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Does first trimester prenatal screening impact on maternal anxiety? A prospective cohort study

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ABSTRACT

Aims: The objective of the present study was to evaluate the anxiety levels of pregnant women who were admitted for combined first trimester screening test, and to determine the effect of screening results on maternal anxiety.

Methods: The present study was carried out prospectively between March and June 2025, and comprised 148 pregnant women. The Spielberger State-Trait Anxiety Inventory was utilised in order to evaluate the participants' state (STAI-I) and trait (STAI-II) anxiety levels. The STAI-Ia and STAI-II were administered to participants at their first admission, and first-trimester screening was performed. Following the counselling of first trimester screening results the State Anxiety Index (STAI-Ib) was re-administered to the participants. Changes in participants' anxiety levels were evaluated.

Results: The mean pre-screening state anxiety scores (STAI-Ia) of the patients were higher than their trait anxiety scores (STAI-II) (39.80±6.08 and 36.68±4.70 respectively; p<0.001). A total of 12 patients (13.9%) exhibited positive results in their first trimester screening tests. Patients with positive test results had higher state anxiety scores after first-trimester screening and counselling (STAI-Ib), compared to pre-screening scores (STAI-Ia) (40.00±7.26 vs. 43.25±7.38, p=0.003). 75% of the patients with positive test results demonstrated a probable clinical anxiety score. In patients with negative test result, state anxiety scores reduced compared to pre-sceening scores (39.79±6.00 vs. 36.93±5.27, p<0.001).

Conclusion: Admission for first trimester screening has been shown to induce state anxiety in the patients. Social and psychological support should be provided to prevent the negative effects of maternal anxiety, especially in patients with positive screening results.

Keywords: Maternal anxiety, first trimester screening, down syndrome, fetal anomaly

INTRODUCTION

Pregnancy is a physiological period of life that brings about many biological, hormonal and psychological changes in the pregnant woman. In the course of adapting to such changes, there is an elevated risk of emotional and psychological disorders, including anxiety, depression, stress and sadness. Recent research has revealed that emotional disorders during pregnancy are more prevalent than previously estimated. Socioeconomic status, unplanned pregnancy, advanced maternal age, and high-risk pregnancy have been identified as factors that can influence the psychological well-being of pregnant women.[1]

The possibility of a structural or genetic malformation in the fetus is a cause of concern for the mother, and is often associated with maternal anxiety.[2] The advent of medical technology has made prenatal screening and diagnosis of a wide range of structural and genetic abnormalities possible. Down syndrome (trisomy 21) is the most common chromosomal abnormality compatible with life and can be detected prenatally.[3] A combined nuchal translucency (NT) measurement and biochemical screening test for Down syndrome performed between 11-14 weeks of gestation has been shown to detect up to 87% of fetuses with Down syndrome and is also recommended by national pregnancy follow-up programmes.[4,5] However, screening for fetal anomalies can cause unnecessary concern or anxiety in women because it raises the possibility of a problem with the fetus.[6] It has been reported that maternal anxiety during the prenatal period is affected by obstetric complications, and that children of pregnant women with anxiety are at increased risk of adverse outcomes in terms of socioemotional development.[7,8]

The objective of the present study was to investigate the impact of combined first trimester screening test on maternal anxiety.

METHODS

This prospective cohort study was conducted at Yozgat City Hospital between March and June 2025. Ethical approval for the study was obtained from the Yozgat Bozok University Rectorate Non-interventional Clinical

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Researches Ethics Committee (Date: 05.03.2025, Decision No: 2025-GOKAEK-255_05.03.2025-370). The study was conducted in accordance with the tenets of the Declaration of Helsinki. Prior to participation, all subjects were thoroughly informed about the study and its associated procedures, and subsequently provided written informed consent.

