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Research

Effects of Peers and Family Members on Smoking Habits in Adolescents: A Meta-Analysis

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ABSTRACT

Background: Nowadays, smoking is one of the biggest public health problems worldwide. It is a major cause of disease and mortality that can be prevented early. One out of 10 deaths worldwide is caused by tobacco use. 40 million people died each year due to tobacco. Adolescents start smoking in response to social effects, imitating the behavior of friends, family members, and others they admire. This meta-analysis study aimed to analyze the effect of peers and family members who smoked on smoking habits in adolescents.
Subjects and Method: Meta-analysis was conducted by searching for articles from databases such as PubMed, SpringerLink, Elsevier, Science Direct, and Google Scholar. The keywords were "peers" OR "parenting style" OR "family influence" AND "smoking" AND "behavior" AND "adolescents" AND "cross-sectional". The inclusion criteria were full-text articles with a cross-sectional design, English and Indonesian languages, students aged 14-24 years as the study subjects. The final results of the study were presented using the adjusted odds ratio (aOR). The articles were analyzed using Revman 5.3 software.
Results: 17 articles were analyzed. The results showed that peers and family members increased smoking habits in adolescents; the result was statistically significant with peers (aOR= 2.77; 95% CI= 1.67 to 4.60; p <0.001; I^2= 96%) and family members (aOR= 1.69; 95% CI= 1.35 to 2.13; p<0.001; I^2=65%).
Conclusion: Peers and family members affects smoking habits in adolescents. It is statistically significant.

Keywords: Peers, family members, smoking habits, adolescents, cross-sectional

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BACKGROUND

Nowadays, smoking is one of the biggest public health problems worldwide. It is a major cause of disease and mortality that can be prevented early (Ball et al., 2018).

The World Health Organization (WHO) stated that more than 4 million deaths occurred in a year due to tobacco. It increased to 10 million deaths per year by 2020. In American States, 440,000 people died each year due to diseases caused by smoking. In addition, 5.6 million people lost potential lives, 82 billion people lost productivity, and 75 billion people were in direct medical costs (Reda et al, 2019).

In general, smoking occurs during adolescence which results in smoking behavior in adult life (Moor et al., 2015). Smoking behavior is an activity of burning cigarettes or tobacco, inhaling the smoke, exhaling it, and repeating it until the cigarette runs out (Riadinata, 2018).

According to the ecological systems theory, an understanding of individual behavior must consider the environmental system where the individual is embedded as each system includes roles, norms, and rules that affect one another, thus building adolescents development. Smoking in adolescents is strongly associated with psychosocial factors in the family, school, and peer groups. Peer networks play an important role in smoking behavior in adolescents (Simetin et al., 2011).

Currently, there are around 1.2 billion smokers worldwide, which is close to 20% of the world's population in 2014 (World Cancer Report-WHO, 2014). The results of a study by the WHO Report On The Global Tobacco Epidemic 2011 found that smoking habits did not only occur in developed countries, but also in developing countries in the African continent and the Asian region (WHO, 2015).

1.2 billion smokers were currently found in several regions: Asia Pacific by 56%, Europe by 24%, USA by 11%, and Africa and the Middle East by 9%. 10% or 121 million of these smokers came from 10 countries in the Southeast Asia, thus making this region had the largest number of smokers in the Asia Pacific. It contributed 20% of the causes of global tobacco deaths (SEATCA, 2014). Among the 1 billion smokers worldwide, 50% were young people consumed 6 trillion cigarettes per year. In 2020, 7 out of 10 smoking deaths would occur in LMICs (low- and middle-income countries). If current trends continue, tobacco would kill more than 8 million people worldwide each year by 2030 (Aryal, 2014). Based on these data, the authors were interested in investigating the effects of peers and family members on smoking habits in adolescents.

