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Meta-analysis

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Meta Analysis: The Effects of Parental Smokers, Peer Smokers, and Stress on Smoking Behavior in Teenagers

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ABSTRACT

Background: The habit of smoking is one of the health problems that the world is still facing today. The habit of smoking generally starts from youth, where it can have an impact on the health and cognitive behavior of adolescents that is sustainable. This study aims to estimate the influence of smoking parents, close friends of smokers, and stress on smoking habits in adolescents based on values obtained from several previous similar studies.
Subjects and Method: This study used a systematic review study design and meta-analysis. The primary articles used were obtained from online databases (Google Scholar, Elsevier, PubMed, Springer Link, and Science Direct) published in 2012-2022. Population: teenagers. Intervention: parents of smokers, close friends of smokers, and stress. Comparison: parents don't smoke, close friends don't smoke, and don't get stressed. Outcome: smoking habit. In searching for primary articles, the researcher used the keywords "parents smoking" AND "peers smoking OR friends smoking" AND "stress" AND "adolescents OR youth" AND "smoking behavior" AND "cross-sectional study". This study uses full text articles with a cross-sectional study design and contains aOR (adjusted odds ratio) values. The selection of articles is done using PRISMA flow diagrams. Primary article analysis using the Review Manager 5.4 application.
Results: Articles with a sample size of 378,135 from Finland, Saudi Arabia, Brazil, Nigeria, South Korea, Taiwan, Malaysia, Turkey, Nepal, Ethiopia, Iran, Tunisia, France and Spain were selected for this meta-analysis. This study showed that adolescents whose parents smoked (aOR = 2.18; 95% CI = 2.12 to 2.25; p< 0.001), close friends smoked (aOR = 6.09; 95% CI = 2.71 to 13.70; p< 0.001), and stress significantly increased smoking behavior in adolescents (aOR = 1.41; 95% CI = 1.33 to 1.49; p< 0.001).
Conclusion: Parents of smokers, close friends of smokers, and stress may all increase the risk of smoking.

Keywords: parents, close friends, stress, smoking, teenagers.

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BACKGROUND

Smoking is one of the public health problems that the world is still facing today. From 133 countries, as many as 303 million people, both teenagers and adults, consume cigarettes. Countries with high income levels annually consume more than 1,000 cigarettes per adult. This is inversely proportional to countries that have middle to lower income levels. For every adult, the number of cigarettes consumed increases by more than 500 cigarettes. ASEAN is the region that contributes the largest smokers in the world, namely 1.457 billion cigarettes every day.

More than 85% of smokers are in the South and Southeast Asia region and it is estimated that the greatest risk of cancer is in these regions. In 2017, there were 2.5 million DALYs and 90,791 lives were not saved worldwide due to diseases of the mouth, pharynx and esophageal cancer (SEATCA, 2021). Based on World Health Statistics data, in general there are 10 women aged 13-15 years and 1 in 5 men at the same age consume tobacco (WHO, 2014). Each year, smoking kills more than 8 million people. Among them, more than 7 million people died due to direct use of cigarettes and around 1.2 million people died as a result of exposure to cigarette smoke (WHO, 2022).

In general, a smoker first tries to smoke in his teens. According to the Center for Disease Control and Prevention (CDC), 9 out of 10 adults first tried smoking at the age of 18 (CDC, 2022). Smoking habits in adolescents not only cause an increased risk of violence in adolescents, but can lead to an increased risk of dangerous health problems (Park, 2011). Cigarettes have a negative impact on active and passive smokers. This can be detrimental to health, such as causing lung cancer, Chronic Obstructive Pulmonary Disease (COPD), asthma, heart disease, diabetes, immune disorders, reproductive problems, eye disease, and causes of death (CDC, 2014).

Smoking at a young age can influence lifestyles to become unhealthy by consuming alcohol and dangerous drugs and reducing body fitness. Cigarettes also cause strokes at a young age and also experience oral and dental problems (AU DHAC, 2019). Cigarettes can increase the risk of developing tuberculosis and health problems related to immunity (US DHHS, 2014). In addition, nicotine in cigarettes can interfere with brain development in the prefrontal cortex. This section is a part of the brain that functions as an executive and self-control. This section is an area of the brain that is still developing during adolescence. This can lead to an increased risk of psychiatric disorders and cognitive disorders in adolescence (Goriounova and Mansvelder, 2012).

Adolescence is a period of transition from children to adults. In this period there are changes in emotions, skills, interests and behavior (Hurlock, 2011). At this time, adolescents will experience many changes in terms of environment, living conditions, and responsibility (Derefinko et al., 2016). With these changes, 34.5% of teenagers in Bangladesh who feel frustrated then smoke to feel calm. In addition, because teenagers have a high interest in something, there are 48.3% of teenagers who are curious to try smoking (Hossain et al., 2015).

Mental conditions such as depression, anxiety, and stress have a strong relationship with smoking habits in adolescents (US Department of Health and Human Services, 2012). In India, as many as 89% of adolescents smoke due to unstable mental and emotional conditions. From the results of the study, it was found that these adolescents smoked because they felt disappointed, angry, and stressed (Anjum et al., 2016). A study explained that smoking is

one way to increase one's self-confidence. This is directly proportional to adolescents who smoke because they have low self-esteem compared to adolescents who do not smoke (Duncan et al., 2018).

