Original Article

Risk factors for depression symptoms in adolescents

A population-based study

Dewinda Candrarukmi, MD, Fitri Hartanto, MD, Dr, Tunjung Wibowo, MD, Dr, Hari W. Nugroho, MD, Dr, Moh S. Anam, MD, Dr, Braghmandita W. Indraswari, MD, MSc, Qodri Santosa, MD, Dr, Nazliah Hanum, MD.

ABSTRACT

الأهداف: تحديد انتشار أعراض الاكتئاب وتحديد عوامل الخطر المرتبطة بها بين المراهقين.

المنهجية: أجريت دراسة مقطعية باستخدام استبيان عبر الإنترنت أكمله 1,413 مراهقًا من محافظتي جاوة الوسطى ويوجياكارتا. استخدمنا النسخة الإندونيسية المعتمدة من مقياس اكتئاب الأطفال (CDI) لقياس أعراض الاكتئاب.

النتائج: تم تحديد أعراض الاكتئاب لدى 28.5% من المشاركين. كشفت التحليلات متعددة المتغيرات عن عوامل خطر مهمة، بما في ذلك الجنس الأنثوي (OR 3.962، 95% CI 2.684–5.849)، كون الأم ربة منزل (OR 4.155، 95% CI 1.424–12.126) أو تعمل في مجال الزراعة/العمل اليدوي/الأعمال الحرة (OR 3.665، 95% CI 1.216–11.051)، العيش مع الأب البيولوجي (OR 5.386، 95% CI 1.458–19.894) أو الأوصياء غير الوالدين (OR 1.826، 95% CI 1.059–3.146)، وغياب الأشقاء (OR 1.459، 95% CI 1.057–2.013). كما ارتبطت العوامل السلوكية، مثل مدة النوم غير الطبيعية (أقل من 6 ساعات أو أكثر من 8 ساعات في الليلة، OR 3.750، 95% CI 2.833–4.964)، التدخين (OR 4.272، 95% CI 2.110–8.649)، الاستهلاك المتكرر للمشروبات السكرية (أكثر من 3 مرات/أسبوع، OR 2.472، 95% CI 1.623–3.765)، والأمراض المزمنة التي تتطلب تناول الأدوية بانتظام (OR 2.057، 95% CI 1.177–3.595) ارتباطًا قويًا بأعراض الاكتئاب.

الخلاصة: تكشف هذه الدراسة عن الارتفاع في انتشار أعراض الاكتئاب بين المراهقين وتسلط الضوء على التفاعل المعقد بين العوامل الديموغرافية والسلوكية والاجتماعية. وتؤكد النتائج على ضرورة التدخلات المستهدفة القائمة على الأدلة لتحسين الصحة النفسية

Objectives: To ascertain the prevalence of depressive symptoms and identify related risk factors among adolescents.

Methods: A cross-sectional survey was carried out using an online questionnaire completed by 1,413 adolescents from Central Java and Yogyakarta Provinces, Indonesia. The validated Indonesian version of the Children's Depression Inventory (CDI) was used to evaluate depressive symptoms.

Results: Symptoms of depression were identified in 28.5% of participants. Multivariate analysis revealed important risk factors, including female gender (OR 3.962, 95% CI 2.684–5.849), having mother who is a housewife (OR 4.155, 95% CI 1.424–12.126) or works in labor/farming/self-employment (OR 3.665, 95% CI 1.216–11.051), residing with a biological father (OR 5.386, 95% CI 1.458–19.894) or non-parental guardians (OR 1.826, 95% CI 1.059–3.146), and lack of siblings (OR 1.459, 95% CI 1.057–2.013). Behavioral factors such as abnormal sleep duration (<6 hours or >8 hours per night, OR 3.750, 95% CI 2.833–4.964), smoking (OR 4.272, 95% CI 2.110–8.649), frequent consumption of sugary beverages (>3 times/week, OR 2.472, 95% CI 1.623–3.765), and chronic illnesses requiring regular medication (OR 2.057, 95% CI 1.177–3.595) were also strongly linked to depressive symptoms.

