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Development of a Social Anxiety Model Based on Dark Personality Traits and Metacognition With the Mediating Role of Alexithymia Among University Students in Kermanshah

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A B S T R A C T

Objective: The objective of this study was to develop and test a structural model of social anxiety based on dark personality traits and meta-worry, with alexithymia as a mediating variable, among university students.

Methods and Materials: This applied study used a descriptive–correlational design based on structural equation modeling. The statistical population consisted of all students enrolled in universities in Kermanshah during the second semester of the 2024–2025 academic year. A total of 238 students were selected using convenience sampling. Data were collected using the Social Phobia Inventory, the Dirty Dozen Dark Personality Traits Questionnaire, the Meta-Worry Questionnaire, and the Toronto Alexithymia Scale (TAS-20). Data analysis was conducted at descriptive and inferential levels using SPSS version 21 and SmartPLS version 3, applying the partial least squares approach due to non-normal data distribution.

Findings: Structural equation modeling results indicated that dark personality traits did not have a significant direct effect on social anxiety ($p > .05$). In contrast, meta-worry showed a positive and significant direct effect on social anxiety ($\beta = 0.42$, $p < .01$). Dark personality traits had a significant positive effect on alexithymia ($\beta = 0.24$, $p < .01$), and meta-worry also had a significant positive effect on alexithymia ($\beta = 0.49$, $p < .01$). Indirect path analyses revealed that dark personality traits were significantly related to social anxiety through alexithymia ($\beta = 0.07$, $p < .01$). Similarly, meta-worry was significantly related to social anxiety through alexithymia ($\beta = 0.14$, $p < .01$). Overall model fit indices indicated a strong and acceptable fit for both the measurement and structural models.

Conclusion: The findings suggest that social anxiety in university students is primarily influenced by meta-worry directly and by dark personality traits indirectly through deficits in emotional awareness, highlighting the central mediating role of alexithymia in translating dispositional and metacognitive vulnerabilities into social anxiety symptoms.

Keywords: *social anxiety; dark personality traits; metacognition; alexithymia.*

1. Introduction

Social anxiety is among the most prevalent and impairing internalizing problems in adolescence and young adulthood, typically emerging or consolidating during the developmental window when peer evaluation, romantic interests, and academic performance pressures intensify. In university populations, social anxiety is associated with avoidance of social and performance situations, diminished academic participation, disrupted interpersonal functioning, and reduced quality of life. Recent epidemiological and campus-based evidence continues to underscore that subclinical and clinical manifestations of social anxiety are widespread among undergraduates and graduate students, and that correlates such as perceived social pressures, maladaptive coping patterns, and individual differences in personality and emotion-related processes contribute to symptom severity and functional impairment (Baldaçara et al., 2024; Benson & Kemjika, 2024). Given the centrality of social interaction and evaluative performance in academic contexts, understanding the cognitive–affective mechanisms that maintain social anxiety in university students is critical for identifying targets for prevention and intervention and for constructing integrative explanatory models.

Contemporary accounts of social anxiety emphasize that the disorder is not only a consequence of heightened threat appraisal of social evaluation but also a product of downstream cognitive regulation patterns that lock individuals into self-focused attention, anticipatory worry, and avoidance. Cognitive–behavioral perspectives suggest that dysfunctional beliefs, safety behaviors, and biased interpretations of social cues can foster persistence of symptoms, while emotion regulation difficulties may limit adaptive processing of social stressors. Empirical work in student and adolescent samples has shown that cognitive coping strategies and basic personality traits are meaningfully related to social anxiety symptoms, supporting the view that dispositional and cognitive factors jointly shape vulnerability (Akan & Birtek, 2024; Nikpour & Moslehi Jouybari, 2023). In addition, systematic syntheses highlight that perfectionistic concerns—particularly maladaptive evaluative standards and fear of negative evaluation—are robustly associated with social anxiety, providing further evidence that social anxiety reflects an interplay of personality-linked tendencies and cognitive processing biases (Ferber et al., 2024). However, the field has increasingly recognized that focusing solely on broad personality traits or overt cognitions may miss "darker" dispositional tendencies and higher-order metacognitive processes that can indirectly fuel anxiety through impaired emotional insight and maladaptive self-regulation.

One promising dispositional framework for extending models of social anxiety is the "dark" constellation of personality. The Dark Triad—Machiavellianism, narcissism, and psychopathy—captures socially aversive tendencies including manipulativeness, callousness, entitlement, and impulsive antagonism. A widely used brief assessment is the Dirty Dozen, which operationalizes the Dark Triad in a concise format and has been validated across samples (Jonason & Webster, 2010; Yousefi & Piri, 2016). More recent theoretical developments propose that socially and ethically aversive traits may share a common core, often conceptualized as a Dark Factor of Personality, which can unify diverse aversive tendencies and clarify why various "dark" traits show convergent associations with interpersonal dysfunction and maladaptive outcomes (Scholz, 2024). At the applied level, dark traits have been examined in organizational, interpersonal, and risk domains, demonstrating their relevance to everyday functioning well beyond clinical settings (Harms et al., 2024; Yamen, 2024). Empirical evidence indicates that dark trait profiles predict problematic relational attitudes and behaviors such as jealousy, mate poaching, and permissive sociosexual orientation, suggesting that these traits may also shape how individuals anticipate evaluation and navigate social threat contexts (Craib et al., 2024). In parallel, research has linked dark traits to mental health symptom networks, including associations with depressive symptoms among university students, underscoring that dark traits may be implicated in internalizing pathways as well as externalizing patterns (Li et al., 2024). Within Iranian samples, structural research has also connected dark personality dimensions to anxiety-related constructs, supporting the cultural and contextual relevance of examining dark traits in relation to anxiety phenomena (Babaei Quzullu et al., 2018; Rashidi & Sheibani, 2024).

