ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

STUDY ON THE CONCENTRATION OF SERUM URIC ACID LEVEL AND ITS ASSOCIATION WITH GESTATIONAL DIABETES

Suganya M[1], Maheshkumar[2], Suganthi P[3], Divya M[4]

[1]Associate Professor, Department of Obstetrics and Gynecology, Government Nagapattinam Medical College Hospital, India.
[2]Assistant Professor, Department of Biochemistry, Government Nagapattinam Medical College Hospital, India.
[3]Assistant Professor, Department of Obstetrics and Gynecology, Government Thiruvarur Medical College Hospital, India.
[4]Assistant Professor, Department of Obstetrics and Gynecology, Government Thiruvarur Medical College& Hospital, India.

Received Date: 03/01/2024 Accepted: 17/01/2024

Corresponding Author: Dr Divya M, Assistant Professor, Department of Obstetrics and Gynecology, Govt Thiruvarur Medical College& Hospital, India.
Email: dhivyamanoharan512@gmail.com

ABSTRACT

Background: The human body's metabolic balance is crucial for health, with disruptions leading to diseases like diabetes mellitus. Pregnancy heightens susceptibility to chronic conditions due to hormonal and biochemical changes. Gestational diabetes is increasingly common, especially in urban areas. This study focuses on assessing uric acid levels during early pregnancy and their connection, to gestational diabetes. **Aim And Objective:** To study the concentration of Serum Uric acid level and its association with Gestational diabetes. **Methodology:** A prospective observational study was conducted on 125 antenatal women in their first trimester at Government Thiruvarur Medical College. Exclusion criteria included pre-existing conditions like diabetes, hypertension, and certain medications. Serum uric acid levels were measured, and gestational diabetes was screened using random oral glucose tolerance tests. **Result:** The study involved 125 antenatal women, examining age, BMI, serum uric acid, OGCT, HbA1C, and GDM prevalence. Results showed 23.2% developed GDM. Serum uric acid levels were significantly higher in GDM cases, with a cutoff of 3.75 mg/dl demonstrating high sensitivity (89.6%) for predicting GDM risk. **Discussion:** Diabetes, particularly gestational diabetes mellitus (GDM), is increasing globally, with uric acid (UA) levels in early pregnancy being an effective predictor. The study found UA levels above 3.75 mg/dl in 89.7% of GDM cases, showing high sensitivity (89.6%). BMI also influences GDM risk, but further studies considering all factors are needed. **Conclusion:** The research stated uric acid range is the best way of measuring and identifying condition of diabetes among persons at early maternal stage which helps to prevent the risk not only to persons affected but also it reduces the risks of developing diabetes to offspring. Since it is very cost effective with greater specificity the government should implement these screening facilities to all health centres specifically in unreserved areas for the feasibility of more people in utilizing the benefits and also to reduce the prevalence and complications of diabetes during pregnancy.

Keywords: URIC ACID LEVELS, GESTATIONAL DIABETES, EARLY PREGNANCY.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

INTRODUCTION

The human body is the most complicated component mechanism in comparison to other thing across globe. The maintenance of healthy body tissues involves the maintenance of numerous metabolic and biochemical regulations in the human host.

The interruption or variation in the pathways of metabolism and the alterations of serum levels in blood makes the person to become more susceptible to many systemic and chronic forms of diseases.

The variation in the regulation of the normal mechanism of host becomes more frequent particularly during the gestational period. Pregnancy is the most vulnerable stage which paves the pathway for numerous types of chronic diseases due to the changes in the hormones and fluctuations in the biochemical serum levels.

The Diabetes Mellitus affects the people globally in the recent years with the increased prevalence of 9.3% in 2019 which might enhance up to 10.9% by the year 2045. As of now below half billion persons were affected with diabetic condition in global and with advancing years it might increase to 51% especially in the developing countries.

The gestational diabetes is the most worsen condition among women and is getting increased in the recent times. It occurs due to the intolerance in levels of glucose during pregnancy period.

