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Adult Attachment, Psychological Stress, and Quality of Life: Insights into Italian Veterinary Medicine Students' Mental Health

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Declarations

Ethics approval and consent to participate: This study received ethical approval from the Research Ethics Board of the University of Parma (Prot. 0184302). Moreover, the study was designed and conducted in accordance with the Ethical Code of the Italian Association of Psychology, the European Code of Conduct for Research Integrity, and the guidelines of the American Psychological Association.

Consent for publication: Not applicable

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Consent to Participate: Every participant provided their informed consent to participate.

Human Ethics and Consent to Participate declarations: This study received ethical approval from the Research Ethics Board of the University of Parma (Prot. 0184302). Moreover, the study was designed and conducted in accordance with the Ethical Code of the Italian Association of Psychology, the European Code of Conduct for Research Integrity, and the guidelines of the American Psychological Association. All participants provided their informed consent to participate.

Authors' contributions:

Anna Panzeri: Conceptualization, Methodology, Formal analysis, Data Curation, Writing – Original Draft; Gianluca Santoro: Conceptualization, Methodology, Writing – Original Draft; Mattia Pezzi: Data Curation, Writing – Original Review & Editing; Silvia Macelloni: Writing – Original Review & Editing; Marta Brscic: Writing – Original Review & Editing; Alessandro Schianchi: Writing – Original Review & Editing; Pasquale Caponnetto: Writing – Original Review & Editing; Alessandro Musetti: Conceptualization, Methodology, Investigation, Writing – Original Draft, Supervision.

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Abstract

Background: Veterinary medicine students face distinctive challenges, such as exposure to animal suffering and academic pressures, which can adversely affect their quality of life (QoL), particularly regarding mental health. Although the role of adult attachment in healthcare professionals' QoL is well-documented in research, the potential mediating role of stress in this association has yet to be fully elucidated.

Methods: This cross-sectional study utilized self-report questionnaires to assess 926 Italian veterinary medicine students on adult attachment styles, stress, mental health QoL, lifetime mental-health issues, and demographics.

Results: Descriptive results showed elevated levels of stress and reduced mental health QoL compared to normative samples. Regression analysis revealed various significant predictors of lower mental health QoL, including being a woman, advanced year of study, lifetime mental health issues, stress, and preoccupied and fearful attachment styles. Mediation analysis showed that stress partially mediated the negative association between preoccupied and fearful attachment styles and mental health QoL.

Conclusions: Psychological interventions for veterinary medicine students should address both stress and relationship difficulties, with attention to attachment-related vulnerabilities. These findings underscore the importance of comprehensive mental health support in veterinary education.

Keywords: veterinary medicine student, adult attachment, stress, quality of life, mental health.

Background

Extensive scientific research has highlighted that healthcare professionals involved in both human and animal care are at high risk of developing psychological problems, including reduced quality of life (QoL) and well-being [1–3]. Metanalytic evidence has revealed alarming prevalence estimates of mental health disorders among healthcare workers showing 21.7% post-traumatic stress disorder, 16.1% anxiety disorders, 13.4% major depression disorder, 7.4% acute stress disorder [2]. Recently, growing attention has focused on mental health risks among veterinary medicine professionals and students [3–6]. These groups exhibit high rates of mental health issues, including depression, anxiety, and stress-related disorders [3, 7]. A recent systematic review has found that over 55% of veterinary medicine students experience moderate depressive symptoms, while 52% report moderate anxiety symptoms [4]. Several factors contribute to these poor mental health outcomes. Admission to veterinary programs typically depends on competitive entrance examinations emphasizing academic achievement; however, these assessments may not adequately evaluate personal attributes essential for managing the emotional and practical challenges inherent in the veterinary profession [8]. From the outset, students are required to engage with academically demanding courses, such as anatomy, starting from the first year [9]. Concurrently, they must navigate common stressors associated with university life, such as relocating from home, adapting to unfamiliar environments, coping with academic pressure, and confronting the developmental tasks of emerging adulthood [10–12]. Additionally, experiences of discrimination based on ethnicity or sexual orientation may further intensify students' stress and hinder their adjustment [13, 14].

During advanced stages of training, veterinary medicine students are frequently exposed to emotionally demanding situations including the treatment of animals with a range of clinical conditions and severities (e.g., terminal illness, euthanasia) [4, 15]. Repeated exposure to animals suffering and the distress of owners has been linked to an increased risk of vicarious traumatization [16, 17]. Many students enter veterinary medicine programs with idealized expectations of caring for companion animals; however, their education and future professional roles often involve working with livestock and slaughterhouse settings. This discrepancy between initial aspirations and

professional realities can contribute to emotional distress and disillusionment. Perfectionism, commonly observed among practicing veterinarians, is often driven by high clinical demands and responsibilities. Although less extensively studied in veterinary medicine students, this trait likely emerges during training and may exacerbate stress and burnout by fostering unrealistic standards and self-criticism [18]. Additional contributing factors—such as excessive academic workload, financial debt, ambiguous curriculum expectations, social isolation, and chronic sleep deprivation—have all been negatively associated with the QoL among veterinary medicine students [3, 7].

Quality of life in veterinary medicine students and its risk-factors

QoL serves as a key indicator of how various stressors affect individuals' overall functioning and is closely linked to mental health outcomes [19]. Conceptually, QoL is a multifaceted construct encompassing psychological and physical health, social relationships, and environmental factors, thereby reflecting a person's overall well-being [20]. A growing amount of evidence has consistently shown that veterinary medicine students report lower QoL compared to both the general population and students in other academic disciplines. This disparity is often attributed to elevated levels of depression, burnout, emotional exhaustion, and other poor mental health indicators within this population [21–24].

Despite increasing attention to the overall QoL of veterinary medicine students, there remains a notable lack of updated data specifically addressing their QoL related to mental health and stress—particularly within the Italian context. Most Italian studies have focused on post-graduate or licensed veterinary professionals [6, 25, 26], while research involving veterinary medicine students is limited. Among the few existing studies, only a small number have examined mental health QoL or well-being in this population [27–29]. In contrast, countries such as Australia, Austria, Canada, and Switzerland have produced a more substantial body of research on the challenges faced by veterinary medicine students [4, 16, 30–32]. This gap underscore the need for further research among Italian veterinary medicine students. Recognizing and understanding the psychological conditions of veterinary medicine students is a crucial first step toward developing targeted psychological interventions and informing policy decisions. Emphasizing the mental health QoL is particularly important, as stress in

young university students tends to exert more pronounced effects on mental health than on physical well-being [31, 33].

