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Relationship Between Cognitive Flexibility, Pregnancy-Related Anxiety, and Attentional Functions in Pregnant Women

Aslı Deşer, Sibel Tunç Karaman, Okcan Basat

University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Clinic of Family Medicine, İstanbul, Türkiye

ABSTRACT

Introduction: This study aimed to examine cognitive flexibility and pregnancy-related anxiety among pregnant women and to explore their relationships with attentional functions during pregnancy.

Methods: A cross-sectional study was conducted with 125 pregnant women attending the Family Medicine Outpatient Clinic of Gaziosmanpaşa Training and Research Hospital. Data were collected using a descriptive information form, the cognitive flexibility inventory (CFI), the pregnancy-related anxiety scale (PRAS), and verbal fluency tests (phonemic and semantic).

Results: Participants had a mean age of 28.5±6.01 years (range: 18-44). The mean total number of words produced in verbal fluency tests was 70.95±24.0. The mean PRAS score was 70.86±14.20, reflecting low-to-moderate anxiety levels. Their mean CFI score was 68.65±10.66, suggesting moderate-to-good cognitive flexibility. PRAS and CFI scores were negatively correlated (r: –0.238, p=0.008), while CFI scores were positively correlated with total word count (r: 0.299, p=0.001). Participants who reported persistent attention difficulties and forgetfulness had significantly higher PRAS scores than those without these complaints (p=0.010 for attention difficulties and p=0.011 for forgetfulness).

Conclusion: Pregnant women in this study exhibited low-to-moderate pregnancy-related anxiety and moderate-to-good cognitive flexibility. Higher cognitive flexibility was significantly associated with lower anxiety and better verbal fluency. Although no direct link was found between anxiety and verbal fluency, self-reported attentional difficulties were associated with higher anxiety and reduced cognitive flexibility. These findings suggest that cognitive flexibility may act as a protective factor during pregnancy and may represent a promising target for prenatal mental health interventions.

Keywords: Anxiety, attention, cognitive flexibility, pregnancy

Introduction

Pregnancy represents a unique and complex period in a woman's life, involving profound biological, physiological, psychological, and social changes (1). Alongside the physical adaptations needed to sustain fetal development, women often face psychosocial stressors such as limited socioeconomic resources, work–family responsibilities, and adjustments to new maternal roles (2). These demands, coupled with hormonal fluctuations, can heighten emotional vulnerability; recent studies estimate that 15–25% of pregnant women worldwide experience clinically significant psychological distress, with similar rates reported in Türkiye (3).

Pregnancy-related anxiety is conceptually distinct from generalized anxiety disorders, encompassing concerns about the baby's health, childbirth complications, maternal appearance, and postpartum responsibilities (4). It has been linked to adverse maternal and neonatal outcomes, including preterm birth, impaired maternal–infant bonding, and postpartum depression. Such anxiety may also affect cognitive domains such as attention, memory, and executive functioning, underscoring the importance of resilience factors that could mitigate its impact (5).

Cognitive flexibility—the ability to shift perspectives, adapt strategies, and generate alternative responses—plays a critical role in adapting to change (6). Lower cognitive flexibility has been consistently reported in individuals with anxiety disorders compared to healthy controls (7). In pregnancy, higher flexibility may help women manage rapid and multidimensional changes, potentially reducing the psychological burden of anxiety (8). However, to the best of our knowledge, no study in Türkiye has directly examined the interplay between cognitive flexibility, pregnancy-related anxiety, and attentional functioning.

Many pregnant women also report cognitive changes, often described as "baby brain" or "placental brain". These self-perceived issues—reduced attention, forgetfulness, slower memory retrieval—are supported by some neuropsychological findings showing poorer performance in attention, memory, and visuospatial tasks among pregnant women compared with non-pregnant controls (9). Although objective and subjective findings do not always align, recent reviews indicate that such complaints are

Address for Correspondence: Assoc. Prof. Sibel Tunç Karaman, MD, University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Clinic of Family Medicine, İstanbul, Türkiye
E-mail: drsibeltunc@hotmail.com **ORCID ID:** orcid.org/0000-0003-1833-8758

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common among pregnant women, with a substantial proportion reporting changes in memory and attention (10). It is plausible that diminished cognitive flexibility could exacerbate attentional difficulties, whereas greater flexibility may provide a protective advantage.