The prevalence of Diabetes Mellitus during gestational period was higher among urban regions of India ranging from 4% to 18% and it was higher among the states with prevalence rate of 17.9% of persons in Tamilnadu, 35% in Punjab and 41% of people in Lucknow states of India.

Gestational Diabetes Mellitus is the most frequent disorders occurs in the pregnancy phase tends to increase the occurrence of complications during the time of delivery. This condition increases the major burden globally since it not only affects the gestational women it also poses a great chance for the foetus susceptible to the condition of Diabetes Mellitus.

Therefore, it is mandatory for the persons during gestational time should be diagnosis accurately with greater caution to avoid the complications during delivery and also to make the offspring not subjected to systemic problems.

The uric acid is key mediators for the adequate functioning of the kidney and it is strongly linked in predicting the Diabetes Mellitus especially in gestational stage.

The uric acid makes the insulin becomes resistible by causing damage to the endothelial cells and are responsible for the production of inflammation and oxidative stress in the cells and increases the chance of resistant to insulin.

Various researches reported the interlinkage of the uric acid level and Diabetes Mellitus of gestational period and due to the controversies of the findings and to detect the exact interpretation to avoid the complications of pregnancy associated Diabetes Mellitus.

This current focused to assess the concentration of uric acid value during the first trimester of gestational period and its association with the diabetes mellitus.

AIM OF THE STUDY

To study the concentration of Serum Uric acid level and its association with Gestational diabetes.

MATERIALS AND METHODS

- Prospective observational study conducted in Government Thiruvarur Medical

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

College.

- Aim of work will be explained to the pregnant women and informed consent obtained.
  - Study population; 125 antenatal women, the study conducted for 6 months

INCLUSION CRITERIA

Antenatal women in their 1st trimester of pregnancy (<13 weeks of Gestation).
Both Primi and Multi gravida irrespective of previous mode of Delivery.

EXCLUSION CRITERIA

- Pre gestational diabetes
- Chronic hypertension
- Gout
- Smoking and alcohol intake
- Renal disease
- Liver disease
- Drugs known to increase Uric acid levels in blood. Eg aspirin, phenothiazines, diuretics.

METHODS

- Blood sample is taken for estimation of Sr. Uric Acid for all Antenatal women with in 1st trimester.
  Blood sample collected will be Centrifuged to separate the serum stored at – 70 degree up to examination.
- Cut off taken in my study is 4 mg/dl (AJOG,Vol 201,Oct 2009)

SCREENING FOR GDM

- All patients will undergo random oral GCT (75gms) between 22- 24 weeks.
  If the value is > 200 mg/dl patient is considered to have GDM OR
- If plasma glucose level > 140 mg/dl patient at increased risk of developing GDM will then undergo FBS, PPBS

Statistical analysis

The data collected were entered into Microsoft excel 360 in order to create a master chart. The master chart was then loaded into statistical package for social sciences (SPSS) version 26 for further statistical analysis. Both quantitative and qualitative variables were present in the master chart. Both descriptive and inferential statistics were used for analysis.

For describing the qualitative variables, frequency and percentages were used. For describing the quantitative data, mean and standard deviation were used. To find out the difference in mean between two groups, independent samples T test was applied. TO find out the cut off for serum uric acid level for predicting GDM development, ROC curve was used. Medcalc's diagnostic test evaluation calculator was used to estimate the sensitivity, specificity, positive predictive value, negative predictive value and the diagnostic accuracy of the cut off obtained.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

RESULTS

The mean age among the participant was 25.28 ± 3.37 years.
44.8% were in the age group 25 to 29 years and 44% were in the age group 19 to 24 years.
49.6% participants were primi and 50.4% were multi gravida.
The mean BMI among the participants was 21.27 ± 1.55 Kg/m^2.
56% participants were having a BMI of 21 to 23 Kg/m^2 and 33.6% had BMI of 18 to 20 Kg/m^2.

The mean serum uric acid among the participants was 3.78 ± 0.74 mg/dl.
59.2% participants were having serum uric acid of 3.1 to 4 mg/dl and 22.4% were having a level of 4.1 to 5 mg/dl.