Previous studies have identified several factors that are negatively associated with QoL and mental health among veterinary medicine students. Demographic variables such as older age and being a woman have been associated with poorer mental health outcomes [33, 34] and lower QoL [4]. A history of mental health difficulties is another well-established vulnerability factor that increases susceptibility to future psychological distress [31]. Academic stress—often intensified by the demanding nature of veterinary curricula—has been directly linked to lower QoL and poorer mental health outcomes [4, 29, 32]. Additional stressors, such as balancing part-time employment with academic responsibilities, can further exacerbate difficulties in managing workload [32]. Delays in completing exams or assignments may also contribute to heightened stress and feelings of being overwhelming [35]. Despite these insights, the role of psychological factors that may buffer or exacerbate mental health QoL remains insufficiently understood, highlighting the need for further investigation.

Attachment, stress and quality of life: A psychodynamic perspective

Beyond demographic (e.g., gender, age) and contextual (e.g., academic-related) factors, psychological processes may affect stress and mental health QoL among veterinary medicine students. Attachment theory provides a robust psychodynamic framework for understanding these processes [25]. Examining adult attachment styles in this population is theoretically and practically relevant.

Attachment is an innate motivational system that drives individuals to seeking-proximity behaviors towards caregivers and significant others to experience a sense of safety and protection. Early interactions within childhood attachment relationships shape a child's representations of the self, others, and the relationships between the self and others—also termed "Internal Working Models" [36]. These representations tend to remain stable across the lifespan, contributing to attitudes in close relationships and responses to distressing circumstances in adulthood [37, 38].

Bartholomew and Horowitz [39] identified four adult attachment styles—secure, dismissing, preoccupied, fearful—based on combinations of positive or negative representations of the self and others. Secure attachment, characterized by a positive view of both self and others, involves a sense of

autonomy and confidence in close relationships. Dismissing attachment, characterized by a positive representation of the self and a negative representation of others, involves a highly self-reliant attitude and the tendency to avoid closeness. Preoccupied attachment, characterized by a negative representation of the self and a positive representation of others, is marked by fear of rejection and the need for external validation. Fearful attachment, characterized by a negative representation of both self and others, reflects an increased need of dependence and, concurrently, distrust of others. Furthermore, a negative view of the self involves a high degree of anxiety in close relationships, whereas a negative view of others involves high levels of avoidance in such relationships.

Adult attachment also affects individual responses to stress. Secure attachment is associated with resilience and adaptive stress regulation, whereas insecure attachment increases vulnerability to chronic stress and maladaptive coping [40–42]. Specifically, attachment anxiety is characterized by hyperactivation of the attachment system, which involves heightened emotional reactivity and reassurance-seeking, while attachment avoidance is characterized by deactivation of the attachment system, which includes emotional suppression and interpersonal disengagement [38].

Across diverse populations, both major and minor stressors have been shown to negatively affect QoL [43, 44]. In high-pressure professions such as healthcare professionals, stress can exacerbate the imbalance between effort and reward, resulting in discomfort, reduced job satisfaction, and diminished QoL [45]. Notably, attachment insecurity has been linked to lower QoL, with post-traumatic stress symptoms acting as a mediating factor of this relationship [46, 47]. Evidence from Musetti et al. in 2020 [25] further suggests that veterinary medicine professionals with preoccupied or fearful attachment styles are at greater risk of emotional exhaustion, burnout, and compassion fatigue, reporting lower professional QoL than those with a secure attachment style. These differences likely stem from the emotion regulation strategies associated with each attachment style: while secure individuals tend to engage in flexible coping, effective help-seeking, insecure individuals may rely on strategies related to hyperactivation or deactivation of the attachment system that undermine adaptive stress responses [48].

Among veterinary medicine students, individual differences in attachment-related strategies may affect their mental health QoL. Veterinary medicine students with high attachment anxiety may

experience greater emotional reactivity, whereas those with high attachment avoidance may withdraw from social support, both of which may contribute to ineffective stress management. However, studies investigating the role of adult attachment styles in QoL in veterinary medicine students are still limited, particularly within the Italian context. Understanding how adult attachment styles shape stress responses and affect mental health QoL could be critical for identifying psychological vulnerabilities and informing targeted interventions. Such insights could support the development of strategies aimed at fostering emotional resilience, enhancing academic engagement, and promoting well-being during the formative years of professional identity development in veterinary medicine.

Currently, no studies have directly examined the role of adult attachment styles in veterinary medicine students' stress responses or mental health-related QoL. This gap underscores the importance of gathering empirical evidence to determine whether attachment-informed preventive strategies are appropriate for this population. Understanding how adult attachment styles shape coping strategies and well-being during training could provide critical insights for designing interventions aimed at fostering resilience and reducing psychological vulnerability. Such interventions might include mentoring programs, emotion regulation training, and peer support initiatives tailored to attachment-related needs.

The Present Study

Given the increasing awareness of mental health challenges among veterinary medicine students, it is crucial to investigate these issues within the Italian context, where empirical data remain limited. While international literature has documented the mental health challenges faced by veterinary medicine students [4, 5, 15], updated insights into the mental health QoL and stress levels of Italian veterinary medicine students are notably absent. Furthermore, the concurrent role of adult attachment styles, stress, and other relevant variables, including age, gender, prior mental health history, year of enrollment, academic delays (e.g., postponed exams), and employment status, on the mental health QoL remains underexplored. Based on existing literature, it is expected that Italian veterinary medicine students will report elevated stress levels and reduced mental health QoL. Building on prior findings by Musetti et al. in 2020 [25], the present study aims to address these gaps through a two-fold aim. First, the current study aims (A1) to provide an updated description of the psychological

conditions of Italian veterinary medicine students in terms of stress and mental health QoL, also comparing their stress and mental health QoL levels with those from normative samples. In addition, the study aims (A2) to examine the psychodynamic underpinnings of mental health QoL by testing a mediation model in which adult attachment styles have predicting effects on mental health QoL through the mediating role of stress. The following hypotheses are proposed:

B1) secure adult attachment will be positively associated with mental health QoL, whereas insecure attachment styles will be negatively associated with mental health QoL;

B2) stress will be negatively associated with mental health QoL;

B3) the association between adult attachment styles and mental health QoL will be mediated by stress.

