# Anxiety and Its Associated Factors Among School-aged Adolescents in East Jakarta, Indonesia during the Coronavirus Disease-2019 Pandemic

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## Abstract

**BACKGROUND:** The coronavirus disease-2019 (COVID-19) pandemic can be a significant psychological stressor which is associated with increased levels of anxiety and stress during the COVID-19 pandemic.

To determine adolescent anxiety prevalence and associated risk factors.

**MATERIALS AND METHODS:** An online cross-sectional survey was performed from February to April 2021 at SMPN 9, East Jakarta, on 304 adolescents. The subjects were examined using sociodemographic form and self-report measures of anxiety, COVID-19 knowledge, and physical activity. The statistical significance level was set at $p < 0.05$.

**RESULTS:** Median age was 14 years (range 12–16) and prevalence of anxiety 19.4%. Multivariable logistic regression findings: gender (adjusted odd ratio [aOR] = 2.50; 95% confidence interval [CI] = 1.26–4.98; $p = 0.009$), physical activity (aOR = 2.16; 95% CI = 1.15–4.06; $p = 0.017$;), knowledge level of COVID-19 (aOR = 1.81; 95% CI = 0.99–3.32; $p = 0.053$); age (aOR = 0.53; 95% CI = 0.19–1.46; $p = 0.218$); education (aOR = 0.96; 95% CI = 0.35–2.64; $p = 0.932$). Gender and physical activity were significantly associated with risk of adolescent anxiety.

**CONCLUSION:** Inactive physical activity status increases the risk of adolescent anxiety. Governmental regulations are needed on the planning and implementation of a health education program for increasing physical activity among adolescents to improve physical and mental health. As a follow-up to this study, there is a need for conducting a study to determine changes in prevalence rates of adolescent anxiety during as well as after the pandemic and its associated risk factors with a better design study.

## Introduction

Corona Virus Disease 2019 (COVID-19), caused by the SARS coronavirus 2 (SARS-CoV-2), has spread globally and also to Indonesia, where it was first officially announced on March 2, 2020 [1]. In response to the fact that Daerah Khusus Ibukota (DKI) Jakarta had a high-COVID-19 infection rate, the Governor of DKI issued Regulation No. 33/2020, covering the implementation of Large Scale Social Restrictions as one of the measures for COVID-19 management [2].

The impact of these restrictions in the educational field was the redirection of face-to-face learning to an online one [3], the breakdown in social interactions with peer support groups, and the disordered activities of daily living of adolescents, the solution of which constitutes one of the stress-coping mechanisms for the students [4], resulting in a higher prevalence of adolescent anxiety during the pandemic of around 24.9%–37.4% [5], [6], [7].

Adolescents aged 10–19 years are in a phase of life with physical, emotional, and social changes that render them susceptible to anxiety [8]. In adolescence, anxiety may interfere with activities of daily living and, unless managed properly, may persist into adulthood [9]. Adolescents with anxiety disorders have various important social and academic issues [10], associated with a two-fold increase in the risk of arthritis, heart disease, and digestive tract disorders [11], and poor quality of life [12]. In addition, the high cost of healthcare for the aforementioned diseases, the average total expenditure per year is $6405, which markedly rises with anxiety levels [13].

Several studies have been conducted to determine the factors associated with adolescent anxiety in during the pandemic, but the results are still inconclusive. The higher risk of female adolescents for anxiety in comparison with male adolescents was shown in several studies [7] but not in another study [14].

Physical inactivity is associated with increased levels of anxiety and stress during COVID-19 pandemic [15]. One study showed that being physically active may shield adolescents from the results of the fear of COVID-19, but there is no significant relationship between these two conditions [16].

Other factors that are still unclear in their relation to adolescent anxiety are age [5], [14], educational level [4], [5], financial strain [17], number of COVID-19 household cases [14], [18], residence in urban/rural areas [5], changes in teaching pattern [19], entertainment media, reading [18], and knowledge of COVID-19 [5].

In addition, the adolescent anxiety prevalence is significantly affected by the interval between the onset of the pandemic and the implementation of a study, and by ethnic and sociocultural factors [20], which may result in variations in the reported prevalence of COVID-19 in a given country and region. The large influence of anxiety on adolescents, their families, and the government underlines the need for the identification of the factors related to adolescent anxiety as the basis for the government and policymakers to plan and implement mental health programs for adolescents during the pandemic.

The results of studies on the risk factors of adolescent anxiety are still inconsistent, and there is also a need for accurate data on the prevalence of adolescent anxiety, which vary between countries and regions because they are affected by the duration of the pandemic, the regulations on social distancing that are applied by the government, and ethnic and sociocultural factors. Therefore, this study aimed to determine the prevalence of adolescent anxiety during the pandemic and its associated risk factors.