Table 1

Serum Uric acid (mg/dl)	**Frequency (n=125)**	**Percentage (%)**
2.1-3	13	10.4
3.1-4	74	59.2
4.1-5	28	22.4
>5	10	8

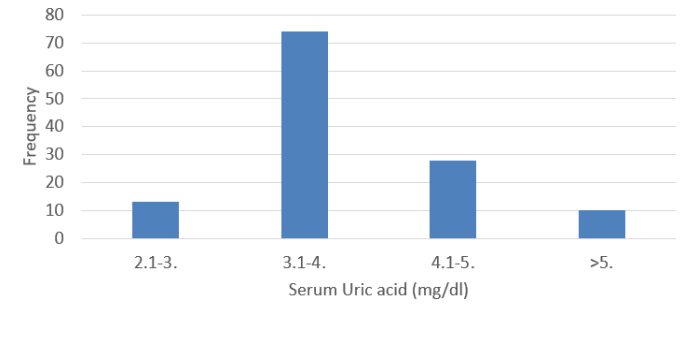

Figure 1
Distribution of the participants according to Serum Uric acid

Table 2: Distribution of the participants according to OGCT values.

OGCT (mg/dl)	**Frequency (n=125)**	**Percentage (%)**
61-90	39	31.2
91-120	43	34.4
121-150	28	22.4
>150	15	12

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

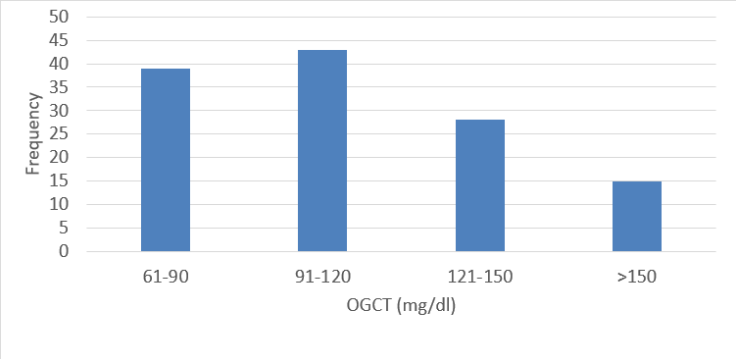

Figure 2: Bar chart showing distribution according to OGCT.

The mean OGCT values was 110.26 ± 28.61 mg/dl.
34.4% were having OGCT value of 91 to 120 mg/dl and 31.2% were having value of 61 to 90 mg/dl.

Table 3: Distribution of the participants according to HbA1C.

HbA1C (%)	**Frequency (n=125)**	**Percentage (%)**
≤ 4	23	18.4
4.1-4.5	61	48.8
4.6-5	28	22.4
>5	13	10.4

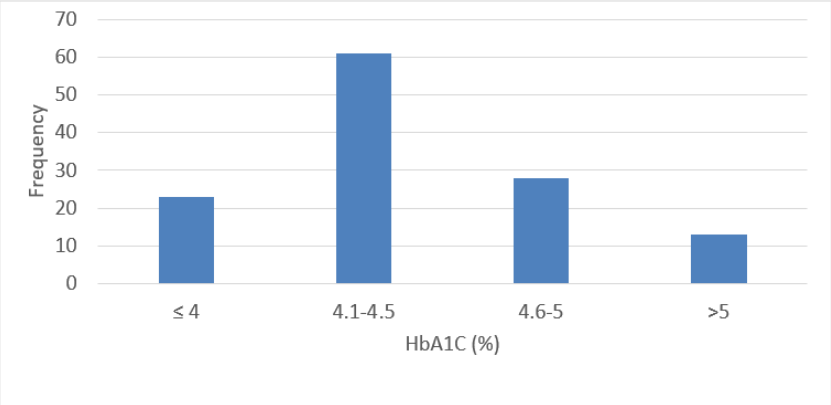

Figure 3: Bar chart showing distribution according to HbA1C values.