SUBJECTS AND METHOD

1. Study Design

This study was a systematic review and a meta-analysis. This study used secondary data from previous study results. The articles were obtained from several databases including PubMed, SpringerLink, Elsevier, Science Direct, and Google Scholar. The keywords were "peers" OR "parenting style" OR "family influence" AND "smoking" AND "behavior" AND "adolescents" AND "cross-sectional".

2. Inclusion Criteria

The inclusion criteria were full-text articles with a cross-sectional study design and using English and Indonesian languages. The study subjects were students aged 14-24 years. The final results of the study were presented using the adjusted odds ratio (aOR).

3. Exclusion Criteria

The exclusion criteria were non-full-text articles, non-English articles, and published before 2000.

4. Operational Definition of Variables

The article search was carried out by considering the eligibility criteria defined using the PICO model. The population of this study was adolescents. The intervention was peers and family members who smoked. The comparison was peers and family members who did not smoke. The outcomes were smoking habits.

Peers were people with a level of age and maturity that was about more or less the same, namely at the age of 12 and 13 years.

Family was one of the first environments for a child or adolescent to get more knowledge before leaving the family circle. Family members consisted of father, mother, brother, and sister.

5. Data Analysis

The data were processed using the Review Manager (RevMan 5.3). This study used a random-effect model.

RESULTS

The process of searching for articles through databases with journals is in Figure 1. The articles were obtained from 4 continents: Asia, Europe, America, and Africa.