Conclusion: This study reveals the increased prevalence of depressive symptoms in adolescents and highlights the complex interplay of demographic, behavioral, and social determinants. Findings emphasize the necessity for targeted, evidence-based interventions to enhance adolescent mental health.

Keywords: adolescents, depression, risk factors, lifestyle

Adolescence is the transition phase from childhood to adulthood. In accordance with the World Health Organization's definition of adolescence, this developmental period spans 10–19 years of age. Adolescence is a crucial stage that, in addition to the growth spurt, presents changes regarding secondary sexual characteristics, fertility, and psycho–mental–cognitive–social functions.[1,2] The psychological changes are driven by the maturity of development and maturation within the central nervous system, particularly a sprawl that includes activity function area. Adolescent health behaviors are interrelated with not only cognitive development but also several risk and protective factors linked to the social environment and adolescent mental health.[3]

Indonesia has an adolescent population of approximately 44 million.[4] Adolescent development varies based on gender, culture, and physical or social stressors.[5] Adolescents are likely to be able to consider the future when making complex decisions, but they still rely heavily on emotions in their decision-making. Physical and social experimentation increases the risk of health problems in older teens. Consequently, they face additional stressors that put them at risk of disordered eating, depression, and other forms of mental illness.[5] In Indonesia, according to the report on The Indonesia Health Survey 2023, depression affects 2% of adolescents aged 15 to 24 years.[6]

Throughout the COVID-19 outbreak, adolescent cohort studies and meta-analyses reported an increase in depressive symptoms and generalized anxiety, with rates reaching 11.6% and 29%, respectively.[5,7] These findings were further supported by Jeelani et al[8] who discovered that depression in the Indian Kashmir school-going adolescents was linked to a history of COVID-19 infection. Challenges include prevalent social isolation, unachieved developmental milestones, school shutdowns, quarantine measures, heightened family stress, and reduced peer interaction led to feelings of uncertainty, disruption of everyday routines, and worries about family well-being, which eventually contributed to an increase in generalized anxiety.[9] Zhou et al[10] found that female gender and academic level were the higher risk factor for depressive and anxiety symptoms.

Mental health is crucial for the development of children and adolescents. Detecting and managing mental health problems in this age group is of utmost importance as several mental issues often originate during childhood and adolescence.[11]

Therefore, it is essential to ascertain the prevalence of depression in adolescents and discover the factors that contribute to its onset. Early detection of these factors is recommended to prevent and treat depression in adolescents.

Methods. This study utilized a cross-sectional approach. Online questionnaire data were gathered from adolescents in Central Java and Yogyakarta Special Region Provinces using the Google Forms platform from May to August 2023. The inclusion criteria were adolescents aged 10–17 years living or studying in Central Java and Yogyakarta Special Region Provinces and both parents and children agreeing to participate. The exclusion criteria were incomplete questionnaire responses. The minimum sample size for a confidence level of 95% was 769 samples. The Dr. Moewardi Hospital Surakarta Health Research Ethics Committee provided ethical approval for this study.

The Children's Depression Inventory (CDI) was utilized to evaluate depressive symptoms. The Indonesian version of the instrument has been validated previously.[12] Previous research has consistently demonstrated the reliability and validity of the CDI across diverse populations. Notably, one study pointed out the CDI's effectiveness in distinguishing depressive disorders from anxiety and disruptive behavior disorders, with optimal cutoff scores significantly enhancing its screening accuracy.[13] Furthermore, a CDI total score of 20 has been recognized as the optimal threshold for screening depressive symptoms, achieving a sensitivity of 0.83 and a specificity of 0.89.[14] These results reinforce the CDI's utility as a robust tool for accurately identifying depressive symptoms in clinical and research settings.[14,15] An individual is considered to have depressive symptoms if their CDI score is ≥20.

A correlation analysis was performed to appraise the validity of the 27 questions in the CDI questionnaire items based on data obtained from the participants. Pearson correlation analysis revealed that all CDI questions 1–27 exhibited positive r values, with $p < 0.05$, which confirmed their validity. Additionally, the reliability assessment, conducted using Cronbach's alpha, yielded a value of 0.889 ($\propto => 0.6$, N=1343), which indicated the reliability of the questionnaire.