The mean HbA1C values was 4.43 ± 0.47 %. 48.8% had HbA1C of 41. To 4.5 % and 22.4% had HbA1C of 4.6 to 5%.

Table 4: Distribution according to gestational diabetes mellitus among the participants.

Gestational diabetes mellitus	**Frequency (n=125)**	**Percentage (%)**
Present	29	23.2
Absent	96	76.8

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

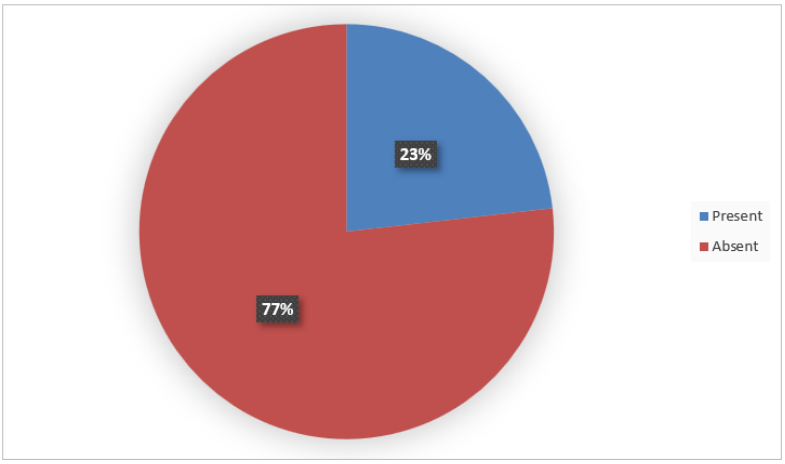

Figure 4: Pie chart showing distribution according to presence of GDM.
23.2% participants were diagnosed to have gestational diabetes mellitus.

Table 5: Comparison of mean uric acid levels at first trimester among those with and without GDM.

Variable	GDM		Normal		T value	P value
	Mean	SD	Mean	SD		
Uric acid (mg/dl)	4.56	0.84	3.55	0.52	7.84	0.001

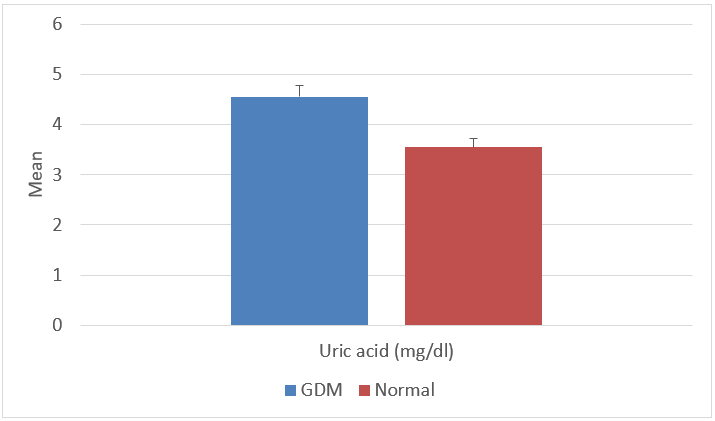

Figure 5: Bar chart showing comparison of mean Uric acid between the groups.

The mean Uric acid among the participants who developed GDM was 4.56 ± 0.84 mg/dl and among those normal was 3.55 ± 0.52 mg/dl. The mean serum uric acid at first trimester was more among the participants who developed GDM than those who did not.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

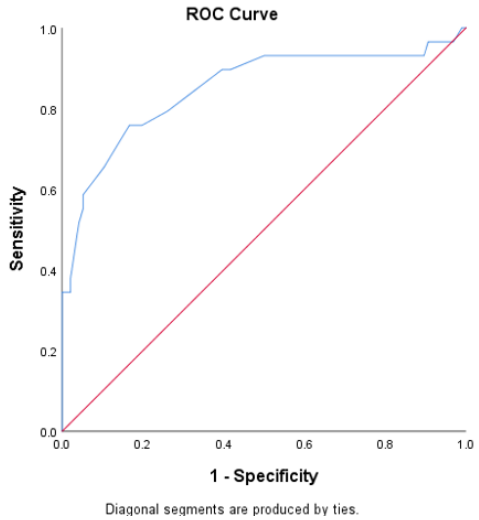

Figure 6: Receiver operator characteristic curve for predicting GDM by Serum uric acid values.