2. Methods

2.1 Study design

This study employed a cross-sectional design. Given the limited empirical evidence on veterinary medicine students in the Italian context, a cross-sectional approach was appropriate for establishing baseline prevalence estimates and examining associations between variables of interest.

A pragmatic recruitment strategy was implemented to maximize participation across different academic years and institutions in Italy, considering that the population of Italian veterinary medicine students is finite and relatively small, and effect size estimates for the relationships of interest in this population were lacking. Our goal was to obtain the most comprehensive snapshot possible of this understudied population. Participants were recruited online through social media advertisements posted by the International Veterinary Students' Association of Italy. The survey was administered online via Qualtrics in an anonymous format. Participants were informed that their involvement was entirely voluntary and that all responses would remain anonymous. The online survey included an informed consent form, a sociodemographic sheet, and self-report measures. Only individuals who consented to participate in the study completed the sociodemographic sheet and self-report measures. Every participant provided their informed consent to participate. It took about 15 minutes to complete

the survey, with no time constraints. No identifying information, including Internet Protocol addresses, was collected.

This study received ethical approval from the Research Ethics Board of the University of Parma (Prot. 0184302). Moreover, the study was designed and conducted in accordance with the Ethical Code of the Italian Association of Psychology, the European Code of Conduct for Research Integrity, and the guidelines of the American Psychological Association.

2.2 Inclusion and exclusion criteria

Participants were eligible for inclusion if they met the following criteria: (1) enrollment in a veterinary medicine program in Italy, specifically a five-year single-cycle Master's degree course; (2) age 18 years older. Exclusion criteria included failure to complete the survey.

2.3 Measures

Sociodemographic Data

The sociodemographic sheet gathered information on age, gender, education, civil status, work status, mental health history, year of enrollment in the veterinary degree and exam progress.

Adult Attachment

The *Relationship Questionnaire* (RQ) [39, 49] is a self-report instrument designed to assess adult attachment styles. The RQ consists of four first-person statements that refer to secure, dismissing, preoccupied and fearful attachment styles, respectively. Participants rate their level of agreement with each statement on a 7-point Likert scale ranging from "strongly disagree" (= 1) to "strongly agree" (= 7). An example of an item is: "*I am uncomfortable getting close to others. I want emotionally close relationships, but I find it difficult to trust others completely, or to depend on them. I worry that I will be hurt if I allow myself to become too close to others*" (referred to preoccupied attachment style). The RQ showed good psychometric properties, as well as test-retest reliability [50] and discriminant validity [51]. Its Italian adaptation has been largely employed in previous research [25, 47, 52].

Stress

Stress was assessed using the *Depression Anxiety Stress Scales-21* (DASS-21) [53, 54]. This self-report instrument assesses symptoms of depression, anxiety, and stress. It includes 21 items rated on a 4-point Likert scale (0 = "It has never happened to me," 3 = "It has happened to me almost always"). The DASS-21 includes a total scale and three subscales that respectively assess depression, anxiety and stress. The score on each subscale is obtained by summing 7 items ranging from 0 to 3, thus its total score ranges from 0 to 21. In the present study, only the stress subscale was employed. An example item from this subscale is: "*I felt that I was using a lot of nervous energy.*" The normative sample in the Italian validation study reported a mean score of 6.4 with a SD of 3.8 on the stress subscale of the DASS-21 [53]. It is noteworthy that the DASS-21 is a screening tool, not a diagnostic instrument; elevated scores indicate symptom severity warranting further assessment. The Italian version has demonstrated excellent internal consistency, both in a general population sample and in a clinical group, with good two-week test-retest reliability [53]. In this study, the stress scale of DASS-21 reported good internal consistency (McDonald's omega = .91; Cronbach's alpha = .88).

Mental Health Quality of Life

Mental health QoL was measured with the *Short Form-12 Health Survey* (SF-12) [55], that derives from the Short-Form 36 Health Survey [56]. The SF-12 is a self-report instrument that assesses health-related QoL through 12 items. Response options vary across items, ranging from dichotomous options (e.g., "yes" or "no") to Likert scales ranked on 3 to 6 response categories. The SF-12 consists of two scales, namely physical (PCS) and mental health (MCS) summary components. Both scales consist of 6 items. For this study, we only used the MCS. An example item from this scale is: "*How much of the time during the past 4 weeks have you felt calm and peaceful?.*" Higher MCS scores indicate better perceived mental health QoL. Vilagut et al. [56] proposed cutoff values (45.6 for the past 30 days; 48.9 for the past 12 months) as screening indicators for potential risk of depressive disorders, not diagnostic thresholds. Scores below these cutoffs suggest the need for further clinical evaluation but do not confirm a diagnosable condition. In a recent Italian study involving medical students, Carpi et al. [60] reported a mean MCS score of 42.43 (SD = 10.79). In the present study, the MCS showed strong internal consistency, with McDonald's omega = .88 and Cronbach's alpha = .85.

2.4 Statistical analysis

All statistical analyses were conducted with R software [57] and the R Studio [58] environment, with the packages *psych* [59] and *lavaan* [60]. Descriptive statistics were used to outline sample characteristics and psychological variables levels, which were then compared to normative data for the Italian population. Pearson's correlations coefficients were calculated to examine associations between variables.

To test our hypotheses, two complementary sets of analyses were conducted. First, a multiple linear regression was performed to comprehensively investigate whether sociodemographic characteristics, attachment styles and stress were significant predictors of mental health QoLAssumptions of linear regression were tested and met. Subsequently, a mediation analysis was performed to test the theoretically driven hypothesized relationships among constructs–specifically, whether the associations between adult attachment styles and mental health QoL were mediated by stress. The mediation model included age, gender, year of enrollment, employment status (i.e., being a working student or not), academic delay (i.e., being late with exams or not), and history of mental health issues as covariates. The significance of indirect effects in the mediation model was assessed using percentile bootstrapping with 5,000 resamples. Post-hoc power analyses indicate that the sample size (N = 926) was sufficient to reliably detect the effects reported in this study (see details in Supplementary Materials) [61, 62]. An alpha level of 0.05 was adopted, with statistical significance determined by whether the 95% confidence interval for the indirect effect exclude zero.