Factors that cause adolescents to smoke are also influenced by parents who smoke, there is coercion from friends, and some smoke because they want to feel prominent in their group. In addition, the initiation of smoking in adolescents can be influenced by parenting styles, siblings' habits and the notion that smoking can relieve stress and boredom (American Thoracic Society, 2017). In South Korea, Vietnam and Thailand the number of teenagers who smoke in each country is 4.7%, 2.8% in Vietnam and 10.9%. There are several factors that influence adolescents to smoke in these three countries, namely personal factors, family environment, social environment, and characteristics of public places in these countries (Kyoung and Sung, 2019).

Smoking habits in adolescents are related to the smoking habits of their close friends. From the results of the study, it was found that close friends who smoke have an influence 6 times in influencing adolescents to smoke compared to close friends who do not smoke (Saari et al., 2014). Friends of the same age play a role in influencing smoking in adolescence. The closer friends who smoke, the greater the impact on smoking habits (Shartle, 2021).

The more influences that surround adolescents, the more likely these adolescents are to smoke (Kim and Kim, 2018). Based on studies related to the influence of existing smoking parents, close friends of smokers, and stress on smoking habits in adolescents, researchers are interested in conducting a deeper analysis in this regard by looking at the magnitude of exposure to the risk of smoking in adolescents using a meta-analytic research method to obtain right conclusion.

SUBJECTS AND METHOD

1. Study Design

The study design was a systematic review and meta-analysis. The primary articles used in this study were obtained from online databases including Google Scholar, Elsevier, PubMed, Springer Link, and Science Direct. The primary article search process in this study used the keywords “parents smoking” AND “peers smoking OR friends smoking” AND “stress” AND “adolescents OR youth” AND “smoking behavior” AND “cross-sectional study”. From the total number of articles, the researcher filtered out the articles that matched the researcher's criteria using the PRISMA flow diagram.

2. Step of Meta-Analysis

The meta-analysis was carried out in five steps as follows:

1) Formulate research questions in the PICO format (Population, Intervention, Comparison, Outcome).
2) Search for primary study articles from various electronic and non-electronic databases.
3) Conduct screening and critical assessment of primary research articles.
4) Perform data extraction and synthesize effect estimates into RevMan 5.3.
5) Interpret and conclude the results

3. Inclusion Criteria

The inclusion criteria for this study were full text articles, in English, and using a cross-sectional study design, articles published in 2012-2022, there was an adjusted odds ratio (aOR) with the results of research on smoking habits, the research subjects were teenagers.

4. Exclusion Criteria

The exclusion criteria for this study were incomplete articles, articles that were not in

English, articles using RCT research methods, case control, quasi experiments, protocol studies, and pilot studies, as well as articles published before 2012.

5. Operational Definition of Variables

The primary article search process in this study was based on the criteria determined by the PICO model. Population: teenagers. Intervention: parents of smokers, close friends of smokers, and stress. Comparison: parents don't smoke, close friends don't smoke, and don't get stressed. Outcome: smoking habit.

Smoking habit is defined as the activity of smoking tobacco which is used by burning and sucking. This activity is often done and can lead to dependence making it difficult for a smoker to avoid it. The instrument used is the instrument and the data scale is dichotomous.

Smoking parents are defined as fathers and/or mothers who actively smoke every day. The instrument used is a questionnaire, and the data scale is dichotomous.

Close friends of smokers are defined as people who are of approximately the same age and maturity level. The instrument used was a questionnaire and the data scale was dichotomous.

Stress is defined as the feelings experienced by adolescents when facing pressure that originates from the biological, psychological, and social systems that are felt. The instrument used is a questionnaire and the data scale is a dichotomy

6. Instruments

This systematic review was carried out following the PRISMA flow diagram guidelines, with an assessment of the quality of the articles using the Critical Appraisal Skills Program for Cross-Sectional (CEBMa, 2014).

7. Data Analysis

Research that has been collected is selected based on predetermined criteria. This study uses secondary data from the results of previous studies. Data processing from articles that have been collected will use the Review Manager application (Revman 5.3). Data processing is done by calculating the effect size and heterogeneity values to determine the combined research model and form the final results of the meta-analysis in the form of forest plots and funnel plots.

RESULTS

The primary article searches in this study used databases, namely Google Scholar, Elsevier, PubMed, Springer Link, and Science Direct. The process of screening articles according to the research criteria can be seen in the PRISMA flow diagram (Figure 1). The initial search process obtained 1,217 then after going through the screening process, 294 articles were obtained which were considered as primary articles of this study, including 10 articles discussing the influence of people, 9 articles discussing the influence of close friends, and 8 articles discussing the influence of stress on habits. Smoking in adolescents. The articles obtained came from 4 continents, namely America (Brazil), Africa (Nigeria, Tunisia, and Ethiopia), Asia (Saudi Arabia, Turkey, Malaysia, South Korea, Iran, Nepal and Taiwan), Europe (Finland, Spain, and France) which can be seen in Figure 2.

Study quality assessment was carried out quantitatively, where this study used study quality assessment for a cross-sectional design based on the Center for Evidence-Based Management (CEBMa) in 2014. The results of the study quality assessment based on CEBMa can be seen in Table 1.

Table 2 contains brief descriptions of 10 articles relating to the influence of parents on adolescent smoking habits in vari-

ous countries. Table 3 contains a brief description of 9 articles that discuss the influence of close friends on smoking habits in adolescents from various countries, and there are 8 articles that discuss the influence of stress on smoking habits in adolescents from various countries.