Despite evidence linking cognitive flexibility to better coping and lower childbirth fear, few studies have integrated these domains to examine whether flexibility can buffer the cognitive effects of pregnancy-related anxiety (8,11). Addressing this gap could inform interventions to enhance maternal cognitive and emotional well-being. Therefore, the present study aimed to investigate the relationship between cognitive flexibility, pregnancy-related anxiety, and attentional functions by combining self-reports with objective neuropsychological measures to better understand cognitive–emotional adaptation during pregnancy.

Methods

Study Design, Setting, and Participants

This cross-sectional study was conducted at the Family Medicine Outpatient Clinic of Gaziosmanpaşa Training and Research Hospital between June 8 and September 30, 2023. The study included 125 volunteer pregnant women who met the inclusion criteria.

Eligible participants were pregnant women aged ≥18 years who had sufficient Turkish literacy and comprehension to complete the study and provided informed consent. Exclusion criteria included diagnosed psychiatric disorders affecting cognition, cognitive impairment, inability to cooperate, or hearing and speech impairments.

Sample Size Estimation

The sample size was calculated using G*Power version 3.1.9.4, based on effect size estimates from prior research. The required sample size was determined to be 108 participants (α: 0.05, power: 0.95). A total of 125 participants were recruited, exceeding the required minimum sample size.

Data Collection

Data were collected using a descriptive information form, the cognitive flexibility inventory (CFI), the pregnancy-related anxiety scale (PRAS), and verbal fluency tests (phonemic and semantic).

Descriptive Information Form

This form, developed by the researchers, included questions on sociodemographic characteristics (age, education level, employment status, income level), general medical and obstetric history (e.g., presence of chronic disease, gestational week, number of pregnancies, high-risk pregnancy status), and self-reported cognitive flexibility and attention. High-risk pregnancy encompasses pre-existing medical conditions, previous and current pregnancy complications, advanced maternal age, and multiple pregnancy.

Pregnancy-Related Anxiety Scale

The PRAS was developed by Brunton et al. (12) in 2018 and adapted into Turkish by Kurt and Arslan (13) in 2021. The 31 items are grouped into nine subscales and are rated on a four-point Likert scale from 1 ("Never") to 4 ("Very often"). Nine items are reverse-scored. The total score ranges from 31 to 124, with higher scores indicating greater pregnancy-related anxiety. The Cronbach's alpha was 0.92 for the original version and 0.89 for the Turkish version (12,13).

Cognitive Flexibility Inventory

The CFI was developed by Dennis and Vander Wal (14) in 2010 to assess the ability to generate alternative, adaptive, and appropriate responses in challenging situations. The Turkish adaptation and validation were conducted by Gulum and Dag (15) in 2012. The 20-item scale includes two subscales: "Alternatives" and "Control". Six items are reverse-scored. Total scores range from 20 to 100, with higher scores reflecting greater cognitive flexibility. Cronbach's alpha values for the "Alternatives" subscale were 0.91, and for the "Control" subscale, 0.86 and 0.84 in initial and final measurements (14,15).

Verbal Fluency Tests

Verbal fluency tests assess phonemic (lexical) and semantic (categorical) fluency. They are widely used in clinical neurological and cognitive assessments, including patients with dementia, Parkinson's disease, psychosis, and depression, as well as healthy individuals. These tests are advantageous because they are easy to administer, brief, and reliant on verbal skills rather than literacy.

In the semantic fluency test, participants are asked to name as many items as possible from a specific category (e.g., animals, fruits, supermarket items) within a limited time. In the phonemic fluency test, participants produce as many different words as possible starting with a specific letter. In the Turkish version, the letters "K", "A", and "S" are commonly used because they occur with high frequency in the language. Scoring can be conducted separately for each letter/category or as a total score (16,17).