The area under the curve was 0.850 with 95% CI of 0.755 to 0.944.
With the coordinates obtained from the ROC curve a serum uric acid level of 3.75 mg/dl was taken as cut off.

Table 6: Degree of agreement between the estimated cut off and development of GDM.

Serum uric acid (mg/dl)	GDM		Normal	
	N	%	N	%
≥ 3.75	26	89.7	38	39.6
< 3.75	3	10.3	58	60.4

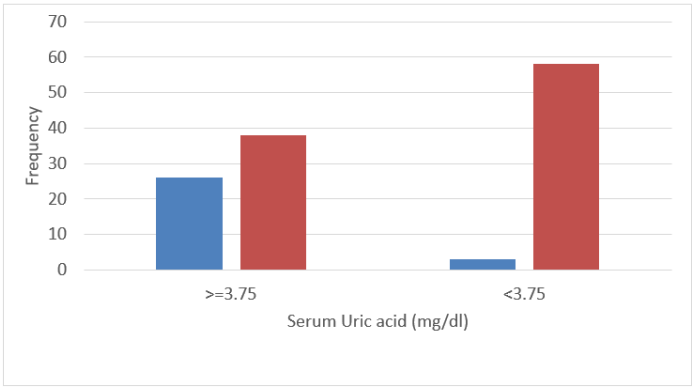

Figure 7: Bar chart showing agreement between serum uric acid cutoff and GDM.
The kappa agreement value was 0.352 (P value 0.001)
There was fair agreement between the cut off and the actual development of GDM.

Table 7: Predicting ability of serum uric acid of more than or equal to 3.75 mg/dl for development of GDM.

Statistic	Value	95% CI
Sensitivity	89.66%	72.65% to 97.81%

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

Specificity	60.42%	49.92% to 70.25%
Positive Predictive Value	40.62%	34.17% to 47.42%
Negative Predictive Value	95.08%	86.74% to 98.28%
Accuracy	67.20%	58.23% to 75.33%

The sensitivity was found to be 89.6% and specificity to be 60.4% indicating serum uric acid level of more than or equal to 3.75 mg/dl during first trimester could act as effective screening tool for predicting the development of GDM.

DISCUSSION

Diabetes have become the serious burden globally and it affects people of all age categories and it affects the pathways of metabolism and makes the person prone to many vulnerable infections and affects the quality of people at large scale.

Numerous factors involved in the occurrence of diabetes still the exact cause remains to be inconsistent. The factors such as systemic infections, resistance to insulin formation, gestational period, SES, BMI, etc; among this diabetes occurs more frequently during maternal stage and the prevalence becoming greater in recent times which enhances the risks of complications even in foetus if not diagnosed and treated earliest.

The diabetes diagnosed at initial stage is very pivotal to avoid risk and lower the mortality; hence the study focused on predicting GDM condition by assessing the concentration of uric acid level at the early stage of pregnancy.

The current study reported UA values were greater and it was beyond 3.75 mg/dl in 89.7% persons with the condition of diabetes in the early period of gestation and the UA level was significant with the GDM diagnosis with high rate of sensitivity as 89.6% which coincides with research of Rasika et al 2014 done for assessing the efficiency of UA as a biomarker in determining DM at gestation among Pondicherry residents and stated that UA can be used as an effective biomarker in diagnosing GDM persons and UA concentration had a strong influence in predicting diabetes at initial trimester of pregnant persons to prevent complications and the diagnosis becomes more evident at maternal stage below fifteen weeks. Li et al in 2020 done research among people in assessing the accurate biomarker for detecting diabetes on early maternal phase and concluded that UA had a greater efficiency in determining GDM patients. Another recent research performed by Wu et al in 2022 also stated that uric acid concentration tends to greater among persons subjected to GDM and had greater correlation in detecting GDM which was in parallel to the finding of current data of research.