Despite these advances, the relationship between dark traits and social anxiety is theoretically complex. On one hand, narcissistic entitlement and psychopathic fearlessness may seem inconsistent with social fear; on the other hand, manipulative interpersonal styles, interpersonal distrust, and emotional coldness may foster unstable relationships, concealment, and heightened sensitivity to social threat in certain contexts. Recent findings suggest that dark personality characteristics can relate to self-concealment and appearance-related anxieties, which are themselves

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proximal to social anxiety and social evaluative concerns (Jin et al., 2024). Moreover, dark and light personality features have been examined as predictors of risky relational and sexual tendencies, implying that these traits reflect broader self-regulatory and interpersonal patterns that could plausibly connect to anxiety via mediators such as emotion awareness and coping (Minaei Namin & Ghaffari, 2024). Dark trait indicators have also been used to predict suicidal ideation in students with depressive symptoms, demonstrating that these traits may intensify maladaptive psychological processes in vulnerable populations (Mirkhan, 2024). In adolescents, dark traits have been modeled alongside identity distress, bullying, and school violence, illustrating that dark traits may operate through social-contextual pathways that increase interpersonal conflict and psychological strain (Jahangiri, 2024). Therefore, rather than expecting a simple direct effect from dark traits to social anxiety, an integrative account must consider indirect mechanisms—particularly those involving emotional processing and metacognitive regulation—that translate dispositional tendencies into anxious symptom expression.

Metacognitive theory provides a complementary lens for capturing higher-order cognition that may link personality to anxiety outcomes. In the metacognitive model of generalized anxiety, "meta-worry" refers to worry about worry—negative beliefs about the uncontrollability and danger of worrying, as well as beliefs that worry itself is harmful or will lead to negative outcomes. This model posits that meta-worry maintains and escalates anxiety by triggering perseverative thinking and dysfunctional coping responses (Wells, 2005). Empirical research has supported robust links between meta-worry, intolerance of uncertainty, and symptoms of worry, anxiety, and depression, suggesting that meta-worry is a transdiagnostic vulnerability process rather than a phenomenon limited to generalized anxiety disorder (Khawaja & McMahon, 2011; Ren et al., 2020). More recent studies have extended metacognitive models into interpersonal domains, indicating that meta-worry can be relevant to interpersonal problems and thereby potentially to social anxiety, where interpersonal concerns and evaluative threat are core features (Nordahl et al., 2024). In adolescent samples, meta-worry has been examined as a key mediator or mechanism linking cognitive vulnerabilities to social anxiety symptoms, supporting its relevance to social evaluative fears and avoidance (Yu et al., 2023; Zhang et al., 2021). Within Iranian research, cognitive and metacognitive predictors have been shown to relate to anxiety, reinforcing the importance of metacognition as a culturally relevant construct in psychological vulnerability models (Qaderi et al., 2015). Although some Iranian work has explored meta-worry in relation to religious doubt, the broader implication is that metacognitive beliefs and worry about worry are meaningfully associated with internal experiences that can spill over into social functioning and distress (Shirani et al., 2016).

If dark traits and meta-worry both contribute to maladaptive self-regulation, an important question is how these influences become "embodied" in the person's emotional experience and expressed as social anxiety. Alexithymia—characterized by difficulties identifying feelings, difficulties describing feelings, and an externally oriented thinking style—represents a compelling mediator for this purpose. The Toronto Alexithymia Scale (TAS-20) is a foundational measure with established validity evidence, enabling rigorous operationalization of alexithymia in research and clinical contexts (Bagby et al., 1994). Conceptually, alexithymia reflects deficits in emotion awareness and labeling that constrain adaptive emotion regulation; it is associated with reduced insight into affective states and greater reliance on somatic cues or concrete thinking. Research has highlighted links between emotional intelligence and alexithymia, supporting the view that alexithymia captures a core limitation in understanding and utilizing emotional information (Parker et al., 2001). Longitudinal evidence further suggests that deficits in emotion awareness are related to internalizing symptoms over time, implying that alexithymia-like processes can contribute to anxiety and depression trajectories (Rieffe & De Rooij, 2012). In clinical and health psychology contexts, alexithymia has also been framed as relevant to patient communication and treatment engagement, indicating that it is not a niche construct but rather a clinically meaningful dimension of emotional functioning (Montisci et al., 2023).

Importantly for the present study, alexithymia has been repeatedly associated with social anxiety. In particular, self-awareness deficits characteristic of alexithymia are linked to social anxiety symptoms, suggesting that difficulties recognizing and articulating emotions may intensify uncertainty in social contexts and increase reliance on avoidance to manage undifferentiated distress (Panayiotou et al., 2020). Recent work in school-aged samples similarly indicates that alexithymia contributes to social anxiety, reinforcing the cross-age relevance of this pathway (Zhao et al., 2024). Beyond social anxiety specifically, alexithymia has been implicated in depression and broader psychological

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distress in university students, and has been modeled in SEM frameworks alongside anxiety and social pressure, illustrating its centrality in student mental health models (Sun et al., 2024). Meta-analytic evidence indicates that alexithymia can mediate the relationship between adverse experiences and subsequent psychopathology, supporting the plausibility of alexithymia as a mechanistic bridge linking distal vulnerabilities and proximal symptom expressions (Kick et al., 2024). In Iranian research, alexithymia has also been studied as a mediator between psychosocial variables and symptom outcomes, indicating that this construct operates as a meaningful explanatory mechanism in local contexts (Besharat, 2013; Mohammadi & Jafari, 2020; Pahlavan et al., 2019).

