ORIGINAL RESEARCH ARTICLE

# Burden of Depression and its Determinants among Tribal School-Going Adolescents in Kalvarayan Hills, Tamil Nadu - A Cross-Sectional Study

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## ABSTRACT

**Background:** Tribal adolescents in India represent a vulnerable and under-researched population with respect to mental health. This study assessed the burden of depression and its associated factors among school-going tribal adolescents in the Kalvarayan Hills, Tamil Nadu.

**Methods:** A cross-sectional study was conducted among 400 adolescents aged 10-19 years using multistage random sampling. Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9). Sociodemographic, psychosocial, and lifestyle variables were collected using a structured questionnaire. Associations were evaluated using chi-square test and multivariable logistic regression to identify independent predictors.

**Results:** The prevalence of depression was 25.5%. Significant independent predictors included inadequate sleep, thinness, lack of parental monitoring, absence of family emotional support, peer pressure, and excessive sedentary behaviour. Sociodemographic variables such as age, gender, and socioeconomic status were not significant after adjustment. The model demonstrated good fit and acceptable explanatory power.

**Conclusion:** A considerable proportion of tribal adolescents experience depressive symptoms, largely influenced by modifiable psychosocial and lifestyle factors. Strengthening family support systems, promoting healthy behaviours, and integrating mental health screening within school health programs are essential for early identification and intervention in this population.

**Key-words:** Depression, Tribal Population, PHQ-9, Psychosocial factors, Tamil Nadu, India

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## INTRODUCTION

Tribal groups are generally characterized by certain shared features, including a common mode of living, residence within a defined geographical area, use of a common dialect, cultural homogeneity and a cohesive social organization.[1] At the same time, different tribal groups vary considerably from one another in terms of ethnicity, language, cultural practices, belief systems, and health-related behaviors.[1] Scheduled Tribes are constitutionally recognized communities identified under Article 342 of the Constitution of India.[2] India is one of the major low- and middle-income countries with a significant tribal presence, with tribal communities accounting up 8.6% of the country's overall population.[3] Despite more than seven decades of independence, India continues to struggle with widening healthcare disparities between tribal and non-tribal populations. Notably, over 25% of the poorest individuals in the country belong to tribal communities.[3]

Mental illnesses are becoming increasingly prevalent worldwide, particularly with rapid urbanization and socio-cultural transitions.[4]India is home to the second-largest tribal population globally[4], emphasizing how critical it is to identify and treat the mental health issues this community faces.

The adolescent period marks the shift from childhood to adult life and involves substantial physical, emotional and social changes that lay the foundation for health and behaviour in later life.[5] Globally, psychiatric morbidity remains one of the most significant health concerns affecting children and adolescents, with adolescents being particularly vulnerable to depression during this developmental phase.[6] Scheduled Tribes experience significant mental health disparities, with high rates of anxiety, depression, and substance use disorders, exacerbated by socioeconomic challenges and barriers to accessing mental health services.[7] These considerations highlight the need to examine depression and psychosocial risk factors among tribal adolescents.

According to the Global Burden of Disease (GBD) 2021 study, mental disorders account for 5.4% of the global disease burden, with depression being the second leading cause of years lived with disability (YLDs), contributing 56.3 million YLDs worldwide in 2021.[8] Evidence from southern India indicates a substantial burden, with a cross-sectional study reporting that 39.3% of rural adolescents exhibited depressive symptoms.[9] In contrast, studies from northern India suggest an even greater vulnerability among tribal adolescents, with reported prevalence ranging from 31.3% to 66.8%.[10,11] In addition to this high prevalence, adolescent mental health outcomes, including suicidal behaviours, are influenced by interpersonal relationships within families and the broader social context, which may function as both risk factors and protective factors.[12]

Although adolescent mental health has been studied in India, limited studies have specifically examined tribal adolescents in Tamil Nadu. A multicentric study that included tribal adolescents from Nilgiris (Tamil Nadu)[13] reported psychiatric morbidity. However, published studies focusing exclusively on tribal adolescents from hill regions such as Kalvarayan Hills are scarce. Hence, the present study was undertaken to address this gap. Generating context-specific data is essential to support early identification and to inform culturally appropriate mental health interventions in this underserved population.

The study was conducted to determine the burden of depression and associated sociodemographic, psychosocial, and lifestyle factors among tribal school-going adolescents residing in the Kalvarayan Hills, Tamil Nadu.