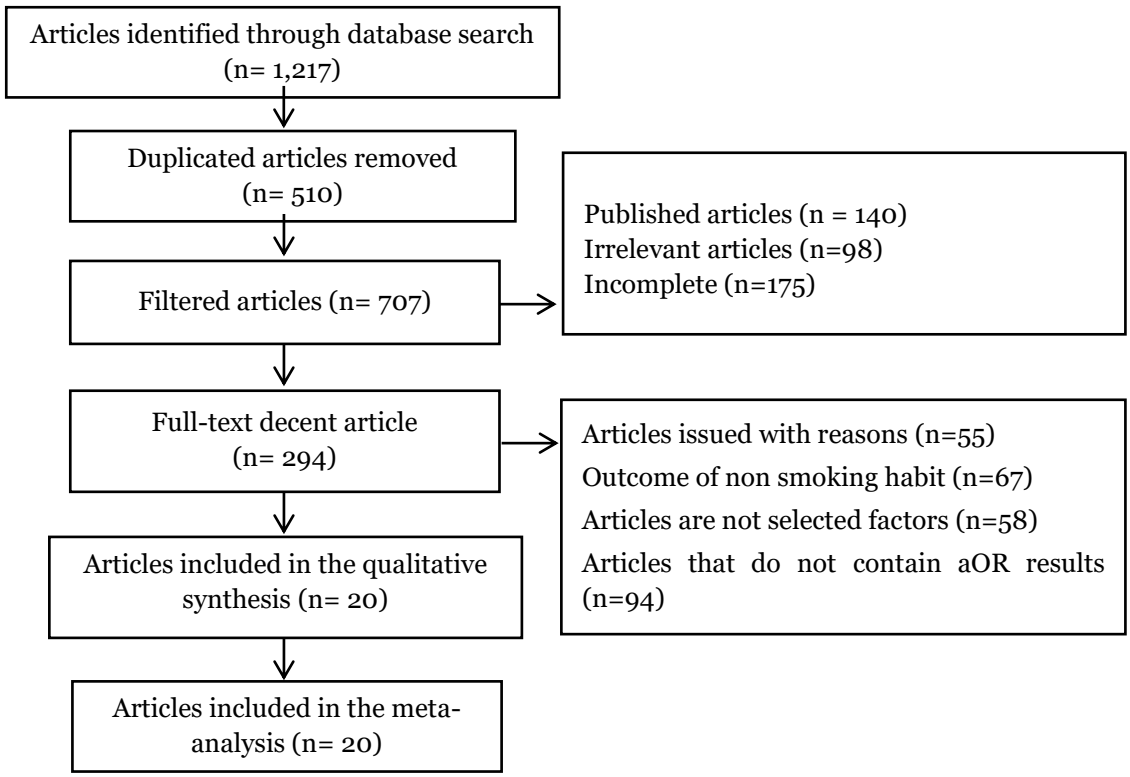

Figure 1. Results of Prisma Flow Diagrams

Figure 2. Resarch Distribution Map

Table 1. Critical Appraisal using CEBM

Primary Study	Criteria												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Aho et al. (2018)	2	2	2	2	2	2	2	2	2	2	2	2	24
Al-Zalabani dan Kasim (2015)	2	2	2	2	2	2	2	2	2	2	2	2	24
Ayed et al. (2021)	2	2	2	2	2	0	2	2	2	2	2	2	20
Bhaskar et al (2016)	2	2	2	2	2	1	2	2	2	2	2	2	23
Bonilha et al. (2014)	2	2	2	2	2	1	2	2	2	2	2	2	23
anrade et al. (2017)	2	2	2	2	2	1	2	2	2	2	2	2	23
Duko et al (2019)	2	2	2	2	2	1	2	2	2	2	2	2	23
Itanyi et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	24
Karimy et al. (2013)	2	2	2	2	2	2	1	2	2	2	2	2	23
Kim dan Kim (2018)	2	2	2	2	2	1	2	2	2	2	2	2	23
Kim dan Park (2016)	2	2	2	2	2	1	2	2	2	2	2	2	23
Lee dan Lee (2019)	2	2	2	2	2	1	2	2	2	2	2	2	23
Lee et al. (2020)	2	2	2	2	2	2	0	2	2	2	2	2	20
Liang et al. (2022)	2	2	2	2	2	2	2	2	2	2	2	2	24
Lim et al. (2014)	2	2	2	2	2	1	2	2	2	2	2	2	23
Othman et al. (2021)	2	2	2	2	2	1	2	2	2	2	2	2	23
Ozteqin et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	24
Roble et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	24
Santano-Mogena et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	24
Tavaloacci et al. (2013)	2	2	2	2	2	1	2	2	2	2	2	2	23

Description of the question criteria:

1. Do the research objectives clearly address the focus/problem of the research?
2. Is the research method (research design) suitable for answering the research question?
3. Is the research subject selection method clearly written?
4. Does the sampling method give rise to bias (selection)?
5. Does the research sample take represent the designated population?
6. Was the sample size based on pre-study considerations?
7. Is the measurement method achievable?
8. Are the research instruments valid and reliable?
9. Was statistical significance assessed?
10. Was a confidence interval given for the main outcome?
11. Are there any confounding factors that have not been taken into account?
12. Are the results applicable to your research?

Description of scoring:

Yes = 2;
Hesitate=1;
No =0

Table 2. Summary of Articles the Influence of Smoking Parents on Teenagers' Smoking Habits.