Ethical Approval

The study protocol was approved by the Gaziosmanpaşa Training and Research Hospital Clinical Research Ethics Committee (approval number: 76, date: June 7, 2023). All procedures were carried out in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 22. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Descriptive statistics (means, standard deviations, frequencies) were used to summarize the data. Group comparisons for normally distributed variables were conducted using one-way analysis of variance (post-hoc Tukey HSD test), while the Kruskal–Wallis test (post-hoc Dunn's test) was applied for non-normally distributed variables. An independent-samples t-test was used for two-group comparisons of normally distributed variables, and the Mann–Whitney U test was used for non-normally distributed variables. Correlation analyses were performed using Pearson's correlation coefficient for normally distributed variables and Spearman's rho for non-normally distributed variables. Internal consistency of the scales was assessed using Cronbach's alpha coefficient. Statistical significance was set at $p<0.05$.

Results

This cross-sectional study included 125 pregnant women aged 18–44 years (mean: 28.55±6.01). Gestational age averaged 20.58±9.09 weeks (range: 5–39), and the number of pregnancies averaged 2.38±1.49 (range: 1–5). Table 1 presents participants' sociodemographic, obstetric, and cognitive-experiential characteristics. Overall, 20.0% (n=25) of participants had a pre-pregnancy chronic disease; 22.4% (n=28) were classified as high-risk; and 39.2% and 38.4% reported frequent or constant attention difficulties and forgetfulness, respectively.

Table 2 summarizes the descriptive statistics for PRAS, CFI, and verbal fluency scores. PRAS averaged 70.86±14.20, indicating low-to-moderate pregnancy-related anxiety, while CFI averaged 68.65±10.66, reflecting moderate-to-high cognitive flexibility. Subscale data and reliability coefficients for both scales are provided in the table.

In verbal fluency performance, total word count (phonemic + semantic) was 70.95±24.0, with phonemic fluency at 32.39±12.48 and semantic fluency at 38.56±12.64.

As shown in Table 3, Pearson correlation analysis revealed a significant negative association between PRAS and CFI scores (r: –0.238, p=0.008). CFI scores were positively correlated with verbal fluency word count (r: 0.299, p=0.001). No significant correlation was found between PRAS and word count (p>0.05).

Table 4 presents a comparison of PRAS, CFI, and verbal fluency scores across sociodemographic, obstetric, and attention-related variables. Education level was significantly associated with both CFI (p=0.020) and word count (p=0.001), while income level was associated with CFI (p=0.001) and verbal fluency (p=0.001). Self-reported cognitive complaints were strongly associated with outcomes: frequent attention difficulties were linked to higher PRAS scores (p=0.004); frequent forgetfulness was associated with higher PRAS (p=0.010) scores, lower CFI scores (p=0.010), and lower verbal fluency scores (p=0.001).

Table 5 presents correlation analyses among clinical variables. Gestational age was positively correlated with CFI (r: 0.220, p=0.014), and the number of pregnancies was negatively correlated with verbal fluency (r: 0.256, p=0.004). Maternal age showed no significant associations with PRAS, CFI, or verbal fluency scores.

Table 1. Sociodemographic, obstetric, and cognitive experience characteristics of the participants (n=125)

Variables		n	%
Sociodemographic characteristics			
Education level	Literate	7	5.6
	Primary school	30	24
	Middle school	35	28
	High school	30	24
	University	23	18.4
Marital status	Single	9	7.2
	Married	116	92.8
Income level	Low	45	36
	Moderate	51	40.8
	High	29	23.2
Obstetric characteristics			
Pre-pregnancy chronic disease	No	100	80
	Yes	25	20
High-risk pregnancy	No	97	77.6
	Yes	28	22.4
Attending regular antenatal follow-up	No	37	29.6
	Yes	88	70.4
Attention- and memory-related experiences during pregnancy			
Self-reported attention difficulties during pregnancy	Never	16	12.8
	Rarely	60	48
	Often	39	31.2
	Always	10	8
Forgetfulness during pregnancy	Never	13	10.4
	Rarely	64	51.2
	Often	41	32.8
	Always	7	5.6