Integrating these strands suggests a coherent conceptual pathway: dark personality traits may predispose individuals to maladaptive interpersonal strategies, reduced empathy, emotional disengagement, or defensiveness, which can manifest as diminished emotional awareness and greater difficulty labeling internal states—hallmarks of alexithymia. In parallel, meta-worry may amplify cognitive arousal and perceived loss of control over internal experiences, thereby undermining emotion identification and description, particularly in socially evaluative situations. Alexithymia can then function as a proximal mechanism through which dispositional and metacognitive vulnerabilities translate into social anxiety, because unclear internal states increase uncertainty and perceived threat and reduce confidence in emotion regulation during social interactions. This integrative view aligns with recent Iranian structural modeling approaches that examine antecedents of student social anxiety and identify cognitive–emotional pathways that shape symptom expression (Hassanvand Amouzadeh, 2024; Jafari Bazvand & Taherzadeh, 2024; Marhamati et al., 2023; Soleimani et al., 2020). It also resonates with intervention-oriented research indicating that cognitive-behavioral training can reduce meta-worry and improve social adjustment, implying that meta-worry is not only theoretically relevant but also practically modifiable and thus a valuable target in explanatory models (Asadi & Naseri, 2024).

At the same time, the clinical significance of modeling social anxiety in students is underscored by guideline-level recommendations that emphasize evidence-based assessment and treatment planning for social anxiety disorder. Comprehensive treatment guidance highlights the importance of accurately characterizing symptom patterns and maintaining mechanisms, including cognitive and emotion-related contributors, to guide intervention selection and sequencing (Baldaçara et al., 2024). Additionally, work examining correlates of social phobia in university settings emphasizes that student mental health services require empirically grounded models that clarify which risk factors are most central, and how they relate to each other within specific educational contexts (Benson & Kemjika, 2024). Methodologically, recent research using physiological monitoring in socially evaluative tasks (e.g., speech activity) illustrates the potential value of connecting subjective anxiety mechanisms to objective indices of arousal and regulation; although not central to the present design, such findings support the broader premise that social anxiety is a multi-system phenomenon shaped by cognitive–emotional regulation processes (Sahu et al., 2025).

The current study is also motivated by the need to better differentiate direct versus indirect pathways from dark traits to social anxiety. Some evidence suggests that dark traits show strong links to problematic interpersonal attitudes and behaviors, but their relationship with internalizing symptoms may depend on intermediate processes such as concealment, emotion dysregulation, or impaired emotion awareness (Craib et al., 2024; Jin et al., 2024). Likewise, meta-worry has been directly associated with social anxiety symptoms in youth samples, and it may also operate by increasing difficulty in emotion regulation and experiential avoidance, which are themselves linked to social anxiety (Marhamati et al., 2023; Yu et al., 2023). Therefore, specifying alexithymia as a mediator allows a theoretically plausible and empirically testable account of how dispositional aversiveness and metacognitive vulnerability might converge on social anxiety outcomes in students.

Given these considerations, the present research advances the literature by integrating dark personality traits and meta-worry within a single structural equation model and by explicitly testing alexithymia as a mediating mechanism among university students in Kermanshah. Such a model is responsive to the growing emphasis on integrative, mechanism-focused approaches in psychology and can inform both assessment priorities (e.g., screening for meta-worry and alexithymia in socially anxious students) and intervention planning (e.g., combining metacognitive and emotion-awareness components alongside standard cognitive-behavioral techniques). It also extends prior work on student social anxiety by incorporating socially aversive personality dispositions and contemporary metacognitive theory, while grounding the model in validated measures and established psychometric foundations (Bagby et al., 1994;

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Connor et al., 2000; Gündüz et al., 2022; Jonason & Webster, 2010; Wells, 2005). Finally, given evidence that meta-worry can function as a cognitive trigger for social anxiety processes and that alexithymia is associated with social anxiety and broader student distress, testing a mediated model is a theoretically justified step toward clarifying the architecture of vulnerability in this population (Nordahl et al., 2024; Panayiotou et al., 2020; Sun et al., 2024).

The aim of this study was to develop and test a structural model of social anxiety based on dark personality traits and meta-worry, with alexithymia as a mediator, among university students in Kermanshah.