Author (Year)	Country	Sample	Study Design	Population	Intervention	Comparison	Outcome
Aho et al. (2018)	Finland	34,776	Cross-sectional	Adolescents with an average age of 17 years	Smoker mother	Mother is not a smoker	Smoking habit
Al-Zalabani dan Kasim (2015)	Saudi Arabia	3,400	Cross-sectional	Teens aged 11-19 years	Both parents smoke	Both parents are non-smokers	Smoking habit
Danrade et al. (2017)	Brazil	1,231	Cross-sectional	Teenagers aged 14-17 years	Smoker dad smoker	Father is a non-smoker	Smoking habit
Itanyi et al. (2020)	Nigeria	4,332	Cross-sectional	Teenage students grades 8-10 in junior high school	Both parents smoke	Both parents are non-smokers	Smoking habit
Karimy et al. (2013)	Iran	365	Cross-sectional	Adolescents with an average age of 16 years	Both parents smoke	Both parents are non-smokers	Smoking habit
Lee et al (2020)	South Korea	65,528	Cross-sectional	Teenagers aged 12-18 years	Both parents smoke	Both parents do not smoke	Smoking habit
Lim et al. (2014)	Malaysia	25,507	Cross-sectional	Teenagers aged 12-17 years	Both parents smoke	Both parents do not smoke	Smoking habit
Oztekin et al. (2021)	Turkey	707	Cross-sectional	Adolescents who have an average age of 15 years	Smoker dad	Dad doesn't smoke	Smoking habit
Roble et al. (2021)	Ethiopia	341	Cross-sectional	Teenagers aged 10-19 years	Smoking parents	Parents do not smoke	Smoking habit
Aho et al. (2018)	Finland	34,776	Cross-sectional	Adolescents with an average age of 17 years	Smoker mother	Mother is not a smoker	Smoking habit

Table 3. Summary of Articles Influence of Smokers' Close Friends on Smoking Habits in Adolescents.

Author (Year)	Country	Sample	Study Design	Population	Intervention	Comparison	Outcome
Al-Zalabani dan Kasim (2015)	Saudi Arabia	3,400	Cross-sectional	Teens aged 11-19 years	All friends are smokers	Friends don't smoke	Smoking habit
Bhaskar et al. (2016)	Nepal	1,540	Cross-sectional	Teenagers aged 10-18 years	Smoker's close friend	Close friends don't smoke	Smoking habit
Duku et al. (2019)	Ethiopia	564	Cross-sectional	Adolescents aged 15-22 years	Have a close friend who smokes	Don't have smoking friends	Smoking habit
Itanyi et al. (2020)	Nigeria	4,332	Cross-sectional	Teenage students grades 8-10 in junior high school	All smoking friends	Friends don't smoke	Smoking habit
Karimy et al. (2013)	Iran	365	Cross-sectional	Adolescents with an average age of 16 years	Smoker's close friend	Close friends don't smoke	Smoking habit
Liang et al. (2022)	Taiwan	27,524	Cross-sectional	Teenagers aged 12-18 years	Most of my friends are smokers	No smoking friends	Smoking habit
Othman et al. (2021)	Malaysia	3,387	Cross-sectional	Junior high school students	Smoker's close friend	Close friends don't smoke	Smoking habit
Roble et al. (2021)	Ethiopia	341	Cross-sectional	Teenagers aged 10-19 years	Have a smoking friend	Close friends are non-smokers	Smoking habit
Santano-Mogena et al. (2021)	Spanish	377	Cross-sectional	Teenagers aged 12-16 years	Don't have real friends	Friends don't smoke	Smoking habit

Table 4. Adjusted odds ratio (aOR) and 95% CI regarding the effect of parental monitoring on sexual risk behavior in adolescents

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Aho et al. (2018)	2.46	2.21	2.73
Al-Zalabani dan Kasim (2015)	2.95	1.60	5.22
Danrade et al. (2017)	2.58	1.06	6.28
Itanyi et al. (2020)	2.26	1.43	3.57
Karimy et al. (2013)	4.75	1.38	12.35
Lee et al. (2020)	4.72	4.49	4.97
Lim et al. (2014)	1.65	1.38	1.97
Oztekin et al. (2021)	2.32	1.22	4.44
Roble et al. (2021)	1.8	0.9	3.6
Aho et al. (2018)	2.57	1.32	5.02

Table 5. aOR and 95% CI data of anxiety on increased alcoholic beverage consumption behavior

(Author, year)	aOR	95% CI	
		Lower Limit	Upper Limit
Ben Ayed et al. (2021)	1.98	1.2	3.28
Bonilha et al. (2014)	1.52	1.08	2.13
Karimy et al. (2013)	1.13	0.83	1.53
Kim dan Kim. (2018)	1.40	1.31	1.49
Kim and Park (2016)	15.99	4.17	61.30
Lee and Lee (2019)	1.19	0.67	2.10
Lim et al. (2014)	1.31	1.02	1.70
Tavolacci et al. (2013)	1.62	1.11	2.36

