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Research Article

Factors Associated with Stress, Anxiety, and Depression Among Management School Students in Senegal

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Abstract

Mental health among students in Senegal remains an under-explored area, with limited research and prevention efforts. At the African Center for Higher Studies in Management (CESAG), students face high academic demands, highlighting the importance of investigating stress, anxiety, and depression within this population. This study aimed to identify factors associated with anxiety-depressive states, specifically stress, anxiety and depression, among CESAG students. A cross-sectional, observational, descriptive, and analytical study was conducted from July 22 to August 23, 2024. Data were collected through an electronic questionnaire. Stress, anxiety, and depression were assessed using the Perceived Stress Scale (PSS), the Generalized Anxiety Disorder-7 (GAD-7) score, and the Patient Health Questionnaire-9 (PHQ-9) score, respectively. Data analysis was performed using RStudio (version 2024.12.1.563). Informed and voluntary consent of the participants was ensured. A total of 426 students completed the online questionnaire. The mean age was 23.4 years. Stress was observed in 45.6% of students, anxiety in 21.4%, and depression in 35.4%. Risk factors for stress included belonging to the [20-25 years[age group (ORa = 5.68, 95%CI [1.67-19.31]) or the ≥30 years group (ORa = 8.8, 95%CI [1.5-51.64]), poor sleep quality (ORa = 7.05, 95%CI [2.32-21.44]), low financial income (ORa = 11.23, 95%CI [4.34-29.06]), low self-esteem (ORa = 15.13, 95%CI [3.18-72.13]) or moderate self-esteem (ORa = 7.96, 95%CI [2.83-22.4]), a negative emotional state (ORa = 4.7, 95%CI [1.64-13.46]), and the absence of physical activity (ORa = 5.03, 95%CI [1.88-13.49]). Living alone was a protective factor against anxiety among students (ORa = 0.16, 95%CI [0.09-0.29]). Depression was associated with several risk factors: poor sleep quality (ORa = 8.07, 95%CI [2.72-23.88]), low financial income (ORa = 4.38, 95%CI [1.42-13.48]), living alone (ORa = 3.53, 95%CI [1.1-11.34]), poor diet (ORa = 13.03, 95%CI [3.84-44.18]), low self-esteem (ORa = 18.21; 95%CI [2.62-126.41]) or moderate self-esteem (ORa = 9.19, 95%CI [1.66-51.01]), and a negative emotional state (ORa = 5.54, 95%CI [1.64-18.71]). A passive coping style was found to be protective (ORa = 0.25, 95%CI [0.08-0.8]). These findings emphasize the importance of preventive strategies to promote CESAG students' mental health and well-being. Targeted awareness campaigns and psychological support are essential to achieving this goal.

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1. Introduction

Anxiety-depressive states are mental health conditions characterized by persistent emotional distress, cognitive dysfunction, and reduced ability to cope with daily demands. They include stress, anxiety, and depression as core components. Stress refers to the consequence of an organism's inability to adequately respond to mental, emotional, or physical demands. Anxiety is characterized by intense feelings of fear, accompanied by somatic symptoms indicating an overactive autonomic nervous system. Depression manifests as a loss of interest or pleasure, sadness, feelings of guilt or low self-esteem, disrupted sleep or appetite, extreme fatigue, and poor concentration [1]. A mentally healthy student is one who thinks clearly and logically, is able to initiate appropriate social relationships, and is eager to learn with a substantial ambition to implement their future plans [2].

Previous studies have shown that stress negatively affects students' physical and cognitive abilities [3-5]. When associated with anxiety and depression, occupational stress as experienced by students can influence their quality of life and decrease academic performance due to impaired cognitive functioning induced by anxiety, such as memory disturbances, mental blockages, difficulty making decisions, and increased sensitivity to others' evaluations. Similarly, high levels of stress, anxiety, and depression can lead to poor quality of life, substance abuse, and suicide [5].

Globally, the incidence of stress, anxiety, and depression among students is increasingly reported [6-9]. Studies have indicated that over 85% of students report feeling overwhelmed by the growing demands of academic programs. This is further compounded by high levels of precariousness and family separation, as young adults often have to live in large cities to pursue their education. Most students must quickly gain independence, learn to manage their finances, and balance and increased academic workload with social activities. Choices regarding specialized programs, the search for internships, and the management of administrative tasks related to their career choices can also generate significant anxiety. These external pressures can lead to increased anxiety, loneliness, depression, sleep disturbances, and even suicidal thoughts [3, 10].

In Senegal, as in most sub-Saharan African countries, mental health remains a poorly explored field of research and action [11]. Research in this area is described as "rare, fragmented, and ineffective" [12-20]. In the country, mental health is influenced by various mystical-religious interpretations [12]. The promotion and prevention of mental health and well-being among adolescents and young people is not a priority in the existing mental health services. The Department of Mental Health (DSM) of the Ministry of Health and Social Action (MSAS) highlights the gap between the resources available and the objectives to be achieved in order to ensure better mental health for groups identified as most vulnerable [21, 22].

The African Center for Higher Studies in Management, known as CESAG [23], is an international public institution based in Dakar (Senegal), specializing in training, consulting, and research in economics and management sciences. A prestigious and excellent institution under the supervision of the Central Bank of West African States (BCEAO), it trains students from sub-Saharan Africa, who are held to a high level of academic rigor. Generating data on mental health and well-being issues within this population is a significant contribution to the field of research in Senegal and sub-Saharan Africa. This contribution is all the more noteworthy as it concerns a priority target group for mental health and well-being: a young, student population facing real academic and social pressures.

Thus, our research was justified by the importance of exploring stress, anxiety, and depression among CESAG students, with the aim of contributing to the enhancement of knowledge on mental health in demanding academic environments. The findings of this study could provide insights for targeted interventions aimed at improving students' well-being and fostering an educational environment conductive to their personal development within the institution.

2. Materials and Methods

This was a cross-sectional, observational, descriptive, and analytical study conducted from July 22 to August 23, 2024. The study population consisted of all students officially enrolled at CESAG during the 2023-2024 academic year. Inclusion criteria required that participants had access to a digital device for the online self-administration of the data collection tool. Excluded from the study were ten students who were recruited to assist the principal investigator in raising awareness in the classrooms selected for the sample. The sample size was calculated using Schwartz's formula (N=384), adjusted for the cluster effect (N=576), and further increased by 5% to account for non-respondents, resulting in a final target sample size of 605 students.

The sample was selected using a two-stage cluster sampling method. In the first stage, a comprehensive list of 70 classes was established, followed by a simple random selection with cumulative enrollment. The threshold of 605 students was reached upon selecting the 23rd class. In the second stage, all students from the randomly selected classes were included exhaustively.

The variables of interest were assessed using self-administered tools: the Perceived Stress Scale (PSS) for stress [24], the Generalized Anxiety Disorder-7 (GAD-7) score for anxiety [25], and the Patient Health Questionnaire-9 (PHQ-9) score for depression [26]. Explanatory variables related to biological, psychological, and social context determinants were collected in accordance with the study's conceptual framework, based on the biopsychosocial health model (G. Engel, 1977). Figure 1 presents the conceptual framework of the study.