## Materials and Methods

### Study design and participants

This cross-sectional analytical observational study was conducted at SMP Negeri 9, East Jakarta, from February to April 2021, using these inclusion criteria: (i) male/female junior high school students; (ii) age 12–16 years; (iii) currently in grades VII-IX; (iv) agreeing to become study participants; (v) consent of subjects and their parents/legal guardians after being fully informed about the study. Participants with self-reported anxiety disorders or consumption of anti-anxiety medications before the pandemic or during data collection were excluded. The participants were selected through simple random sampling from the student register.

Estimation of the sample size was done by assuming an anxiety disorder prevalence among adolescents of 24.9% [21], $Z\alpha$ at $\alpha$ 5% = 1.96, and measurement accuracy of 0.05, then with the number of persons in the finite populations at the data collection site being 884, the estimated smallest sample in this study was 218.

All subjects and parents/legal guardians gave written informed consent before the start of the study, which was approved by the Medical Ethics Committee, Faculty of Medicine, Universitas Trisakti, under No. 42/KER-FK/2/2021.

### Measurements

Because of the risk of transmission of infection in the pandemic situation, data collection was not by direct face-to-face interviews but by questionnaire in an online survey using Google forms. Filling-in of the questionnaires by the participants was guided by investigators through zoom meeting teleconferences after prior explanations.

The subjects' knowledge about COVID-19 was evaluated using a questionnaire from Saefi *et al.* [22], comprising 18 items on etiology, symptoms, at-risk groups, transmission, and prevention. Each item received a score of 1 for a true answer and zero for a false one. This knowledge questionnaire had been validated in Indonesian undergraduate students with a reliability of 0.98 [22]. The knowledge level was deemed to be good if the knowledge of the respondent was higher than or equal to the group's median value, and deemed to be poor if the respondent's score was below the group's median.

The physical activity of the participants in the pandemic era was evaluated according to the WHO recommendations on physical activity during the COVID-19 pandemic for children and adolescents aged 5–17 years, namely minimally 60 min/day [23]. Sample questions on participants' physical activity were: (i) How many days per week did you perform physical activity indoors/outdoors in the last week? The responses to the questions comprised an eight-point measurement scale (from 0 = "not a single day" up to 7 = "7 days/week"); (ii) How many minutes per day (on average) do you perform physical activity? The response to this question was recorded as the average time in minutes per day used in performing physical activity. Physical activity status in our study was categorized as active if the adolescents performed physical activity minimally 60 min/day, and as inactive if they performed physical activity for <60 min/day.

The symptoms of anxiety were measured using the 7-item self-reported Generalized Anxiety Disorder-7 (GAD-7) instrument. The subjects had to indicate the occurrence of each symptom over the past 2 weeks using a 4-point Likert scale (0 = not at all, 1 = several days, 2 = more than half a day, and 3 = almost every day), with total scores ranging from 0 to 21. A GAD-7 score of >4 (present) was categorized as indicating anxiety and a GAD-7 score of ≤4 (absent) as not indicating anxiety [7].

### Statistical analysis

Before the data analysis, data cleaning was performed using consistency, range, and logical checks. The Kolmogorov–Smirnov test of normality was applied to all numerical variables. The prevalence of anxiety disorder was reported as a proportion. Categorical data were presented as the number of respondents (n), percentage (%), odds ratio (OR), and 95% confidence interval (95%CI). A simple logistic regression test was used to determine the relationship of sociodemographic characteristics, COVID-19 knowledge level, and physical activity with adolescent anxiety. Factors with a $p < 0.25$ in the simple logistic regression test were candidate variables to be analyzed with a multivariable logistic regression test, with the level of significance set at $p < 0.05$.

## Results

### Characteristics of respondents

A total of 356 students were successfully recruited for participation in this study. After excluding 52 students who did not fulfill the eligibility criteria or did not complete the questionnaire, the final sample subjected to data analysis comprised 304 students. The prevalence of participants with severe anxiety was 59 (19.4%) [Table 1]. Table 1 shows the respondents' sociodemographic characteristics, physical activity, COVID-19 knowledge level, and the presence or absence of anxiety.

