinical Biochemistry* [Internet]. 2023 Jun 20; Available from: <http://dx.doi.org/10.1007/s12291-023-01140-5>
  29. Ashfaq F, Aljaadi AM, Salaka AS, Noorwali EA, Khatoon F, Khan MI. Comparison of TCN-2 (776C>G) Gene Polymorphism and Vitamin B12 Status with Different Body Mass Index among Saudi Adults. *Life* [Internet]. 2023 May 15;13(5):1185. Available from: <http://dx.doi.org/10.3390/life13051185>
  30. Mughal h, Abdullah m, Jamil a, Malik a, Rasheed s, Khatoon f. Efficacy of methotrexate alone or with low-dose prednisone in alopecia areata totalis. *Biological and Clinical Sciences Research Journal* [Internet]. 2023 Jun 23;2023(1):332. Available from: <http://dx.doi.org/10.54112/bcsrj.v2023i1.332>
  31. SIDDIQUI E, ABBASI M, KHOSA M, MOHSIN R, JABEEN N, SIDDIQUE U, et al. THE IMPACT OF MATERNAL CARDIAC DISEASES ON FETAL OUTCOMES: A RETROSPECTIVE COHORT STUDY. *Biological and Clinical Sciences Research Journal* [Internet]. 2023



- Jun 16;2023(1):315. Available from: <http://dx.doi.org/10.54112/bcsrj.v2023i1.315>
32. Altamimi T, Balouch F. Mini Review; Role of Changes in SARS-CoV-2 Spike Protein and Its Human Interaction. Egyptian Academic Journal of Biological Sciences C, Physiology and Molecular Biology [Internet]. 2023 Jun 9;15(1):503–7. Available from: <http://dx.doi.org/10.21608/eajbsc.2023.303781>
  33. Ali S, Saeed SJ, Zahid S, Rashid I, Khatoon F, Altamimi TN. Impact of Evaluation of Tumour Grade by Core Needle Biopsy on Clinical Risk Assessment and Patient Selection for Adjuvant Systemic Treatment in Breast Cancer. Pakistan Journal of Medical and Health Sciences [Internet]. 2023 Mar 15;17(2):817–9. Available from: <http://dx.doi.org/10.53350/pjmhs2023172817>
  34. **Khan MI, Hashmi MO, Abid SUH, Khan B, Iqbal H, Khatoon F. Mid-Term Clinical and Echocardiographic Outcomes of Percutaneous Transvenous Mitral Commissurotomy in Patients with Rheumatic Mitral Stenosis. Pakistan Journal of Medical and Health Sciences [Internet]. 2023 Mar 15;17(2):793–5. Available from: <http://dx.doi.org/10.53350/pjmhs2023172793>**
  35. **Khatoon f, mohammad alshammari sm, alshammari na, alshurtan ks, alshammari ns, alreshidi fs, et al. Perception, awareness and attitude towards varicose veins among employees working in prolonged sitting and standing postures in hail region, saudi arabia. Medical science [internet]. 2023 may 2;27(135):1–8. Available from: <http://dx.doi.org/10.54905/disssi/v27i135/e206ms2985>**
  36. **Khan m, nouman m, hashim h, latif s, husain s, sattar s, et al. A correlation biomarker between bmi and lipid peroxidation in type 2 diabetes mellitus with and without other complications. Biological and clinical sciences research journal [internet]. 2023 Apr 21;2023(1):253. Available from: <http://dx.doi.org/10.54112/bcsrj.v2023i1.253>**
  37. **Sohair A M Shommo, Firas S. Azzeh, Alsolami Ahmed Khatoon F Et Al, Prevalence Of Serum Vitamin Deficiency In Pakistan Of Chronic Fatigue Without Any Systemic Illness 2023. Volume -12, Special Issue-13 (2023 Doi: 10.53555/Ecb/2023.12.Si13**
  38. Ahmed S , Mahmood T , Mudasar M, Khatoon F et al. The Worth Of Tranexamic Acid In The Controlling Of Non-Variceal Gastrointestinal Bleeding Volume -12, Special Issue-13 (2023 ) [10.53555/ecb/2023.12.Si13.1982023.25/1/2023](http://dx.doi.org/10.53555/ecb/2023.12.Si13.1982023.25/1/2023)
  39. Gul S, mir n, Fatima k, tahir s, Younis ns, Khatoon F, et al. Catheter-related infections in hemodialysis: frequency and microbiological profile patients undergoing antimicrobial lock therapy with gentamicin for prophylaxis. Biological and Clinical Sciences Research Journal [Internet]. 2023 Apr 18;2023(1):247. Available from: <http://dx.doi.org/10.54112/bcsrj.v2023i1.247>
  40. Alreshidi FF, Alshammari RF, Alenazi SH, Alshammry TE, Altamimi TN, Almughais ES, et al. Sciatica pain in Saudi population: Knowledge and attitude towards sciatica pain and treatment methods among the population of Hail in Saudi Arabia. Medical Science [Internet]. 2023 Mar 1;27(133). Available from: <http://dx.doi.org/10.54905/disssi/v27i133/e142ms2906>
  41. Zahra A, Hassan SU, Hassan MS, Parveen N, Park JH, Iqbal N, Khatoon F, Atteya MR. Effect of physical activity and sedentary sitting time on psychological quality of life of people with and without disabilities; A survey from Saudi Arabia. Front Public

Health. 2022 Sep. fpubh.2022.998890  
PMID: 36225781; PMCID:  
PMC9548647.<https://doi.org/10.3389/fpubh.2022.998890>

42. Almughais, E. S., Abdullah Alshammari, K. A., Alshammari, H. H., Alreshidi, F. F., Alarfaj, R., Alshammari, R. F., Altamimi, T. N., Aboras, R., Almeahadi, S. A., & Balouch, F. K. (2023, February 5). "Assessment of knowledge and practice of Carpal tunnel syndrome among pregnant and non-pregnant women in Hail region, Saudi Arabia." *Medical Science*, 27(132), 1–8.  
<https://doi.org/10.54905/diss/v27i132/ee16ms2910>
43. Khatoon, F., Alshammari, R. A., Batool, A., Elhaj, A. H., Alreshidi, F. F., Elhussein, G. E. M. O., Abdalla, R. A. H., Elhag, A. B. M., & Balouch, Z. (2022, October 30). Systematic Review on Implication for DNA Assisted Technology into Molecular Medicine and the useful is the application of Genome Wide Studies. *Pakistan Journal of Medical & Health Sciences*, 16(10), 217–220.  
<https://doi.org/10.53350/pjmhs221610217>
44. Khatoon, F. (2022, August 30). Association of Genetic and Reproductive Hormone with Infertility in Male. *Progress in Medical Sciences*, 1–11.  
[https://doi.org/10.47363/pms/2022\(6\)175](https://doi.org/10.47363/pms/2022(6)175)
45. Kausar, M. A., Shahid, S., Anwar, S., Kuddus, M., Khan, M. K. A., Khalifa, A. M., Khatoon, F., Alotaibi, A. D., Alkhodairy, S. F., Snoussi, M., & Arif, J. M. (2022, February 4). Identifying the alpha-glucosidase inhibitory potential of dietary phytochemicals against diabetes mellitus type 2 via molecular interactions and dynamics simulation. *Cellular and Molecular Biology*, 67(5), 16–26. <https://doi.org/10.1007/s12013-022-01000-0>