During the course of the study, a total of 224 patients underwent first-trimester Down syndrome screening and basic first-trimester fetal anatomy scan. All examinations were performed between 11 and 14 weeks of gestation by a perinatologist or obstetrician qualified in nuchal translucency measurement. Examinations were performed according to the international guidelines.[9] Patients over 35 years of age, patients referred with suspicion of fetal anomaly, patients who could not speak Turkish, multiple pregnancies, patients with active psychiatric disease or history of psychiatric disease, patients with detected fetal anomaly or non-living fetus during examination and patients who refused to participate in the study were excluded from the study. A total of 148 patients who met the study's inclusion criteria were included in the study.

A standardised scale, the Spielberger State-Trait Anxiety Inventory (STAI), was employed in order to evaluate the anxiety levels of the patients.[10] The version of the scale that had been adapted for use in Turkey by Öner in 1985 was utilized.[11] The scale comprises a total of 40 questions; 20 questions are aimed at assessing state anxiety (STAI-I), which indicates how one feels at a particular moment, and 20 questions are aimed at assessing trait anxiety (STAI-II), which indicates how one generally feels. Participants are invited to respond to each question using a 4-point Likert Scale, allocating 4 points to the situation that best reflects them and 1 point to the situation that least reflects them. The STAI is comprised of two distinct categories of statements. Direct statements are employed to express negative emotions (e.g. I am tense, I feel strained), whilst inverted statements are used to express positive emotions (e.g. I feel calm, I feel secure). Firstly, the total weights of the direct and inverted statements are calculated separately, then the sum of the weights score of the inverted statements is subtracted from the sum of the weights score of the direct statements. A constant and predetermined value is added to this number. For the state anxiety scale, this value is 50; for the trait anxiety scale, it is 35. The final value represents the individual's anxiety score. Scores on this scale range from 20, indicating minimal anxiety, to 80, reflecting severe anxiety. A score greater than 40 is regarded as an indicator of possible clinical anxiety levels in a pregnant women.[12]

The flowchart illustrating the study's methodology is presented in **Figure 1**. The clinical and sociodemographic characteristics of the patients admitted for combined first trimester screening test were obtained upon initial presentation. Patients who met the study's inclusion criteria were thoroughly informed about the study and provided with written consent. The STAI-I and STAI-II scales were administered to the participants by the study assistant prior to the combined first trimester screening test. In order to ascertain the participants' pre-screening anxiety levels, the STAI-I scores were utilised (STAI-Ia). Furthermore, in order to determine the baseline anxiety levels of the participants, the STAI-II scores were utilised. A standardised first trimester ultrasonographic examination, incorporating NT measurement, was subsequently conducted. To complete combined first trimester screening test, blood samples were obtained from patients exhibiting ultrasonographically normal fetal anatomy. Once the screening test had been completed within one week, patients with a risk value above the 1/270 threshold for Down syndrome were grouped as positive test result, while patients with a risk value below the threshold were grouped as negative test result. The combined first trimester screening test was not performed in patients with abnormal findings on sonographic examination and the medical counselling was provided to the patient. All patients were counselled on their screening test results. The counselling interview encompassed a comprehensive information of the principles, reliability, accuracy, and the potential for false positive and negative results associated with combined first trimester screening test. The interview also addressed cell-free fetal DNA testing and invasive diagnostic procedures such as chorion villus sampling and amniocentesis, and the associated risks. During counselling, all patients with a positive test result were offered invasive diagnostic testing. Following the counselling about the results, the state anxiety test was re-administered (post-screening; STAI-Ib). The STAI-II was not re-administered to the participants, as it is considered to represent a more stable state of anxiety, and the change in trait anxiety scores would not be significant. Individuals manifesting clinical anxiety were referred to the clinical psychologists.