## METHODOLOGY

**Study Setting and design:** This cross-sectional study was conducted among tribal school-going adolescents in the Kalvarayan Hills, Tamil Nadu, India. Data were collected from July to October 2025.

**Study population:** Tribal school-going adolescents aged 10-19 years who were enrolled in the selected higher secondary schools under the chosen PHC and were present during the data collection period were included in the study. Adolescents who were unwilling to participate, did not provide consent/assent, or were absent on the day of data collection were excluded.

**Sample size:** Joshi V et al.[14] reported a prevalence of depression of 34.3% among adolescents, (as reported in the Results section under "Mental health status assessment" of their study), which was used to determine the sample size. The predicted sample size was 347 using the formula $n = Z^2pq/d^2$, where Z = 1.96, p = 34.3%, q = 65.7%, and d = 5%. The final sample size was rounded to 400 adolescents after taking into consideration a 10% non-response rate. Multistage random sampling was adopted to recruit the participants.

Efforts were made to minimize selection bias by including all eligible higher secondary schools under the selected PHC and by selecting participants using simple random sampling from the attendance register. All eligible students present on the day of data collection were invited to participate. However, characteristics of non-participants were not systematically recorded which may limit assessment of potential selection bias.

**Data collection tool**: Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9). The tool was originally developed and validated in adult primary care populations by Kroenke K et al.[15] Subsequently, the PHQ-9 has been validated for use among adolescents, demonstrating good reliability and diagnostic accuracy in detecting major depressive disorder.[16] In the Indian context, the PHQ-9 has also

been validated among adolescents[17] and shown to have acceptable psychometric properties supporting its use in the present study population, including younger adolescents. In the present study, the questionnaire was administered by the investigator in a standardized manner to ensure clarity and comprehension among younger participants.

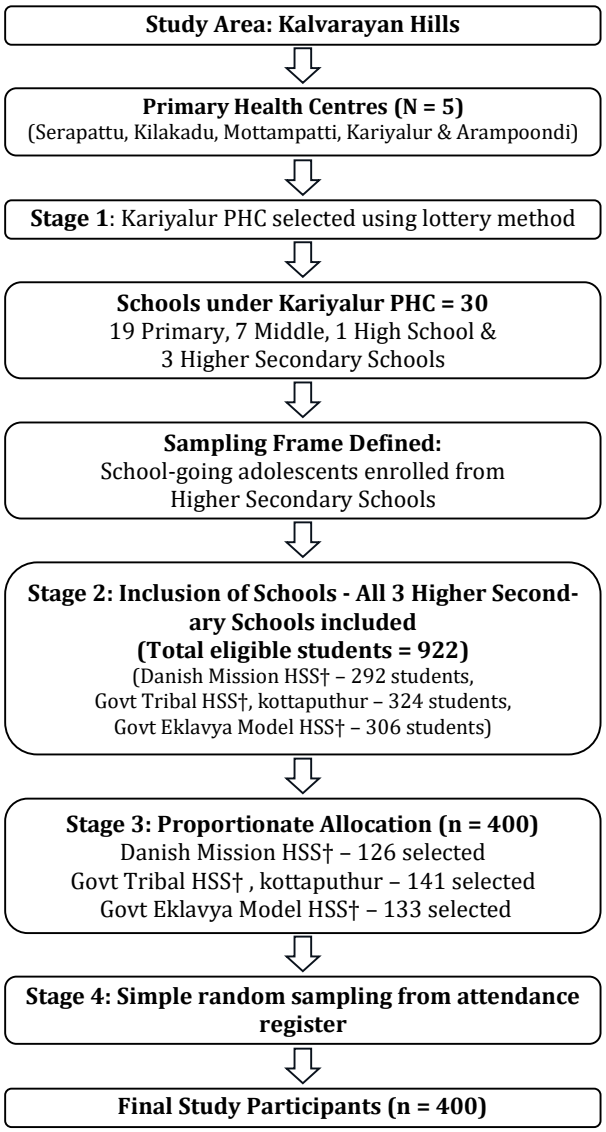


**Figure 1: Flowchart of the multistage sampling procedure used for selection of study participants (n = 400) († HSS: Higher Secondary School)**

Each of the nine items is scored on a four-point Likert scale ranging from 0 ("not at all") to 3 ("nearly every day"), yielding a total score between 0 and 27. Based on standard scoring guidelines, severity was categorized as No depression (0 to 4), mild depression (5 to 9), moderate depression (10 to 14), moderately severe depression (15-19), and severe depression (20-27).