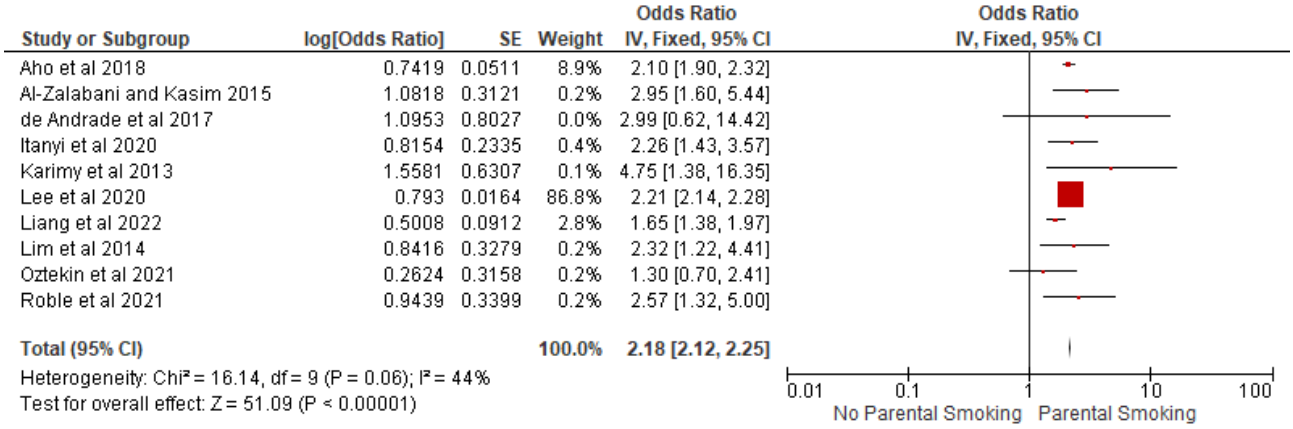

Figure 3. Forest plot of the influence of smoking parents on smoking habits in adolescents

The forest plot in Figure 3 shows that smoking parents have an influence on smoking habits in adolescents, and this effect is statistically significant. Adolescents whose parents are smokers have a risk of smoking 2.18 times compared to non-smoker parents (aOR= 2.18; 95% CI= 2.12 to 2.25; p< 0.001).

The forest plot also showed low heterogeneity of effect estimates between pri-

mary studies (I^2= 44%; p= 0.060). Thus, the calculation of the average effect estimate is carried out using the fixed effect model approach.

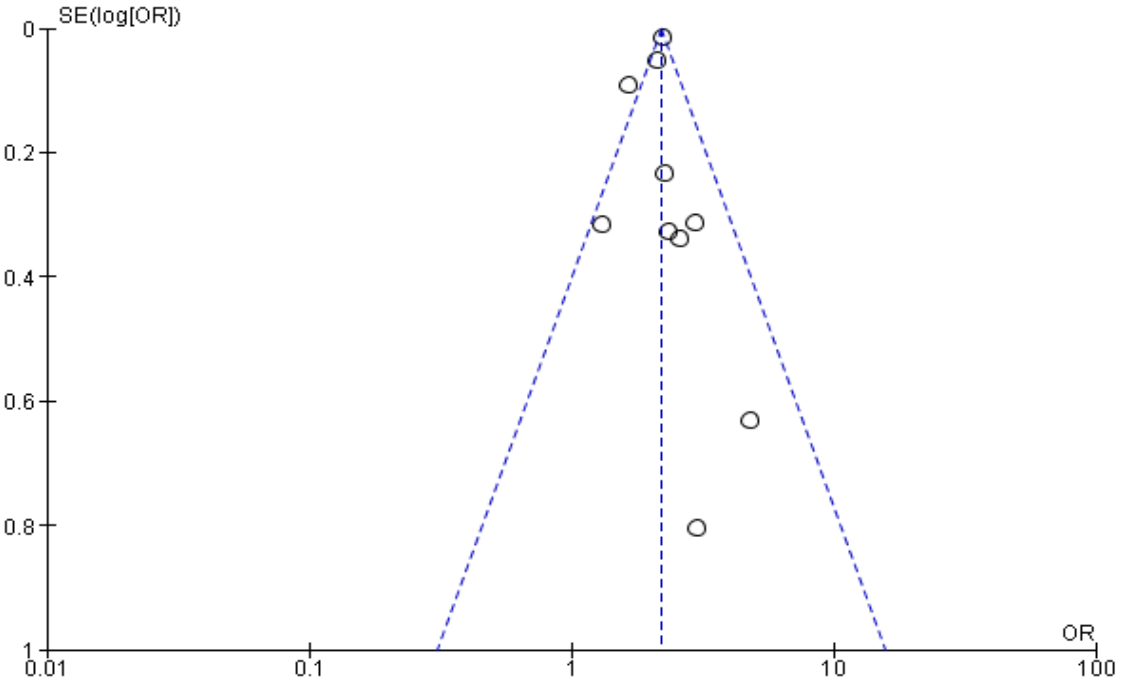

Figure 4. Funnel plot of the influence of smoking parents on smoking habits in adolescents

The funnel plot in Figure 4 shows the asymmetrical distribution of the estimated effects to the right and left of the estimated mean vertical line. The primary study effect estimates are more distributed to the right of the vertical line than to the left, which is the same as the location of the mean effect estimate to the right of the null hypothesis vertical line in the forest plot. Thus this funnel plot shows publication bias which overestimates the true effect (over estimate).