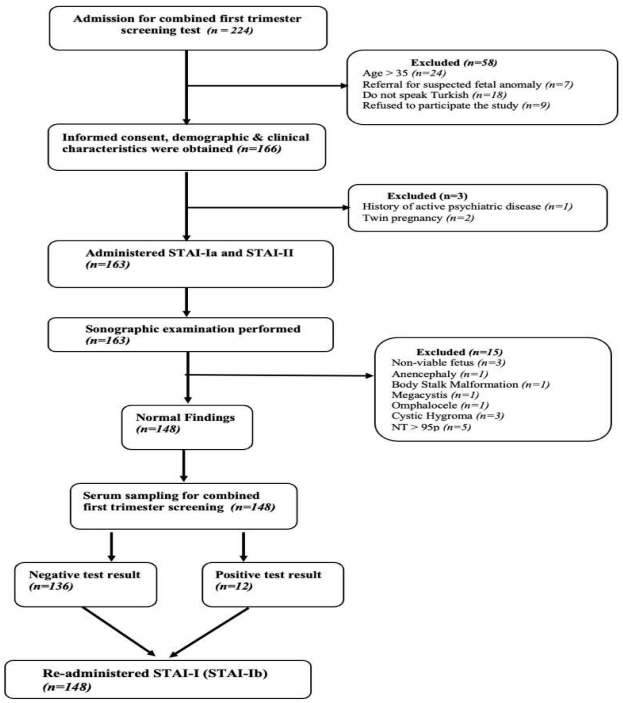

Figure 1. Follow-up chart of the patients

STAI: State-Trait Anxiety Inventory

An a priori power analysis was performed using G*power version 3.1.9.7 to estimate the required sample size. In the study conducted by Akalın et al.[13] on fetal congenital heart

disease during pregnancy, state anxiety scores were found to be 46.28±7.18 before fetal echocardiography and 43.48±7.97 after fetal echocardiography. The effect size, as determined by this study, was calculated to be 0.3681385. When the relevant effect size was employed (linear bivariate regression one group size of slope), it was determined that a minimum of 85 pregnant patients were required for the study to be adequate with 95% power and 5% alpha error. Consequently, the sample size of 148 participants is more than sufficient to test the hypotheses of the study.

Continuous data are presented as mean±standard deviation or median (range) according to the data distrubution, while categorical data are presented as frequency and percentages. In order to compare the clinical and sociodemographic characteristics of the groups Mann-Whitney U test, chi-square test or Fischer exact test (due to low expected cell counts) was employed. Spearman's rank correlation was used to evaluate the association between quantitative variables. A paired samples T test or Wilcoxon test (in instances where the assumptions of the paired T test were not met) was conducted to compare anxiety levels before and after combined first-trimester screening test. The Statistical Package for the Social Sciences, version 22 for Windows (IBM Corporation, Armonk, NY, USA), was utilised for all statistical analyses. Statistical significance was interpreted as $p<0.05$.

RESULTS

In total, 148 patients who met the specified inclusion criteria were enrolled in the study during its course. Figure 1 presents the flow chart outlining the selection of patients included and excluded from the study. In the present study, 12 patients were identified as positive test result due to their combined screening test results for Down syndrome exceeding the 1/270 threshold. In 136 patients, no major sonographic abnormalities were detected and the combined screening test results were below the threshold value, so the screening was considered negative.

The clinical and sociodemographic characteristics of the patients are presented in Table 1. The positive test result and negative test result groups did not differ with regard to age, gestational age, gravidity, parity, history of miscarriage, rate of consanguineous couples, rate of having a healthy child, rate of having a history of a child with anomaly, rate of maternal comorbidity, educational level, working status and monthly income level ($p>0.05$).

The mean pre-screening state anxiety scores of the patients were found to exceed their trait anxiety scores (STAI-Ia, STAI-II; 39.80±6.08 and 36.68±4.70 respectively, $p<0.001$). This finding indicates that patients referred for combined first-trimester screening test exhibit a higher state anxiety level in comparison to their trait anxiety. Spearman's correlation analysis revealed no correlation between patients' pregnancy associated plasma protein-A (PAPP-A) and human chorionic gonadotropin (hCG) levels and their pre- and post-screening state anxiety scores ($p>0.05$, n=148). A weak positive correlation was identified between the patients' trait anxiety scores (STAI-II) and hCG levels (Figure 2; $r=0.235$, $p=0.004$, n=148); however, no correlation was observed with PAPP-A levels ($p>0.05$, n=148).