Statistical analysis. Categorical data are presented as frequencies and percentages (%), while parametric

data are expressed as means±standard deviations, accompanied by their range (minimum to maximum). Bivariate and multivariate analyses were conducted using logistic regression. In this study, a significance level of $p<0.05$ was deemed statistically significant. Data analyses were completed using IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, NY, USA).

Results. Of the 1,413 participants enrolled, 1,343 fulfilled the inclusion and exclusion requirements and were admitted in the study. Table 1 outlines the baseline characteristics of the study population. The mean age was 14.48±1.61 years, with a range of 10–17 years, and girls were predominant (72.3%). Based on the

Table 1 - Demographic distribution of study subjects (N=1,413).

Variables	n (%)
Age, mean years, Mean ±Standard diviation	14.48 ±1.61
Gender (%)	
Male	375 (27.7)
Female	978 (72.3)
Nutrition status (%)	
Severe malnutrition	18 (1.3)
Undernourished	297 (22)
Good nutrition	602 (44.5)
Overnutrition	186 (13.7)
Obesity	250 (18.5)
Father's education (%)	
No education	22 (1.6)
Elementary and Junior high school	554 (40.9)
Senior high school	496 (36.7)
Diploma and Bachelor	281 (20.8)
Mother's education (%)	
No education	15 (1.1)
Elementary and Junior high school	574 (42.4)
Senior high school	453 (33.5)
Diploma and Bachelor	311 (23)
Father's occupation(%)	
Jobless	57 (4.2)
Labor, farmer, employer	760 (56.2)
Civil servants, soldiers, police	111 (8.2)
Doctor, nurse	22 (1.6)
Others	403 (29.8)
Mother's occupation (%)	
Housewife	801 (59.2)
Laborer, farmer, employer	222 (16.4)
Civil servants, soldiers, police	77 (5.7)
Doctor, nurse	49 (3.6)
Others	204 (15.1)
Family experienced layoffs during the pandemic (%)	
Yes	121 (8.9)
No	1232 (91.1)

Table 1 - Demographic distribution of study subjects (N=1,413) (continuation).

Variables	n (%)
Marital status of parents (%)	
Married	1147 (84.8)
Divorced	117 (8.6)
Others	89 (6.6)
Guardians with current residence (%)	
Biological father-biological mother	1041 (76.9)
Biological father-step mother	10 (0.7)
Stepfather-biological mother	55 (4.1)
Biological father only	16 (1.2)
Biological mother only	115 (8.5)
Others	116 (8.6)
Number of families living in 1 house (%)	
<5 people	763 (56.4)
≥5 people	590 (43.6)
Siblings living in the same house (%)	
Yes	1020 (75.4)
No	333 (24.6)
Step-siblings living in the same house (%)	
Yes	50 (3.7)
No	1303 (96.3)
Duration of using devices/watching TV (%)	
Never use devices/watch TV	87 (6.4)
< 2 hours/day	407 (30.1)
≥ 2 hours/day	859 (63.5)
Frequency and duration of exercise (%)	
Never exercise	401 (29.6)
Once/week, with less than 30 minutes each time	419 (31)
> Once a week, with less than 30 minutes each	277 (20.5)
> Once a week, with 30 minutes each	107 (7.9)
> Once a week, with more than 30 minutes each	149 (11)
Sleep duration (%)	
< 6 hours	420 (31)
6-8 hours	770 (56.9)
> 8 hours	163 (12)
Frequency of drinking sugary drinks (%)	
Once/week	260 (19.2)
2-3 times/week	638 (47.2)
>3 times/week	455 (33.6)
Smoking habit (%)	
Yes	51 (3.8)
No	1302 (96.2)
Family members who died during the pandemic (%)	
Yes	87 (6.4)
No	1266 (93.6)
Having a disease that requires regular medication/control (%)	
Yes	73 (5.4)
No	1280 (94.6)
Living with a member of the family suffering from diseases that require regular medication/control (%)	
Yes	210 (15.5)
No	1143 (84.5)

Table 2 - Sociodemographic characteristics in relation to depressive symptoms.