For analytical purposes, a PHQ-9 score ≤4 was considered absence, while a score >4 was considered presence of depression. Although a cut-off of ≥10 is mostly used in clinical settings to identify probable major depressive disorder, this study aimed to estimate the burden of depression in a community-based school setting rather than diagnose clinical depression. Therefore, a lower cut-off was used to capture adolescents with at least mild depressive symptoms. A similar cut-off has been adopted in recent Indian community-based studies among school-going adolescents.[18]

**Study variables:** Depression served as the outcome variable. Independent variables included sociodemographic characteristics (age, gender, and socioeconomic status[19]), family-related factors, lifestyle-related variables, and psychosocial influences.

Parental monitoring, family emotional support, peer pressure, and perceived friendliness of peers were each assessed using a single structured item capturing the adolescent's perception of family and peer influences.

Parental monitoring reflected supervision over daily activities; family emotional support referred to perceived emotional support from family members; peer pressure assessed experience of pressure from friends to engage in unwanted behaviours; and perceived friendliness of peers represented the adolescent's view of classmates as supportive and friendly.

Responses were recorded using Likert-type options (e.g., always, sometimes, rarely, never) and were dichotomized into favourable and unfavourable categories for analysis.

BMI-for-age Z-scores were calculated using WHO AnthroPlus software based on the WHO 2007 Growth Reference for children and adolescents aged 5-19 years to assess the nutritional status of the participants. Normal weight was categorized between -2 SD and +1 SD, underweight as BMI-for-age less than -2 SD, overweight as >+1 SD, and obesity as >+2 SD.[20]

Self-reported average daily duration of moderate-to-intense physical exercise was used to measure physical activity. Participants who engage in moderate-to-intense physical exercise for at least 60 minutes each day were categorized as having adequate physical activity, whereas those engaging in less than 60 minutes per day were classified as having inadequate physical activity, based on established adolescent physical activity recommendations.[21]

Sedentary behaviour was assessed based on self-reported average daily recreational screen time, including television and mobile phone. Participants reporting > 2 hours per day of screen time were classified as having excessive sedentary behaviour, while those reporting 2 hours or less per day were categorized as having acceptable sedentary behaviour.[22]

Self-reported average daily duration of sleep was used to measure sleep duration. Participants reporting at least 8 hours of sleep per day were categorized as having adequate sleep, while those reporting less than 8 hours were classified as having inadequate sleep. This cut-off was based on established sleep

recommendations indicating that adolescents require a minimum of 8-10 hours of sleep per night, although younger adolescents may require longer durations.[23]

**Statistical analysis:** Categorical variables were summarized using descriptive statistics. The association between depression and independent factors was evaluated using the $\chi^2$ test. As recommended by Hosmer and Lemeshow, Variables with p <0.25 in the bivariate analysis were entered into the multivariable logistic regression model to determine independent predictors using the Enter technique. 95% confidence intervals for adjusted odds ratios (AORs) were provided. Statistical significance was set at $p < 0.05$. To evaluate the model's fit Hosmer-Lemeshow goodness-of-fit test was used. To examine the model's explanatory power Nagelkerke's R2 was used, and the Variance Inflation Factor (VIF) and tolerance were used to evaluate multicollinearity. Complete case analysis was performed as no missing data were observed.

**Ethical considerations:** The SRM Medical College Hospital and Research Center's Institutional Ethics Committee granted ethical permission (permission No: SRMIEC-ST0924-1750). The school administration gave their prior consent before any data was collected. Parents or guardians provided informed consent, and the teenagers who participated provided their assent. Anonymity and secrecy were scrupulously upheld, and participation was entirely voluntary. While conducting the study, the ethical guidelines of Helsinki's Declaration were followed.

## RESULTS

The chosen higher secondary schools had 922 students enrolled in total. Out of them, 400 students were chosen via proportional random selection, and all of them took part in the survey, resulting in a 100% response rate.