2. Methods and Materials

2.1. Study Design and Participants

The present study was applied in terms of its objective, as its findings contributed to identifying factors associated with social anxiety and to developing a predictive model of this phenomenon based on effective personality and cognitive characteristics. From a methodological perspective, this study was descriptive–correlational and employed structural equation modeling (SEM). In this research, the relationships between the predictor variables of dark personality traits and metacognition with the dependent variable of social anxiety were examined through the mediating variable of alexithymia, and the proposed model was evaluated. The statistical population of the study consisted of all students enrolled in universities in the city of Kermanshah during the second semester of the 2024–2025 academic year. Since SEM methodology is, to a considerable extent, similar to certain aspects of multivariate regression, principles for determining sample size in multivariate regression can be applied to SEM. In multivariate regression analysis, the ratio of sample size to independent variables should not be less than 5. A more conservative ratio of 10 observations per independent variable has been suggested by Halinski and Furlow (1970) and Miller and Kunce (1973). From the perspective of James Stevens (1995) and Kline (1990), considering 15 observations per predictor variable in multiple regression analysis using the standard ordinary least squares method is regarded as a good rule of thumb. Therefore, in SEM methodology, sample size determination can generally range from 5 to 15 observations per measured variable. In the present study, which aimed to develop a model of social anxiety based on dark personality traits and metacognition with the mediating role of alexithymia among students in Kermanshah, the sample size was determined based on the minimum SEM rule. The research instruments included the Social Anxiety Questionnaire (three components: fear, avoidance, physiological factors), the Dark Personality Traits Questionnaire (three components: Machiavellianism, psychopathy, narcissism), the Metacognition Questionnaire (one component), and the Alexithymia Questionnaire (three components: difficulty identifying feelings, difficulty describing feelings, externally oriented thinking). According to the formula $5Q < n < 15Q$, where Q represents the number of observed variables and n represents the sample size, it is emphasized that the minimum sample size should not be less than 200 participants. Therefore, in the present study, considering 10 observed variables and 15 samples per indicator, a minimum of 150 participants was determined; however, to improve the generalizability of the results, a total of 238 participants were examined, who were selected using convenience sampling. Inclusion criteria were as follows: being a student enrolled in one of the universities in Kermanshah during the second semester of the 2024–2025 academic year; being within the age range of 18 to 35 years (consistent with the typical university student age range); absence of a diagnosis of severe psychological disorders (such as schizophrenia spectrum disorders or acute major depressive disorders) that could influence participants' responses (based on self-report); not using psychiatric medications affecting emotional and cognitive processing during the past six months (based on self-report); voluntary willingness to participate in the study and complete the questionnaires; and obtaining written informed consent to participate in the study with assurance of confidentiality of personal information. Exclusion criteria included: failure to complete the questionnaires properly or providing invalid responses (based on the researcher's evaluation); experiencing severe stressful events during the past three months (such as bereavement or major life crises) that could influence social anxiety, alexithymia, or metacognition; simultaneous participation in other similar psychological studies that might affect the obtained data; voluntary withdrawal from participation at any stage of the study; and the presence of statistical outliers or invalid response patterns in the questionnaires indicating lack of care in completion. The required data were collected using the Social Anxiety Questionnaire by Connor et al. (2000), the Dark Personality Traits Questionnaire by Jonason and Webster (2010), the Metacognition Questionnaire by Wells (2005), and the Alexithymia Questionnaire by Bagby et al. (1994).

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2.2. *Measures*

This questionnaire was developed by Connor et al. (2000) to assess social anxiety. The Connor Social Anxiety Questionnaire is a self-report scale consisting of 17 items, with each item scored on a 5-point Likert scale. Response options range from very much (score 5), much (score 4), somewhat (score 3), little (score 2), to not at all (score 1). This questionnaire contains no reverse-scored items. The psychometric properties of the Social Anxiety Questionnaire were reported as follows: test–retest reliability in groups diagnosed with social anxiety disorder ranged from correlation coefficients of 0.78 to 0.89. Internal consistency, as measured by Cronbach's alpha, was reported as 0.94 for the total scale in a normal population, and for the subscales fear (0.98), avoidance (0.92), and physiological distress (0.80) (Connor et al., 2000). In Iran, in the study by Hasanvand Amouzadeh (2016), convergent validity of the Social Anxiety Questionnaire with phobic anxiety (SCL-90-R) and the CEQ scale was reported as r = 0.83 and r = 0.47, respectively, and discriminant validity with the SERS and MBRSQ scales was reported as r = −0.70 and r = −0.44, respectively. Reliability assessed by Cronbach's alpha, the Spearman–Brown coefficient, and test–retest reliability was reported as 0.97, 0.97, and 0.82, respectively. In the present study, Cronbach's alpha for the social anxiety construct was calculated as 0.913, and its composite reliability was 0.945. The average variance extracted (AVE) for this construct was 0.852, indicating adequate convergent validity.

The Dark Personality Traits Questionnaire was developed by Jonason and Webster (2010). This questionnaire consists of 12 items, and respondents are asked to rate the extent to which each item corresponds to their personal characteristics on a 7-point scale (from strongly disagree = 1 to strongly agree = 5). In this scale, each of the three dark personality traits is measured by four items. The results of four studies conducted by the scale developers, Jonason and Webster (2010), indicated that this scale demonstrated high and acceptable validity and reliability. Test–retest reliability coefficients for the total scale and subscales, as reported by the original authors, ranged from 0.76 to 0.87. Examination of the psychometric properties of the short form of the Dark Personality Traits Scale in the Iranian population by Yousefi and Piri (2016) indicated that this scale possesses sufficient and appropriate psychometric properties for use in the Iranian context. In the present study, Cronbach's alpha for the dark personality traits construct was reported as 0.534, and its composite reliability was 0.757. The AVE for this construct was calculated as 0.526. Given that the AVE exceeded the minimum acceptable threshold of 0.30, the convergent validity of this construct was confirmed.

The Metacognition Questionnaire is an instrument developed by Wells (2005) to assess the perceived danger of metaworry, as well as the frequency and strength of beliefs about metaworry. This questionnaire was designed to evaluate the metacognitive model of generalized anxiety disorder as defined in DSM-IV. The Metacognition Questionnaire consists of seven items related to the perceived dangers of worry. To assess the frequency of beliefs about metaworry, responses are rated on a 4-point Likert scale (never = 1, often = 2, sometimes = 3, most of the time = 4). Accordingly, the minimum score on this questionnaire is 7 and the maximum score is 28. Lower scores indicate lower levels of metaworry, whereas higher scores indicate higher levels of metaworry. Criterion validity of the questionnaire was assessed by examining the significance of its relationship with other metacognitive scales. The Metacognition Questionnaire demonstrated a particularly strong positive correlation with negative beliefs about worry as measured by the Metacognitions Questionnaire. In terms of construct validity, the Metacognition Questionnaire is able to distinguish outpatients meeting DSM-IV criteria for generalized anxiety disorder from individuals with somatic anxiety or those without anxiety (Wells, 2005). Cronbach's alpha coefficients for the frequency of metaworry scale and the belief about metaworry scale were reported as 0.88 and 0.95, respectively (Wells, 2009, as cited in Ghaderi et al., 2015). In Iran, Ghaderi et al. (2015) reported a Cronbach's alpha of 0.82 for the frequency of metaworry scale. Additionally, in the study by Shirani et al. (2016), convergent validity of the Metacognition Questionnaire was examined through its correlations with the BAI, BDI-II, and GHQ-28. The results indicated that metaworry was positively and significantly associated with BAI and BDI-II scores, as well as with the subscales of general health. In the present study, Cronbach's alpha for the metacognition construct was calculated as 0.918, and its composite reliability was 0.935. The AVE was 0.672, indicating satisfactory convergent validity for this construct.