Category parameter	With depression symptoms		Asymptomatic		Bivariate				Multivariate			
					P-value	OR	95% CI		P-value	OR	95% CI	
	n	(%)	n	(%)			Lower	Upper			Lower	Upper
Age (years) Mean ±SD	14.71±1.47		14.73±1.59		<0.001*	1.152	1.067	1.243	0.457	1.035	0.945	1.135
Gender												
Male	52	(13.5)	323	(33.4)	Ref.							
Female	334	(86.5)	644	(66.6)	<0.001*	3.222	2.336	4.442	<0.001*	3.962	2.684	5.849
Nutritional status												
Severe malnutrition	9	(2.3)	9	(0.9)	0.032*	2.810	1.096	7.205	0.084	2.778	0.872	8.855
Undernourished	83	(21.5)	214	(22.1)	0.588	1.090	0.798	1.489				
Good nutrition	158	(40.9)	444	(45.9)	Ref.							
Over nutrition	61	(15.8)	125	(12.9)	0.082	1.371	0.961	1.958				
Obesity	75	(19.4)	175	(18.1)	0.263	1.204	0.869	1.668				
Father's education												
No Education	9	(2.3)	13	(1.3)	0.208	1.770	0.728	4.306				
Elementary and Junior high school	170	(44.0)	384	(39.7)	0.443	1.132	0.825	1.554				
Senior high school	128	(33.2)	368	(38.1)	0.485	0.889	0.640	1.236				
Diploma and Bachelor	79	(20.5)	202	(20.9)	Ref.							
Mother's education												
No Education	8	(2.1)	7	(0.7)	0.023*	3.356	1.179	9.553	0.428	1.648	0.479	5.667
Elementary and Junior high school	176	(45.6)	398	(41.2)	0.099	1.299	0.952	1.772				
Senior high school	123	(31.9)	330	(34.1)	0.590	1.095	0.788	1.521				
Diploma and Bachelor	79	(20.5)	232	(24.0)	Ref.							
Father's occupation												
Doctor, nurse	4	(1.0)	18	(1.9)	Ref.							
Jobless	21	(5.4)	36	(3.7)	0.118	2.625	0.783	8.800				
Labor, farmer, employer	228	(59.1)	532	(55.0)	0.240	1.929	0.646	5.762				
Civil servants, soldiers, police	28	(7.3)	83	(8.6)	0.483	1.518	0.474	4.867				
Others	105	(27.2)	298	(30.8)	0.414	1.586	0.525	4.792				
Mother's occupation												
Doctor, nurse	5	(1.3)	44	(4.6)	Ref.							
Housewife	237	(61.4)	564	(58.3)	0.006*	3.698	1.448	9.441	0.009*	4.155	1.424	12.126
Labor, farmer, employer	70	(18.1)	152	(15.7)	0.005*	4.053	1.540	10.662	0.021*	3.665	1.216	11.051
Civil servants, soldiers, police	20	(5.2)	57	(5.9)	0.036*	3.088	1.074	8.876	0.088	2.724	0.861	8.620
Others	54	(14.0)	150	(15.5)	0.021*	3.168	1.194	8.406	0.090	2.563	0.863	7.607
Family experienced layoffs during the pandemic												
Yes	44	(11.4)	77	(8.0)	0.047*	1.487	1.006	2.198	0.214	1.348	0.841	2.159
No	342	(88.6)	890	(92.0)	Ref.							
Marital status of parents												
Married	297	(76.9)	850	(87.9)	Ref.							
Divorced	52	(13.5)	65	(6.7)	<0.001*	2.290	1.554	3.374	0.492	1.245	0.667	2.327
Others	37	(9.6)	52	(5.4)	0.002*	2.036	1.309	3.167	0.523	1.238	0.643	2.382
Guardians in current residence												
Biological father-biological mother	261	(67.6)	780	(80.7)	Ref.							
Biological father-step mother	6	(1.6)	4	(0.4)	0.021*	4.483	1.255	16.009	0.266	2.493	0.499	12.442
Step father-biological mother	21	(5.4)	34	(3.5)	0.032*	1.846	1.053	3.237	0.781	1.112	0.526	2.351
Biological father only	10	(2.6)	6	(0.6)	0.002*	4.981	1.793	13.837	0.012*	5.386	1.458	19.894
Biological mother only	43	(11.1)	72	(7.4)	0.005*	1.785	1.193	2.670	0.083	1.760	0.928	3.337
Others	45	(11.7)	71	(7.3)	0.002*	1.894	1.271	2.823	0.030*	1.826	1.059	3.146
Number of families living in 1 house												
<5 people	227	(58.8)	536	(55.4)	0.258	1.148	0.904	1.458				
Siblings living in the same house												
Yes	275	(71.2)	745	(77.0)	Ref.							
No	111	(28.8)	222	(23.0)	0.026*	1.355	1.038	1.768	0.021*	1.459	1.057	2.013
≥5 people	159	(41.2)	431	(44.6)	Ref.							