3. Results

3.1 Descriptives statistics of the socio-demographic characteristics of the sample

The sample comprised 926 veterinary medicine students (mean age 23.14 with *SD* = 2.37) of whom 82.18% identified as women. Most participants were either single (72.6%) or in a relationship (27.2%), and nearly all were childless (99.7%). Only 10.3% reported being employed alongside their studies. Geographically, 57.5% were living in northern Italy, 21% in central Italy, and the remainder in southern regions. A majority (86.8%) were on schedule with their exams. Additionally, 30.6% reported a history of mental health difficulties during their lifetime. Complete descriptive statistics are presented in Table 1, with further details available in the Supplementary Material.

Table 1. Descriptive statistics of the sample

	Women (*n* = 761)	Men (*n* = 165)	Total (*N* = 926)
Age, mean (SD)	23.125 (2.376)	23.224 (2.333)	23.143 (2.368)
Civil status, n (%)			
Married / cohabiting	212 (27.9%)	40 (24.2%)	252 (27.2%)
Separated	1 (0.1%)	0 (0.0%)	1 (0.1%)
Single	547 (71.9%)	125 (75.8%)	672 (72.6%)
Widow	1 (0.1%)	0 (0.0%)	1 (0.1%)
Working student	76 (10.0%)	19 (11.5%)	95 (10.3%)
Year of enrollment, n (%)			
First	104 (13.7%)	17 (10.3%)	121 (13.1%)
Second	144 (18.9%)	26 (15.8%)	170 (18.4%)
Third	164 (21.6%)	32 (19.4%)	196 (21.2%)
Fourth	170 (22.3%)	43 (26.1%)	213 (23.0%)
Fifth	179 (23.5%)	47 (28.5%)	226 (24.4%)
Delayed with exams, n (%)	95 (12.5%)	27 (16.4%)	122 (13.2%)
Mental health issues lifetime, n (%)	254 (33.4%)	29 (17.6%)	283 (30.6%)
MCS, mean (SD)	30.42 (9.05)	34.87 (9.94)	31.21 (9.37)
DASS-21 stress, mean (SD)	12.11 (4.64)	10.22 (4.66)	11.77 (4.70)
RQ secure, mean (SD)	2.93 (1.85)	3.64 (1.83)	3.06 (1.87)
RQ dismissing, mean (SD)	3.78 (1.92)	3.57 (1.93)	3.74 (1.92)
RQ preoccupied, mean (SD)	3.67 (2.03)	3.45 (2.03)	3.63 (2.03)
RQ fearful, mean (SD)	4.29 (1.94)	3.82 (2.03)	4.20 (1.96)

Note: Working student = "no" was coded as 0, and "yes" was coded as 1; Delayed with exams = "no" was coded as 0, and "yes" was coded as 1; Mental health issues = "no" was coded as 0, and "yes" was coded as 1; MCS = *Mental Component Summary*; DASS-21 = *Depression Anxiety Stress Scale*-21; RQ = *Relationship Questionnaire*.

Moreover, prior to conducting regression and mediation analyses, the distributions, skewness and kurtosis of dependent variables were examined (Supplementary Materials): scores on stress and mental health QoL scales demonstrated acceptable normality, with skewness values ranging from -0.16 to 0.65 (< |2|) and kurtosis values ranging from -0.55 to -0.04 (< |2|), supporting the appropriateness of subsequent analyses.

3.2 Descriptive statistics of the clinical variables

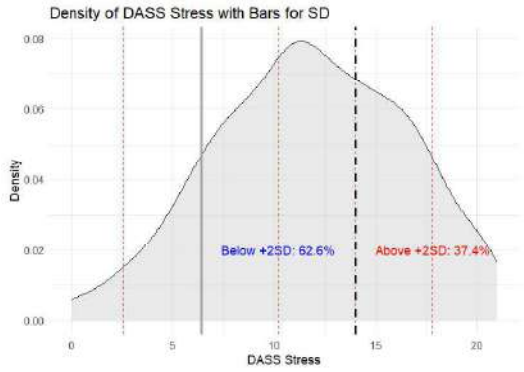
The clinical variables–stress and mental health QoL–were described using established clinical cutoffs and compared with normative data from previous studies.

3.2.1 Stress scale of the DASS-21

Results from the present study were compared to normative data from the Italian validation study of the DASS-21 (M = 6.4, SD = 3.8) [53]. As illustrated in Figure 1, the distribution of stress scores in the current sample revealed that over 37% of veterinary medicine students reported scores

equal or exceeding two standard deviations above the normative mean, suggesting elevated stress symptoms that may warrant further attention, though not necessarily indicating psychopathology. Accordingly, a substantial proportion of veterinary medicine students experienced high levels of stress.

Figure 1. Density distribution of stress scores

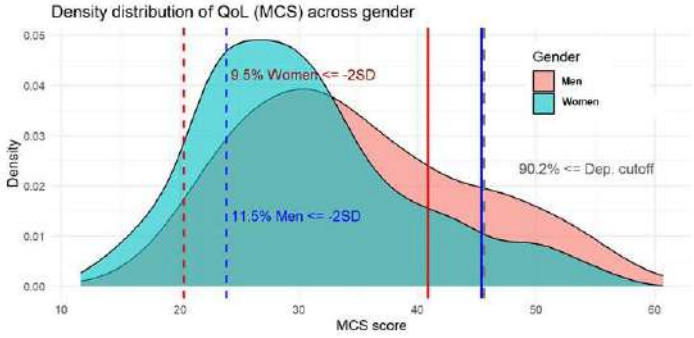


Note: The continuous gray line represents the mean of the normative sample on the stress scale of the DASS-21 (6.4). The black dashed line represents +2 *SD* from the mean of the normative sample (6.4 + 3.8 × 2 = 14). The red dashed lines represent intervals at 1 *SD*.