Table 1. Clinical and sociodemographic characteristics of the patients

		Negative test result (n=136)	Positive test result (n=12)	p-value
Age (years)		27.5 (18-35)	27.5 (21-35)	0.757
Gestational age (weeks)		12.0 (11.0-14.0)	12.0 (11.0-14.0)	0.749
Gravida	1 ≥2	42 (30.9) 94 (69.1)	4(33.3) 8 (66.7)	0.545
Parity	No ≥1	51 (37.5) 85 (62.5)	5 (41.7) 7 (58.3)	0.501
History of miscarriage	No Yes	104 (76.5) 32 (23.5)	10 (83.3) 2 (16.7)	0.450
Consanguineous marriage	No Yes	117 (86.0) 19 (14.0)	12 (100.0) 0 (0.0)	0.179
Having healty child	No Yes	58 (42.6) 78 (57.4)	5 (41.7) 7 (58.3)	0.948
Anomalous child*	No Yes	125 (91.9) 11 (8.1)	12 (100.0) 0 (0.0)	0.381
Maternal comorbidity	No Yes	115 (84.6) 21 (15.4)	10 (83.3) 2 (16.7)	0.587
Education	Primary High school or University	52 (38.2) 84 (61.8)	4 (33.3) 8 (66.7)	0.499
Working status	Housewife Employed	76 (55.9) 60 (44.1)	9 (75.0) 3 (25.0)	0.164
Monthly income level	Low Middle or high	60 (44.1) 76 (55.9)	6 (50.0) 6 (50.0)	0.461

Data was presented as median (min-max), number and percentage (%), *History of pregnancy termination due to an anomalous fetus or having a child with an anomaly

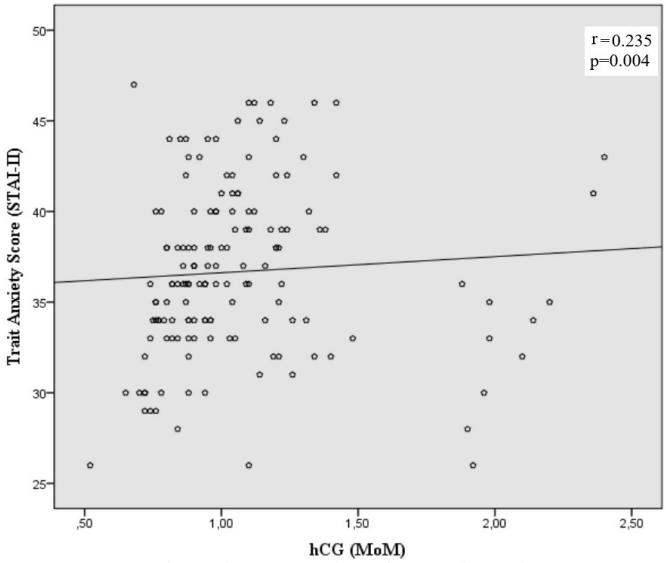

Figure 2. Scatterplot and regression lines for correlation between STAI-II scores and hCG levels (MoM) of pregnant women (n=148) (r: Correlation coefficient)

STAI: State-Trait Anxiety Inventory, hCG: Human chorionic gonadotropin

The state anxiety scores of the patients are presented in Table 2, for both pre-screening (STAI-Ia) and post-screening (STAI-IIb). In patients who has positive test results, state anxiety scores were observed to increase following first-trimester screening test and counselling when compared to the scores obtained pre-screening (40.00±7.26 vs. 43.25±7.38, p=0.003). Anxiety scores increased in all patients with positive test results. Moreover, in 9 of the 12 patients (75%), the anxiety scores exceeded the probable clinical anxiety threshold of 40 points. In patients with negative test results, state anxiety scores reduced compared to pre-sceening scores (39.79±6.00 vs. 36.93±5.27, p<0.001). Although state anxiety scores decreased in patients with a history of miscarriage (39.76±6.71 vs. 38.41±6.58, p=0.115), consanguineous marriage (39.42±6.18 vs. 38.11±6.75, p=0.122) and maternal comorbidity (37.13±5.37 vs. 36.96±4.16, p=*0.766*) after first trimester screening and counselling compared with to the pre-screening scores, these findings were not statistically significant. Patients with a history of pregnancy termination due to an anomalous fetus or having a child with an anomaly had lower state anxiety scores after the first trimester screening test and counselling (41.36±6.08 vs. 35.91±6.12, p=0.01).