The UA levels get aggravated if the persons affected with DM conditions particularly during initial maternal state. The uric acid makes the insulin becomes resistible by causing damage to the endothelial cells and are responsible for the production of inflammation and oxidative stress in the cells and increases the chance of resistant to insulin. The elevated UA count causes predispose the condition preeclampsia developed at pregnant period which increases the chance of fatality among maternal women and also to the offspring.

The research also stated that BMI had a great impact in enhancing the triggering factors for the occurrence of diabetes in maternity phase which also correlated with the current data that most patients participated in research had variations in balancing their BMI with 33.6% had underweight and 10.4% are obese. This strongly states that BMI also have a prominent part in triggering the higher possibility for diabetes particularly at maternal period; still in both the studies reported there was no link was detected in the concentration of UA values and BMI.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

The study of shah in 2011 stated that the BMI was a good predictor in identifying persons subjected to diabetes particularly on maternal phase and BMI strong linked to GDM cases but still BMI was not a predictor of GDM combined biochemical investigation will be helpful in obtaining exact interpretation of cases. This was correlated with the findings done by Koukhan et al by the 2021 year stated BMI poses the major risk of persons to diabetes on gestation which highly significant to the present study findings

Another research done by El-Gharib et al in 2013 [40] also reported BMI tends to poses the higher susceptibility of diabetes occurrence in persons of maternal phase and had a strong significant with GDM. The report also noted that most cases had range of 4mg/dl UA and was strongly influential to diabetes of early maternal phase which highly coincidence with the current research data stated that more than 3.75 was an average range of UA value with high percentage of sensitivity was detected and significant in the interpretation of diabetes particularly at early gestation.

Overall validation of research reported that most cases had alteration in balancing of BMI with 33.6% underweight cases and maximum of 44.8% pregnant persons belongs to 25 to 29 age groups. The range of HbA1c among participants was 4.1-4.5 mg/dl with rate 49% and the OGCT value highest rate as 34% with range of 91-120 mg/dl. The average range of uric acid value was more than 3.7 mg/dl with high specificity of 67% and sensitivity as 89.66% and the UA concentration was the best biomarkers in predicting the condition of diabetes occurring at maternity stage.

The limitations of the research are other variables include SES, dietary patterns, environmental factors were not considered. Since multiple factors were involved in the cause of developing diabetes on gestation each factor should take into account and give special attention for the possible prevention of GDM condition.

The generalization and standardization in age were not specified in the data. Since the economic background and ethnicity had a great impact on occurrence of many systemic diseases especially diabetes should be prioritized as a special factor which was not given much importance in the study.

The link of BMI in onset of diabetes during maternity had not described briefly. Since BMI is another major factor enhances the risk in developing numerous complications of the persons and importance of managing BMI of gestational phase should be described in a detailed way. The specificity of other biomarkers should also be considered for comparison to get optimum outcome. The inclusion of serum values from all stages of pregnancy might also helpful Furthermore, studies should be done with inclusion of all confounding variables for the betterment of analysis and also for maximum beneficiaries.

CONCLUSION

The research stated uric acid range is the best way of measuring and identifying condition of diabetes among persons at early maternal stage which helps to prevent the risk not only to persons affected but also it reduces the risks of developing diabetes to offspring. Since it is very cost effective with greater specificity the government should implement these screening facilities to all health centres specifically in unreserved areas for the feasibility of more people in utilizing the benefits and also to reduce the prevalence and complications of diabetes during pregnancy.