Analysis using logistic regression tests. *Significant at *p*<0.05. CI: confidence interval, SD: standard deviation, OR: odds ratio, Ref: reference

Table 2 - Sociodemographic characteristics in relation to depressive symptoms (continuation).

Category/Parameter	With depression symptoms		Asymptomatic		Bivariate				Multivariate			
					P-value	OR	95% CI		*P*-value	OR	95% CI	
	n	(%)	n	(%)			Lower	Upper			Lower	Upper
Step-siblings living in the same house												
Yes	21	(5.4)	29	(3.0)	0.034*	1.861	1.048	3.305	0.755	1.130	0.525	2.433
No	365	(94.6)	938	(97.0)	Ref.							
Duration of using devices/watching TV												
Never use device/watch TV	94	(24.4)	313	(32.4)	Ref.							
<2 hours/day	31	(8.0)	56	(5.8)	0.016*	1.843	1.123	3.026	0.335	1.330	0.745	2.374
≥ 2 hours/day	261	(67.6)	598	(61.8)	0.007*	1.453	1.107	1.909	0.441	1.135	0.823	1.565
Frequency and duration of exercise												
Never exercise	170	(44.0)	231	(23.9)	0.001*	2.076	1.370	3.145	0.053	1.625	0.995	2.653
Once/week, with less than 30 minutes each time	79	(20.5)	340	(35.2)	0.060	0.655	0.422	1.017				
> Once/week, with less than 30 minutes each	72	(18.7)	205	(21.2)	0.967	0.991	0.630	1.559				
> Once/week, with 30 minutes each	26	(6.7)	81	(8.4)	0.734	0.905	0.510	1.606				
> Once/week, with more than 30 minutes each	39	(10.1)	110	(11.4)	Ref.							
Smoking habit												
Yes	29	(7.5)	22	(2.3)	<0.001*	3.489	1.979	6.154	<0.001*	4.272	2.110	8.649
No	357	(92.5)	945	(97.7)	Ref.							
Family member who died during the pandemic												
Yes	32	(8.3)	55	(5.7)	0.080	1.499	0.953	2.357				
No	354	(91.7)	912	(94.3)	Ref.							
Having disease that require regular medication/control												
Yes	38	(9.8)	35	(3.6)	<0.001*	2.908	1.808	4.678	0.011*	2.057	1.177	3.595
No	348	(90.2)	932	(96.4)	Ref.							
Family with diseases that require regular medication/control												
Yes	76	(19.7)	134	(13.9)	0.008*	1.524	1.118	2.078	0.226	1.253	0.870	1.806
No	310	(80.3)	833	(86.1)	Ref.							

Analysis using logistic regression tests *Significant at *p*<0.05. CI: confidence interval, SD: standard deviation, OR: odds ratio, Ref: reference

CDI questionnaire, 386 (28.5%) exhibited symptoms of depression, and 334 (86.5%) participants who had depressive symptoms were girls.