The Toronto Alexithymia Scale developed by Bagby et al. (1994) was designed to measure difficulty identifying feelings, difficulty describing feelings, and externally oriented thinking, and consists of 20 items. The items are rated on a 5-point Likert scale as follows: strongly agree (5), somewhat agree (4), neither agree nor disagree (3),

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somewhat disagree (2), and strongly disagree (1). The total score range of the questionnaire is 20 to 100. Higher scores indicate greater levels of alexithymia, whereas lower scores indicate lower levels of alexithymia. The psychometric properties of the Toronto Alexithymia Scale–20 have been examined and confirmed in numerous studies (Parker et al., 2001). Cronbach's alpha coefficient for this scale was reported as 0.75 by Rieffe and De Rooy (2012). In the Persian version of the Toronto Alexithymia Scale–20, Cronbach's alpha for alexithymia was reported as 0.85, indicating good internal consistency. In the study by Besharat (2013), test–retest reliability of the Toronto Alexithymia Scale–20 was confirmed in a sample of 67 participants over a four-week interval, with coefficients ranging from 0.80 to 0.87. Additionally, in the study by Pahlavan et al. (2019), concurrent validity of the scale was examined and confirmed based on correlations between this scale and measures of emotional intelligence, psychological well-being, and psychological distress. Furthermore, in the study by Mohammadi and Jafari (2020), Cronbach's alpha was reported as 0.70. In the present study, Cronbach's alpha for the alexithymia construct was calculated as 0.725, and its composite reliability was 0.830. The AVE for this construct was reported as 0.644, confirming adequate convergent validity.

2.3. Data Analysis

Data were analyzed using SPSS version 21 and SmartPLS version 3 at descriptive and inferential levels. Descriptive statistics were used to summarize demographic characteristics and study variables, while inferential analyses were conducted using partial least squares structural equation modeling (PLS-SEM) due to non-normal data distribution. Model evaluation included assessment of measurement model reliability and validity (Cronbach's alpha, composite reliability, and average variance extracted), structural model fit (R^2 and Q^2), and significance of direct and indirect paths using bootstrapping procedures.

3. Findings and Results

Based on the demographic information, a total of 238 university students participated in this study. Of these, 75.2% were female and 23.11% were male; 1.7% did not respond to the question. In addition, 81.9% were single and 17.7% were married; 0.4% did not respond. Moreover, 34.5% were aged 18–22 years, 37.4% were aged 23–27 years, 10.1% were aged 28–31 years, and 17.7% were aged 32–35 years; 0.4% did not respond. Finally, 3.7% were enrolled in an associate degree program, 4.6% in a bachelor's program, 55.9% in a master's program, and 36.1% in a doctoral program. Table 1 presents the descriptive statistics for the study variables and their components.

Table 1

Descriptive Statistics of Scores for the Study Variables

Variable	Component	N	Minimum	Maximum	Mean	SD
Total Social Anxiety Score	—	238	10	70	27.02	12.59
Social Anxiety	Fear	238	10	30	15.74	4.47
Social Anxiety	Avoidance	238	0	24	6.98	5.32
Social Anxiety	Physiological Factors	238	0	16	4.31	3.84
Total Dark Personality Traits Score	—	238	12	58	33.28	7.57
Dark Personality Traits	Machiavellianism	238	4	20	7.27	3.48
Dark Personality Traits	Psychopathy	238	4	20	10.33	3.40
Dark Personality Traits	Narcissism	238	4	20	15.68	3.67
Metaworry	—	238	7	28	12.84	5.15
Total Alexithymia Score	—	238	22	84	50.38	11.93
Alexithymia	Difficulty Identifying Feelings	238	7	35	17.66	6.25
Alexithymia	Difficulty Describing Feelings	238	5	25	13.16	4.54
Alexithymia	Externally Oriented Thinking	238	9	30	19.56	3.69

Based on Table 1, at the total-score level, the highest mean pertains to alexithymia (M = 50.38) and the lowest mean pertains to metaworry (M = 12.84), while total social anxiety (M = 27.02) and dark personality traits (M = 33.28) fall in the mid-range. At the component level for social anxiety, fear shows the highest mean (M = 15.74) and physiological factors show the lowest mean (M = 4.31). Among the dark personality trait components, narcissism

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has the highest mean (M = 15.68) and Machiavellianism has the lowest mean (M = 7.27). Among alexithymia components, externally oriented thinking shows the highest mean (M = 19.56), whereas difficulty describing feelings shows the lowest mean (M = 13.16). Thus, across components, fear (social anxiety), narcissism (dark personality traits), and externally oriented thinking (alexithymia) show the highest means, while physiological factors, Machiavellianism, and difficulty describing feelings are at the lowest levels.

The collected data were analyzed using two software packages, SPSS version 21 and SmartPLS version 3, at both descriptive and inferential levels. Because the study data were not normally distributed, the study hypotheses were tested using linear regression within a path analysis framework in SmartPLS version 3, applying the partial least squares (PLS) method. Accordingly, prior to structural equation modeling, the assumptions relevant to this statistical method were examined and confirmed, including (1) absence of multicollinearity, (2) independence of errors, and (3) the existence of relationships among the scores of the dependent variables. In addition, before interpreting the results, the fit of the research model was evaluated. In PLS-SEM (PLS version 3), model fit is assessed in three parts: fit of the measurement models, fit of the structural model, and overall model fit.