Data are presented as n (number) and % (percentage)

Table 2. Descriptive statistics for PRAS, CFI, and verbal fluency scores

	Min-max	Mean ± SD	Cronbach's alpha
PRAS			
Total score	34–112	70.86±14.20	0.888
Subscale scores			
Concerns about childbirth	6–24	15.22±5.06	0.904
Body image concerns	4–16	8.21±3.45	0.889
Attitudes toward childbirth	3–12	6.92±2.34	0.779
Concerns about motherhood	3–12	5.93±2.34	0.719
Acceptance of pregnancy	3–11	4.81±2.16	0.810
Anxiety indicators	3–12	8.27±2.44	0.835
Attitudes toward healthcare professionals	3–10	5.50±1.87	0.779
Avoidance	3–12	7.20±3.39	0.938
Concerns about the baby	3–12	8.80±2.05	0.814
CFI			
Total score	39–95	68.65±10.66	0.867
Subscale scores			
Control	8–33	18.43±4.99	0.714
Alternative	24–65	50.22±8.57	0.929
Verbal fluency test			
Total word count	31–156	70.95±24.00	-
Verbal fluency (total)	11–78	32.39±12.48	-
Letter "K"	5–31	11.81±4.44	-
Letter "A"	3–26	10.62±4.55	-
Letter "S"	3–26	9.96±4.39	-
Category fluency (total)	20–78	38.56±12.64	-
Animals	0–31	13.98±5.06	-
Fruits	4–24	9.42±4.04	-
Market items	7–31	15.15±5.19	-

Data presented as minimum (min), maximum (max), mean and standard deviation (SD) values. PRAS: Pregnancy-related anxiety scale, CFI: Cognitive flexibility inventory

Table 3. Correlation between pregnancy-related anxiety scale, cognitive flexibility inventory, and verbal fluency test (total word count) scores

		PRAS total score	CFI total score	Total word count
PRAS total score	r	1		
	p			
CFI total score	r	-0.238	1	
	p	**0.008***		
Total word count	r	0.077	0.299	1
	p	0.392	**0.001***	

Pearson correlation analysis. *p<0.05. PRAS: Pregnancy-related anxiety scale, CFI: Cognitive flexibility inventory

Table 4. Comparison of scale scores according to sociodemographic, obstetric and attention-related characteristics

		PRAS total score	CFI total score	Total word count
		Mean ± SD	Mean ± SD	Mean ± SD
Education level	Literate	66.86±5.87	64.43±9.73	56±17.05
	Primary school	69.03±17.33	65.97±8.96	61.8±24.18
	Middle school	70±14.33	66.37±12.29	63±18.24
	High school	73.37±14.01	71.07±10.88	73.27±18.17
	University	72.52±11.57	73.74±7.76	96.52±21.73
Marital status	p	[1]0.664	**[1]0.020***	**[2]0.001***
	Single	79.44±18.74	64.89±12.11	67.22±15.87
	Married	70.2±13.67	68.94±10.54	71.24±24.55
Income level	p	[3]0.060	[3]0.274	[4]0.778
	Low	70.47±16.41	64.69±10.52	59.18±17.36
	Moderate	70.47±14.18	68.67±10.83	72.25±22.69
	High	72.17±10.43	74.76±7.45	86.93±25.87
	p	[1]0.854	**[1]0.001***	**[2]0.001***
Pre-pregnancy chronic disease	No	70.97±14.17	69.03±10.71	70.69±23.01
	Yes	70.44±14.63	67.12±10.5	72±28.12
	p	[3]0.868	[3]0.425	[4]0.892
High-risk pregnancy	No	71.22±14.77	68.65±11.34	70.02±25.95
	Yes	70.54±13.77	68.65±10.07	71.82±22.22
	p	[3]0.654	[3]0.171	[4]0.457
Attending regular antenatal follow-up	No	69.29±15.53	66.97±11.03	64.03±18.67
	Yes	72.47±12.64	70.35±10.07	77.98±26.78
	p	[3]0.891	**[3]0.015***	**[4]0.023***
Self-reported attention difficulties during pregnancy	Never	64.00±16.54	70±14.34	78.44±19.5
	Rarely	68.77±13.30	69.35±10.09	68.52±21.73
	Often	74.21±11.08	68.05±9.89	70.85±28.18
	Always	81.40±19.03	64.6±10.73	74±26.61
	p	**[1]0.004***	[1]0.560	[2]0.286
Forgetfulness during pregnancy	Never	68.62±16.19	64.38±14.72	77.92±23.94
	Rarely	67.05±12.98	69.28±10.44	68.03±22.81
	Often	74.59±12.81	69.98±8.86	71.66±24.09
	Always	88.14±13.15	63.00±12.30	80.57±33.49
	p	[3]0.912	**[3]0.010***	**[4]0.001***