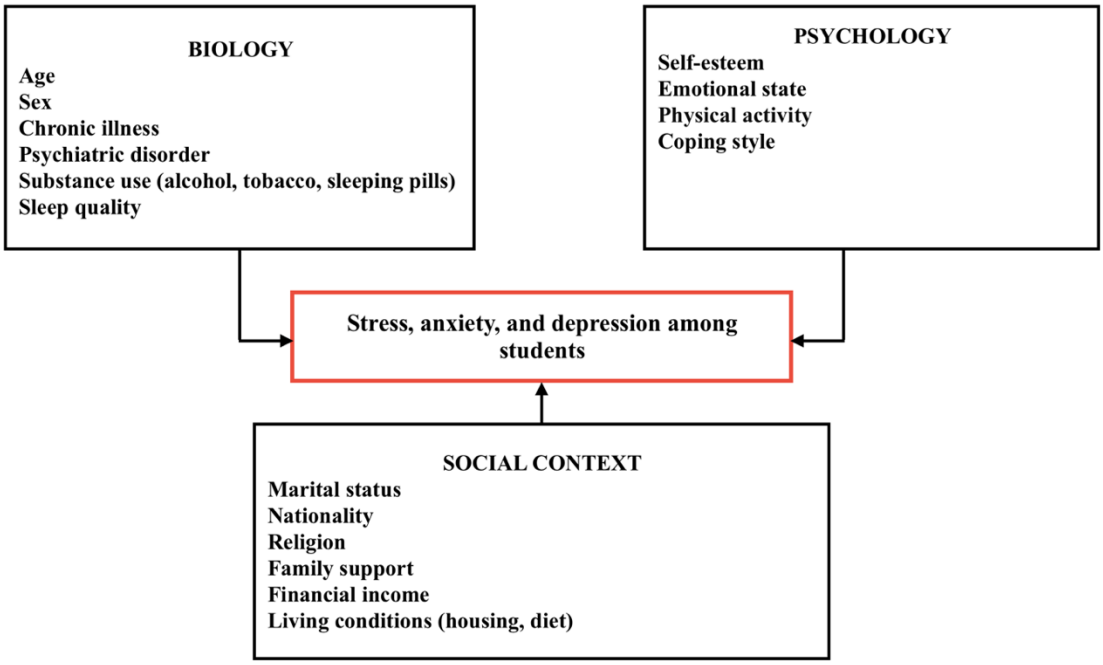

Figure 1. *Conceptual framework of the study, based on G. Engel's biopsychosocial model.*

The PSS assesses the perception of stress in daily life through ten items. The questions measure how frequently life situations were perceived as stressful over the past month. Each item is scored from 0 (*never*) to 4 (*very often*), with a maximum total score of 40 points. The interpretation of the results is as follows: 0-13: *low stress*; 14-26: *moderate stress*; 27-40: *high stress.*

The GAD-7 score assesses the severity of anxiety disorders using seven items. The questions focus on anxiety symptoms experienced over the past two weeks. Each item is scored from 0 (*not at all*) to 3 (*nearly every day*), with a total score ranging from 0 to 21 points. The interpretation of the results is as follows: 0-4: *minimal anxiety*; 5-9: *mild anxiety*; 10-14: *moderate anxiety*; 15-21: *severe anxiety*.

The PHQ-9 score assesses depression using nine items. The questions cover depressive symptoms experienced over the past two weeks. Each item is scored from 0 (*not at all*) to 3 (*nearly every day*), with a total score ranging from 0 to 27 points. The interpretation of the results is as follows: 0-4: *minimal depression*; 5-9: *mild depression*; 10-14: *moderate depression*; 15-19: *moderately severe depression*; 20-27: *severe depression*.

Self-esteem was first measured using a numerical scale ranging from 1 to 10, with 1 representing the lowest level of self-esteem and 10 the highest. It was then categorized into three levels: *low*, *moderate*, and *high*, corresponding to the intervals [0-8], and [8-10], respectively. The thresholds were defined to capture clear distinctions in self-perception. A score below 5 indicated a predominantly negative self-view, while a score of 8 or above denoted a particularly high and confident self-regard, distinguishing it from more moderate levels of self-esteem.

The coping style was assessed through a single-choice question asking participants to select the strategy they most commonly used. The response options were based on the following typologies: problem-focused coping (actively seeking solutions to encountered problems), emotion-focused coping (distancing oneself from the problem, practicing sports or meditation), avoidance coping (ignoring or repressing the problem, using psychoactive substances to forget it), and social support-seeking (asking for help from others).

A questionnaire (annex) based on the conceptual frame-

work, was deployed online via the KoboToolbox platform for data collection. It consisted of 30 items distributed across four chapters as follows:

1) information on the biological dimension: age, sex, medical history, substance use (tobacco, alcohol, sleeping pills), and sleep quality;
2) information on the social context: marital status, nationality, religion, family support, financial income level, and living conditions (housing and diet);
3) information on the psychological dimension: self-esteem, emotional state, physical activity, and coping style;
4) information on the variables of interest: PSS, GAD-7 score, and PHQ-9 score.

A pre-test of the questionnaire was conducted using 17 students from the Higher School of Applied Economics (ESEA), another training institution comparable to CESAG, before validating the final version. The principal investigator provided prior training to the ten recruited students who assisted in raising awareness in the selected classrooms regarding the survey aspects, before conducting the pre-test and data collection. The data collection process was conducted entirely online. The link to the final version of the questionnaire was shared with the sample students via WhatsApp. The team of ten recruited students visited the selected classrooms to announce the upcoming launch of the study and encourage the objective self-administration of the questionnaire. They were volunteers and received no financial compensation.

At the end of the data collection period, the online database was exported and cleaned using Microsoft Excel from the Office 365 suite. Data analysis was performed using RStudio (version 2024.12.1.563) [27]. The statistical analysis involved a descriptive analysis of the biological, social, and psychological dimensions, as the variables of interest, followed by an inferential analysis, first bivariate, then multivariate.

In the descriptive analysis, the results are presented as frequency and percentage for qualitative variables, and as mean and standard deviation (SD) for quantitative variables. When relevant, the medians and extremes of the quantitative variables are also presented.

In the analytical section, the variables of interest were recoded into binary qualitative variable (yes or no). Students classified as having moderate or high stress were considered stressed, while those with low stress were considered not stressed. Students classified as having moderate or severe anxiety were considered anxious, while those with minimal or mild anxiety were considered not anxious. Students classified as having moderate, moderately severe, or severe depression were considered depressed, while those classified as having minimal or mild depression were not depressed.

Similarly, explanatory variables with more than two categories were recoded into binary variables. The categories *yes, occasionally* and *yes, regularly* were combined into a single category *yes*, reflecting any level of exposure or behavior, regardless of frequency. This approach was guided by public health considerations, as even occasional use may have potential health impacts. Sleep quality and diet were recoded into *poor* (very poor and poor) and *good* (average, good, and very good). This categorization aimed to distinguish unfavorable conditions from acceptable or beneficial ones in terms of general well-being. Financial income was recoded into *low* (very low and low) and *good* (average, good, and very good), allowing for the identification of economic disparities while maintaining a balanced distribution of participants across categories. Emotional state was recoded into *negative* (very negative and somewhat negative) and *positive* (neutral, somewhat positive, and very positive), based on the assumption that a neutral emotional state is closer to a positive than a negative disposition. Coping style was recoded into categories *passive* (distancing oneself, ignoring or repressing, using psychoactive substances in response to problems) and *active* (actively seeking a solution, asking for help, and practicing sports or meditation in response to problems). This recoding was based on a widely accepted conceptual distinction in psychology between passive and active coping strategies. Passive strategies involve avoidance or withdrawal behaviors, which are generally less effective in the long term. In contrast, active strategies focus on directly addressing the problem or managing stress in a healthy, constructive manner.

The bivariate analysis involved cross-tabulating the variables stress, anxiety, and depression with all other variables. The p-values were calculated in order to perform a multivariate analysis that included all variables with a p-value less than or equal to 25% from the bivariate analysis.

The multivariate analysis was performed using binary logistic regression. We used the *stepwise backward* method through two different approaches. The first approach involved conducting an *automated stepwise backward* with all variables that had a p-value less than or equal to 25% from the bivariate analysis. The second approach involved an *automated stepwise backward full model* with all collected variables, including those with a p-value greater than 25% from the bivariate analysis. The most parsimonious model from the two approaches was selected.

The parsimony of the models (one model for stress, one for anxiety, and one for depression) was assessed using the *Akaike Information Criterion* (AIC). The residuals were analyzed using graphical methods. Subjects with leverage effects (outliers) were removed to enhance the robustness of the models. Multicollinearity was checked using the *Variance Inflation Factor* (VIF). Interactions between variables in the selected models were examined, tested, and ultimately, the best models were retained by comparing the AICs of the models with interactions and those without. The calibration of the models was tested using the Hosmer-Lemeshow test. Model performance was assessed, including Receiver Operating Characteristic (ROC) curves and Areas Under the Curves (AUC).

The results of the analyses were extracted from RStudio, and data entry and text processing were performed using

Microsoft Word.