**Table 1: Distribution of sociodemographic characteristics, physical activity status, coronavirus disease-2019 knowledge level and anxiety of respondents (n = 304)**

| Characteristics | Frequency, n (%) |
|---|---|
| Age (years), median (minimum–maximum) | 14 (12–16) |
| 12 | 20 (6.6) |
| 13 | 65 (21.4) |
| 14 | 137 (45.1) |
| 15 | 78 (25.6) |
| 16 | 4 (1.3) |
| Gender | |
| Male | 109 (35.9) |
| Female | 195 (64.1) |
| Educational level | |
| Grade VII | 105 (34.5) |
| Grade VIII | 111 (36.5) |
| Grade IX | 88 (28.9) |
| Residence | |
| Jakarta | 275 (90.5) |
| Outside Jakarta | 29 (9.5) |
| Physical activity status[a], median (minimum–maximum) | 30 (30–720) |
| Active | 131 (43.1) |
| Inactive | 173 (56.9) |
| COVID-19 knowledge level[a], median (minimum–maximum) | 16 (11–18) |
| Good | 184 (60.5) |
| Poor | 120 (39.5) |
| Anxiety[a], median (minimum–maximum) | 1 (0–17) |
| Absent | 245 (80.6) |
| Present | 59 (19.4) |

[a]Classification of categorical data: Physical activity status: Active (total time for physical activity ≥ 60 min/day), inactive (total time for physical activity < 60 min/day); COVID-19 knowledge: Good (score > 16), poor (score ≤ 16); anxiety: Absent (GAD-7 score ≤ 4), present (GAD-7 score > 4). COVID-19: Coronavirus disease-2019, GAD-7: Generalized anxiety disorder-7.

Relationship of sociodemographic characteristics, physical activity, and COVID-19 knowledge level with the anxiety of respondents.

The results of the bivariate analysis of the study participants with and without anxiety, based on sociodemographic characteristics, physical activity, and COVID-19 knowledge level, are shown in Table 2.

**Table 2: Relationship of sociodemographic characteristics, physical activity status, and coronavirus disease-2019 knowledge level with anxiety of respondents (n = 304)**

| Variables | Anxiety[a] | | OR | p[c] | 95% CI |
|---|---|---|---|---|---|
| | Present, n (%) | Absent, n (%) | | | |
| Age (years) | | | | | |
| < 15 | 37 (16.7) | 185 (83.3) | 0.55 | 0.049* | 0.23–0.99 |
| ≥ 15 | 22 (26.8) | 60 (73.2) | 1 | | |
| Gender | | | | | |
| Male | 13 (11.9) | 96 (88.1) | 0.44 | 0.015* | 0.22–0.85 |
| Female | 46 (23.6) | 149 (76.4) | 1 | | |
| Educational level | | | | | |
| Grades VII–VIII | 38 (17.6) | 178 (82.4) | 0.68 | 0.212* | 0.57–1.24 |
| Grade IX | 21 (23.9) | 67 (76.1) | 1 | | |
| Residence | | | | | |
| Jakarta | 54 (19.6) | 221 (80.4) | 1.17 | 0.757 | 0.43–3.21 |
| Outside Jakarta | 5 (17.2) | 24 (82.8) | 1 | | |
| Physical activity status[a] | | | | | |
| Active | 17 (13.0) | 114 (87.0) | 0.46 | 0.016* | 0.25–0.86 |
| Inactive | 42 (24.3) | 131 (75.7) | 1 | | |
| COVID-19 knowledge level[a] | | | | | |
| Good | 30 (16.3) | 154 (83.7) | 0.61 | 0.092* | 0.34–1.08 |
| Poor | 29 (24.2) | 91 (75.8) | 1 | | |

[a]Classification of categorical data: Physical activity status: active (total time for physical activity ≥ 60 min/day), inactive (total physical activity < 60 min/day); COVID-19 knowledge level: Good (score > 16), poor (score ≤ 16); anxiety: Absent (GAD-7 score ≤ 4), present (GAD-7 score > 4), [c]Statistical analysis with simple logistic regression test; p meets requirements for performing analysis with the multivariable logistic regression test, OR: Odds ratio, CI: Confidence interval, COVID-19: Coronavirus disease-2019, GAD-7: Generalized anxiety disorder-7.

In the bivariate analysis using the simple logistic regression test, five variables met the requirements for a multivariable logistic regression test ($p < 0.25$), namely age, gender, educational level, physical activity, and COVID-19 knowledge level [Table 2].

### Multivariable analysis results of associated factors versus anxiety

Multivariable logistic regression analysis showed that female participants had a 2.50-fold significantly higher risk for experiencing anxiety than had male participants (aOR = 2.50; 95%CI = 1.26–4.98; p = 0.009). Participants with inactive physical activity status had a 2.16-fold significantly higher risk for experiencing anxiety than did those with active physical activity status (aOR = 2.16; 95% CI = 1.15–4.06; p = 0.017) [Table 3].