Table 2

Fit Indices for the Measurement Models and Structural Model

Construct	Cronbach's Alpha	Composite Reliability	AVE	R^2	Adjusted R^2	Q^2	Redundancy (Red)
Social Anxiety	0.913	0.945	0.852	0.447	0.440	0.607	0.350
Dark Personality Traits	0.534	0.757	0.526	—	—	0.147	—
Metaworry	0.918	0.935	0.672	—	—	0.481	—
Alexithymia	0.725	0.830	0.644	0.376	0.371	0.376	0.213

Assessment of the measurement models involved evaluating reliability and convergent validity of the study constructs (Fornell & Larcker, 1981). Reliability values for all constructs, except dark personality traits, were above 0.70, indicating acceptable reliability of the model constructs. However, because standardized questionnaires validated in Iran were used to collect data for these variables, and provided that the overall model fit is adequate, the lower reliability and composite reliability values for the relevant sub-constructs may be considered tolerable. The AVE values for all constructs exceeded 0.30. Given that the factor loadings, Cronbach's alpha coefficients, composite reliability, and AVE values for each latent variable were above the defined cutoffs, the reliability and validity of the research model were supported.

Consistent with the PLS data analysis algorithm, after establishing measurement model fit, the structural model fit was examined. In this section, three criteria were evaluated: (a) the coefficient of determination (R^2), (b) the Stone–Geisser criterion (Q^2), and (c) the redundancy criterion. The Stone–Geisser criterion indicated that the model's predictive power for dark personality traits was weak ($Q^2 < 0.15$), whereas predictive power for social anxiety, metaworry, and alexithymia was strong ($Q^2 > 0.35$). Overall, the model's mean predictive power was in the strong range ($Q^2 > 0.35$) and therefore acceptable.

In addition, the coefficients of determination for social anxiety and alexithymia were in the strong range ($R^2 > 0.33$). In the examined model, the mean R^2 was also in the strong range ($R^2 > 0.33$) and acceptable.

To assess overall model fit, which simultaneously evaluates both the measurement and structural components, the goodness-of-fit (GoF) index is computed as: GoF = √(average communality × average R^2). Based on this equation, the mean communality of the model variables was 0.403 and the mean R^2 was 0.411. Therefore, GoF = √(0.403 × 0.411) = √(0.165) = 0.406. According to the thresholds of 0.10, 0.25, and 0.36 for weak, medium, and strong fit, respectively (Henseler et al., 2009), the obtained GoF value (0.406) indicates strong and acceptable overall model fit. Accordingly, the proposed model demonstrates satisfactory fit, and the relationships within the model can be interpreted.

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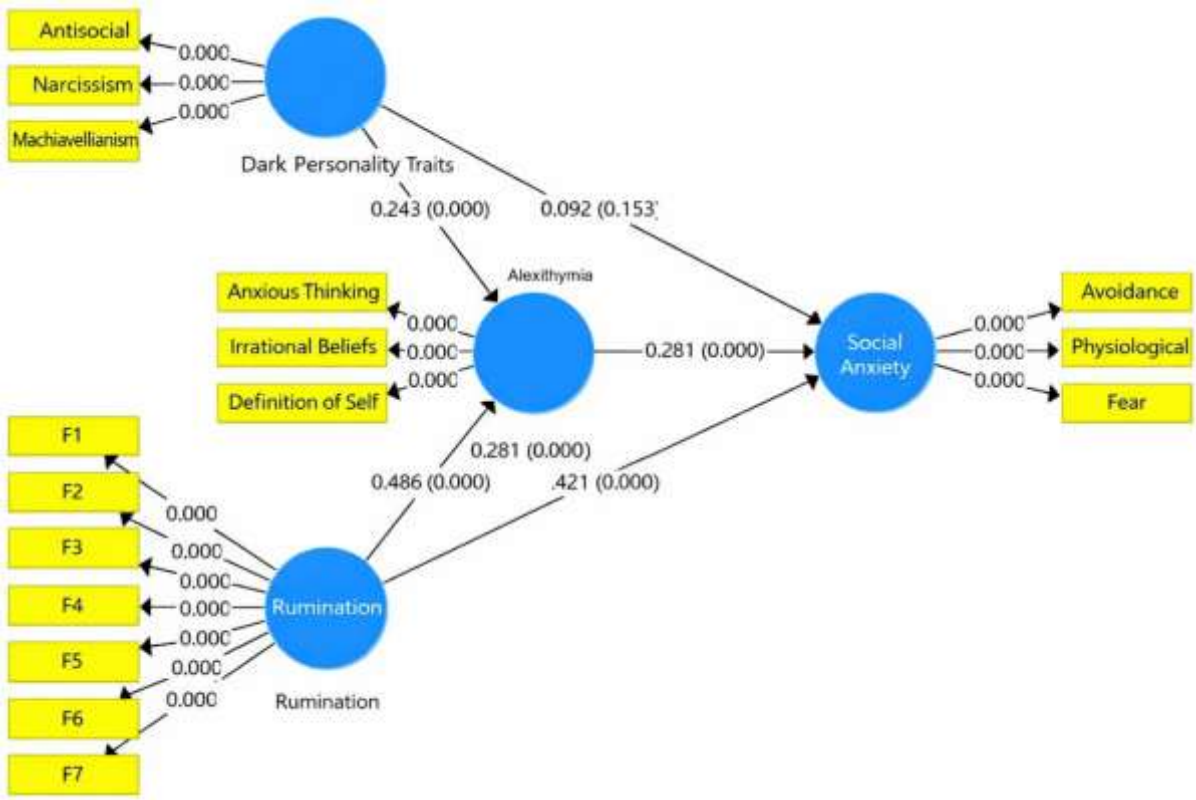
Figure 1

Structural Model With Estimated Path Coefficients



In this model, social anxiety is the criterion (outcome) variable, dark personality traits and metaworry are the predictor variables, and alexithymia is the mediating variable. Table 3 presents a summary of the estimated direct effects in the model.