A consent form requesting student approval was included at the beginning of the online questionnaire. No medications were administered, nor were biological fluid samples taken, nor were clinical or paraclinical examinations conducted in the study. Participation was voluntary, anonymous, and non-remunerated. However, practical psychological support advice was provided to students who needed it. The collected data were kept and processed in a strictly confidential manner.

3. Results

3.1. Descriptive Results

A total of 426 students completed the online questionnaire. The respondents had a mean age of 23.4 years (SD = 4.60) and a median age of 23.0 years (range = 17-37 years). The most represented age group was [20-25 years[(36.8%), followed equally by those under 20 years and those aged [25-30 years[(25.6% each). The majority of respondents were female (57.3%). A history of chronic diseases was reported by 9.4% of respondents, while no participant reported a history of psychiatric disorders. Occasional alcohol consumption was reported by 67 students (15.7%), whereas 18 students (4.2%) stated that they consumed alcohol regularly. Additionally, 7.3% of students reported occasional smoking. Sleep quality was rated as very poor and poor by 20.2% and 14.3% of students, respectively. Four students (0.9%) reported occasional use of sleeping pills, while five students (1.2%) stated they used them regularly.

The most represented nationality was Senegalese (32.1%). The majority of respondents identified as Muslim (57.5%) or Christian (40.8%). Most participants were single (91.3%). The majority of students received financial support from their families, either occasionally (26.1%) or regularly (72.3%). Financial resources were perceived as very low by 21.1% of respondents and low by 27.9%. Students living alone accounted for 21.6% of the sample, while those living in shared accommodations represented 28.2%. Diet quality was rated as very poor and poor by 18.5% and 13.6% of students, respectively.

Students most frequently reported moderate self-esteem (36.6%) or high self-esteem (36.2%), while 27.2% reported low self-esteem. A very negative emotional state was reported by 27.7% of respondents, whereas 12.4% described their emotional state as somewhat negative. Only 30.3% of respondents engaged in regular physical activity. The predominant coping style was passive (54.9%), including 23.0% who distanced themselves from problems, 18.5% who ignored or repressed them, and 13.4% who used psychoactive substances to cope. The most frequently reported active coping style was actively seeking solutions to problems (23.7%), followed by asking for help from others (11.5%). Table 1 presents the descriptive results of the biological, social, and psychological dimensions.

Table 1. *Descriptive results of biological, social, and psychological dimensions (N=426).*

Variables	Frequency (n)	Percentage (%)
Biological dimension		
Age group		
<20 years	109	25.6
[20-25 years [	157	36.8
[25-30 years [	109	25.6
≥30 years	51	12.0
Sex		
Female	244	57.3
Male	182	42.7
Chronic illness		
No	386	90.6
Yes	40	9.4
Psychiatric disorder: No	426	100.0
Alcohol		
No	341	80.0
Yes, occasionally	67	15.7
Yes, regularly	18	4.2
Tobacco		
No	395	92.7
Yes, occasionally	31	7.3
Sleeping pills		
No	417	97.9
Yes, occasionally	4	0.9
Yes, regularly	5	1.2
Sleep quality		
Very poor	86	20.2
Poor	61	14.3
Average	110	25.8
Good	75	17.6
Very good	94	22.1
Social dimension		
Nationality		
Senegalese	137	32.1
Ivorian	85	20.0

Variables	Frequency (n)	Percentage (%)
Burkinabe	58	13.6
Nigerien	54	12.7
Bissau-Guinean	47	11.0
Others	45	10.6
Religion		
Islam	245	57.5
Christianity	174	40.8
Others	7	1.6
Marital status		
Single	389	91.3
Married	33	7.7
Divorced	4	0.9
Family support		
No	7	1.6
Yes, occasionally	111	26.1
Yes, regularly	308	72.3
Financial income		
Very low	90	21.1
Low	119	27.9
Average	141	33.1
Good	65	15.3
Very good	11	2.6
Housing		
Living alone	92	21.6
Shared accommodation	120	28.2
With family	214	50.2
Diet		
Very poor	79	18.5
Poor	58	13.6
Average	98	23.0
Good	109	25.6
Very good	82	19.2
Psychological dimension		
Self-esteem		
Low	116	27.2
Moderate	156	36.6
High	154	36.2
Emotional state		
Very negative	118	27.7
Somewhat negative	53	12.4
Neutral	80	18.8
Somewhat positive	113	26.5
Very positive	62	14.6
Physical activity		
No	194	45.5
Yes, occasionally	103	24.2
Yes, regularly	129	30.3
Coping style		
Actively seeking to solve the problem	101	23.7
Distancing oneself from the problem	98	23.0
Ignoring or repressing the problem	79	18.5
Using a psychoactive substance to forget	57	13.4
Asking for help from others	49	11.5
Practicing sports or meditation	42	9.9

Age*: mean (SD) = 23.4 (4.60); median [minimum, maximum] = 23.0 [17.0, 37.0]

The mean score on the PSS was 13.8 (SD = 7.74), with a median score of 12 (range = 0-32). Moderate and high stress levels were observed in 39.7% and 5.9% of students, respectively. The mean GAD-7 score was 4.93 (SD = 4.82), with a median score of 3 (range = 0-17). Moderate and severe anxiety were reported by 17.6% and 3.8% of students, respectively. The mean PHQ-9 score was 7.72 (SD = 6.75), with a median score of 6 (range = 0-23). Moderate depression, moderately severe depression, and severe depression were in 15.0%, 12.7%, and 7.7% of students, respectively. Figure 2 illustrates the distribution of students based on the PSS, GAD-7, and PHQ-9 scales.

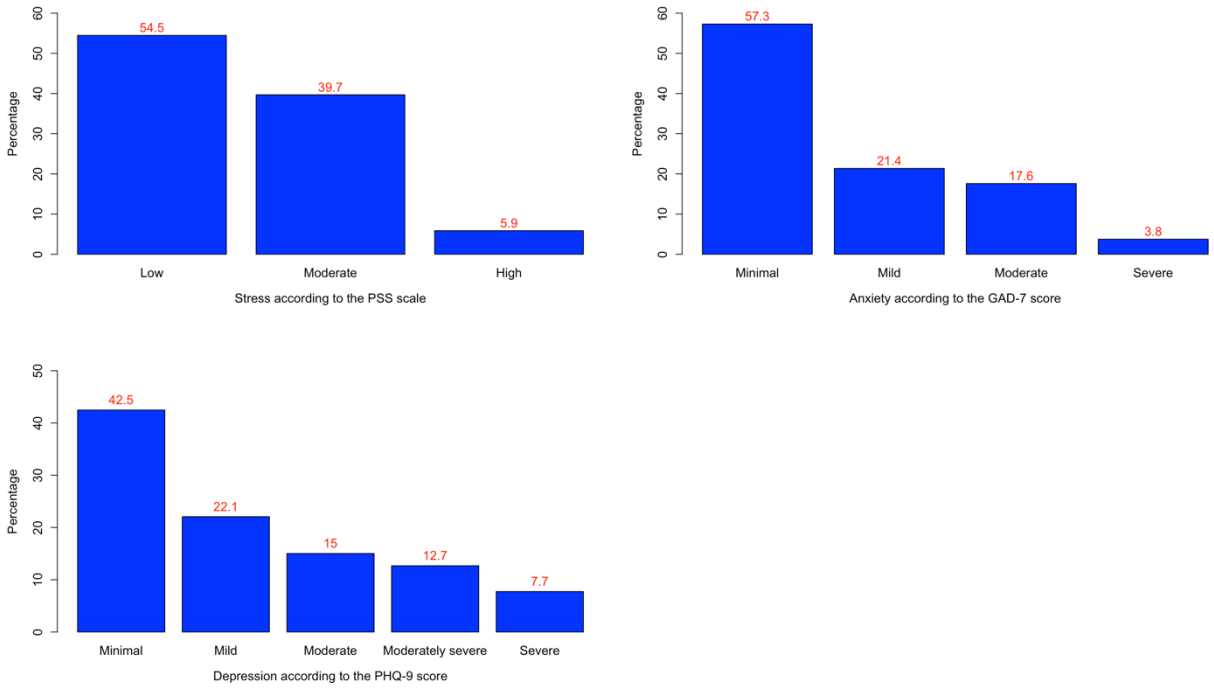

Figure 2. *Distribution of students according to the PSS, GAD-7 score, and PHQ-9 score.*