3.2.2 Mental Component Summary (MCS)

In this study, MCS scores were higher in men (M = 45.39, SD = 10.76) compared to women (M = 40.87, SD = 10.28), with the difference being statistically significant (t = 5.292, df = 226.64, p < 0.001) and reflecting a moderate effect size (Cohen's d = |0.48|). Figure 2 presents the density distribution of MCS scored by gender, with women represented in salmon and men in light blue. In our sample 11.5% of men and 9.5% of women scored below two standard deviations (dashed lines) from the mean MCS values (solid lines) reported by Carpi et al.'s study [63] on Italian medical students. Furthermore, 90.2% of the total sample scored below the 30-day cutoff for depressive disorders (grey dashed line at y = 45.6) as proposed by Vilagut et al. [64]. It is important to emphasize that scores below this threshold indicate potential risk rather than confirmed diagnosis and serve to identify individuals who may benefit from further clinical assessment.

Figure 2. Scores of the Mental Component of Quality of Life measured with SF-12



Note: Solid lines represent the mean MCS values, dashed lines represent -2 *SD* from the mean.

3.3 Correlations

Pearson's correlations were used to assess associations between psychological variables and mental health QoL. As shown in Table 2, the strongest negative correlation was observed between stress and mental health QoL (r = -0.66, p < 0.001). Importantly, none of the correlations exceeded the threshold for multicollinearity, suggesting that the variables retained sufficient independence for inclusion in subsequent multivariate analyses.

Table 2. Correlations between psychological variables

	1.	2.	3.	4.	5.
1. MCS	-				
2. DASS-21 Stress	-0.66***	-			
3. RQ secure	0.17***	-0.14***	-		
4. RQ fearful	-0.23***	0.22***	-0.43***	-	
5. RQ preoccupied	-0.21***	0.19***	-0.17***	0.15***	-
6. RQ dismissing	0.07*	-0.05	-0.16***	-0.02	-0.25***

Note: MCS = *Mental Component Summary*; DASS-21 = *Depression Anxiety Stress Scale-21; RQ = Relationship Questionnaire*; * p < 0.05; ** p < 0.01; *** p < 0.001.

3.4 Multiple Linear Regression

A multiple linear regression analysis was conducted using the *lavaan* package in R, employing the maximum likelihood estimator and 5,000 bootstrap resamples to ensure robust estimation of standard errors and confidence intervals. Results are presented in Table 3.

Table 3. Results of the regression model

MCS ~	estimate	SE	*z*	CI lower	CI upper	*p*
intercept	46.20	2.66	17.37	41.01	51.37	<0.001
Age	0.10	0.12	0.81	-0.14	0.34	0.420
Gender	-1.90	0.61	3.13	-3.13	-0.73	0.002
Year of enrollment	-0.72	0.22	-3.29	-1.15	-0.28	0.001
Mental health issues	-1.22	0.48	-2.56	-2.17	-0.28	0.010
Delayed with exams	-1.14	0.72	-1.58	-2.50	0.32	0.114
Working student	0.52	0.74	0.71	-0.91	2.00	0.479
DASS-21 Stress	-1.17	0.05	-21.81	-1.27	-1.06	<0.001
RQ secure	0.26	0.14	1.85	-0.01	0.53	0.064
RQ dismissing	0.10	0.13	0.81	-0.14	0.35	0.421
RQ preoccupied	-0.33	0.13	-2.63	-0.58	-0.09	0.009
RQ fearful	-0.25	0.13	-1.99	-0.50	0.001	0.047

Note: Gender = "man" was coded as 0, and "woman" was coded as 1; Delayed with exams = "no" was coded as 0, and "yes" was coded as 1; Mental health issues = "no" was coded as 0, and "yes" was coded as 1; Working student = "no" was coded as 0, and "yes" was coded as 1; MCS = *Mental Component Summary;* DASS-21 = *Depression Anxiety Stress Scale-21;* RQ = *Relationship Questionnaire*.

Comment [g1]: Anche qui dovremmo modificarlo, se lo modifichiamo nel testo.

Gli asterischi per indicare i valori di p, invec non sono necessari (dato che riportiamo il valore per intero).

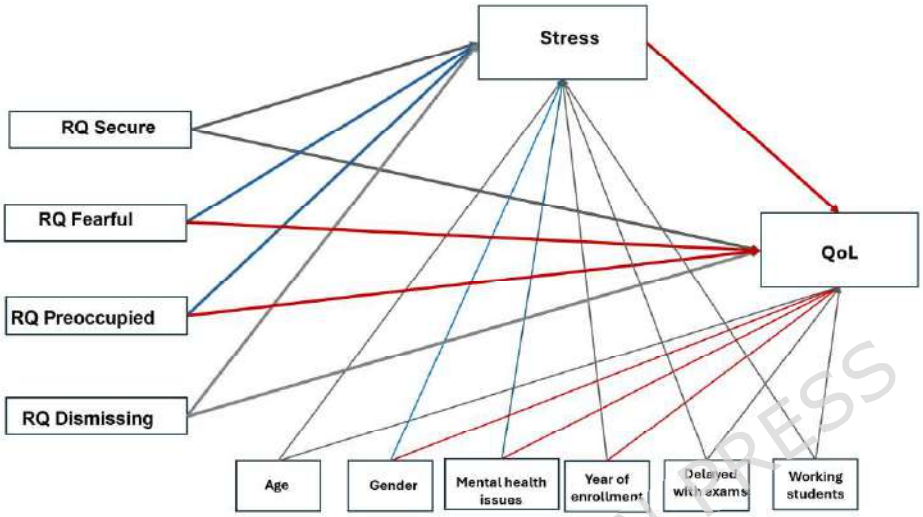
The regression model accounted for approximately 47.1% of the variance of mental health QoL, as indicated by the R^2 value. Being a woman (est = -1.90, SE = 0.61, p = 0.002), year of enrollment in the veterinary program (est = -0.72, SE= 0.22, p = 0.001), a history of lifetime mental health issues (est = -1.22, SE= 0.48, p = 0.010), stress (est = -1.17, SE= 0.05, $p < 0.001$), stress (est = -1.17, se = 0.05, $p < 0.001$), and preoccupied (est = -0.33, SE= 0.13, p = 0.009) and fearful attachment styles (est = -0.25, SE= 0.13, p = 0.047) emerged as negative predictors of mental health QoL.