REFERENCES

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

1. Borna, S. *et al.* Correlation between PAPP-A serum levels in the first trimester of pregnancy with the occurrence of gestational diabetes, a multicenter cohort study. *BMC Pregn. Childb.* **23**, 847. https://doi.org/10.1186/s12884-023-06155-7 (2023).
2. Niu, Z. R., Bai, L. W. & Lu, Q. Establishment of gestational diabetes risk prediction model and clinical verification. *J. Endocrinol. Invest.* https://doi.org/10.1007/s40618-023-02249-3 (2023).
3. Mishu, F. A. *et al.* Estimation of serum creatinine and uric acid in Bangladeshi gestational diabetic mother attending in tertiary care hospital. *Mymensingh Med. J.* **28**, 352–355 (2019).
4. Raets, L., Beunen, K. & Benhalima, K. Screening for gestational diabetes mellitus in early pregnancy: What is the evidence?. *J. Clin. Med.* https://doi.org/10.3390/jcm10061257 (2021).
5. Catalano, P. M. *et al.* The hyperglycemia and adverse pregnancy outcome study: Associations of GDM and obesity with pregnancy outcomes. *Diabetes Care* **35**, 780–786. https://doi.org/10.2337/dc11-1790 (2012).
6. Sweeting, A., Wong, J., Murphy, H. R. & Ross, G. P. A clinical update on gestational diabetes mellitus. *Endocr. Rev.* **43**, 763–793. https://doi.org/10.1210/endrev/bnac003 (2022).
7. Agnoletti, D., Cicero, A. F. G. & Borghi, C. The impact of uric acid and hyperuricemia on cardiovascular and renal systems. *Cardiol. Clin.* **39**, 365–376. https://doi.org/10.1016/j.ccl.2021.04.009 (2021).
8. Borna, S. *et al.* Correlation between PAPP-A serum levels in the first trimester of pregnancy with the occurrence of gestational diabetes, a multicenter cohort study. *BMC Pregn. Childb.* **23**, 847. https://doi.org/10.1186/s12884-023-06155-7 (2023).
9. Khan, F. Y. *et al.* Role of uric acid levels in the development of gestational diabetes mellitus: A review. *Cureus* **14**, e31057. https://doi.org/10.7759/cureus.31057 (2022).
10. Su, S. *et al.* Serum uric acid and the risk of gestational diabetes mellitus: A systematic review and meta-analysis. *Gynecol. Endocrinol.* **39**, 2231101. https://doi.org/10.1080/09513590.2023.2231101 (2023).
11. Yue, C., Ying, C. & Li, X. Elevated serum uric acid is associated with gestational diabetes mellitus: An observational cohort study. *J. Clin. Endocrinol. Metab.* **108**, e480–e486. https://doi.org/10.1210/clinem/dgac760 (2023).
12. Li, Y. *et al.* Association of serum uric acid, urea nitrogen, and urine specific gravity levels at 16–18 weeks of gestation with the risk of gestational diabetes mellitus. *Diabetes Metab. Syndr. Obes.* **13**, 4689–4697. https://doi.org/10.2147/DMSO.S282403 (2020).
13. Zhao, Y., Zhao, Y., Fan, K. & Jin, L. Serum uric acid in early pregnancy and risk of gestational diabetes mellitus: A cohort study of 85,609 pregnant women. *Diabetes Metab.* **48**, 101293. https://doi.org/10.1016/j.diabet.2021.101293 (2022).
14. Ghasemi, A. Uric acid-induced pancreatic beta-cell dysfunction. *BMC Endocr. Disord.* **21**, 24. https://doi.org/10.1186/s12902-021-00698-6 (2021).
15. Lou, Y. *et al.* Sex-specific association of serum uric acid level and change in hyperuricemia status with risk of type 2 diabetes mellitus: A large cohort study in China. *J. Diabetes Res.* **2020**, 9637365. https://doi.org/10.1155/2020/9637365 (2020).
16. Pleskacova, A. *et al.* Uric acid and xanthine levels in pregnancy complicated by gestational diabetes mellitus-the effect on adverse pregnancy outcomes. *Int. J. Mol. Sci.* https://doi.org/10.3390/ijms19113696 (2018).

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

17. Hu, T. *et al.* UHPLC-MS/MS-based metabolomics and clinical phenotypes analysis reveal broad-scale perturbations in early pregnancy related to gestational diabetes mellitus. *Dis. Mark.* **2022**, 4231031. https://doi.org/10.1155/2022/4231031 (2022).