**Table 3: Results of multivariable logistic regression analysis (n = 304)**

| Variables | aOR | P[c] | 95% CI |
|---|---|---|---|
| Age (years) | | | |
| < 15 | 0.53 | 0.218 | 0.19–1.46 |
| ≥ 15 | 1 | | |
| Gender | | | |
| Female | 2.50 | 0.009* | 1.26–4.98 |
| Male | 1 | | |
| Level of education | | | |
| Grades VII–VIII | 0.96 | 0.932 | 0.35–2.64 |
| Grade IX | 1 | | |
| Physical activity status[a] | | | |
| Inactive | 2.16 | 0.017* | 1.15–4.06 |
| Active | 1 | | |
| Level of knowledge[b] | | | |
| Poor | 1.81 | 0.053 | 0.99–3.32 |
| Good | 1 | | |

[a]Categorization of cofactor data: Physical activity status: Active (total time for physical activity ≥ 60 min/day), inactive (total physical activity < min/day); COVID-19 knowledge level: Good (score > 16), poor (score ≤ 16), [c]Statistical analysis with multiple logistic regression test at level of significance of p < 0.05. aOR: Adjusted odds ratio, CI: Confidence interval, COVID-19: Coronavirus disease-2019.

## Discussion

Our study shows that the prevalence of adolescent anxiety was 19.4% [Table 1] which was much greater than in the meta-analyses covering studies before the pandemic, with global prevalence rates of anxiety in children and adolescents of 3.2% and 6.5 %, respectively [23], [24], but lower than the 24.9%–37.4% found in studies conducted during the pandemic era [5], [6], [7]. The difference in prevalence between our study and the other studies may be the result of the data collection being performed at a time when the community had adapted to the "new normal" conditions, the course and characteristics of COVID-19 were better known, and vaccines for the disease had been developed.

In addition, regional differences in confirmed COVID-19 cases may have resulted in differing prevalence rates of anxiety between our study and the others. The regional frequency of these cases is much related to the strictness of the regulation and implementation of COVID-19 preventive and educational programs that can lessen the negative impact of the pandemic on mental problems [7], [25]. Apart from any variation in prevalence in our study as compared to other studies, our results are consistent with these other studies [5], [6], [7], which also found increased prevalence rates for pandemic adolescent anxiety.

During the pandemic in Indonesia, online mental health services have been developed [26], that have been studied by the Acceptability of Mental-Health Mobile-App Survey [27], as have also health services through the media, but these health services are general and are not specifically designed for adolescents, who constitute the age group most susceptible to anxiety. Therefore, online mental health services should be developed specifically for adolescents to optimally assist them. Of no less import is parental support during the pandemic, to overcome the mental health stressors occurring as a result of the pandemic. Tang *et al*. [6] showed that open discussions between parents and children may reduce the latter's psychopathological symptoms in the pandemic era.

Our finding that female participants had a 2.50-fold significantly higher risk for anxiety than had male participants, agrees with those of Chen *et al*.[7], Duan *et al*. [28], Zhou *et al*. [5], and Magson *et al*. [29] that showed a higher risk among female adolescents for experiencing anxiety as compared to male adolescents. In contrast, Xie *et al*. [14] showed that gender could not be used for predicting anxiety. The presence of a gender difference in the prevalence of anxiety is supported by other studies [30], [31].

The underlying mechanisms of the gender difference in anxiety are differences in brain structure and function that play a role in the susceptibility to anxiety (prefrontal cortex, hippocampus, and extended amygdala complex), fluctuations in gonadal hormones during the phases of a woman's life (such as puberty), and genetic, neurodevelopmental, environmental, and neurobiological factors, that comprise yet another group of hypothetical factors explaining these gender differences [30], [31].

In addition, the presence of between-gender sociocultural differences in facing the occurring problems may also contribute to gender differences in adolescent anxiety prevalence. Female adolescents more frequently use preoccupied and anxious coping [30] that may be responsible for their greater susceptibility to stress and fear of the pandemic. Implementation of large-scale social restrictions can cause loss of school routine, which is the main coping mechanism in adolescent girls [4], [32], although this statement should be further investigated. Therefore, one of the possible measures is promoting the safe interaction of adolescents (especially the females) with peer groups, such as utilizing various online communication media to meet their need for social support during the pandemic. Overall, peer support may be of benefit for ameliorating mental health status during the pandemic [33], although the importance of online peer support for mental attacks in adolescents needs to be further investigated [34].