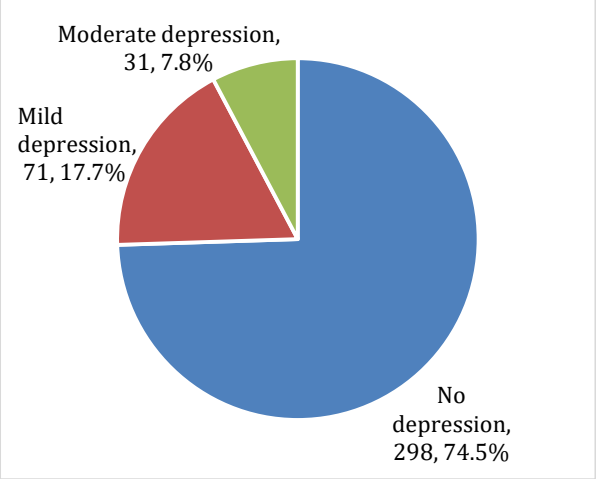


**Figure 2: Depression severity distribution among study participants according to PHQ-9 scores (n = 400).**

**Table 1: Participants' Sociodemographic Profile (n = 400)**

| Variable | Participants(%) |
|---|---|
| **Age** | |
| 10-14Years | 287 (71.8) |
| 15-19 years | 113 (28.2) |
| **Gender** | |
| Female | 156 (39) |
| Male | 244 (61) |
| **Type of family** | |
| Nuclear | 227 (56.7) |
| Joint | 88 (22) |
| 3 generation family | 85 (21.3) |
| **Total No. of Family members** | |
| ≤5 | 264 (66) |
| >5 | 136 (34) |
| **Father's education** | |
| Literate | 284 (71) |
| Illiterate | 116 (29) |
| **Mother's education** | |
| Literate | 232 (58) |
| Illiterate | 168 (42) |
| **Father's occupation** | |
| Agricultural work | 385 (96.2) |
| Non-Agricultural work | 15 (3.8) |
| **Mother's occupation** | |
| Agricultural work | 389 (97.2) |
| Non-Agricultural work | 11 (2.8) |
| **Socioeconomic status** | |
| Upper | 0 (0) |
| Upper-middle | 4 (1) |
| Middle | 14 (3.5) |
| Lower-middle | 50 (12.5) |
| Lower | 332 (83) |

n = 0 indicates that no participants belonged to the 'Upper' socioeconomic category; this does not represent missing data.

**Table 2: Family, Lifestyle, and Psychosocial Profile of the Participants (n = 400)**

| Variable | Participants (%) |
|---|---|
| **Living situation** | |
| Living With both parents | 319 (79.8) |
| single / neither parent | 81 (20.2) |
| **With Parental monitoring** | 133 (33.2) |
| **Having Family emotional support** | 189 (47.2) |
| **Having Peer pressure** | 213 (53.2) |
| **Having Kindness of friends** | 241 (60.2) |
| **Adequate Physical activity** | 147 (36.8) |
| **Excessive Sedentary behaviour** | 101 (25.3) |
| **BMI status** | |
| Severe thinness | 39 (9.7) |
| Thinness | 109 (27.3) |
| Normal | 247 (61.8) |
| Overweight | 5 (1.2) |
| **≥8 hrs Sleep** | 302 (75.5) |

Most of them were aged 10-14 years (71.8%), and males constituted 61% of the sample. Most participants belonged to nuclear families (56.7%) and lower socioeconomic class (83.0%). Parental illiteracy was noted among 29% of fathers and 42% of mothers (Table 1).

With regard to family and lifestyle factors, 66.8% reported lack of parental monitoring and 52.8% reported lack of family emotional support. More than

half (53.2%) experienced peer pressure, and 63.2% had inadequate physical activity. Excessive sedentary behaviour was observed in 25.3%, and 24.5% reported sleeping less than 8 hours per day. Table 2 presents detailed features.

Overall, the prevalence of depression among the adolescents were 102(25.5% (95% CI: 21.2%-30.2%)). The distribution of depression severity among participants is presented in Figure 2.

Bivariate analysis showed that gender, socioeconomic status, sleep duration, BMI status, parental monitoring, family emotional support, peer pressure, kindness from friends, and sedentary behaviour significant association with depression (p <0.05). Depression was higher among male adolescents compared to female, those belonging to higher socioeconomic class, thinness, adolescents with sleep duration <8 hours, those with thinness, lack of parental monitoring, absence of family emotional support, presence of peer pressure, lack of kindness from friends, and excessive sedentary behaviour.