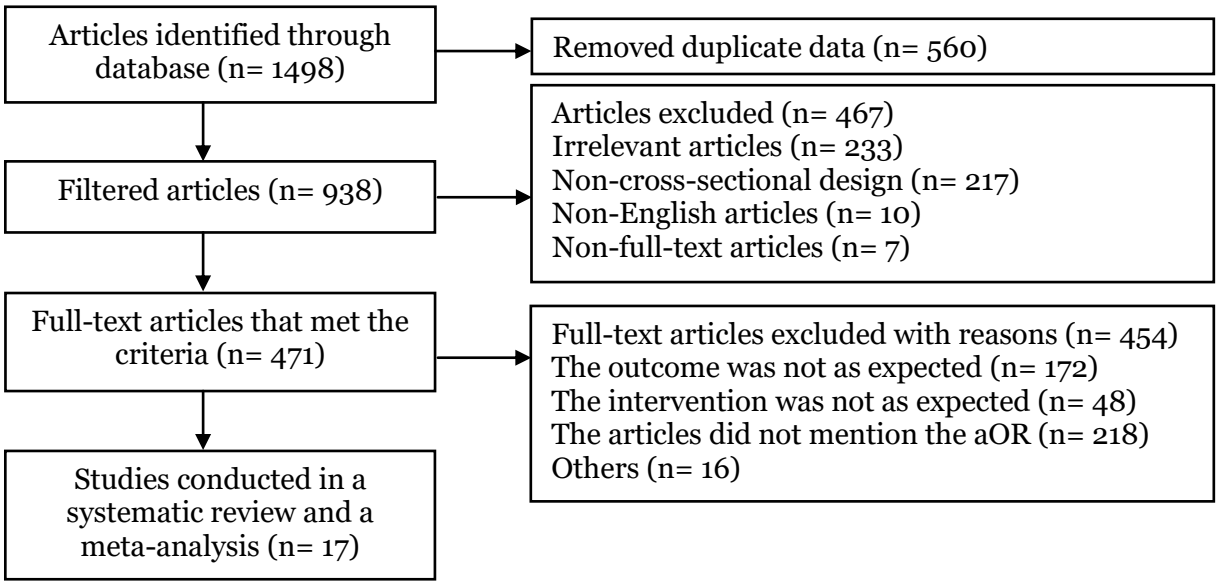


Figure 1. PRISMA flow diagram

1. The effects of peers on smoking habits in adolescents

a. Summary Source

Table 1. The description of the primary study included in the meta-analysis

Author (year)	Title	Country	Study design	Population and Sample	Intervention (I) and Comparison (C)	Outcome
Aryal et al. (2014)	Correlates of smoking susceptibility among adolescents in a peri-urban area of Nepal: A population-based-cross-sectional study in the Jhaukel-Duwakot health demographic surveillance site	Nepal	Cross-sectional	352 male and female respondents aged 14-16 years (n= 500)	I: Peers who smoked C: Peers who did not smoke	Peers affected smoking habits (it increased 2.45 times the susceptibility to smoke)
Backhouse et al. (2017)	Link between perceived smoking beha-viour at school and student smoking status: A large survey among Italian adolescents	Italy	Cross-sectional	1.889 students aged 14-19 years (44% males and 56% females) (n= 1,889)	I: Peers who smoked C: Peers who did not smoke	Peers increased the susceptibility to smoke in adolescents
Gaffar et al. (2013)	Sociodemographic factors associated with tobacco smoking among intermediate ad secondary school students in Jazan Region of Saudi Arabia	Saudi Arabia	Cross-sectional	3.923 males and females aged 15-19 years (n= 4.100)	I: Peers who smoked C: Peers who did not smoke	Peers increased the prevalence of smoking habits (males; 19.1% and female 4.7%)
Hock et al. (2014)	Prevalence and factors associated with smoking intentions among non-smoking and smoking adolescents in Kota Tinggi, Johor, Malaysia	Malaysia	Cross-sectional	2.300 high school students aged 13-16 years	I: Best friends or peers who smoked C: Best friends or peers who did not smoke	Best friends or peers who smoked affected smoking habits
Huang et al. (2012)	Analysis of influential factors associated with the smoking behavior of Aboriginal school children in remote Taiwanese mountainous areas	Taiwan	Cross-sectional	630 males and 609 females of high school students aged ±14 years (n= 1,239)	I: Peers or best friends who smoked C: Peers or best friends who did not smoke	Peers/best friends are a greater predictor of smoking habits in adolescents
Leatherdale et al. (2010)	The influence of friends, family, and older peers on smoking among elementary school students: Low risk students in high-risk schools	Canada	Cross-sectional	4.286 students in the 6th and 7th grade of 57 primary schools aged ±12 years	I: Peers who smoked C: Peers who did not smoke	Peers who smoked significantly increased smoking habits in adolescents
Lim et al. (2020)	Smoking among school-going adolescents in selected secondary school in Peninsular Malaysia-Finding from the Malaysian adolescents health risk behaviour	Malaysia	Cross-sectional	2.991 high school students aged 16-17 years	I: Peers who smoked C: Peers who did not smoke	Peers increased smoking habits in adolescents. The prevalence of

	(MyaHRB) Study					smoking was 14.6%
Moor et al. (2015)	Socioeconomic inequalities in adolescents smoking across 35 countries: A multilevel analysis of the role of family, school, and peers	Europe	Cross-sectional	52.907 students aged 15 years from 35 countries in Europe dan South America	I: Peers who smoked C: Peers who did not smoke	Peers increased smoking habits by 100% in males and 81% in females
Purnaningrum et al. (2017)	Association between cigarete advertise-ment, peer group, parental education, family income, and pocket money with smoking behavior among adolescents in Karanganyar District, Central Java	Indonesia	Cross-sectional	100 adolescents aged 14-24 years	I: Peer group who smoked C: Peer group who did not smoke	Peers group with high smoking habits would increase smoking habits among adolescents
Reda et al. (2012)	Determinants of Cigarette Smoking Among School Adolescents in Eastern Ethiopia: A Cross- Sectional Study	Ethiopia	Cross-sectional	1.721 school-age children aged 13-19 years (n= 1,890)	I: Peers who smoked C: Peers who did not smoke	Peers who smoked were important determinants of smoking behavior and habits in adoles-cents (32.4%), the prevalence was 11.8% in males and 1.1% in females.
Simetin et al (2010)	Inequalities in Croatian pupils' unhealthy behaviours and health outcomes: Role of school, peers, and family affluence	Europe	Cross-sectional	1.166 children aged 11 years and 1,630 children aged 15 years	I: Peers who smoked C: Peers who did not smoke	41,0% of peers who smoked affected smoking habits in adolescents
Skullberg et al (2019)	Smoking adolescents males at Pulau Weh, Indonesia	Indonesia	Cross-sectional	291 male students aged 13-15 years	I: Peers who smoked C: Peers who did not smoke	40% of peers who smoked affected smoking habits in adolescents