3.5 Mediation model

A mediation analysis was computed to test whether the relationships between adult attachment styles and mental health QoL were mediated by stress. The tested model included various covariates such as age, gender, year of enrollment in the university program, history of lifetime mental health issues, exam delay status, and employment status as a working student. The model was estimated using *lavaan* package in R, applying the maximum likelihood estimator and with 5,000

bootstrap resamples to ensure robust inference. A graphical representation of the model is provided in Figure 3. Parameter estimates are reported in Table 4 and commented in the Supplementary Materials.

Figure 3. Graph of the mediation model



Note: Blue lines represent positive associations, red lines represent negative associations, and grey lines represent non-statistically significant associations. Gender = "man" was coded as 0, and "woman" was coded as 1; Mental health issues = "no" was coded as 0, and "yes" was coded as 1; Delayed with exams = "no" was coded as 0, and "yes" was coded as 1; Working student = "no" was coded as 0, and "yes" was coded as 1; RQ = *Relationship Questionnaire*; QoL = mental health Quality of Life.

Overall, the model explained 13% of the variance in stress and 46% of the variance in mental health QoL. In light of the aims of the current study, results showed that preoccupied and fearful attachment styles had significant negative effects on mental health QoL, both directly and indirectly through stress. Dismissing and secure attachment styles did not exhibit significant direct, indirect, or total effects. Among the covariates, gender, and lifetime mental health issues had a statistically significant effect on both stress and mental health QoL. Additionally, year of enrolment had a statistically significant effect on mental health QoL.

Table 4. Results of the mediation model

DASS- 21 Stress ~		estimate	SE	CI lower	CI upper	Std	*p*
RQ Secure	(a4)	-0.07	0.09	-0.25	0.11	-0.03	0.424
RQ Dismissing	(a1)	0.01	0.08	-0.16	0.17	0.00	0.952
RQ Preoccupied	(a2)	0.35	0.08	0.20	0.50	0.15	<0.001
RQ Fearful	(a3)	0.35	0.09	0.18	0.52	0.15	<0.001
Age	(dm1)	0.16	0.09	-0.02	0.33	0.08	0.082
Gender	(dm2)	1.33	0.38	0.59	2.07	0.11	<0.001
Year of enrollment	(dm3)	0.03	0.15	-0.26	0.32	0.01	0.861
Mental health issues	(dm4)	1.90	0.33	1.24	2.52	0.19	<0.001
Delayed with exams	(dm5)	0.69	0.47	-0.24	1.61	0.05	0.144
Working student	(dm6)	-0.70	0.50	-1.70	0.29	-0.05	0.161
MSC ~		**estimate**	**SE**	**CI lower**	**CI upper**	**Std**	***p***
Stress	(b)	-1.17	0.05	-1.27	-1.06	-0.59	<0.001
RQ Secure	(c4)	0.26	0.14	-0.02	0.53	0.05	0.064
RQ Dismissing	(c1)	0.10	0.13	-0.14	0.35	0.02	0.423
RQ Preoccupied	(c2)	-0.33	0.12	-0.57	-0.09	-0.07	0.007
RQ Fearful	(c3)	-0.25	0.13	-0.50	-0.01	-0.05	0.045
Age	(dd1)	0.10	0.12	-0.14	0.35	-0.03	0.423
Gender	(dd2)	-1.90	0.62	-3.09	-0.67	-0.08	0.002
Year of enrollment	(dd3)	-0.72	0.22	-1.16	-0.28	-0.11	<0.001
Mental health issues	(dd4)	-1.23	0.48	-2.15	-0.26	-0.06	0.01
Delayed with exams	(dd5)	-1.14	0.73	-2.55	0.30	-0.04	0.121
Working student	(dd6)	0.52	0.72	-0.87	1.95	0.02	0.469
Indirect effects		**estimate**	**SE**	**CI lower**	**CI upper**	**Std**	***p***
ind1: dismiss. → stress → QoL	(a1*b)	-0.01	0.10	-0.19	0.19	0.00	0.952
ind2: preocc. → stress → QoL	(a2*b)	-0.41	0.09	-0.59	-0.23	-0.09	<0.001
ind3: fearful → stress →QoL	(a3*b)	-0.41	0.10	-0.61	-0.21	-0.09	<0.001
ind4 secure → stress → QoL	(a4*b)	0.09	0.11	-0.12	0.30	0.02	0.427
Total effects (indirect + direct)		**estimate**	**SE**	**CI lower**	**CI upper**	**Std**	***p***
total1 (ind1 + c1)		-0.01	0.10	-0.19	0.19	0.00	0.952
total2 (ind2 + c2)		-0.73	0.15	-1.03	-0.45	-0.16	<0.001
total3 (ind3 + c3)		-0.66	0.17	-1.00	-0.34	-0.14	<0.001
total4 (ind4 + c4)		0.34	0.18	-0.01	0.70	0.07	0.059
Covariances		**estimate**	**SE**	**CI lower**	**CI upper**	**Std**	***p***
RQ Dismiss. ~~ RQ Preocc.		-0.98	0.13	-1.24	-0.73	-0.25	<0.001
RQ Dismiss. ~~ RQ Fearful		-0.08	0.13	-0.32	0.17	-0.02	0.52
RQ Dismiss. ~~ RQ Secure		-0.57	0.12	-0.81	-0.33	-0.16	<0.001
RQ Preocc. ~~ RQ Fearful		0.58	0.13	0.33	0.83	0.15	<0.001
RQ Preocc. ~~ RQ Secure		-0.63	0.12	-0.87	-0.39	-0.17	<0.001
RQ Fearful ~~ RQ Secure		-1.56	0.12	-1.79	-1.33	-0.43	<0.001

Note: Gender = "man" was coded as 0, and "woman" was coded as 1; Mental health issues = "no" was coded as 0, and "yes" was coded as 1; Delayed with exams = "no" was coded as 0, and "yes" was coded as 1; Working student = "no" was coded as 0, and "yes" was coded as 1; DASS-21 = *Depression Anxiety Stress Scale-21;* MCS = *Mental Component Summary*; RQ = *Relationship Questionnaire*; QoL = mental health Quality of Life.