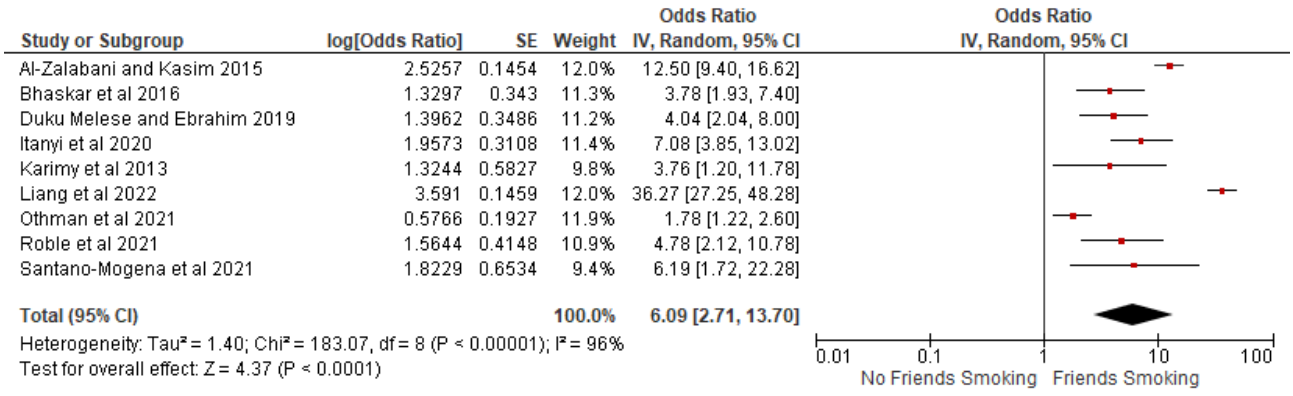

Figure 5. Forest plot of the influence of smokers' close friends on smoking habits in adolescents

The forest plot in Figure 5 shows that there is an influence of close friends of smokers on smoking habits in adolescents, and this effect is statistically significant. Adolescents

whose close friends smoked had a risk of smoking 6.09 times compared to non-smoker friends (aOR= 6.09; 95% CI= 2.71 to 13.70; p<0.001). The forest plot also showed high heterogeneity of effect estimates between primary studies (I2= 96%; p< 0.001). Thus the calculation of the average effect estimate is carried out using the random effect model approach.

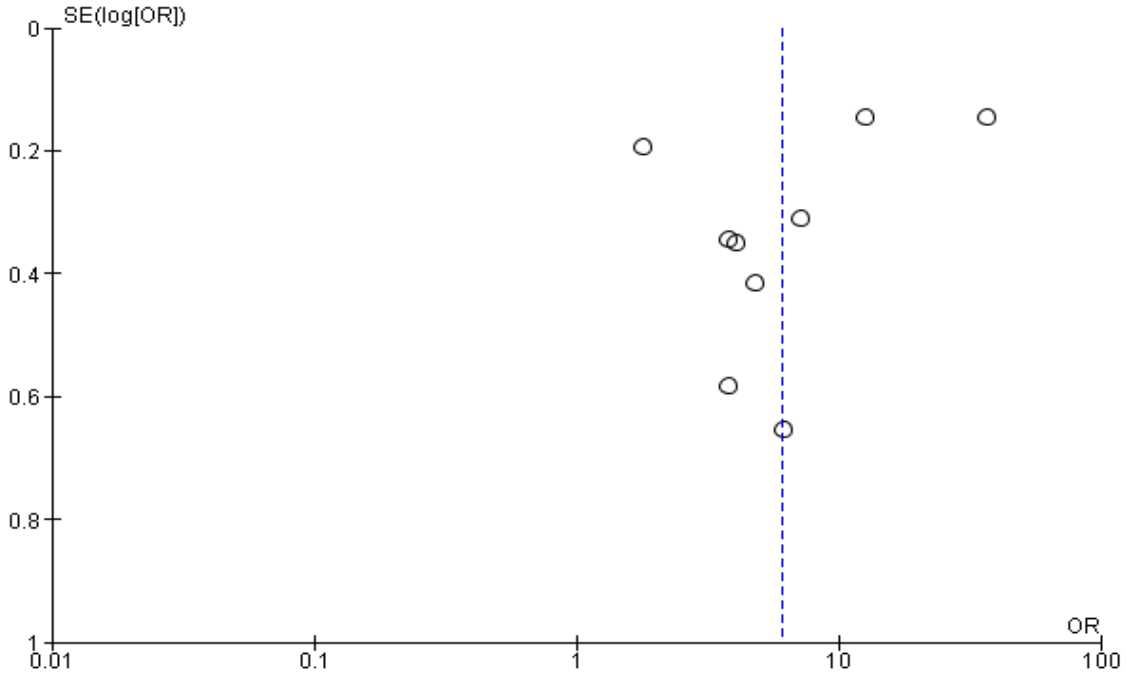

Figure 6. Funnel plot of the influence of smokers' close friends on smoking habits in adolescents

The funnel plot in Figure 6 shows the asymmetrical distribution of the estimated effects to the right and left of the estimated mean vertical line. The estimated effect of the primary study is more distributed to the left of the vertical line than to the right, which is different from the location of the average effect estimate to the right of the vertical line of the null hypothesis in the forest plot. Thus this funnel plot shows a publication bias that underestimates the true effect (under estimate).