b. Forest Plot

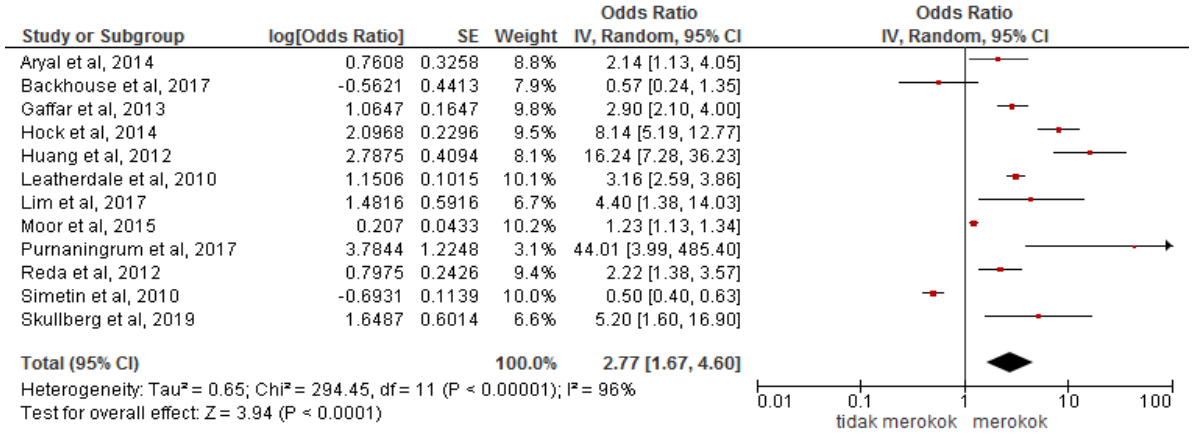
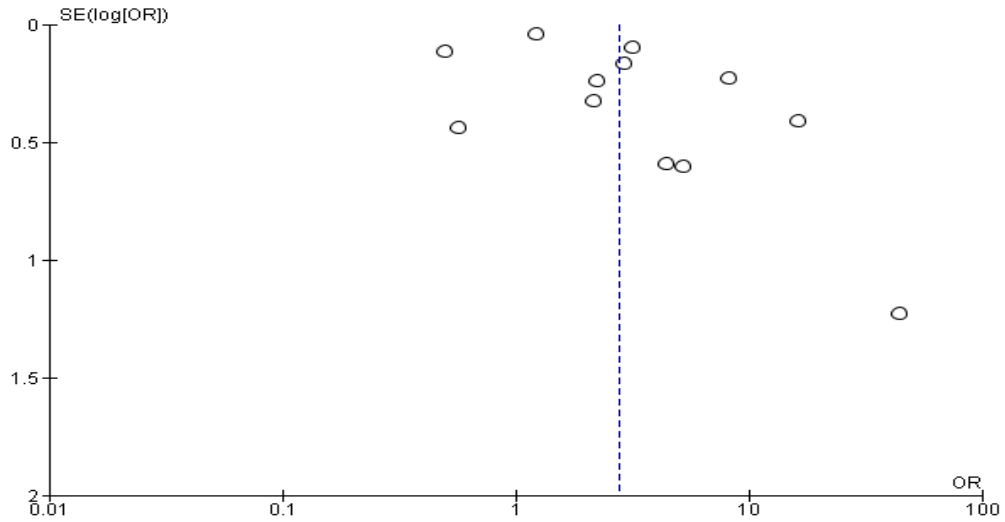


Figure 3. The forest plot of the effects of peers on smoking habits in adolescents