4. Discussion

While recent literature has predominantly focused on healthcare professionals working with humans— such as physicians, nurses, and psychologists—growing evidence indicates that veterinarians are also at high risk for psychological and mental health challenges [3, 23, 65]. The present research had a twofold aim. First, aimed to provide an updated description of stress levels and mental health QoL related to mental health among Italian veterinary medicine students. Second, grounded in attachment theory, the study sought to explore the role of adult attachment in mental health QoL. Specifically, it examined whether the relationships between adult attachment styles and mental health QoL were mediated by stress, while accounting for relevant covariates.

The present study offers valuable insights into the mental health of veterinary medicine students—a population increasingly recognized as at risk for distress [3, 23, 65]. In this sample, a substantial portion of veterinary medicine students (37.4%) reported elevated scores on the stress subscale of the DASS-21[53]. Additionally, scores on the MCS of the SF-12, which measures mental health QoL, were notable low, with 11.5% of men and 9.5% of women in this study falling more than two standard deviations below the mean of a sample of Italian medical students [63] . Notably, a vast majority (90.2%) reported scores on the MCS of SF-12 below the cutoff of 45.6 for depressive disorders over a 30-day period [64]. It is crucial to emphasize that the DASS-21 and SF-12 are screening instruments rather than diagnostic tools. While these findings indicate that a substantial proportion of veterinary medicine students reported elevated stress symptoms and reduced mental health QoL–with scores suggesting potential risk–these results should not be interpreted as prevalence estimates of clinical disorders. Rather, they highlight the need for comprehensive mental health assessment and support services. These findings must be interpreted with caution due to the non-representative nature of the sample, which limits generalizability to the broader population of veterinary medicine students. Nonetheless, results suggest that many veterinary medicine students may experience significant psychological difficulties, raising concerns not only for their personal well-being but also for their academic and professional trajectories. Elevated stress levels have been associated with increased fatigue, reduced accuracy, and a heightened risk of academic dropout and

eventual departure from the veterinary profession [7]. Furthermore, our findings are consistent with previous studies conducted in other European countries that found elevated levels of stress and indicators of poor mental health, such as depressive symptoms [4, 16, 30–32].

A multiple regression analysis showed that lower mental health QoL among veterinary medicine students was significantly associated with being a woman, a history of mental health difficulties, being in the final years of the veterinary medicine program, heightened stress, and increased levels of preoccupied and fearful attachment styles. The model accounted a satisfactory proportion of variance in mental health QoL ($R^2 = 0.47$), underscoring that multiple factors may contribute to poorer mental health QoL in this population. The significant association with being a woman aligns with research indicating higher reported rates of internalizing symptoms among women [32]. Additionally, the significant association with a history of mental health difficulties is consistent with studies suggesting that a history of mental health difficulties may increase the likelihood of experiencing poorer mental health outcomes among veterinary medicine students [4, 33], as well as in other populations [66, 67]. It is noteworthy that year of enrollment emerged as another sociodemographic variable significantly associated with mental health QoL. Veterinary medicine students in the later stages of their academic training might face increased academic and professional pressures, which could contribute to declining mental QoL. In fact, cumulative academic, clinical, and emotional demands intensify over time, potentially becoming excessively stressful as veterinary medicine students approach graduation. Our results align with prior research indicating that the final stages of veterinary education are marked by heightened stress and psychological strain [23, 68]. The significant association between stress and poorer mental health QoL provides further support to previous studies suggesting that stress may decrease mental health QoL among undergraduate students [69], including those enrolled in veterinary medicine programs [24]. Additionally, the predictive role of preoccupied and fearful attachment styles, which are characterized by a negative view of the self, suggests that feelings of unworthiness and defectiveness in close relationships, along with a tendency to exhibit the hyperactivation of the attachment system, may exacerbate difficulties in interpersonal functioning and emotion regulation, impairing mental health QoL [46, 48, 70].

To further explore the relationships between adult attachment styles and mental health QoL among veterinary medicine students, the potential mediating role of stress in these relationships was tested. A mediation analysis revealed that stress partially mediated the negative association between preoccupied and fearful attachment styles and mental health QoL. Accordingly, veterinary medicine students exhibiting preoccupied and fearful attachment styles may be more likely to experience elevated stress, which in turn contributes to poorer mental health outcomes. In fact, the hyperactivation of the attachment system, which entails the intensification of one's own signal of distress, negative beliefs about one's own capacities and exaggerate proximity-seeking efforts, might fail in allowing individuals with preoccupied and fearful attachment styles in adequately regulating stress levels [48, 71], undermining mental health QoL. These findings underscore the critical role of adult attachment styles in shaping veterinary medicine students' psychological responses to stress and their mental health QoL. Consistent with the work of Musetti et al. [25], who identified similar patterns in a sample of veterinary professionals, this study highlights how insecure attachment styles characterized by a negative view of the self (i.e., preoccupied and fearful) can significantly affect how veterinary medicine students interpret and cope with the emotional demands of their academic and professional environment.

It is noteworthy that correlational analyses showed that secure attachment is significantly associated with both stress and mental health QoL. However, regression and mediation analyses showed non-significant associations between these variables. These findings suggest that, when controlling for other attachment styles, high levels of preoccupied and fearful attachment styles may be particularly relevant in influencing stress levels and mental health QoL among veterinary medicine students exposed to academic pressures. Similarly, although correlation analysis revealed a very mild negative association between dismissing attachment and mental health QoL, regression and mediation analyses showed that dismissing attachment was not related to either stress or mental health QoL. Notably, this adult attachment style is characterized by the avoidance of intimacy and the tendency to resort to deactivation of the attachment system, which might prevent the individual from consciously experiencing intense negative feelings, except under conditions of extreme stress [72, 73]. Otherwise, these findings might be partly explained by the high self-reliance of individuals with a dismissing

attachment style [39], as well as by their potentially reduced emotional awareness and interoceptive sensitivity, which may lead them to underreport their experience of distress in self-report instruments [74, 75].