[1]One-way ANOVA test, [2]Kruskal-Wallis test, [3]Student's t-test, [4]Mann-Whitney U test, *p<0.05, Data presented as mean and standard deviation (SD) values. ANOVA: Analysis of variance, PRAS: Pregnancy-related anxiety scale, CFI: Cognitive flexibility inventory

Table 5. Correlation of scale scores with age, gestational age, and number of pregnancies

		PRAS total score	CFI total score	Total word count
Age	r	-0.089	0.088	0.095
	p	0.326	0.329	0.294
Gestational age	r	-0.112	**0.220**	0.079
	p	0.212	**0.014***	0.382
Number of pregnancies	r	-0.118	-0.050	**-0.256**
	p	0.189	0.580	**0.004***

*Pearson correlation analysis; p<0.05. PRAS: Pregnancy-related anxiety scale, CFI: Cognitive flexibility inventory

Discussion

This study examined the interrelationships between pregnancy-related anxiety, cognitive flexibility, and attentional functions in a cohort of pregnant women. Participants reported low-to-moderate anxiety and moderate-to-good cognitive flexibility. Greater flexibility was consistently linked with lower anxiety and better verbal fluency, suggesting that it may serve as a psychological resource during pregnancy. Anxiety, however, showed no significant association with verbal fluency.

The influence of sociodemographic factors on both psychological and cognitive outcomes revealed nuanced patterns. Maternal age, often considered a determinant of psychological well-being and obstetric risk, showed no significant association with anxiety or cognitive performance in this cohort. This finding is consistent with several regional studies, although some reports link advanced maternal age with elevated anxiety (18-20). This discrepancy may reflect differences in coping strategies among older mothers.

Beyond maternal age, other sociodemographic variables such as education and income also revealed complex patterns. Educational attainment and income showed no consistent associations with pregnancy-related anxiety in this cohort. While some Turkish studies reported mixed findings (21,22). International reviews identified lower education as a risk factor for prenatal anxiety (23). In our sample, higher education was linked to better cognitive flexibility and verbal fluency, echoing evidence that educational experiences strengthen cognitive reserve and problem-solving capacity (24). Income patterns were similarly heterogeneous, with cultural and family support buffering financial stress in lower-income groups, and heightened expectations creating pressures in higher-income groups (25). Together, these findings underscore how socioeconomic context shapes maternal psychological experiences in complex ways.