The interpretation of the results from the meta-analysis process can be seen through a forest plot. Figure 3 shows that peers who smoked 2.77 times significantly increased smoking habits in adolescents (aOR=2.77; 95% CI=1.67 to 4.60; p<0.001; I^2=96%). Therefore, the distribution of data was heterogeneous (random-effect model).

c. Funnel Plot



Gambar 4. The funnel plot of the effects of peers on smoking habits in adolescents

Based on figure 4, there was no publication bias indicated by the symmetrical plots on the right and left, where 7 plots were on the right and 5 plots were on the left. The plot on the left of the graph had a standard error between 0 and 0.5. Besides, the plot on the right had a standard error between 0 and 0.5.

2. The effects of family members on smoking habits in adolescents

a. Summary Source

Table 2. The description of the primary study included in the meta-analysis

Author (year)	Title	Country	Study design	Population and sample	Intervention (I) and Comparison (C)	Outcome
Alves et al. (2016)	The role of parental smoking on adolescentsmoking and its social patterning: A cross-sectional survey in six Euoropean cities	Europe	Cross-sectional	11,015 male and female students as the respondents aged 14-16 years	I: Family members (parents) who smoked C: Family members (parents) who did not smoke	The prevalence of parents who smoked was higher occurred in adolescents with low socioeconomic status
Bakhruji et al. (2017)	Carious lesions of permanent molars and oral health practices of parents and peers in Saudi male adolescents	Saudi Arabia	Cross-sectional	294 students aged 12-15 years	I: Family members who smoked C: Family members who did not smoke	Family members increased the susceptibility to smoke in adolescents
Hashmi et al. (2014)	Family and peer effect on young and adolescent smoking in Bangladesh	Bangladesh	Cross-sectional	995 male students aged 10-24 years	I: Family members who smoked C: Family members who did not smoke	45% of adolescents were more susceptible to smoke if there were family members who smoked
Hock et al. (2014)	Prevalence and factors associated with smoking intentions among non-smoking and smoking adolescents in Kota Tinggi, Johor, Malaysia	Malaysia	Cross-sectional	2.300 high school students aged 13-16 years	I: Family members who smoked C: Family members who did not smoke	Family members who smoked affected smoking habits
Huang et al. (2012)	Analysis of influential factors associated with the smoking behavior of Aboriginal school children in remote Taiwanese mountainous areas	Taiwan	Cross-sectional	630 males and 609 females of school-age children aged ±14 years (n= 1.239)	I: Family members who smoked C: Family members who did not smoke	Family who smoked was a stronger predictor of smoking habits in adolescents
Lehtren et al. (2020)	School achievement and oral health behaviour among adoles-cents in Finland: A national survey	Finland	Cross-sectional	45.877 students aged 14-20 years	I: Family members (parents) who smoked C: Family members (parents) who did not smoke	Family members (parents) affected smoking habits in adolescents
Li et al. (2020)	Prevalence of Smoking and Its Associated Risk Factors Among Secondary School Students in Kelantan, Malaysia	Malaysia	Cross sectional	1.500 male and females students aged 13-17 years	I: Family members who smoked C: Family members who did not smoke	Family members who smoked affected smoking habits in adolescents

Lim et al. (2020)	Smoking among school-going adolescents in selected secondary school in Peninsular Malaysia-Finding From the Malaysian adolescents health risk behaviour (MyaHRB) Study	Malaysia	Cross-sectional	2.991 high school students aged 16-17 years	I: Family members who smoked (parents who smoked and or a parent who smoked) C: Family members who did not smoke	Family members who smoked (parents who smoked and/or parents who smoked) increased smoking habits in adolescents. The prevalence of smoking was 14.6%
Reda et al. (2012)	Determinants of cigarette smoking among school adolescents in Eastern Ethiopia: A Cross-Sectional Study	Ethiopia	Cross-sectional	1.721 adolescents aged 13-19 years (n= 1,890)	I: Family members who smoked C: Family members who did not smoke	Family members who smoked were important determinants of smoking behavior and habits in adolescents with a prevalence of 11.8% in males and 1.1% in females