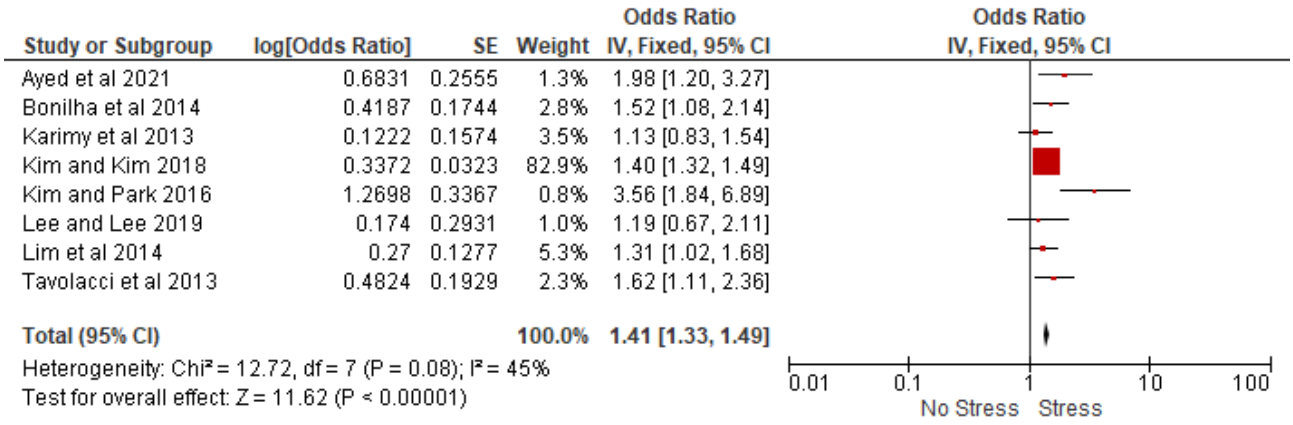

Figure 7. Forest plot of the effect of stress on smoking habits in adolescents

The forest plot in Figure 7 shows that there is an effect of stress on smoking habits in adolescents, and this effect is statistically significant. Adolescents who experience stress have a risk of smoking 1.41 times compared to adolescents who do not experience stress (aOR= 1.41; 95% CI= 1.33 to 1.49; p<0.001). The forest plot also showed low heterogeneity of effect estimates between primary studies (I2 = 45%; p < 0.001).

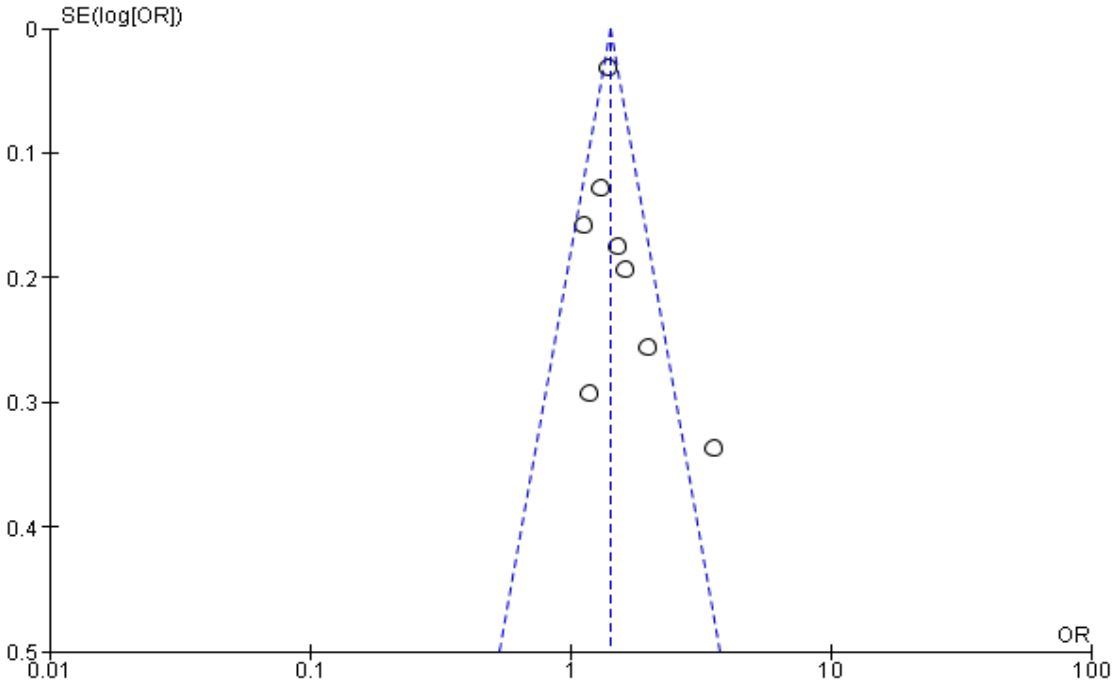

Figure 8. Funnel plot of the effect of stress on smoking habits in adolescents

The funnel plot in Figure 8 shows the asymmetrical distribution of the estimated effects to the right and left of the estimated mean vertical line. The primary study effect estimates are more distributed to the right of the vertical line than to the left, which is the same as the location of the mean effect estimate to the right of the null hypothesis vertical line in the forest plot. Thus, this funnel plot shows publication bias which overestimates the true effect (over estimate).

DISCUSSION

This systematic research review and meta-analysis describes the topic of the influence of smoking parents, close friends of smokers, and stress on smoking habits in adolescents. The independent variables in this study were adolescents who had smoking parents and close friends of smokers and adolescents who experienced stress. While the outcome that became the dependent variable in this study was smoking habits in adolescents. The primary research results used in this research analysis were obtained from various countries and had a large sample size. This can lead to increased heterogeneity in research results.

The influence of smoking parents on smoking habits in adolescents

There are 10 cross-sectional research articles used to conduct a meta-analysis study regarding the influence of smoking parents on smoking habits in adolescents. The forest plot results of these articles show that adolescents whose parents are smokers are 2.18 times more likely to smoke than parents who are non-smokers (aOR= 2.18; 95% CI= 2.12 to 2.25; p<0.001).

The results of this study are supported by other studies, namely research conducted on 3400 adolescents aged 11-19 years in Medina, Saudi Arabia. The results showed that the prevalence of smoking in adolescents was 15.17% (95% CI = 13.95-16.39). This study also predicts that the important factors that influence smoking in adolescents are parents. Both parents who smoke have a 2.95 times risk of increasing the incidence of smoking among adolescents and this result is statistically significant. In this case, parents have a relationship and play an important role in monitoring the development of children, especially adolescents. Teenagers will observe and imitate the habits of their parents. Thus, parents have a strong influence in shaping the habits of a teenager (Al-Zalabani and Kasim, 2015).