Regarding covariates, mediation analysis further supported the role of being a woman, being in the later years of the veterinary program, and a history of mental health difficulties as significant predictors of lower mental health QoL. Additionally, being a woman and prior mental health issues were associated with higher stress levels, further highlighting their role as key risk factors in the psychological well-being of veterinary medicine students. In fact, these findings are in line with previous evidence from various countries [3, 21, 30–34, 65, 68].

In both the regression and mediation models, certain covariates—such as age, exam delays, and being a working student—did not show significant associations with mental health QoL. Although these factors are often considered relevant in contributing to mental health outcomes in student populations [22, 29, 33, 63], our findings suggest that other sociodemographic characteristics and certain psychological vulnerabilities may be more relevant in influencing mental health QoL.

Limitations and future research

This study has some limitations that warrant consideration. Exclusive reliance on self-report measures may introduce biases such as social desirability and recall inaccuracies. The cross-sectional design precludes capturing changes in psychological variables over time and establishing the directionality of their associations. Although the relationships among the variables in the mediation model were hypothesized on the basis of attachment theory, the cross-sectional design of the study does not allow us to definitively substantiate potential causal effects. In fact, alternative causal pathways are possible (e.g., lower mental health QoL contributing to increased stress). Future longitudinal studies tracking changes in adult attachment styles, stress levels, and mental health QoL over time are essential to ascertain the directionality and temporal dynamics of these relationships. The use of convenience sampling via online platforms may reduce the representativeness of the sample, thereby limiting the generalizability of the findings to the broader population of veterinary

medicine students. Furthermore, the study sample consisted predominantly of women (82.18%). Although gender was included as a covariate in the mediation analysis, the gender imbalance might have influenced the results. To address these limitations, future studies should consider adopting longitudinal designs that allow for the examination of temporal dynamics and causal relationships. Incorporating multi-method approaches–such as combining self-report instruments with behavioral or physiological measures–would enhance the validity and the robustness of the findings. Moreover, the use of probability sampling techniques and broader recruitment strategies could improve sample diversity and external validity. Finally, future research should explore other potential mediating variables of the relationship between adult attachment styles and mental health QoL, such as maladaptive metacognitive beliefs, emotion dysregulation, and coping strategies.

Strengths

The present study offers several notable strengths that enhance its contribution to the understanding of mental health among veterinary medicine students, particularly within the Italian context. First, the study is innovative in its focus on veterinary medicine students in Italy—a population that have been largely underrepresented in the existing literature. By providing an updated overview of their mental health status, the study fills a critical gap and offers valuable baseline data for future research and intervention planning. Second, the study tested theoretically grounded hypotheses regarding the relationships between adult attachment styles, stress, and mental health QoL. This conceptual framework allows for a more nuanced understanding of the psychological mechanisms affecting veterinary medicine students' mental health QoL, moving beyond symptom-level description to investigate potential underlying relational and emotional factors. Third, the relatively large sample size enhances the statistical reliability of the findings, allowing for more robust conclusions about the population under study. This is particularly important in mental health research, where individual variability can be substantial. Fourth, the use of validated instruments ensures the comparability of the current results with those of other studies in the field. These strengths make the study a relevant addition to veterinary mental health research.

Clinical implications

The present research offers several important recommendations for the development of interventions tailored to the vulnerabilities and difficulties of veterinary medicine students, with particular attention to the role of adult attachment styles in shaping mental health outcomes. The considerable proportion of veterinary medicine students in our sample who exhibit high levels of stress and clinically relevant impairments in mental health QoL suggests that university policies should promote student well-being. Effective prevention and intervention strategies should not only aim to reduce academic and occupational stressors but also to focus on enhancing veterinary medicine students' adaptive coping mechanisms and emotion regulation skills. Encouraging help-seeking behaviors and normalizing psychological distress are also essential components of a supportive academic environment. Reducing stigma and increasing awareness of available mental health services can significantly improve veterinary medicine students' willingness to seek support. Initiatives such as peer support groups, mental health workshops, and campus-wide awareness campaigns have demonstrated effectiveness in fostering a culture of openness and reducing barriers to care [33, 76].

Additionally, the current study suggests that individuals with preoccupied or fearful attachment styles may experience heightened stress in challenging situations, which, in turn, may reduce mental health QoL. These findings imply that attachment-focused psychoeducational programs may be particularly effective in reducing the risk of poor mental health QoL. These programs could aim to enhance individuals' understanding of how negative representations of the self and others, along with related interpersonal difficulties, may contribute to maladaptive responses to stressful situations, while simultaneously promoting the use of adaptive coping and emotion regulation strategies. Also, such programs would not only support veterinary medicine students during their academic training but also prepare them for the emotional demands of veterinary practice.

In summary, these findings underscore the importance of comprehensive, multi-level approaches to supporting veterinary medicine student mental health, with particular attention to individual differences in attachment styles that shape vulnerability to stress and capacity to benefit from support. By implementing attachment-informed screening, mentorship, psychoeducation, and intervention programs, veterinary schools can more effectively support students' resilience, academic

achievement, and long-term professional well-being. Such efforts not only benefit individual students but also contribute to developing a healthier, more emotionally resilient veterinary workforce better equipped to manage the inherent emotional demands of the profession.

Conclusions

In conclusion, the study emphasizes the significant mental health challenges faced by veterinary medicine students, indicating that a considerable proportion experience elevated stress levels and markedly low mental health QoL. While these findings are based on screening instruments rather than diagnostic assessments, they nonetheless highlight significant mental health concerns that deserve attention from educational institutions and mental health professionals. The findings highlight that veterinary medicine students who are women, those in more advanced stages of their academic training, those with a history of mental health difficulties, and those exhibiting preoccupied and fearful attachment styles may be at increased risk for reduced mental health QoL. Importantly, the results showed that preoccupied and fearful attachment styles were associated with poorer QoL both directly and through indirect effects of stress. Although further research is needed to detect the causal relationships between these variables, our findings are consistent with a theoretical model based on attachment theory and provides relevant insights on the potential mechanism entailed in mental health QoL in veterinary medicine students. Specifically, the study advocates comprehensive and target intervention strategies. Preventive and support programs should incorporate attachment-informed approaches that address both stress management and emotion regulation. By focusing on these vulnerability factors and promoting adaptive coping mechanisms, universities and mental health professionals can more effectively support veterinary medicine students' resilience, academic achievement, and mental health.

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