Physical inactivity is associated with increased levels of anxiety and stress during the COVID-19 pandemic [15]. Regular physical activity is known to have positive effects on psychological health including: (i) improving one's self-esteem and a sense of well-being; (ii) reduction of stress, anxiety, and depression by making changes in the hypothalamic-pituitary-adrenal axis and mediation of the endogenous opioid system; and (iii) upregulation of different trophic factors, such as brain-derived neurotrophic factor, the most abundant neurotrophin in the brain, which positively influences both anxiety and depressive disorders [35].

In the present study, participants who did not actively perform physical activity had a 2.16-fold significantly higher risk for experiencing anxiety than those who actively performed physical activity. The studies on the physical activity to adolescent anxiety relationship during the pandemic show inconsistent results. Zhang *et al*. [36] showed that physical activity had a direct lowering effect on negative emotions. Wright *et al*. [16] found that physical activity may reduce the negative impact of fear of the coronavirus, but there was no significant correlation between physical activity and adolescent anxiety. Our study results agree with the findings of Chen *et al*. [7], who showed that persons who do physical activity for >60 min/day have 0.84-fold significantly lower risks for experiencing anxiety as compared to those who perform physical activity for < 30 min/day.

The inconsistent study results in determining the relationship between physical activity and adolescent anxiety may be caused by other influencing factors of

anxiety (e.g., gender). The study by Buchan *et al.* [37] showed that associations between physical activity and mental symptoms were unidirectional and differed between male and female high school students, where higher baseline levels of physical activity of moderate to vigorous intensity were associated with less anxiety in male students, but with more anxiety at follow-up in female students.

In our opinion, outdoor physical activity may be selected provided that a safe distance from bystanders is feasible (in parks, fields, home surroundings), and by always following the health protocol (e.g., by wearing masks). Online physical activity education may become one of the alternative approaches for increasing physical activity in adolescents during the pandemic. A randomized pilot trial by Haley *et al.* [38] showed that increased Internet-based physical activity in adolescents with mental health disorders may reduce depression in the intervention group. Deng *et al.* [39] showed that web-based physical activity education may significantly reduce the anxiety score in adolescents, which is associated with regularly performing a physical activity of more than 1-2 times/week, with a duration of physical activity of >1h and of >2,000 pedometer steps.

Our study shows that age, educational level, and COVID-19 knowledge level are not significantly associated with adolescent anxiety.

### Implications of the study

Our finding of a high adolescent anxiety prevalence should be immediately followed-up. The government and health policy-makers for planning and allocation of resources and infrastructure facilities should institute prevention and intervention as early as possible through online psychological counseling for students with known anxiety disorders, to depress the prevalence of anxiety and improve the adolescents' quality of life. Support from peer groups, parents, and persons around the adolescents is very much needed, particularly in female adolescents whose psychological characteristics depend on support from persons around them, particularly during the pandemic.

Our study showed that being physically inactive is a risk factor for adolescent anxiety. Regarding the physical activity level necessary for maintaining health as recommended by the WHO [23], adolescents should perform at least 60 min of moderate-to-vigorous-intensity physical activity daily or minimally three times weekly. Apart from routine sports, during the pandemic schools should support the recommendations on physical education and promote physical activity as part of learning through safe media. One method that may be applied is web-based physical education (e.g., studying recorded videos/real-time videos, communicating with a teacher on an education

platform) [39]. The school setting, and particularly the physical educators, should perform a public health service by starting a comprehensive school physical activity program. Adolescents should be encouraged to perform both indoor and outdoor physical activities. The latter improves adolescent mental health and physical well-being during the pandemic [40], with the observance of safe distancing and health protocols.

## Limitations of the study

The weak points in our study are: (i) the cross-sectional study design cannot determine the actual causative factors of anxiety; (ii) the GAD-7 questionnaire used to measure anxiety in adolescents has not been validated for Indonesian adolescents; (iii) physical activity in this study was determined using a self-reported online questionnaire, the evaluation of which may be subjected to recall bias and not always consistent with the evaluation by professional medical personnel in mental health, such that the exact prevalence of anxiety in practice may be higher than indicated by the data; (iv) our study sample is relatively small and limited to one school in Jakarta with a student age range of 12–16 years. Therefore, our results cannot be generalized to regions with different COVID-19 infection rates and officially mandated restrictions.

## Conclusions and Recommendations

Inactive physical activity status increases the risk of adolescent anxiety. Governmental regulations are needed on the planning and implementation of health education programs for increasing physical activity among adolescents, particularly of females, to improve physical and mental health. As a follow-up to this study, there is a need for conducting a study to determine changes in prevalence rates of adolescent anxiety during as well as after the pandemic and its associated risk factors with a better design study.

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