3.2. Analytical Results

3.2.1. Bivariate Analysis

Stress was significantly associated with male gender (OR = 2.02, 95%CI [1.37-2.99]), a history of chronic illness (OR = 2.39, 95%CI [1.22-4.87]), tobacco use (OR = 3.13, 95%CI [1.44-7.39]), and the use of sleeping pills (OR = 8.81, 95%CI [1.56-223]). Poor sleep quality (OR = 36.8, 95%CI [20.1-73.0]), low financial resources (OR = 25.7, 95%CI [15.5-44.0]), living alone OR = 11.4, 95%CI [6.27-22.4]), and poor diet (OR = 63.2, 95%CI [30.0-157]) were also significantly associated with stress. Additionally, low self-esteem (OR = 228, 95%CI [88.9-674]), and moderate self-esteem (OR = 17.8, 95%CI [8.61-42.0]), a negative emotional state (OR = 52.4, 95%CI [29.0-101]), absence of physical activity (OR = 19.4, 95%CI [12.0-32.2]), and a passive coping style (OR = 4.32, 95%CI [2.87-6.59]) were significantly associated with stress.

Anxiety was significantly associated with a history of chronic illness (OR = 2.45, 95%CI [1.20-4.85]), the use of sleeping pills (OR = 7.57, 95%CI [1.89-38.7]), poor sleep quality (OR = 36.9, 95%CI [18.4-83.1]), and low financial income (OR = 28.6, 95%CI [12.4-84.2]). Living alone (OR = 6.38, 95%CI [3.82-10.8]), poor diet (OR = 243, 95%CI [73.6-1706]), low self-esteem (OR = 303, 95%CI [64.5-7149]) or moderate self-esteem (OR = 8.29, 95%CI [1.50-208]), a negative emotional state (OR = 244, 95%CI [53.8-5700]), absence of physical activity (OR = 59.9, 95%CI [21.8-257]), and a passive coping style (OR = 21.0, 95%CI [9.14-61.7]) were also significantly associated with anxiety.

Depression was significantly associated with male gender (OR = 1.83, 95%CI [1.22-2.74]), a history of chronic illness (OR = 2.43, 95%CI [1.25-4.75]), tobacco use (OR = 3.13, 95%CI [1.48-6.87]), the use of sleeping pills (OR = 6.28, 95%CI [1.45-46.9]), poor sleep quality (OR = 41.2, 95%CI [23.6-75.1]), foreign nationality (OR = 1.76, 95%CI [1.13-2.76]), lack of family support (OR = 10.1, 95%CI [1.65-263]), low financial income (OR = 27.1, 95%CI [15.1-52.1]), living alone (OR = 9.83, 95%CI [5.80-17.2]), poor diet (OR = 79.5, 95%CI [41.7-163]), low self-esteem (OR = 308, 95%CI [101-1473]) or moderate self-esteem (OR = 20.6, 95%CI [7.26-89.5]), negative emotional state (OR = 49.6, 95%CI [27.5-94.4]), absence of physical activity (OR = 20.1, 95%CI [11.9-35.3]), and a passive coping style (OR = 4.62, 95%CI [2.97-7.33]). Table 2 presents the results of the bivariate analysis of stress, anxiety, and depression.

Table 2. *Results of the bivariate analysis of stress, anxiety, and depression among CESAG students.*

Stress				
Variables	**No N=232 n (%)**	**Yes N=194 n (%)**	**OR [95%CI]**	**p-value**
Age group				0.053
<20 years	69 (63.3)	40 (36.7)	Ref.	
[20-25 years [	81 (51.6)	76 (48.4)	1.61 [0.98-2.68]	
[25-30 years [	61 (56.0)	48 (44.0)	1.35 [0.79-2.34]	
≥30 years	21 (41.2)	30 (58.8)	2.44 [1.24-4.90]	
Sex				0.001
Female	151 (61.9)	93 (38.1)	Ref.	
Male	81 (44.5)	101 (55.5)	2.02 [1.37-2.99]	
Chronic illness				0.015
No	218 (56.5)	168 (43.5)	Ref.	
Yes	14 (35.0)	26 (65.0)	2.39 [1.22-4.87]	
Tobacco				0.006
No	223 (56.5)	172 (43.5)	Ref.	
Yes	9 (29.0)	22 (71.0)	3.13 [1.44-7.39]	
Alcohol				0.205
No	180 (52.8)	161 (47.2)	Ref.	
Yes	52 (61.2)	33 (38.8)	0.71 [0.43-1.15]	
Sleeping pills				0.013
No	231 (55.4)	186 (44.6)	Ref.	
Yes	1 (11.1)	8 (88.9)	8.81 [1.56-223]	
Sleep quality				<0.001
Good	219 (78.5)	60 (21.5)	Ref.	
Poor	13 (8.84)	134 (91.2)	36.8 [20.1-73.0]	
Nationality				0.064
Senegalese	84 (61.3)	53 (38.7)	Ref.	
Others	148 (51.2)	141 (48.8)	1.51 [1.00-2.29]	
Financial income				<0.001
Good	189 (87.1)	28 (12.9)	Ref.	
Low	43 (20.6)	166 (79.4)	25.7 [15.5-44.0]	
Housing				<0.001
Shared accommodation or living with family	219 (65.6)	115 (34.4)	Ref.	
Living alone	13 (14.1)	79 (85.9)	11.4 [6.27-22.4]	
Diet				<0.001
Good	225 (77.9)	64 (22.1)	Ref.	
Poor	7 (5.11)	130 (94.9)	63.2 [30.0-157]	
Self-esteem				<0.001

Stress				
Variables	**No N=232 n (%)**	**Yes N=194 n (%)**	**OR [95%CI]**	**p-value**
High	146 (94.8)	8 (5.19)	Ref.	
Low	8 (6.90)	108 (93.1)	228 [88.9-674]	
Moderate	78 (50.0)	78 (50.0)	17.8 [8.61-42.0]	
Emotional state				<0.001
Positive	216 (84.7)	39 (15.3)	Ref.	
Negative	16 (9.36)	155 (90.6)	52.4 [29.0-101]	
Physical activity				<0.001
Yes	193 (83.2)	39 (16.8)	Ref.	
No	39 (20.1)	155 (79.9)	19.4 [12.0-32.2]	
Coping style				<0.001
Active	141 (73.4)	51 (26.6)	Ref.	
Passive	91 (38.9)	143 (61.1)	4.32 [2.87-6.59]	
Anxiety				
Variables	No N=335 n (%)	Yes N=91 n (%)	OR [95%IC]	p-value
Age group				0.180
<20 years	88 (80.7)	21 (19.3)	Ref.	
[20-25 years [	129 (82.2)	28 (17.8)	0.91 [0.49-1.72]	
[25-30 years [	83 (76.1)	26 (23.9)	1.31 [0.68-2.53]	
≥30 years	35 (68.6)	16 (31.4)	1.91 [0.88-4.10]	
Sex				0.114
Female	199 (81.6)	45 (18.4)	Ref.	
Male	136 (74.7)	46 (25.3)	1.49 [0.94-2.39]	
Chronic illness				0.016
No	310 (80.3)	76 (19.7)	Ref.	
Yes	25 (62.5)	15 (37.5)	2.45 [1.20-4.85]	
Tobacco				0.393
No	313 (79.2)	82 (20.8)	Ref.	
Yes	22 (71.0)	9 (29.0)	1.57 [0.66-3.47]	
Alcohol				0.094
No	262 (76.8)	79 (23.2)	Ref.	
Yes	73 (85.9)	12 (14.1)	0.55 [0.27-1.04]	
Sleeping pills				0.004
No	332 (79.6)	85 (20.4)	Ref.	
Yes	3 (33.3)	6 (66.7)	7.57 [1.89-38.7]	
Sleep quality				<0.001
Good	270 (96.8)	9 (3.23%)	Ref.	
Poor	65 (44.2)	82 (55.8)	36.9 [18.4-83.1]	