b. Forest Plot

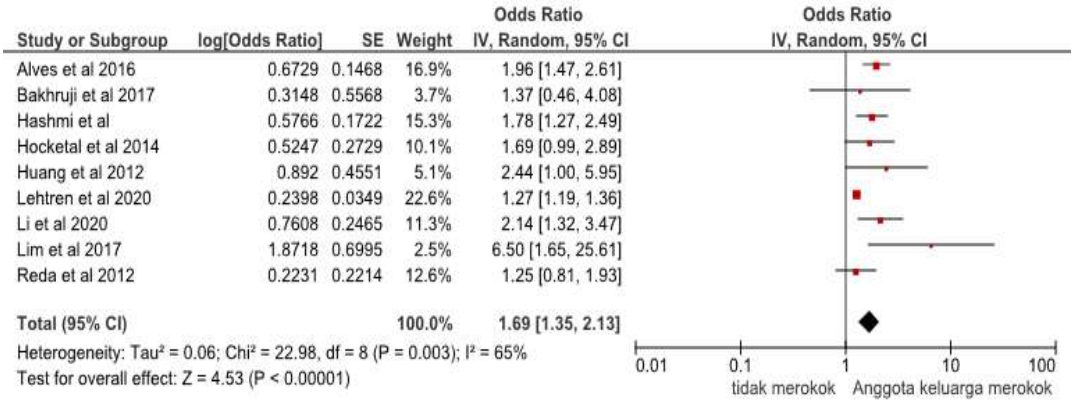


Figure 5. The effects of family members on smoking habits in adolescents

The interpretation of the results from the meta-analysis process can be seen through a forest plot. Figure 5 shows that family members who smoked 1.69 times significantly increased smoking habits in adolescents (aOR= 1.69; 95% CI= 1.35 to 2.13; p<0.001; I^2= 65%). Therefore, the distribution of data was heterogeneous (random-effect model).

c. Funnel Plot

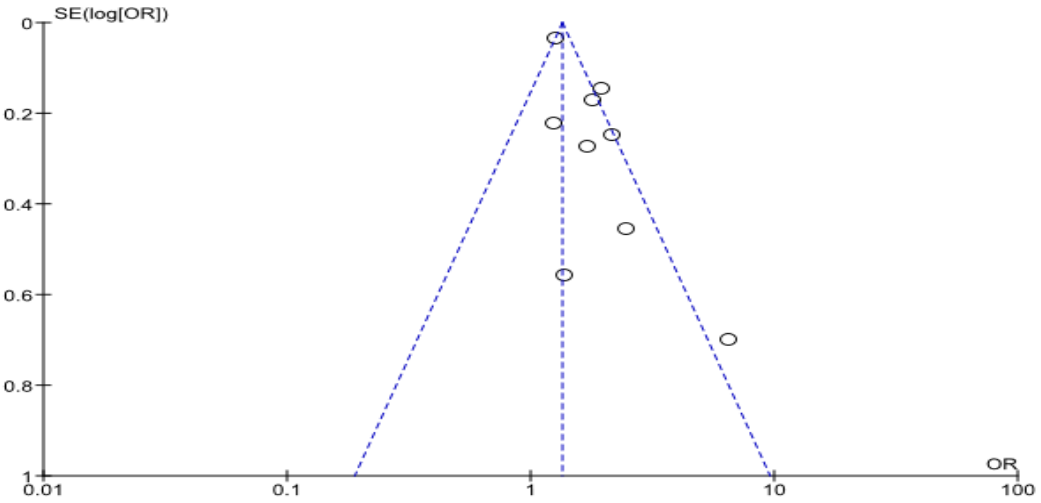


Figure 6. The funnel plot of the effects of family members on smoking habits in adolescents

Based on figure 4, there was no publication bias indicated by the sym-metrical plots on the right and left, where 6 plots were on the right and 3 plots were on the left. The plot on the left of the graph had a standard error between 0 and 0.1. Besides, the plot on the right had a standard error between 0 and 0.8.