Table 3

Summary of Direct Path Coefficients

Path	Path Coefficient	t-value	Significance Level
Dark Personality Traits → Social Anxiety	0.092	1.401	0.162
Metaworry → Social Anxiety	0.421	6.954	0.001
Dark Personality Traits → Alexithymia	0.243	4.064	0.001
Metaworry → Alexithymia	0.486	8.536	0.001

The results of model estimation indicated that there was no direct relationship between dark personality traits and social anxiety among university students in Kermanshah ($p > .05$). In contrast, metaworry showed a positive and significant relationship with social anxiety, with an effect coefficient of 0.42; thus, metaworry was directly associated with increased social anxiety ($p < .05$). Moreover, dark personality traits were positively and significantly related to alexithymia, with an effect coefficient of 0.24; hence, dark personality traits were directly associated with increased alexithymia ($p < .05$). Finally, metaworry was positively and significantly related to alexithymia, with an effect coefficient of 0.49; therefore, metaworry was directly associated with increased alexithymia ($p < .05$). Table 4 presents a summary of the estimated indirect effects in the model.

Table 4

Summary of Indirect Path Coefficients

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Path	Path Coefficient	t-value	Significance Level
Dark Personality Traits → Alexithymia → Social Anxiety	0.067	2.882	0.004
Metaworry → Alexithymia → Social Anxiety	0.137	4.008	0.001

The results further showed that the indirect path from dark personality traits to social anxiety through alexithymia was positive and significant, with an effect coefficient of 0.07. Accordingly, dark personality traits were indirectly associated with increased social anxiety through alexithymia among university students in Kermanshah ($p < .05$). In addition, the indirect path from metaworry to social anxiety through alexithymia was positive and significant, with an effect coefficient of 0.14. Therefore, metaworry was indirectly associated with social anxiety through alexithymia among university students in Kermanshah ($p < .05$).

4. Discussion

The findings of the present study provide an integrative picture of how dark personality traits and meta-worry relate to social anxiety in university students, both directly and indirectly through alexithymia. At the structural level, the results indicated that dark personality traits did not have a significant direct association with social anxiety, whereas meta-worry showed a strong and positive direct effect on social anxiety. In addition, both dark personality traits and meta-worry were positively and significantly associated with alexithymia, and alexithymia, in turn, functioned as a significant mediating mechanism linking these predictors to social anxiety. Taken together, these results support a mediated model in which dispositional and metacognitive vulnerabilities are translated into social anxiety symptoms primarily through deficits in emotional awareness and expression, rather than through simple direct pathways.

The absence of a significant direct relationship between dark personality traits and social anxiety is theoretically meaningful and aligns with an emerging body of literature suggesting that socially aversive personality characteristics do not necessarily manifest as overt internalizing symptoms unless they interact with other psychological processes. Dark traits such as Machiavellianism, narcissism, and psychopathy are often characterized by emotional detachment, manipulativeness, and reduced empathy, which may buffer individuals from immediate social fear or evaluative anxiety in some contexts. This pattern is consistent with prior findings showing that dark traits are more robustly linked to interpersonal dysfunction, antagonistic attitudes, or risky behaviors than to pure anxiety symptoms (Craib et al., 2024; Harms et al., 2024; Yamen, 2024). Studies conducted in student samples have similarly suggested that dark traits may be indirectly related to psychological distress via maladaptive coping, concealment, or emotion-related processes rather than through direct effects on anxiety outcomes (Jin et al., 2024; Li et al., 2024). Iranian research has also reported complex, often indirect, associations between dark personality dimensions and anxiety-related variables, reinforcing the importance of considering mediators in culturally grounded models (Babaei Quzullu et al., 2018; Jahangiri, 2024; Rashidi & Sheibani, 2024). Thus, the current finding that dark personality traits alone did not predict social anxiety directly is consistent with the view that these traits require intervening mechanisms to exert their influence on internalizing symptoms.

In contrast, meta-worry emerged as a powerful direct predictor of social anxiety, underscoring the centrality of metacognitive processes in social evaluative fear. Meta-worry reflects negative beliefs about worry itself, including perceptions of uncontrollability and danger, which can amplify vigilance, self-focused attention, and anticipatory anxiety in social contexts. This result is in line with the metacognitive model proposed by Wells, which posits that meta-worry is a maintaining factor in anxiety disorders by triggering perseverative thinking and maladaptive coping responses (Wells, 2005). Empirical studies have consistently demonstrated that meta-worry is associated with heightened anxiety, intolerance of uncertainty, and depressive symptoms across clinical and nonclinical samples (Khawaja & McMahon, 2011; Ren et al., 2020). More specifically, recent work has shown that meta-worry is relevant to interpersonal and social functioning, supporting its role in social anxiety where concerns about evaluation and perceived loss of control over internal experiences are prominent (Nordahl et al., 2024). Research in adolescent and student populations has similarly identified meta-worry as a key mechanism underlying social anxiety symptoms, often acting as a mediator between cognitive vulnerabilities and anxiety outcomes (Marhamati et al., 2023; Yu et al., 2023; Zhang et al., 2021). The present findings extend this literature by confirming the direct contribution of meta-worry to social anxiety in a university student sample and within a comprehensive structural model that

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simultaneously accounts for personality and emotional variables.