Bivariate and multivariate analyses were carried out to explore the determinant factors of depression in adolescents. Table 2 shows that adolescents who are female [odds ratio (OR 3.962, 95% confidence interval (CI) 2.684–5.849], have a mother who is a housewife (OR 4.155, 95% CI 1.424–12.126) or is employed as a laborer/farmer/self-employed (OR 3.665, 95% CI 1.216–11.051), reside with a biological father (OR 5.386, 95% CI 1.458–19.894) or non-parental guardians (OR 1.826, 95% CI 1.059–3.146), have no siblings living in the same house (OR 1.459, 95% CI 1.057–2.013), sleep for less than 6 h or more than 8 h (OR 3.750, 95% CI 2.833–4.964), have smoking habit (OR 4.272, 95% CI 2.110–8.649), consume sugary beverage more than 3 times/week (OR 2.472, 95% CI 1.623–3.765), and have a chronic illness requiring regular medication (OR 2.057, 95% CI 1.177–3.595) were more likely to experience depressive symptoms.

Among the variables analyzed, the presence of a biological father as the primary guardian in the current residence demonstrated the strongest association with higher odds of depressive symptoms (OR 5.386, 95% CI 1.458–19.894). These findings accentuate the critical role of family dynamics and lifestyle in adolescent mental health.

Discussion. The incidence of depression in adolescents should be addressed because it has acute and lasting consequences. Depression in adolescents is a risk factor for committing suicide and self-harm.[16,17] Furthermore, it can lead to educational and social impairment and increase the incidence of risk-taking behaviors, such as smoking, alcohol abuse, and physical fight.[18]

There are commonalities in the symptoms of depression in adolescents and adults. The diagnostic criteria for depression based on the International Classification of Diseases-10 (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM 5) are similar. However, DSM 5

includes irritability as a critical diagnostic symptom for depression in children and adolescents.[19] Depression in adolescents is often underdiagnosed because of the presence of restlessness, explosive feelings, and intermittent symptoms.[20] Detection of depressive conditions could be missed if the main symptoms are indeterminate physical symptoms, eating disorders, anxiety, school avoidance, decreased school achievement, substance abuse, and behavioral disorders.

This study found that 28.5% of the adolescents suffered from depressive symptoms based on the CDI questionnaire. Of the participants with depressive symptoms, 86.5% were girls. This frequency is higher than the findings of the Indonesia National Adolescent Mental Health Survey (I-NAMHS) conducted in 2021. Based on the I-NAMHS 2021 observations, anxiety disorder, which includes social phobia and generalized anxiety disorder, is the most prevalent mental disorder among adolescents, affecting 3.7%. Major depressive disorder, conduct disorder, post-traumatic stress disorder, and attention deficit hyperactivity disorder follow at 1.0%, 0.9%, and 0.5%, respectively.[21,22] The significantly higher results in our study can be attributed to the fact that I-NAMHS uses a different approach to screen for depression in adolescents, specifically the Diagnostic Interview Schedule for Children (DISC). This result also suggest that a mental health specialist should further evaluate those with symptoms of depression to determine if they meet the criteria for depression based on DSM 5.

The prevalence of depressive symptoms in this survey exceeded the 20.9% reported in Hongkong primary school students, 21.5% in Kuala Lumpur secondary school students, and 26.4% in Nairobi adolescents, all assessed using the same questionnaire and cut-off.[23-25] The elevated prevalence of depressive symptoms in the current study aligns with a meta analyses study by Ma et al[7] that stressed the increase of depression's prevalence (29% [95% CI: 17%, 40%]) within children and adolescents during the COVID-19 pandemic, particularly among female and adolescents. Another investigation conducted during the COVID-19 pandemic with 647 adolescents aged 14–17 years in Bandung obtained higher epidemiological data. The research found that 32.15% of the adolescents experienced depression, which ranged from mild to very severe.[26]

The female gender (OR 3.962, 95% CI 2.684–5.849) increased the likelihood of depressive symptoms in adolescents. This finding is consistent with a previous study by Zhou et al,[10] which indicates that women have a higher likelihood of experiencing symptoms of depression (OR 1.15, 95% CI 1.05–1.26) and anxiety (OR 1.10, 95% CI 1.001–1.21). The ratio of depression between men and women is 1:1 during childhood and increases to 1:1.5–3.0 in early adolescence and adulthood.[27] Multiple studies have demonstrated that depression is more prevalent in adolescent girls than in boys.[28,29]