Table 3. The assessment of Study Quality of Peers and family members on smoking habits in adolescents

Primary Study	Criteria												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Aryal et al. (2014)	1	1	1	1	1	0	1	1	1	1	0	1	10
Backhouse et al. (2017)	1	1	1	1	1	1	1	1	1	0	1	1	11
Gaffar et al.(2013)	1	1	1	1	1	0	0	1	1	1	1	1	10
Hock et al. (2014)	1	1	1	1	1	0	1	1	0	1	1	1	10
Huang et al. (2012)	1	1	1	1	1	1	1	1	1	1	1	1	12
Leatherdale et al. (2010)	1	1	1	1	1	1	1	1	0	1	0	1	10
Lim et al. (2017)	1	1	1	1	1	0	1	1	0	1	0	1	9
Moor et al. (2015)	1	1	0	1	1	1	1	1	1	1	0	1	10
Purnaningrum et al. (2017)	1	1	1	1	1	0	1	1	0	0	1	1	9
Reda et al. (2012)	1	1	1	1	1	0	0	1	1	1	1	1	10
Simetin et al (2010)	1	1	0	1	1	1	1	1	1	1	0	1	10
Skulberg et al (2019)	1	1	1	1	1	1	1	1	1	1	1	1	12
Alvest et al. (2016)	1	1	1	1	1	0	1	1	0	0	1	1	9
Bakhruji et al. (2017)	1	1	1	1	1	0	0	1	1	1	1	1	10
Hashmi et al. (2014)	1	1	1	1	1	1	1	1	0	1	0	1	10
Lehtren et al. (2020)	1	1	1	1	1	1	1	1	1	1	1	1	12
Li et al. (2020)	1	1	0	1	1	1	1	1	1	1	0	1	10

Note in Table 3:

1. Were the objectives clearly discussed the focus/study problem?
2. Was the study method (study design) suitable for answering study questions?
3. Was the method of selecting study subjects clearly written?
4. Did the sampling method create bias (selection)?
5. Did the sample taken represent the designated population?
6. Was the sample size based on pre-study considerations?
7. Was a satisfactory response achieved?
8. Was the study instrument valid and reliable?
9. Was statistical significance assessed?
10. Were confidence intervals given for the main outcome?
11. Were there any counfounding factors that have not been considered?
12. Were the results applicable to your study?

DISCUSSION

This systematic study and meta-analysis study proposed the theme of the effects of peers and family members on smoking habits in adolescents. The independent variable was smoking. A study that discussed data on smoking habits in adolescents was important because there were only several relevant studies published and accessible and it had data access problems (data duplication) (Murti, 2018). Most of the statistical results reported were in the form of a percentage or a crude odd ratio (cOR), where the study did not control for confounding factors.

Confounding factors that affected the relationship or effect of exposure to the occurrence of disease estimated by the study was not the same as the relationship or effect that occurred in the target population, which means that the study result was invalid (incorrect) (Murti, 2018). This systematic and meta-analysis study used a study that controlled for confounding factors. It was shown from the inclusion criteria, namely multivariate analysis. The

statistical result was in the form of the adjusted odd ratio (aOR).

Estimates of the combined effect of peers and family members on smoking habits in adolescents were processed using the RevMan 5.3 application with the generic inverse-variance method. The results of the systematic study and meta-analysis were in the form of a forest plot and a funnel plot. The forest plot showed visually the variation in heterogeneity (Akobeng, 2005 in Murti, 2018). The funnel plot showed the relationship between the effect size of the study and the sample size of the various studies examined which could be measured in many different ways (Murti, 2018).

The effect of peers on smoking habits in adolescents

There were 12 articles of observational study with a cross-sectional design as a source of a meta-analysis of the effects of peers on smoking habits in adolescents. The result of the forest plot of the articles showed that peers who smoked 2.77 times increased smoking habits in adolescents; it was statistically significant (aOR=2.77; 95%CI=1.67 to 4.60; p <0.001; I^2=96%).