Beyond these direct effects, one of the most important contributions of the present study lies in demonstrating the mediating role of alexithymia in the relationships between both dark personality traits and meta-worry with social anxiety. The positive association between dark personality traits and alexithymia suggests that individuals with higher levels of socially aversive traits may experience greater difficulty identifying and describing their emotions, as well as a tendency toward externally oriented thinking. This finding aligns with theoretical accounts proposing that dark traits involve emotional detachment, reduced emotional insight, and limited empathic engagement, which can translate into alexithymic features (Harms et al., 2024; Scholz, 2024). Empirical evidence has linked dark personality dimensions to self-concealment, reduced emotional awareness, and impaired affective processing, supporting the plausibility of this pathway (Jin et al., 2024; Minaei Namin & Ghaffari, 2024). Network-based analyses in student samples have further shown that dark traits cluster with internalizing symptoms through emotion-related nodes, rather than exerting isolated effects (Li et al., 2024). Therefore, the present results suggest that dark personality traits may increase vulnerability to social anxiety primarily by undermining emotional awareness and clarity, rather than by directly heightening fear of social evaluation.

Similarly, the strong positive association between meta-worry and alexithymia observed in this study highlights the close connection between metacognitive vulnerability and emotional processing deficits. Persistent worry about worry can consume cognitive resources, promote avoidance of emotional experiences, and foster confusion about internal states, thereby increasing alexithymic tendencies. Prior research has shown that meta-worry is linked to experiential avoidance, difficulties in emotion regulation, and heightened attentional bias toward threat, all of which can interfere with accurate emotion identification (Qaderi et al., 2015; Ren et al., 2020). In adolescent and student populations, meta-worry has been associated with maladaptive cognitive–emotional regulation strategies that increase social anxiety symptoms, supporting the idea that alexithymia may be a downstream consequence of sustained metacognitive distress (Marhamati et al., 2023; Yu et al., 2023). The present findings add to this literature by empirically confirming alexithymia as a mediator between meta-worry and social anxiety within a single structural framework.

The indirect effects observed in the model further clarify how these processes converge to shape social anxiety. The significant indirect path from dark personality traits to social anxiety via alexithymia indicates that socially aversive traits contribute to social anxiety only insofar as they are associated with emotional unawareness and difficulty articulating feelings. This pattern is consistent with prior evidence that alexithymia is linked to social anxiety and related interpersonal fears, as individuals who cannot clearly identify or communicate their emotions may experience heightened uncertainty and perceived threat in social interactions (Panayiotou et al., 2020; Zhao et al., 2024). Likewise, the indirect effect of meta-worry on social anxiety through alexithymia suggests that metacognitive distress fosters social anxiety partly by disrupting emotional insight and increasing reliance on avoidance or somatic cues. Studies in student populations have repeatedly shown that alexithymia is associated with higher levels of anxiety and depression, and SEM-based research has demonstrated that alexithymia can mediate the effects of cognitive and contextual stressors on mental health outcomes (Kick et al., 2024; Sun et al., 2024). Iranian research has also supported the mediating role of alexithymia between psychosocial variables and symptom severity, reinforcing the cultural relevance of this mechanism (Besharat, 2013; Mohammadi & Jafari, 2020; Pahlavan et al., 2019).

5. Conclusion

These findings support an integrative vulnerability model in which dark personality traits represent a distal dispositional risk, meta-worry represents a proximal cognitive–metacognitive vulnerability, and alexithymia operates as a key emotional mechanism translating these risks into social anxiety symptoms. This model aligns with contemporary calls for mechanism-focused approaches to anxiety that move beyond single-factor explanations and instead emphasize the interaction of personality, cognition, and emotion processes. It also complements recent structural models of social anxiety developed in Iranian student samples, which have emphasized emotion regulation difficulties and cognitive vulnerabilities as central pathways to social anxiety (Hassanvand Amouzadeh, 2024; Jafari Bazvand & Taherzadeh, 2024; Soleimani et al., 2020). Clinically, these results are consistent with guideline-level recommendations that highlight the importance of assessing cognitive and emotional maintaining mechanisms in social anxiety to inform treatment planning (Baldaçara et al.,

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2024). Overall, the present study contributes to the literature by empirically demonstrating that social anxiety in university students is best understood as the outcome of interacting dispositional, metacognitive, and emotional processes rather than as a direct consequence of personality traits alone.

6. Limitations & Suggestions

Despite its contributions, the present study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes causal inferences about the directionality of the observed relationships, particularly the mediating role of alexithymia. Second, the reliance on self-report questionnaires may have introduced common method bias and response distortions, especially given the socially sensitive nature of dark personality traits and emotional awareness. Third, the sample was drawn from university students in a single city, which may limit the generalizability of the results to other age groups, cultural contexts, or clinical populations. Finally, although the structural model demonstrated good fit, unmeasured variables such as social support, attachment styles, or experiential avoidance may also play important roles in social anxiety and were not included in the present model.

Future studies should employ longitudinal or experimental designs to clarify the temporal and causal relationships among dark personality traits, meta-worry, alexithymia, and social anxiety. Expanding the model to include additional emotional and interpersonal variables, such as emotion regulation strategies, self-concealment, or interpersonal sensitivity, may further refine understanding of the pathways to social anxiety. Replicating the model in clinical samples and in diverse cultural or educational settings would also strengthen external validity. Moreover, future research could integrate physiological or behavioral measures alongside self-report data to capture multi-level processes underlying social anxiety more comprehensively.

From an applied perspective, the findings suggest that assessment of social anxiety in university students may benefit from screening not only for overt anxiety symptoms but also for meta-worry and difficulties in emotional awareness. Interventions may be more effective when they incorporate components targeting metacognitive beliefs about worry and enhancing emotion identification and expression skills, alongside traditional cognitive-behavioral techniques. University counseling services could also consider preventive programs that focus on emotional literacy and adaptive coping to reduce the downstream impact of dispositional and metacognitive vulnerabilities on social anxiety.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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