Stress				
Variables	**No N=232 n (%)**	**Yes N=194 n (%)**	**OR [95%CI]**	**p-value**
Nationality				0.341
Senegalese	112 (81.8)	25 (18.2)	Ref.	
Others	223 (77.2)	66 (22.8)	1.32 [0.80-2.24]	
Religion				0.026
Islam	200 (81.6)	45 (18.4)	Ref.	
Christianity	132 (75.9)	42 (24.1)	1.41 [0.88-2.28]	
Others	3 (42.9)	4 (57.1)	5.80 [1.17-32.4]	
Marital status				0.278
Married	23 (69.7)	10 (30.3)	Ref.	
Unmarried	312 (79.4)	81 (20.6)	0.59 [0.28-1.36]	
Financial income				<0.001
Good	212 (97.7)	5 (2.30)	Ref.	
Low	123 (58.9)	86 (41.1)	28.6 [12.4-84.2]	
Housing				<0.001
Shared accommodation or living with family	289 (86.5)	45 (13.5)	Ref.	
Living alone	46 (50.0)	46 (50.0)	6.38 [3.82-10.8]	
Diet				<0.001
Good	287 (99.3)	2 (0.69)	Ref.	
Poor	48 (35.0)	89 (65.0)	243 [73.6-1706]	
Self-esteem				<0.001
High	153 (99.4)	1 (0.65)	Ref.	
Low	35 (30.2)	81 (69.8)	303 [64.5-7149]	
Moderate	147 (94.2)	9 (5.77)	8.29 [1.50-208]	
Emotional state				<0.001
Positive	254 (99.6)	1 (0.39)	Ref.	
Negative	81 (47.4)	90 (52.6)	244 [53.8-5700]	
Physical activity				<0.001
Yes	229 (98.7)	3 (1.29)	Ref.	
No	106 (54.6)	88 (45.4)	59.9 [21.8-257]	
Coping style				<0.001
Active	187 (97.4)	5 (2.60)	Ref.	
Passive	148 (63.2)	86 (36.8)	21.0 [9.14-61.7]	
Depression				
Variables	No N=275 n (%)	Yes N=151 n (%)	OR [95%IC]	p-value
Age group				0.052
<20 years	77 (70.6)	32 (29.4)	Ref.	
[20-25 years [	105 (66.9)	52 (33.1)	1.19 [0.70-2.04]	

Stress				
Variables	**No N=232 n (%)**	**Yes N=194 n (%)**	**OR [95%CI]**	**p-value**
[25-30 years [	68 (62.4)	41 (37.6)	1.45 [0.82-2.57]	
≥30 years	25 (49.0)	26 (51.0)	2.48 [1.25-4.99]	
Sex				0.004
Female	172 (70.5)	72 (29.5)	Ref.	
Male	103 (56.6)	79 (43.4)	1.83 [1.22-2.74]	
Chronic illness				0.011
No	257 (66.6)	129 (33.4)	Ref.	
Yes	18 (45.0)	22 (55.0)	2.43 [1.25-4.75]	
Tobacco				0.003
No	263 (66.6)	132 (33.4)	Ref.	
Yes	12 (38.7)	19 (61.3)	3.13 [1.48-6.87]	
Alcohol				0.154
No	214 (62.8)	127 (37.2)	Ref.	
Yes	61 (71.8)	24 (28.2)	0.67 [0.39-1.11]	
Sleeping pills				0.011
No	273 (65.5)	144 (34.5)	Ref.	
Yes	2 (22.2)	7 (77.8)	6.28 [1.45-46.9]	
Sleep quality				<0.001
Good	250 (89.6)	29 (10.4)	Ref.	
Poor	25 (17.0)	122 (83.0)	41.2 [23.6-75.1]	
Nationality				0.016
Senegalese	100 (73.0)	37 (27.0)	Ref.	
Others	175 (60.6)	114 (39.4)	1.76 [1.13-2.76]	
Religion				0.410
Islam	157 (64.1)	88 (35.9)	Ref.	
Christianity	115 (66.1)	59 (33.9)	0.92 [0.61-1.38]	
Others	3 (42.9)	4 (57.1)	2.34 [0.48-13.0]	
Marital status				0.150
Married	17 (51.5)	16 (48.5)	Ref.	
Unmarried	258 (65.6)	135 (34.4)	0.56 [0.27-1.15]	
Family support				0.009
Yes	274 (65.4)	145 (34.6)	Ref.	
No	1 (14.3)	6 (85.7)	10.1 [1.65-263]	
Financial income				<0.001
Good	203 (93.5)	14 (6.45)	Ref.	
Low	72 (34.4)	137 (65.6)	27.1 [15.1-52.1]	
Housing				<0.001

Stress				
Variables	**No N=232 n (%)**	**Yes N=194 n (%)**	**OR [95%CI]**	**p-value**
Shared accommodation or living with family	253 (75.7)	81 (24.3)	Ref.	
Living alone	22 (23.9)	70 (76.1)	9.83 [5.80-17.2]	
Diet				<0.001
Good	261 (90.3)	28 (9.69)	Ref.	
Poor	14 (10.2)	123 (89.8)	79.5 [41.7-163]	
Self-esteem				<0.001
High	151 (98.1)	3 (1.95)	Ref.	
Low	15 (12.9)	101 (87.1)	308 [101-1473]	
Moderate	109 (69.9)	47 (30.1)	20.6 [7.26-89.5]	
Emotional state				<0.001
Positive	238 (93.3)	17 (6.67)	Ref.	
Negative	37 (21.6)	134 (78.4)	49.6 [27.5-94.4]	
Physical activity				<0.001
Yes	211 (90.9)	21 (9.05)	Ref.	
No	64 (33.0)	130 (67.0)	20.1 [11.9-35.3]	
Coping style				<0.001
Active	158 (82.3)	34 (17.7)	Ref.	
Passive	117 (50.0)	117 (50.0)	4.62 [2.97-7.33]	

3.2.2. Multivariate Analysis

The predictive model for stress had a sensitivity of 91.1% (95%CI [87.1-95.2]) and a specificity of 94.3% (95%CI [91.3-97.3]). Stress was associated with age group: students aged [20-25 years[(ORa = 5.68, 95%CI [1.67-19.31]) and those ≥ 30 years (ORa = 8.8, 95%CI [1.5-51.64]) were more likely to experience stress compared to those under 20 years. Other risk factors for stress included poor sleep quality (ORa = 7.05, 95%CI [2.32-21.44]), low financial income (ORa = 11.23, 95%CI [4.34-29.06]), low self-esteem (ORa = 15.13, 95%CI [3.18-72.13]) or moderate self-esteem (ORa = 7.96, 95%CI [2.83-22.4]), negative emotional state (ORa = 4.7, 95%CI [1.64-13.46]), and absence of physical activity (ORa = 5.03, 95%CI [1.88-13.49]).

The predictive model for anxiety had a sensitivity of 73.0% (95%CI [63.8-82.3]) and a specificity of 4.2% (95%CI [2.1-6.4]). Living alone was identified as a protective factor against anxiety (ORa = 0.16, 95%CI [0.09-0.29]).

The predictive model for depression had a sensitivity of 91.2% (95%CI [86.7-95.8]) and a specificity of 94.5% (95%CI [91.8-97.2]). Risk factors for depression included poor sleep quality (ORa = 8.07, 95%CI [2.72-23.88]), low financial income (ORa = 4.38, 95%CI [1.42-13.48]), living alone (ORa = 3.53, 95%CI [1.1-11.34]), poor diet (ORa = 13.03, 95%CI [3.84-44.18]), low self-esteem (ORa = 18.21, 95%CI [2.62-126.41]) or moderate self-esteem (ORa = 9.19, 95%CI [1.66-51.01]), and negative emotional state (ORa = 5.54, 95%CI [1.64-18.71]). A passive coping style was found to be a protective factor against depression (ORa = 0.25, 95%CI [0.08-0.8]). Table 3 presents the results of the multivariate analysis of predictive factors for stress, anxiety, and depression.