However, age, type of family, family size, living situation, and physical activity were not significantly associated with depression. (Table 3)

In multivariable logistic regression analysis, sleep duration <8 hours (AOR = 2.19; 95% CI: 1.19-4.00), thinness (AOR = 6.82; 95% CI: 3.88-11.98), lack of parental monitoring (AOR = 2.42; 95% CI: 1.24-4.72), absence of family emotional support (AOR = 2.84; 95% CI: 1.53-5.25), peer pressure (AOR=2.05 ;95%CI:1.16-3.64), and excessive sedentary behaviour (AOR = 2.58; 95% CI: 1.40-4.75) remained independent predictors of depression among adolescents.

**Table 3: Association between Sociodemographic, Family, Lifestyle, Psychosocial Factors and depression among Study Participants (n = 400)**

| Variable | Depression (n=102)(%) | No Depression (n=298) (%) | Total (%) | Chi-square | P value |
|---|---|---|---|---|---|
| **Age** | | | | | |
| 15-19 yrs | 29(28.4) | 84(28.2) | 113(28.2) | 0.002 | 0.962 |
| 10-14 yrs | 73(71.6) | 214(71.8) | 287(71.8) | | |
| **Gender** | | | | | |
| Male | 74(72.5) | 170(57.0) | 244(61.0) | 7.676 | **0.006*** |
| Female | 28(27.5) | 128(43.0) | 156(39.0) | | |
| **Type of family** | | | | | |
| Joint /3 generation family | 47(46.1) | 126(42.3) | 173(43.3) | 0.446 | 0.504 |
| Nuclear | 55(53.9) | 172(57.7) | 227(56.7) | | |
| **Total no. of family members** | | | | | |
| ≤5 | 74(72.5) | 190(63.8) | 264(66.0) | 2.617 | 0.106 |
| >5 | 28(27.5) | 108(36.2) | 136(34.0) | | |
| **Socio economic status** | | | | | |
| Upper-middle / Middle | 9(8.8) | 9(3.0) | 18(4.5) | 5.955 | **0.015*** |
| Lower-middle / Lower | 93(91.2) | 289(97.0) | 382(95.5) | | |
| **Sleep** | | | | | |
| ≥8 hrs | 68(66.7) | 234(78.5) | 302(75.5) | 5.775 | **0.016*** |
| <8 hrs | 34(33.3) | 64(21.5) | 98(24.5) | | |
| **BMI** | | | | | |
| No thinness | 35(34.3) | 217(72.8) | 252(63.0) | 48.334 | **<0.001*** |
| Thinness | 67(65.7) | 81(27.2) | 148(37.0) | | |
| **Living situation** | | | | | |
| Living With both parents | 75(73.5) | 244(81.9) | 319(79.8) | 3.281 | 0.070 |
| single / neither parent | 27(26.5) | 54(18.1) | 81(20.2) | | |
| **Parental monitoring** | | | | | |
| Yes | 20(19.6) | 113(37.9) | 133(33.2) | 11.481 | **<0.001*** |
| No | 82(80.4) | 185(62.1) | 267(66.8) | | |
| **Family emotional support** | | | | | |
| Yes | 27(26.5) | 162(54.4) | 189(47.2) | 23.718 | **<0.001*** |
| No | 75(73.5) | 136(45.6) | 211(52.8) | | |
| **Peer pressure** | | | | | |
| No | 34(33.3) | 153(51.3) | 187(46.7) | 9.900 | **0.002*** |
| Yes | 68(66.7) | 145(48.7) | 213(53.3) | | |
| **Kindness of friends** | | | | | |
| Yes | 52(51.0) | 189(63.4) | 241(60.2) | 4.912 | **0.027*** |
| No | 50(49.0) | 109(36.6) | 159(39.8) | | |
| **Physical activity** | | | | | |
| Adequate | 38(37.3) | 109(36.6) | 147(36.8) | 0.015 | 0.902 |
| Inadequate | 64(62.7) | 189(63.4) | 253(63.2) | | |
| **Sedentary behaviour** | | | | | |
| Acceptable | 61(59.8) | 238(79.9) | 299(74.7) | 16.204 | **<0.001*** |
| Excessive | 41(40.2) | 60(20.1) | 101(25.3) | | |

P-value <0.05- statistically significant.