In this study, the mother's occupation was strongly associated with the symptoms of depression in adolescents. Mothers as housewife (OR 4.155, 95% CI 1.424–12.126) or working as laborers/farmers/employers (OR 3.665, 95% CI 1.216–11.051) increased the possibility of experiencing depressive symptoms. This association is probably influenced by economic and knowledge factors regarding COVID-19 during the pandemic. A study by Zhou et al[10] has also reported similar results, which demonstrates that the level of knowledge, prevention efforts, and protection against COVID-19 infection exert a psychological protective effect. Mridha et al[28] conducted a study involving adolescent participants, 4,907 boys and 4,949 girls in India, which observed that adolescents from households with severe food insecurity were more likely to exhibiting depressive symptoms (boys aOR 1.44, 95% CI 1.17–1.79; girls aOR 1.64, 95% CI 1.33–2.0).

The marital status of parents did not affect the incidence of depression in adolescents (*p*=0.492 and 0. 523). Nonetheless, living in the same house with only biological father (OR 5.386, 95% CI 1.458–19.894) or non-parental guardians (OR 1.826, 95% CI 1.059–3.146), increase the risk of depressive symptoms. Recent studies have reported the significant relationship between living with a single biological parent or having no biological siblings and the prevalence of depression in adolescents. Research indicates that adolescents from single-parent households have an elevated risk of developing depressive symptoms compared to those living with both biological parents. For instance, a study by Park and Park[30] found that adolescents in single or stepparent families exhibited higher rates of depressive symptoms and suicidal behaviors than their peers living with both biological parents. This suggests that the absence of a stable parental figure may contribute to emotional distress and mental health challenges during critical developmental years.

Additionally, the dynamics of sibling relationships also play a vital part in adolescent mental well-being. Chi et al[31] reported that adolescents without siblings, particularly those from only-child families, often experience higher levels of depression when family functioning is poor. Consistent with these findings, this study identified that the absence of siblings within

the same household significantly increases the risk of depressive symptoms among adolescents (OR 1.459, 95% CI 1.057–2.013). The lack of sibling support can exacerbate feelings of isolation and emotional distress, as siblings often provide companionship and emotional support that can buffer against depressive symptoms.

The results of the multivariate analysis performed in this study indicated an increased susceptibility to experiencing symptoms of depression in adolescents who slept <6 h or >8 h per day (OR 3.750, 95% CI 2.833–4.964). A comprehensive meta-analysis of relevant research found a substantial relationship between shorter sleep duration and an increased risk of mood disturbances and depressive disorders in adolescents.[32] Zhang et al[33] further underlined this association, noting that adolescents with subpar sleep quality combined with inadequate sleep duration had a markedly higher likelihood of experiencing symptoms of depression (OR=4.04, 95% CI 3.53–4.62). Furthermore, emerging evidence indicates that both insufficient and excessive sleep durations may contribute to the manifestation of depressive symptoms in this population.[34]

Smoking in adolescents is related to an increased risk of depression, but the relationship can be 2-way.[35,36] This study observed that adolescents who smoked regularly had a higher probability of experiencing depressive symptoms (OR=4.272, 95% CI 2.110–8.649). Smoking in adolescents can serve as a coping mechanism to provide a feeling of comfort or relieve stress, but smoking itself can lead to addiction, anxiety, and stress.

Micronutrient deficiencies and malnutrition can impair the physical growth and mental development of children. Orlando et al[37] reported in a meta-analysis there is a positive correlation between unhealthy dietary patterns and both internalizing behaviors (r=0.09, $p < 0.001$, 95% CI 0.06–0.14) and depressive symptoms (r=0.10, $p < 0.01$, 95% CI 0.05–0.17). Adolescents with unbalanced diet, such as frequent consumption of fast-food (aOR 1.73, 95% CI 1.55–1.93) and regular intake of carbonated beverages (aOR 1.59, 95% CI 1.48–1.70), were observed to have a significantly heightened risk of depression.[38] This study corroborates these findings, revealing that consuming sugary-beverages more than 3 times per week (OR 2.472, 95% CI 1.623–3.765) markedly elevates the likelihood of depressive symptoms in adolescents.