This is in line with a study conducted by Aho et al. (2018), who conducted a survey in the spring of 2013 involving 34,776 secondary school students in Finland, that having close friends or peers of male and female who smoked increased smoking behavior in adolescents (37% of women and 36% of men smoked every day).

Based on a study conducted by Smet et al. (2020) in Semarang, Indonesia, with a total sample of 6,276 middle-school students aged 11-17 years which aimed to determine the type of cigarette, the prevalence, and determinants of smoking behavior among adolescents showed that family members and peers who smoked increased significantly from 8.2% to 38.7%.

Based on another study conducted by Balogun et al. (2020) in the Ibadan Utara area, Nigeria, with a total sample of 240 Public-Middle-School students aged 15-24 years showed that the involvement of parents who smoked and peer pressure who smoked increased smoking habits among adolescents (p> 0.001).

Nakaseko et al (2020) conducted a study among adolescents in the Republic of Vanuatu with a sample of 157 students in 7th and 8th grade with a mean age of 13.3 years. It showed that parents, siblings, and peers who smoked increased significantly the smoking habit in adolescents in the Republic of Vanuatu (p<0.05).

The effect of family members on smoking habits in adolescents

There were 8 articles of observational study with a cross-sectional design as a source of a meta-analysis of the effects of family members on smoking habits in adolescents. The result of the forest plot of the articles showed that family members who smoked 1.69 times increased smoking habits in adolescents; it was statistically significant (aOR= 1.69; 95% CI= 1.35 to 2.13; p<0.001; I^2= 65%).

This is in line with a study conducted by Balogun et al. (2019) that the involvement of parents who smoked and the parenting patterns of parents who smoked significantly affected attitudes towards smoking. Therefore, adolescents with smoking parents had the most positive tendency to smoke.

According to a study conducted by Skullberg et al. (2019) in Weh Island, Indonesia, having siblings and parents who smoked increased the risk factors for smoking in adolescents. More than a third of boys in the 13-15 year-age group were found to smoke. This is in line with a study conducted by Huang et al. (2012) that

family members increased the risk factors for smoking in adolescents.

Based on a study conducted by Gaffar et al. (2013), parents who smoked had a very high effect on the risk factors for smoking in adolescents. Another study conducted by Li et al. (2020) showed that the prevalence of males who smoked was significantly higher than females. This is supported by at least one of the parents who smoked.

According to Smet et al. (2020), children aged 11-15 years old were more susceptible to smoke. At 17 years of age, smoking behavior in adolescents has not only increased significantly but it would continue in their lifestyle, thus making them more difficult to quit smoking. However, the effects of the family who smoked with the risk of smoking uptake and its consequences for future health were aspects that have not been systematically reviewed and measured (Bee, 2011).

Based on a meta-analysis of 12 cross-sectional studies of the effects of peers on smoking habits in adolescents, peers who smoked 2.77 times increased smoking habits in adolescents; it was statistically significant (aOR=2.77; 95%CI=1.67 to 4.60; $p<0.001$; $I^2=96\%$).

Based on a meta-analysis of 8 articles of the effect of family members on smoking habits in adolescents, family members who smoked 1.69 times increased smoking habits in adolescents; it was statistically significant (aOR=1.69; 95%CI=1.35 to 2.13; $p<0.001$; $I^2=65\%$).

This study was conducted by combining previous studies obtained from 17 primary studies conducted in several countries including Nepal, Italy, Saudi Arabia, Malaysia, Taiwan, Canada, Europe, Indonesia, Ethiopia, Bangladesh, and Finland.

AUTHOR CONTRIBUTION

Florida was the main researcher who selected the topic, searched, and collected the data. Agus Kristiyanto and Bhisma Murti played a role in analyzing the data and reviewing the documents.

CONFLICT OF INTEREST

This study did not have any conflict of interest.

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