DISCUSSION

The three principal findings of the study are as follows: Firstly, the pre-screening state anxiety scores of the patients were found to exceed their trait anxiety scores. Secondly, state anxiety scores were found to decrease in patients with a negative test results, and increase in patients with a positive test results. Thirdly, state anxiety scores of patients with a history of miscarriage, consanguineous marriage and maternal comorbidities remained unchanged following combined first trimester screening test.

In a large meta-analysis, it was reported that the anxiety levels of patients with early pregnancy were similar to the general population and that offering prenatal screening tests to patients had positive effects on maternal anxiety with a low - moderate level of evidence. Furthermore, no difference was identified between the anxiety scores of patients who accepted or refused to have a Down syndrome screening test.[14] All participants in the present study comprised patients who had applied for combined first-trimester screening test for Down syndrome and their pre-screening state anxiety scores were higher than their trait anxiety scores. This finding can be interpreted as reactive concerns exhibited by patients due to their application for screening rather than being intrinsic. The present study also found a weak relationship between hCG levels and trait anxiety scores. However, it would be erroneous to conclude that elevated hCG levels are associated with increased maternal anxiety, as this interpretation would imply higher anxiety levels during the weeks of pregnancy when elevated hCG values are observed. Moreover, it has been reported that the levels of anxiety experienced by pregnant

Table 2. Prescreening (STAI-Ia) and postscreening (STAI-Ib) state anxiety scores of the patients

		n (%)	STAI-Ia (mean±SD)	STAI-Ib (mean±SD)	p-value
Gravida	1	46 (31.1)	40.35±6.01	37.33±6.33	<0.001
	≥2	102 (68.9)	39.56±6.13	37.50±5.44	<0.001
Parity	No	56 (37.8)	40.39±6.19	37.66±6.48	<0.001
	≥1	92 (62.2)	39.45±6.03	37.32±5.22	<0.001
History of miscarriage	No	114 (77.0)	39.82±5.91	37.16±5.42	<0.001
	Yes	34 (23.0)	39.76±6.71	38.41±6.58	0.115
Consanguineous marriage	No	129 (87.2)	39.86±6.09	37.35±5.56	<0.001
	Yes	19 (12.8)	39.42±6.18	38.11±6.75	0.122[α]
Having healty child	No	63 (42.6)	40.22±6.23	37.76±6.51	<0.001
	Yes	85 (57.4)	39.49±5.99	37.21±5.06	<0.001
Anomalous child*	No	137 (92.6)	39.68±6.09	37.57±5.68	<0.001
	Yes	11 (7.4)	41.36±6.08	35.91±6.12	0.01[α]
Maternal comorbidity	No	125 (84.5)	40.30±6.10	37.54±5.96	<0.001
	Yes	23 (15.5)	37.13±5.37	36.96±4.16	0.766[α]
Screening result	Negative	136 (91.9)	39.79±6.00	36.93±5.27	<0.001
	Positive	12 (8.1)	40.00±7.26	43.25±7.38	0.003[α]

Data was presented as mean±SD, number and percentage (%). α Wilcoxon test, *History of pregnancy termination due to an anomalous fetus or having a child with an anomaly, STAI: State-Trait Anxiety Inventory, SD: Standard deviation

individuals are similar to those observed in the general population.[15] In the study conducted by Mousavi et al.,[16] no relationship was found between anxiety scores and hCG levels in the second trimester.