Recent literature has increasingly called attention to the connection between chronic diseases and the risk of depression in adolescents. The present study found that having a chronic disease requiring routine medication (OR 2.057, 95% CI 1.177–3.595) augmented the odds of adolescents experiencing depressive symptoms. In line with our study, a survey by Suryaputri et al[39] discovered that chronic diseases are associated with risk of depression in adolescents. Adolescents with chronic illnesses often experience unique challenges that can lead to feelings of isolation and distress, thereby increasing their vulnerability to depression. Chronic illnesses can create a cycle of physical and emotional distress, exacerbating depressive symptoms over time. Hards et al[40] conducted a systematic review focusing on self-evaluation and depressive symptoms in adolescents with chronic illnesses, that found that negative self-assessment, often exacerbated by the burden of managing a chronic condition, is significantly associated with increased depressive symptoms. The interplay between physical health challenges and mental health outcomes necessitates a holistic approach to care that addresses both the physical and psychological needs of these adolescents.

The high prevalence of depressive symptoms (28.5%) among adolescents in Central Java and Yogyakarta indicates a pressing need for targeted mental health interventions. Given the identified risk factors—such as female, maternal occupation, and residing with a biological father or non-parental guardians —healthcare providers and educators should prioritize mental health screenings in schools and community health settings. Utilizing validated tools like the Children's Depression Inventory (CDI) can facilitate early detection of depressive symptoms, allowing for timely intervention.[26]

Moreover, the study accentuate the value of family dynamics and socioeconomic factors in adolescent mental health. For instance, maternal occupation as a housewife or laborers/farmers/employers as a risk factor, suggesting that parental education and support systems play a crucial role in adolescent well-being. Programs aimed at educating parents about mental health and promoting healthy lifestyle choices, such as good sleep habit and balanced nutrition, could mitigate the risk of depression.[26] Additionally, the findings underscore the necessity of integrating mental health education into school programs to raise awareness among adolescents about the signs and symptoms of depression. Schools can implement peer support programs and counseling services to foster a supportive environment for students.

Future research should focus on longitudinal studies to better comprehend the causal association between identified risk factors and the development of depressive symptoms in adolescents. Investigating the impact of cultural and environmental factors on mental health outcomes is crucial, particularly in diverse settings like Indonesia. Moreover, expanding the study to include

a broader demographic across different regions of Indonesia could provide insights into regional variations in mental health and the effectiveness of interventions.

Our study has several limitations, including the use of cross-sectional methods, which can only show the association and not the causal relationship between the variables. The adolescents filled out the questionnaires independently and could have been immensely influenced by their knowledge and understanding, especially in the case of sensitive information. The study on the CDI presents several limitations that should be considered. One significant limitation is the variability in the cut-off scores used across different studies and populations, which can affect the tool's sensitivity and specificity in screening for mental depression in adolescents. Follow-up programs for those with depressive symptoms based on the CDI questionnaire are needed to establish the diagnosis. Face-to-face in-depth interviews are important to diagnose depression based on the DSM-5 criteria in participants exhibiting symptoms of depression according to the CDI questionnaire.

In conclusion, the prevalence of adolescents displaying depressive symptoms was relatively high in this study (28.5%). Sociodemographic factors that might increase the depressive symptoms in adolescents include female gender, mother's occupation as a housewife or a laborer/farmer/employer, residing with a biological father or non-parental guardians, absence of siblings, sleep duration <6 h or >8 h, smoking habit, sugary beverage consumption more than 3 times a week, and presence of a chronic disease requiring routine medication.

Timely detection of depressive symptoms, especially in at-risk adolescents, is necessary for early diagnosis and prompt intervention. Addressing adolescent depression in Indonesia requires a multifaceted approach that combines early detection, family involvement, and community education.

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