Obstetric variables also yielded relevant associations. Gestational week was positively associated with cognitive flexibility in our cohort, suggesting that adaptability may increase as pregnancy advances, possibly reflecting psychological adjustment to evolving maternal roles (24). However, gestational week was not significantly related to anxiety, partially consistent with evidence of trimester-specific fluctuations and with a recent Turkish study reporting that pregnancy-specific stress increased with advancing gestational week (26,27). In contrast, parity was negatively associated with verbal fluency, indicating that women with more pregnancies tended to produce fewer words in fluency tasks. This finding diverges from some reports linking primigravida status to higher anxiety rather than cognitive performance (9,11). Multiparous women may experience cumulative fatigue and increased caregiving responsibilities, which could contribute to reduced performance in verbal fluency tasks. These observations highlight the need for future studies in larger, diverse cohorts.

A particularly notable finding was the role of subjective forgetfulness, which was significantly associated with higher anxiety, reduced cognitive flexibility, and poorer verbal fluency. This highlights the close relationship between emotional and cognitive changes during pregnancy. Recent studies report modest declines in memory and attention during pregnancy, consistent with women's subjective complaints (10). While antenatal depression has been linked to attentional biases toward emotional stimuli, other work has found no objective impairments, suggesting a possible gap between perceived and actual performance (28). Such complaints may also reflect unmeasured factors, highlighting the need to combine subjective and objective assessments.

Overall, the results support cognitive flexibility as a potential psychological buffer. Higher cognitive flexibility was associated with reduced anxiety and better attentional performance, supporting theoretical models that view adaptable thinking as a resource for coping with stress (29). Mindfulness-based interventions, including digital applications, have been shown in meta-analyses to reduce perinatal depression and anxiety (30). Their integration into routine antenatal care may represent a practical and scalable strategy to foster psychological stability and cognitive resilience in expectant mothers.

Study Limitations

This study has several limitations that should be acknowledged. The cross-sectional design restricts causal inference, and recruitment from a single center in a socioeconomically low-to-middle region limits generalizability. Reliance on self-reported measures for cognitive flexibility, anxiety, and forgetfulness introduces potential response bias, while the inclusion of only one objective cognitive measure (verbal fluency) narrows the scope of cognitive evaluation. Unmeasured variables—such as sleep quality, nutritional status, hormonal fluctuations, and comorbid psychiatric conditions—may also have influenced outcomes. Furthermore, the modest sample size could limit statistical power, particularly in subgroup analyses.

Nevertheless, this study offers important strengths. It is among the few studies to integrate psychological and cognitive measures during pregnancy, using both subjective and objective assessments. The application of a validated pregnancy-specific anxiety scale ensured sensitivity to gestational concerns often overlooked by general anxiety tools. This multidimensional approach enhances both the methodological rigor and the clinical relevance of the findings. Future research should use longitudinal or interventional designs to clarify causality and test cognitive-flexibility–enhancing interventions. Wider executive and attentional assessments, more diverse samples, and stricter control of confounders will be critical for advancing this field.

Conclusion

Pregnant women in this study exhibited low-to-moderate levels of pregnancy-related anxiety and moderate-to-good cognitive flexibility. Greater cognitive flexibility was consistently associated with lower anxiety and better verbal fluency, underscoring its potential role as a protective cognitive resource during pregnancy. Although anxiety was not directly correlated with objective verbal fluency, self-reported attentional difficulties were associated with both higher anxiety and reduced cognitive flexibility, indicating a complex interplay among emotional state, subjective cognition, and performance-based outcomes. Cognitive flexibility, therefore, emerges as a promising target for interventions aimed at safeguarding maternal mental health and warrants further investigation in larger, more diverse, and methodologically rigorous studies.

Ethics

Ethics Committee Approval: The study protocol was approved by the Gaziosmanpaşa Training and Research Hospital Clinical Research Ethics Committee (approval number: 76, date: June 7, 2023). All procedures were carried out in accordance with the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from all participants.

Footnotes

Authorship Contributions: Surgical and Medical Practices - A.D., S.T.K., O.B.; Concept - A.D., S.T.K., O.B.; Design - A.D., S.T.K., O.B.; Data Collection or Processing - A.D., S.T.K.; Analysis or Interpretation - A.D., S.T.K., O.B.; Literature Search - A.D.; Writing - A.D., S.T.K., O.B.

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