**Table 4: Regression Analysis of Factors Associated with depression among Study Participants (n=400)**

| Variable | Crude OR (95% CI) | P value | AOR (95% CI) | P value |
|---|---|---|---|---|
| **Age 10-14 yrs** (ref 15-19 yrs) | 0.99 (0.60-1.63) | 0.962 | - | |
| **Female** (ref Male) | 0.50 (0.31-0.82) | **0.006*** | 0.71 (0.39-1.28) | 0.251 |
| **Nuclear Family** (ref 3 generation /Joint | 0.86 (0.55-1.35) | 0.504 | - | - |
| **Family members more than 5** (ref ≤5 members) | 0.67 (0.41-1.09) | 0.106 | 0.59 (0.33-1.07) | 0.080 |
| **Lower-middle /lower SES** [ref Upper-middle / middle SES] | 0.32 (0.12-0.84) | **0.015*** | 0.39 (0.12-1.31) | 0.128 |
| **Sleep less than 8 hours** [ref ≥8 hours] | 1.83 (1.11-3.00) | **0.016*** | 2.19 (1.20-4.00) | **0.011*** |
| **BMI - Thin** [ref No thinness] | 5.13 (3.17-8.30) | <0.001* | 6.82 (3.88-11.99) | <0.001* |
| **Living Single/neither parent** [ref Living With both parents] | 1.63 (0.96-2.76) | 0.070 | 0.95 (0.47-1.90) | 0.879 |
| **No Parental monitoring** [ref with parental monitor] | 2.50 (1.46-4.31) | **<0.001*** | 2.43 (1.25-4.73) | **0.009*** |
| **No Family emotional support** [ref with family support] | 3.31 (2.02-5.43) | **<0.001*** | 2.84 (1.54-5.25) | **<0.001*** |
| **Peer pressure** [ref No peer pressure] | 2.11 (1.32-3.38) | **0.002*** | 2.06 (1.16-3.64) | **0.014** |
| **No Kindness of friends** [ref with kindness of friends] | 1.67 (1.06-2.63) | **0.027*** | 1.23 (0.70-2.15) | 0.479 |
| **Inadequate Physical activity** [ref Adequate physical activity] | 0.97 (0.61-1.55) | 0.902 | - | |
| **Excessive Sedentary behaviour** (ref Acceptable) | 2.67 (1.64-4.34) | **<0.001*** | 2.59 (1.41-4.75) | **0.002*** |

P-values <0.05 - statistically significant.
In univariate analysis, variables with p ≥0.25 were excluded from the multivariable logistic regression model.
Ref - Reference category; OR - Odds Ratio; AOR - Adjusted Odds Ratio; CI - Confidence Interval.
SES - Socio-economic class

Gender, socioeconomic status, family size, living situation, and kindness from friends were not significant after adjustment.

Tolerance and the Variance Inflation Factor (VIF) were used to evaluate multicollinearity. There was no indication of multicollinearity because all tolerance values were more than 0.7 and VIF values were less than 2. The logistic regression model explained 23.9% of the variation in depression (Nagelkerke R2 = 0.376) and showed strong fit (Hosmer-Lemeshow $\chi^2 = 5.036$, p = 0.754).

## Discussion

This study demonstrated a moderate burden of depression among tribal school-going adolescents, with several modifiable psychosocial and lifestyle factors showing significant associations.

Male gender in the current study was substantially linked to depression in bivariate analysis, however the connection vanished in the multivariable model following correction. This suggests that the observed gender difference may be explained by underlying psychosocial and behavioural factors rather than gender itself. In the tribal context, male adolescents may experience distinct social pressures, expectations related to economic contribution, or reduced emotional expression due to cultural norms. Additionally, gender-based differences in help-seeking behaviour and reporting patterns may influence symptom disclosure. The attenuation of association after adjustment indicates that family environment, sleep deprivation, peer pressure, and sedentary behaviour may mediate the relationship between gender and depression.

In the present study, adolescents belonging to higher socioeconomic status showed a significantly higher prevalence of depression in the bivariate analysis. This finding may be attributed to increased academic expectations, performance pressure, and psychosocial stress among adolescents from relatively better socioeconomic backgrounds.

The magnitude of association observed for lack of family emotional support (AOR ≈ 2.8) indicates that adolescents without adequate emotional support were more than twice as more likely than their peers to suffer from depression. This finding has important clinical and public health implications. It suggests that depression in this tribal population is strongly influenced by family-level psychosocial factors rather than purely individual characteristics. Therefore, school-based screening programs should be complemented by family-centered interventions, including parental counselling, emotional literacy training and strengthening of parent-adolescent communication. At the community level, tribal health programs under the District Mental Health Programme (DMHP) could incorporate family engagement modules and culturally sensitive mental health education to address these modifiable determinants.