Table 3. *Results of the multivariate analysis of predictive factors for stress, anxiety, and depression among CESAG students.*

Variables	Adjusted OR	95%CI	p-value
Stress: Yes vs No (Ref.)			
Age group: Ref.= <20 years			0.006
[20-25 years [	5.68	[1.67-19.31]	
[25-30 years [	1.66	[0.47-5.8]	
≥30 years	8.8	[1.5-51.64]	
Sex: Male vs Female (Ref.)	1.95	[0.83-4.56]	0.122
Sleep quality: Poor vs Good (Ref.)	7.05	[2.32-21.44]	< 0.001
Nationality: Others vs Senegalese (Ref.)	0.44	[0.16-1.17]	0.096
Religion: Ref. = Islam			0.002
Christianity	0.25	[0.09-0.71]	
Others	39.55	[1.29-1210.19]	
Financial income: Low vs Good (Ref.)	11.23	[4.34-29.06]	< 0.001
Housing: Living alone vs Shared accommodation or living with family (Ref.)	3.09	[0.91-10.41]	0.067
Self-esteem: Ref. = High			< 0.001
Moderate	7.96	[2.83-22.4]	
Low	15.13	[3.18-72.13]	
Emotional state: Negative vs Positive (Ref.)	4.7	[1.64-13.46]	0.004
Physical activity: No vs Yes (Ref.)	5.03	[1.88-13.49]	0.001
Anxiety: Yes vs No (Ref.)			
Age group: Ref.= <20 years			0.541
[20-25 years [	1.38	[0.67-2.82]	
[25-30 years [	1.07	[0.5-2.31]	
≥30 years	0.76	[0.31-1.83]	
Sex: Male vs Female (Ref.)	0.7	[0.41-1.2]	0.194
Chronic illness: Yes vs No (Ref.)	0.67	[0.29-1.56]	0.358
Alcohol: Yes vs Non (Ref.)	1.95	[0.9-4.24]	0.078
Sleeping pills: Yes vs No (Ref.)	0.25	[0.05-1.27]	0.085
Nationality: Others vs Senegalese (Ref.)	1.6	[0.83-3.06]	0.158
Religion: Ref. = Islam			0.158
Christianity	0.79	[0.45-1.39]	
Others	0.19	[0.03-1.09	
Marital status: Unmarried vs Married (Ref.)	1.41	[0.54-3.63]	0.487
Housing: Living alone vs Shared accommodation or living with family (Ref.)	0.16	[0.09-0.29]	< 0.001
Depression: Yes vs No (Ref.)			
Age group: Ref. = <20 years			0.067
[20-25 years [	1.64	[0.44-6.13]	

Variables	Adjusted OR	95%CI	p-value
[25-30 years [	2.39	[0.58-9.82]	
≥30 years	8.85	[1.54-50.98]	
Sleep quality: Poor vs Good (Ref.)	8.07	[2.72-23.88]	< 0.001
Religion: Ref. = Islam			< 0.001
Christianity	0.13	[0.04-0.4]	
Others	1.35	[0-402.11]	
Family support: Yes vs No (Ref.)	0.1	[0.01-1.36]	0.135
Financial income: Low vs Good (Ref.)	4.38	[1.42-13.48]	0.009
Housing: Living alone vs Shared accommodation or living with family (Ref.)	3.53	[1.1-11.34]	0.031
Diet: Poor vs Good (Ref.)	13.03	[3.84-44.18]	< 0.001
Self-esteem: Ref. = High			0.003
Moderate	9.19	[1.66-51.01]	
Low	18.21	[2.62-126.41]	
Emotional state: Negative vs Positive (Ref.)	5.54	[1.64-18.71]	0.005
Coping style: Passive vs Active (Ref.)	0.25	[0.08-0.8]	0.012

4. Discussion

On stress and its associated factors

In our study, 45.6% of students reported experiencing stress, with 5.9% presenting high stress levels. These findings align with previous research. Melaku et al. [1] identified stress symptoms in 40.4% of respondents at Arsi University, Ethiopia, in 2021, including 2.3% with extremely severe symptoms. Similarly, Amamou et al. [7] found that 63.9% of medical students at the University of Sousse, Tunisia, reported high perceived stress in 2022. In Senegal, Mansouri et al. [18] estimated the stress prevalence at 15.2% in the general population during the COVID-19 pandemic.

Key risk factors of stress identified in our study included being in the [20-25 years[age group or aged over 30 and above, poor sleep quality, low financial income, low or moderate self-esteem, negative emotional state, and absence of physical activity.

Several studies have explored the relationship between age and stress in students. Research generally indicates that younger students experience higher stress levels than their older peers, possibly due to a lack of experience, adaptation difficulties, time management challenges, and academic pressure [1, 2, 8, 10]. However, older or more advanced students may also face significant stress due to increased academic workload, higher performance expectations, uncertainty about future employment, and financial constraints. Variations in findings may be attributed to differences in participant inclusion criteria and educational contexts.

Sleep deprivation and poor sleep quality are well-established contributors to stress, as they disrupt emotional regulation processes [28]. In 2010, Lund et al. [29] found that university students with poor sleep quality reported significantly higher stress levels than their well-rested peers in a Midwest urban setting. A 2024 meta-analysis by Nakie et al. [30] confirmed a strong association between poor sleep quality and stress among African university students. Using the Pittsburgh Sleep Quality Index (PSQI), Amamou et al. [7] reported that poor sleep quality is independently associated with high levels of perceived stress (OR = 9.062). Sleep deprivation or sleep disorders such as insomnia may amplify stress perception and reduce resilience in the face of daily challenges.

Financial difficulties are another well-documented stressor among students. Melaku et al. [1] found that students with a monthly income ≤ 700 ETB (Ethiopian Birr) were more likely to experience stress compared to those with a monthly income > 700 ETB (OR = 1.87). Similarly, Pretorius and Blaauw [31] reported that financial difficulties negatively affect students' subjective well-being at a comprehensive South African university. These findings suggest that financial constraints contribute to student stress beyond academic pressures.

Stress has also been linked to self-esteem and emotional state [28]. Mann et al. [32] reported that individuals with low self-esteem are less able to manage stress effectively, as they

are more likely to interpret events as threatening and have a pessimistic view of their ability to cope. Gross et al. [33] observed that individuals who frequently experience negative emotions, such as anger, sadness, or worry, are more prone to stress. These emotions can limit their ability to employ effective coping strategies and exacerbate their stress response.

Finally, physical activity has been associated with lower stress levels. Gerber et al. [34] reported that students who engaged in regular physical activity exhibited lower stress levels. Similarly, Johannes et al. [35] found significant correlations between mental health subscales and total physical activity volume, specifically anxiety ($r = 0.10$) and stress ($r = 0.11$), among South African undergraduate students. These findings suggest that physical activity enhances mood, reduces mental fatigue, and improves sleep quality, thereby supporting better stress management [28].

On anxiety and its associated factors

In our study, 21.4% of students experienced anxiety, with 3.8% showing severe symptoms. Melaku et al. [1] reported anxiety in 60.8% of respondents, with 16.2% with severe symptoms, while Amamou et al. [7] observed anxiety symptoms in 36.1% of respondents. In Senegal, Mansouri et al. [18] found a 5.1% prevalence of anxiety in the general population during the COVID-19 pandemic.

The lower proportion of anxious students in our study may be related to the online data collection method, which could have discouraged anxious individuals from participating. Additionally, the higher prevalence reported by Melaku et al. may be due to differences in the self-assessment tools. Melaku et al. used the DASS-21 (Depression Anxiety Stress Scale-21), which evaluates emotional states of depression, anxiety, and stress over the past week, whereas Amamou et al. used the HADS-10 (Hospital Anxiety and Depression Scale-10), that includes separate subscales for anxiety (HAD-A) and depression (HAD-D). Consequently, the GAD-7 (used in our study) and the HAD-A may have been more specific in detecting anxiety, potentially reducing false positives compared to the DASS-21.