Other research reveals that parents who smoke and have a positive attitude towards smoking can encourage adolescents to increase cigarette consumption or influence smoking initiation in adolescents. smokers' parents had a 1,794 times (p< 0.001) greater influence than non-smokers' parents in influencing teenagers to try cigarettes, also had an effect of 1,743 times (p< 0.001) to make teenagers become light smokers and had an effect of 3,154 times (p< 0.001) to make teenagers become heavy smokers (Scalici and Schulz, 2017).

From the results of other studies, it was also found that one of the environmental factors that can influence smoking habits in adolescents is parents. The risk of smoking in adolescents can be influenced by one of the parents smoking (aOR= 1.51; 95% CI= 1.10 to 2.08; p= 0.001) and will increase if both parents are smokers (aOR= 2.26; 95% CI= 1.43 to 3.57;p< 0.001) (Itany et al., 2020).

Smokers' parents have an influence on changes in smoking habits in adolescents (initially becoming irregular smokers then changing to regular smokers). Smoking habits by parents have a high probability of youth initiation to smoke. Other research shows that smoking parents are predictors of smoking initiation in adolescents only when they are 11-13 years old, beyond that age the influence of parents decreases significantly and the influence of close friends becomes important (Mulvihill, 2014).

The influence of close friends of smokers on smoking habits in adolescents

There are 9 cross-sectional study articles used to conduct a meta-analysis study of the influence of smokers' close friends on smoking habits in adolescents. The forest plot results of these articles show that adolescents whose close friends smoke are 6.09 times more likely to smoke than close friends who are not smokers (aOR= 6.09; 95% CI= 2.71 to 13.70; p<0.001).

Based on the results of research on 318 first-grade teenagers in junior high schools, it was found that most of them had friends who smoked (56.7%). Adolescents who have smoker friends have a desire to smoke in the short term (1 year) by (10.1%) higher than adolescents who do not have smoker friends (0.9%). Meanwhile, the desire to smoke in the long term (5 years) is more common in adolescents who have smoker friends (12.3%) compared to adolescents who do not have smoker friends

(2.8%). From the results of this study, a significant relationship was found between smoking friends and adolescents' desire to smoke (Sutrisno and Melinda, 2021).

Another study was conducted on 772 boys from junior high schools in Pakistan. The study stated that the likelihood of smoking in adolescents who have friends who smoke is 6.04 times compared to friends who do not smoke (aOR= 6.04; 95% CI= 3.63 to 10.17). In adolescence, the pressure from peers or peer friendships will become stronger than the family, so that adolescents are more influenced by the behavior of their friends. In this case, friends who smoke are important predictors of adolescents who smoke (Rozi et al., 2016).

The relationship between adolescents and their friends is a reinforcing factor that can influence every behavior, especially health behavior. There is support, giving understanding and giving encouragement in everything that is obtained from peers and there is a positive influence both from good behavior and ways of thinking, so that adolescents have a high sense of self-esteem. This can give adolescents a high sense of self-esteem so that these adolescents can be accepted, valued and known in their circle of friends and provide motivation because they receive support and positive influence. Conversely, if a teenager is rejected by friends around him and is not cared for, then the teenager will feel lonely and cause feelings of hostility and cause the teenager to have a low sense of self-esteem and have an impact on the learning process at school (Anhar et al., 2021).

Effect of stress on smoking habits in adolescents

There are 8 cross-sectional study articles that are used to conduct a meta-analysis of the effects of stress on smoking habits in adolescents. The forest plot results of these articles show that adolescents who experience stress are 1.41 times more likely to smoke than adolescents who are not stressed (aOR= 1.41; 95% CI= 1.33 to 1.49; p< 0.001).

This research is in line with research conducted on 1,210 young junior high school students in Tunisia. It was found that teenagers who had a stress score (VAS) of 8-10 were 1.98 times more likely to smoke compared to teenagers who were not experiencing stress (aOR= 1.98; 95% CI= 1.2 to 3.28; p= 0.008). Adolescents who have high stress levels are independently associated with an increased frequency of smoking. The effects of nicotine in adolescence can lead to increased susceptibility to the development of learning disorders and long-term effects, which in turn can maintain high stress levels among adolescents and lead to an increase in the amount of tobacco consumed (Ayed et al., 2021).

Other studies also state that smoking prevalence increases significantly with the stress levels in female and male adolescents, but smoking has a strong relationship with stress in female adolescents. This study states that the odds ratios for female adolescents with high levels of stress have a probability of smoking of 15.99 (95% CI= 4.17 to 61.30) while male adolescents with high stress levels have a probability of smoking of 2.34 (95% CI = 1.07). to 5.11) (Kim and Park, 2016).

Stress in adolescents can also be caused by family pressure, social relationships at school, affective relationships (feelings and emotions), and fear of an uncertain future (Reinaldo and Pereira, 2018). In addition, the factors that cause stress in adolescents are academic achievement, appearance and body image, and conflicts with parents or friends. High stress levels in adolescents are significantly associated

with increased use of alcohol, tobacco and other drugs (Park, 2022).

This study has limitations, including publication bias and the articles used in this study were only obtained from 5 databases, namely Google Scholar, Elsevier, PubMed, Springer Link, and Science Direct.

AUTHOR CONTRIBUTION

Riya Ulin Nuha is the main researcher, contributing to determining the topic, finding and collecting primary articles, processing and analyzing data, and writing research manuscripts. Argyo Demartoto and Hanung Prasetya contributed to discussing the methodology and research results.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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