The present study observed an increase in the state anxiety scores of the patients with positive test results. Many historical studies have shown that state anxiety scores of patients with positive test results for Down syndrome increased or have higher state anxiety scores than patients with negative test results.[15,17,18] Increased state anxiety levels in patients with positive test results can be attributed to the possibility of having a child with an anomaly and the emotional, social and economic burden this will bring. The present study also demonstrated that anxiety scores increased in all patients with a positive test result, and in 75 percent of patients the level of anxiety reached a probable clinical level. Therefore, patients with positive test results should be provided with psychological support in addition to medical counseling. In a study conducted by Richmond et al.,[19] it was demonstrated that anxiety levels of the patients with positive test results in the combined first trimester screening test was decreased following the non-invasive prenatal test (NIPT) being reported as low risk. These findings demonstrate the reliability of patients to the NIPT screening test, which exhibits a higher performance for the detection of Down syndrome when evaluated in terms of perinatology. Due to its lower false positive rate, it can be considered an alternative to the combined first trimester screening test, helping to avoid unnecessary maternal anxiety.

Consistent with the existing literature, this study also demonstrates that the post-screening state anxiety scores of patients with negative test results decrease in comparison to the pre-screening scores. In the meta-analysis which evaluated the effect of screening tests on maternal anxiety, it was reported that anxiety scores decreased in patients with negative test results and reached their lowest value in the postpartum period and also suggested that no evidence to support an assumption of residual anxiety in women with negative test results.[14] Bardi et al.[20] reported that 99% of patients expressed a desire to learn as soon as possible whether there was a structural anomaly in the fetus, and that patients' state anxiety scores decreased after normal fetal anatomy was confirmed. The findings of this study also demonstrated a significant decrease in the state anxiety scores of patients with a history of having an anomalous child or a history of pregnancy termination due to anomalous fetus after combined first trimester screening test and basic fetal anatomical scan. This decline may be attributable to the relief by the initial favorable results following a negative experience.

The study revealed no significant decrease in maternal anxiety scores following first trimester screening in pregnancies characterised by a history of miscarriage, consanguineous marriage, and maternal comorbidity. A history of miscarriage has been evidenced to cause negative psychological effects on patients, but the duration of post-miscarriage anxiety remains uncertain.[21] Despite the fact that screening test results are negative, patients' fear of reliving a negative experience, such as a miscarriage, may be the reason why their anxiety scores did not decrease. The increased risk of genetic diseases other than Down syndrome in consanguineous marriages and the increased risk of adverse pregnancy outcomes in those with maternal comorbidities may be the reason why patients' state anxiety scores did not show a significant change after the first trimester screening. As indicated by the findings of the present study, the investigation conducted by Akalın et al.[13] into the impact of fetal echocardiography on maternal anxiety revealed that the effect of fetal echocardiography on maternal anxiety scores was found to be insignificant in patients with a history of miscarriage and in patients with maternal comorbidities.

Limitations

The present study is not without its limitations. Firstly, the relatively small number of patients with positive test results is a notable factor. Secondly, state anxiety scores were assessed after the screening test results but could not be assessed after the diagnostic test, mid-trimester fetal anatomical scan or in postpartum period. The underlying factors contributing to this issue included patient non-compliance with follow-up appointments at the same center, the limitations of genetic diagnostic facilities within the laboratory, and patients' preference for delivering in different cities or institutions. It is recommended to confirm the findings with prospective studies with a larger patient population and longer follow-up period.

CONCLUSION

Consequently, patients' requests for screening tests have been shown to induce state anxiety in the patient. State anxiety levels decreases in patients with negative test results and increases in patients with positive test results. In addition to prenatal screening, diagnosis and follow-up, the importance of providing social and psychological support should be emphasised, particularly for patients with positive screening test results, to prevent the detrimental effects of maternal anxiety on pregnancy outcomes.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Yozgat Bozok University Rectorate Non-interventional Clinical Researches Ethics Committee (Date: 05.03.2025, Decision No: 2025-GOKAEK-255_05.03.2025-370).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Disclosure

The authors report no conflicts of interest in this work.

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