In contrast to Sarbhan Singh et al., who found that young adolescents in Malaysia had a lower prevalence of depressive symptoms (19%) with higher vulnerability among females, the present study observed a higher prevalence (25.5%) and identified lack of parental supervision, peer pressure and lifestyle factors as key determinants, indicating contextual and population-specific differences.[24]

The depression prevalence in the current study (25.5%) was lower than the higher burden reported by Arif Ali et al., who noted significant regional variation, with Arunachal Pradesh exhibiting a prevalence of 41.9%. Like their findings, this study emphasizes the significance of socioeconomic disadvantage, familial factors and peer influence in influencing adolescent mental health, highlighting the role of contextual and environmental determinants.[6]

The prevalence of depression in the present study (25.5%) was lower compared to Joshi V et al. (2021), who reported a prevalence of 34.3% among adoles-

cents, indicating variation in the burden of depressive symptoms across different study settings and populations.[14]

In line with Doddihal C et al.'s results, reported that comparable prevalence of depression (26.6%) with mainly mild symptoms using PHQ-9, the current study noted a similar burden of depression (25.5%). While their study focused on socio-demographic factors and stressful life events, the current study identified psychosocial and lifestyle factors as primary independent determinants.[18]

Unlike Nirudya V et al., whose study indicated a 37% depression prevalence among adolescents in Karnataka without a significant correlation to academic performance, the current study found a lower prevalence (25.5%) and identified psychosocial and lifestyle factors as primary determinants of depression.[25]

Similar findings were reported by of Gharde PM et al., who emphasized the significant impact of adolescent mental disorders and their correlation with psychosocial stressors, the current study identified depression as independently linked to peer pressure, insufficient parental oversight and inadequate family emotional support. Moreover, sleep deprivation, thinness and excessive sedentary behaviour were identified as significant modifiable risk factors, highlighting the necessity for early supportive and preventive interventions.[26]

The prevalence of depression in the present study (25.5%) is comparable to the pooled prevalence reported by Rajkumar E et al. (27%; 95% CI: 17-38%). However, a wide variation ranging from 3.5% to 88.3% was observed across studies, reflecting heterogeneity in study populations and methodologies.[27]

In contrast to Pham MD et al., who identified psychological distress in approximately one-fourth of adolescents, exhibiting significant variations based on schooling status and gender, this study recorded a similar prevalence of depression (25.5%) among school-attending adolescents. In contrast to their findings indicating greater vulnerability among females, the current study identified male adolescents as being at higher risk, underscoring contextual and population-specific variations in adolescent mental health.[28]

Similar to Alex P et al., reported a depression burden in 23.8% adolescents in Tamil Nadu, the present study found a comparable burden of depression (25.5%). However, while their study emphasized school-related factors, the present study identified psychosocial and lifestyle determinants as key independent predictors.[29]

Unlike Parida D et al., found a higher depression prevalence (39%) among school-going adolescents with maternal education as a significant factor, the current study identified a lower prevalence (25.5%). This discrepancy may indicate differences in the study population and context, with the current study prioritizing psychosocial and lifestyle factors over parental education as primary determinants.[30]

## Strength and Limitations

The focus on a hard-to-reach tribal population provides valuable evidence for an under-researched and policy-relevant group. Although a validated screening tool was used, depression was assessed through investigator-administered self-reports, which may have introduced reporting bias. Given the sensitive nature of mental health questions in a school setting, social desirability bias may have led to underreporting of symptoms, potentially resulting in an underestimation of the true prevalence of depression. Additionally, the cross-sectional design limits causal inference, and school-based sampling may restrict generalisability to out-of-school tribal adolescents, who may have different or greater mental health vulnerability.

To further understand the temporal link between psychosocial variables and depression among indigenous adolescents, future research should use longitudinal methods. Intervention studies evaluating school- and family-based mental health programs are also warranted. Additionally, research including out-of-school tribal youth and gender-focused analyses might offer a more thorough knowledge of this population's mental health concerns.

## Conclusion

This study demonstrated a moderate burden of depression among tribal school-going adolescents, with several modifiable psychosocial and lifestyle factors showing significant associations. Integrating mental health screening within school health programmes, strengthening parental involvement, and better sleep habits and active lifestyles are crucial for early prevention and mental health promotion in tribal setting.

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ception and design, data analysis, and manuscript preparation.

**Availability of Data:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

**Declaration of Non-use of Generative AI Tools:** This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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