Furthermore, our study found that living alone was a protective factor against anxiety. Students living alone reported significantly lower anxiety levels compared to those living with roommates or family. This finding contrasts with existing literature, which generally links living alone to a higher risk of anxiety due to social isolation [1, 3, 10, 36]. This discrepancy may result from the underrepresentation of anxious individuals in our sample, as the online data collection method could have acted as a barrier, discouraging more anxious students from participating. Consequently, this may have led to an underestimation of the association between living alone and anxiety. Alternatively, it may reflect a unique academic context, where students frequently engage in social interactions outside the home, mitigating the potential negative effects of living alone.

On depression and its associated factors

In our study, 35.4% of students exhibited depressive symptoms, with 7.7% experiencing severe symptoms. In comparison, Melaku et al. [1] reported a prevalence of 52.3%, including 6.2% with severe symptoms, while Amamou et al. [7] found depressive symptoms in 22.3% of students. In Senegal, Mansouri et al. [18] reported a 13.4% prevalence of depression in the general population during the COVID-19 pandemic. Differences in prevalence rates across studies may be partly explained by variations in the self-assessment tools used. The PHQ-9 (used in our study) and HAD-D may have been more specific in screening for depression than the DASS-21, potentially reducing false positives.

Several risk factors for depression were identified in our study, including poor sleep quality, low financial income, living alone, poor diet, low or moderate self-esteem, and a negative emotional state. A passive coping style was found to be a protective factor.

Sleep disturbances, particularly poor sleep quality and insomnia, are well-documented contributors to depression in students [28]. Coelho et al. [37], in a two-year cohort study, demonstrated this link by highlighting two aspects: first, insomnia as a risk factor for the onset of depressive symptoms in initially asymptomatic students, and second, daytime sleepiness in already symptomatic students, which contributes to the persistence of depressive symptoms. Similarly, a meta-analysis by Bi et al. [38] confirmed that sleep disturbances, including both insomnia and excessive sleepiness, are significantly associated with depressive symptoms.

The role of socio-economic status in mental health is widely recognized. Melaku et al. [1] identified low monthly income as a risk factor for depression, a finding supported by a meta-analysis by Richardson et al. [39], which reported that students facing financial difficulties are more likely to exhibit depressive symptoms. Eisenberg et al. [40] found that American students facing financial constraints were more prone to developing depressive symptoms. Similarly, Hunt et al. [41] demonstrated that financial pressures increase vulnerability to mental health disorders due to daily worries and limitations they impose on social interactions and overall quality of life.

Loneliness is another key determinant of depression among students, as social and family networks play a crucial protective role [28, 36]. Melaku et al. [1] found that students living outside dormitories were more likely to experience depression than those residing in dormitories. A meta-analysis by Santini et al. [42] confirmed that social isolation and loneliness significantly increase depression risk, a finding reinforced by Wu et al. [43], who reported that individuals living alone had a higher likelihood of depression compared to those in shared accommodations. These results highlight the importance of social interactions in mitigating psychological distress, particularly in the university setting, where students navigate major life transitions and academic demands. Students living alone lack the daily social support that shared housing or family environments provide, making them more vulnerable to stress and depressive symptoms.

Diet quality has also been associated with depression. A

systematic review by Lassale et al. [44] found that adherence to a healthy diet, particularly the traditional Mediterranean diet, and avoiding pro-inflammatory foods are linked to a lower risk of depressive symptoms or clinical depression. Jacka et al. [45] similarly reported that young adults with a low-quality diet characterized by high consumption of sugars, saturated fats, and processed foods had higher rates of depression. These findings suggest an association between diet quality and adolescent depression that exists over and above the influence of socioeconomic, family, and other potential confounding factors.

Self-esteem is another well-established factor in depression [28]. Sowislo et al. [46] identified low self-esteem as a significant predictor of depression, rather than merely a consequence of it. This relationship is particularly strong among young adults, including students, for whom self-esteem plays a crucial role in managing academic and social challenges. Sargent et al. [47] examined self–worth contingencies and vulnerability to depressive symptoms in 629 college freshmen over their first semester. They found that higher reliance on external self–worth (based on approval from others, appearance, competition, and academics) predicted increased depressive symptoms, even after controlling for initial level of depressive symptoms, social desirability, gender, and race.

Negative emotional states are closely linked to depression [28]. Kupferberg et al. [48] found that negative emotional states, such as sadness, irritability, and anxiety, are strongly associated with depressive symptoms. Similarly, Eisenberg et al. [40] reported that students experiencing high levels of stress, anger, or other negative emotions had higher levels of depressive symptoms. These findings suggest that academic and social stressors in student life contribute to emotional distress, increasing the risk of depression in this population.

The literature provides diverse perspectives on the effectiveness of coping styles. Most research suggests that active coping strategies (such as problem-solving) are generally more effective in reducing psychological distress, whereas passive coping styles (such as avoidance or submission) are often associated with higher levels of depression and anxiety [49]. Compas et al. [50] found that the maladaptive coping, disengagement coping, and strategies such as emotional suppression, avoidance, and denial are associated with increased psychopathology symptoms, indicating that they act more as risk factors than protective mechanisms. However, there may be circumstances in which passive coping is perceived as protective, particularly in situations where individuals have little or no control over events, and avoidance temporarily alleviates emotional distress. This was highlighted in the study by Holahan et al. [51], which found that in certain contexts, passive coping could reduce short-term stress. However, this should not be mistaken for a long-term protective effect against depression [16].

Strengths and limitations

This study investigates key factors associated with stress, anxiety, and depression in students. The use of validated screening tools (PSS, GAD-7, and PHQ-9) enhances the reliability of the findings.

The main limitations include not reaching the target sample size (426 respondents instead of the expected of 605) and relying exclusively on online data collection. The smaller-than-expected sample size may have increased the risk of type 1 errors. Moreover, online data collection could have discouraged participation among anxious individuals, potentially leading to their underrepresentation and influencing associations between anxiety and related factors.

Future research could build on these findings through a cohort study to better explore causal relationships between stress, anxiety, depression and their determinants among students at the institution.

5. Conclusion

Stress, anxiety, and depression are major concerns that can significantly impact students' mental health, affecting both their well-being and academic performance. This research aimed to identify factors associated with these anxiety-depressive states among CESAG students, who are trained in a demanding academic environment.

This cross-sectional, observational, descriptive and analytical study was conducted from July 22 to August 23, 2024. The sample consisted of 426 students of both genders, regularly enrolled at the institution during the 2023-2024 academic year. Stress, anxiety, and depression were assessed using self-reported questionnaires: the Perceived Stress Scale (PSS) for stress, the Generalized Anxiety Disorder-7 (GAD-7) for anxiety, and the Patient Health Questionnaire-9 (PHQ-9) for depression.

The methodological limitations of the study included the failure to reach the calculated sample size, which increased the risk of type 1 errors, and the exclusive use of online data collection, which may have deterred participation, particularly among anxious individuals.

Our findings highlight the need for preventive strategies to enhance students' mental health and well-being, particularly through awareness campaigns and initiatives designed to strengthen psychological support and prevention.

Abbreviations

AIC	Akaike Information Criterion
AUC	Area Under Curve
BCEAO	Central Bank of West African States
CESAG	African Center for Higher Studies in Management
DASS-21	Depression Anxiety Stress Scale-21
DSM	Department of Mental Health
DSP	Public Health Department
ETB	Ethiopian Birr
ESEA	Higher School of Applied Economics

FMPO	Faculty of Medicine, Pharmacy, and Dentistry
GAD-7	Generalized Anxiety Disorder-7
HADS-10	Hospital Anxiety and Depression Scale-10
CI	Confidence Interval
ISED	Institute of Health and Development
MSAS	Ministry of Health and Social Action
OR	Odds-ratio
ORa	Adjusted Odds-ratio
PHQ-9	Patient Health Questionnaire-9
PSQI	Pittsburgh Sleep Quality Index
PSS	Perceived Stress Scale
ROC	Receiver Operating Characteristic
SD	Standard Deviation
UCAD	Cheikh Anta DIOP University
VIF	Variance Inflation Factor (VIF)

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Disclaimer

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Data Availability Statement

Datasets presented in this article are available from the corresponding author upon reasonable request.

Conflicts of Interest

We, authors of this manuscript, solemnly declare that there are no conflicts of interest among us regarding this publication.

Appendix

Annex: Questionnaire overview

Chapter 1: information on the biological dimension

1. What is your age? _____

2. What is your sex?

☐ Male

☐ Female

3. Do you have any significant medical history? (Check all that apply)

☐ None

☐ Psychiatric disorders

☐ Chronic illness (e.g., diabetes, high blood pressure, etc.)

☐ Other (please specify): _____

4. Do you smoke tobacco?

☐ Yes, regularly (several times per week)

☐ Yes, occasionally (once in a while)

☐ No (never)

5. Do you drink alcohol?

☐ Yes, regularly (several times per week)

☐ Yes, occasionally (once in a while)

☐ No (never)

6. Do you use sleeping pills to help to sleep?

☐ Yes, regularly (several times per week)

☐ Yes, occasionally (once in a while)

☐ No (never)

7. How would you rate your overall sleep quality over the past month, considering factors such as total sleep duration, sleep depth, and frequency of nighttime awakenings?)

☐ Very poor

☐ Poor

☐ Average

☐ Good

☐ Very good

Chapter 2: information on the social context

8. What is your current marital status?

☐ Single
☐ Married
☐ Divorced
☐ Widowed

9. What is your nationality?

☐ Senegalese
☐ Ivorian
☐ Burkinabe
☐ Bissau-Guinean
☐ Beninese
☐ Nigerien
☐ Other (please specify): _____

10. What is your religion?

☐ Islam
☐ Christianity
☐ None
☐ Other (please specify): _____

11. Do you receive family support in your studies?

☐ Yes, regularly
☐ Yes, occasionally
☐ No

12. How would you rate your financial income level?

☐ Very low
☐ Low
☐ Average
☐ Good
☐ Very good

13. What is your current housing situation?

☐ Living alone
☐ Shared accommodation (living with roommates)
☐ Living with family

14. How would you rate the quality of your diet?

☐ Very poor
☐ Poor
☐ Average
☐ Good
☐ Very good

Chapter 3: information on the psychological dimension

15. On a scale from 1 to 10, how would you rate your self-esteem? (1 being very low and 10 being very high) _____

16. How would you describe your emotional state over the past two weeks?

☐ Very negative
☐ Somewhat negative
☐ Neutral
☐ Somewhat positive
☐ Very positive

17. Do you engage in physical activity?

☐ Yes, regularly (several times per week)
☐ Yes, occasionally (once in a while)
☐ No (never)

18. What is your usual approach to dealing with problems? Distance yourself from the problem

☐ Ask for help from others
☐ Ignore or repress the problem
☐ Actively seek for a solution
☐ Use a psychoactive substance to forget the problem (alcohol, tobacco, sleeping pills, etc.)
☐ Practice sports or meditation
☐ Other (please specify): _____

Chapter 4: information on variables of interest

Perceived Stress Scale

Scoring: never = 0 point, almost never = 1point, sometimes = 2 points, often = 3 points, very often = 4 points *= reverse scoring (from never = 4 points to very often = 0 point)

19. Over the past month, how often have you been upset because of an unexpected event?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

20. Over the past month, how often have you felt that you were unable to control the important things in your life?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

21. Over the past month, how often have you felt nervous and stressed?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

22. *Over the past month, how often have you felt confident in your ability to handle your personal problems?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

23. *Over the past month, how often have you felt that things were going your way?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

24. Over the past month, how often have you found that you could not cope with all the things you had to do?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often

☐ Very often

25. *Over the past month, how often have you been able to control irritations in your life?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

26. *Over the past month, how often have you felt that you were in control of things?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

27. Over the past month, how often have you been upset because of things that happened that were outside your control?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

28. Over the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?

☐ Never
☐ Almost never
☐ Sometimes
☐ Often
☐ Very often

Generalized Anxiety Disorder-7

Scoring: not at all = 0 point, several days = 1point, more than half of the days = 2 points, nearly every day = 3 points

29. Over the last two weeks, how often have you been bothered by the following problems?

Feeling nervous, anxious, or on edge:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Being unable to stop worrying or control your worries:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Worrying too much about different things:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Having difficulty relaxing:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Being so restless that it is hard to sit still:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Becoming easily annoyed or irritable:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Feeling afraid, as if something awful might happen:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Patient Health Questionnaire-9

Scoring: not at all = 0 point, several days = 1 point, more than half of the days = 2 points, nearly every day = 3 points

30. Over the past two weeks, how often have you been bothered by any of the following problems?

Little interest or pleasure in doing things:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Feeling down, depressed, or hopeless:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Trouble falling or staying asleep, or sleeping too much:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Feeling tired or having little energy:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Poor appetite or overeating:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Feeling bad about yourself, or that you are a failure or have let yourself or your family down:

☐ Not at all
☐ Several days
☐ More than half of the days
☐ Nearly every day

Trouble concentrating on things, such as reading a document or watching television:

☐ Not at all

- ☐ Several days
- ☐ More than half of the days
- ☐ Nearly every day

Moving or speaking so slowly that other people could have noticed. Or the opposite -being so figety or restless that you have been moving around more than usual:

- ☐ Not at all
- ☐ Several days
- ☐ More than half of the days
- ☐ Nearly every day

Thoughts that you would be better off dead, or of hurting yourself:

- ☐ Not at all
- ☐ Several days
- ☐ More than half of the days
- ☐ Nearly every day

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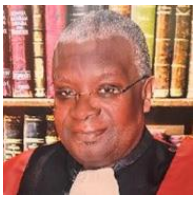
Biography

Gad Papin Oholiab Namndiro is a trained medical doctor, epidemiologist, and currently a PhD student in epidemiology. He holds degrees from the Institute of Health and Development (ISED) at Cheikh Anta Diop University in Dakar and from the African Center for Higher Studies in Management (CESAG), where he received specialized training in the evaluation of projects, programs, and public policies. His background combines strong medical expertise with solid skills in public health and evaluation, placing him at the intersection of medical sciences, epidemiological research, and health policy analysis.

Jean Augustin Diégane Tine is a psychiatrist and epidemiologist. He serves as a Professor of Public Health at Cheikh Anta Diop University in Dakar and heads the Mental Health Department at the Ministry of Health and Social Action in Senegal. He has authored numerous scientific publications on mental health and public health. His academic and institutional commitment has made him a leading figure in the fields of mental health and epidemiology in Senegal and West Africa.

Abdourahmane Sow, a medical doctor and holder of a PhD in public health, currently serves as the Director of the Department of Public Health at the Pasteur Institute of Dakar. He also holds a prominent position as an academic researcher at the Cheikh Anta Diop University of Dakar (UCAD). With a distinguished professional background, he has assumed leading roles within the Senegalese health system and in the West African sub-region. In this capacity, he is a key figure in managing public health crises and events, contributing with discernment and rigor to the development and implementation of large-scale health management strategies.



Ibrahima Seck is a prominent figure in public health in Senegal. He is a Full Professor of Public Health at Cheikh Anta Diop University in Dakar (UCAD), where he also serves as Director of the Institute of Health and Development (ISED) and Head of the Preventive Medicine Department at the Faculty of Medicine, Pharmacy, and Dentistry. He has held several key positions in the Senegalese health sector and has authored numerous scientific publications in public health. His exceptional career and sustained commitment make him a leading authority in his field.

Research Field

Gad Papin Oholiab Namndiro: Epidemiology, adolescent health, clinical aspects related to health, emerging infectious diseases, One Health, antimicrobial resistance, etc.

Jean Augustin Diégane Tine: Epidemiology, mental health, public health, adolescent health, clinical aspects related to health, community health, health policy and planning, health promotion, nutrition and health, pediatrics and child health, rural health, school health, sexual and reproductive health, etc.

Abdourahmane Sow: Epidemiology, public health, emerging infectious diseases, arboviruses, clinical aspects related to health, community health, health policy and planning, health promotion, nutrition and health, rural health, etc.

Ibrahima Seck: Epidemiology, public health, adolescent health, allied health sciences, clinical aspects related to health, community health, environmental health, health policy and planning, health promotion, nutrition and health, pediatrics and child health, rural health, school health, sexual and reproductive health, medicine and health, urban health and women's health, etc.