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Meta-Analysis

The Relationships between Physical Activity, Sleep Duration, Alcohol Consumption, and Hypertension in Adults: Meta-Analysis

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ABSTRACT

Background: Hypertension is a disease that causes damage to body systems. Risk factors for hypertension are changes in socioeconomic, environmental and unhealthy lifestyle such as smoking, lack of physical activity, high-fat and high-calorie foods, and alcohol consumption. This study aims to analyze the relationship between physical activity, sleep duration and alcohol consumption on the incidence of hypertension in adults with a meta-analysis study.
Subjects and Method: This study is a systematic review and meta-analysis with the population: adults (>18 years old). Intervention: low physical activity, short sleep duration and frequent alcohol consumption. Comparison: moderate physical activity, normal sleep duration and no alcohol consumption. Outcome: the incidence of hypertension. The articles used were obtained from several databases: PubMed, SpringerLink, ScienceDirect, and Google Scholar. The keywords are: “physical activity” OR exercise” AND “sleep duration” AND “alcohol consumption” AND "hypertension" OR “high blood pressure”. The article used was a full text article with a cross sectional study design and the results were reported in aOR. Articles were analyzed using the Review Manager 5.3 application.
Results: A total of 27 articles in this study came from 4 continents, namely Asia (South Korea, China, Lebanon, Thailand), Africa (Cameroon, Uganda, Ethiopia, Sudan), Europe (Poland, France, Portugal, Spain) and America (United States of America). The forest plot results showed that adults with low physical activity had 1.41 times higher risk to experience hypertension compared to people who did moderate physical activity (aOR = 1.41; 95% CI = 1.22 to 1.62; p < 0.001). Short sleep duration increased the incidence of hypertension by 1.19 times higher compared to normal sleep duration (aOR = 1.19; 95% CI = 1.06 to 1.32; p = 0.002). Frequent alcohol consumption increased the incidence of hypertension by 1.29 times higher compared to no alcohol consumption (aOR=1.29; 95% CI = 1.12 to 1.49; p=0.0006).
Conclusion: Physical activity, sleep duration and alcohol consumption increase the incidence of hypertension in the adult population.

Keywords: Physical activity, sleep duration, alcohol consumption, hypertension, meta-analysis

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BACKGROUND

As people aged, the human body will experience a decrease in the elasticity of the blood vessels so that blood pressure will automatically rise and cause hypertension. Hypertension is an increase in systolic

blood pressure of more than 140 mmHg and diastolic more than 90 mmHg on two measurements with an interval of five minutes in a state of sufficient rest or calm (Prabhakara, 2020). There are around 1.13 billion people with hypertension in the world, it means 1 in 3 people in the world suffer from hypertension. Every year, the number of people with hypertension continues to increase, therefore, it is estimated that in 2025, 1.5 billion of the world's population are affected by hypertension (WHO, 2017). The African region has the most hypertension sufferers in the world, namely 40%, followed by the Americas at 35%. For the Southeast Asia region, there are 36% of people with high blood pressure (Faselis et al., 2012).

A number of risk factors have been shown to be associated with hypertension, namely family history, gender, smoking habits, physical activity, and lack of knowledge. Hypertension often does not cause certain symptoms in sufferers, so that many people with hypertension are only aware of the disease when it has caused various organ disorders such as impaired heart function (Zhao et al., 2020). Not a few cases of hypertension are found accidentally during routine health checks. Hypertension is called "The Silent Killer". In the absence of symptoms, hypertension is only detected after a long time of suffering (Bruno et al., 2013)

Research conducted in China reported that individuals with low levels of physical activity had a 40% higher risk for hypertension compared to individuals who engaged in moderate physical activity (Faselis et al., 2012). Research conducted in Indonesia stated that someone who is less active in doing physical activity has a 2.667 times higher chance compared to people who do moderate physical activity (OR=2.667; 95%CI=1.09 to 6.46; p=0.028) (Lestari et al., 2020). Research in the United States reported that hypertension can be caused by short sleep duration with (OR = 2.41; 95%= 1.13 to 5.10) (Pergola et al., 2017). Excessive alcohol consumption can also increase the risk or chance of hypertension as a study conducted in Uganda with values (OR= 1.16; 95%CI=0.82 to 1.62) (Kotwani et al., 2013).

Behavioral changes are the best way to control blood pressure. One of these behavioral changes is lifestyle (Faselis et al., 2012). Lifestyle changes have a major influence on the risk of hypertension. A healthy lifestyle can be used as an alternative in the prevention or treatment of hypertension (Sackner et al., 2019). Various studies have been conducted with mixed results around the world, however, further analysis is needed. Therefore, researchers were interested in conducting a meta-analysis to identify the relationship between physical activity, sleep duration and alcohol consumption on the incidence of hypertension in the adult population.

SUBJECTS AND METHOD

1. Study Design

This study used a systematic review and meta-analysis design. The articles used in this study were obtained from several databases, including: PubMed, SpringerLink, ScienceDirect, and Google Scholar. The keywords for article search are as follows: “physical activity” OR exercise” AND “sleep duration” AND “alcohol consumption” AND "hypertension" OR “high blood pressure”.

2. Inclusion Criteria

The articles included in the study are full text with a cross sectional design. The article discussed the risk factors for hypertension in adults. Articles were published in English with a range of 2012-2022. The study sample was adults aged >18 years old, both male and female. The data results

were multivariate. The final results of this study were reported using adjusted odds ratio (aOR).

3. Exclusion Criteria

The exclusion criteria for this study were articles published other than English, statistical results reported in the form of bivariate analysis and articles before 2012.

4. Definition Operational of Variable

The article search was carried out by considering the eligibility criteria with the PICO model. Population: adult age. Intervention: low physical activity, short sleep duration, frequent alcohol consumption. Comparison: moderate physical activity, normal sleep duration, no alcohol consumption. Outcome: incidence of hypertension.

Physical activity is any body movement caused by the work of skeletal muscles that aims to improve body fitness.

Sleep duration is the number of hours a person sleeps in one night. Sleep serves to collect energy that has been lost after doing various activities. The normal time for adults to sleep is 7-8 hours.

Alcohol consumption is a pattern of individual behavior in choosing and consuming alcohol, such as beer, whiskey, vodka, wine, and others.

Hypertension is an abnormal increase in blood pressure with a systolic blood pressure measurement of more than 140 mmHg and a diastolic of 90 mmHg or failure to maintain a blood pressure level below 140/90 mmHg on two different measurements at 5-minute intervals at rest.

5. Study Instruments

Stages of research using PRISMA flow diagrams and assessment of article quality using Critical Appraisal Check List for cross-sectional studies (CEBM, 2014).

6. Data Analysis

The data analysis process used the Review Manager (RevMan 5.3) to determine the effect size and heterogeneity of the study. The results of the meta-analysis data processing were presented in the form of forest plots and funnel plots.

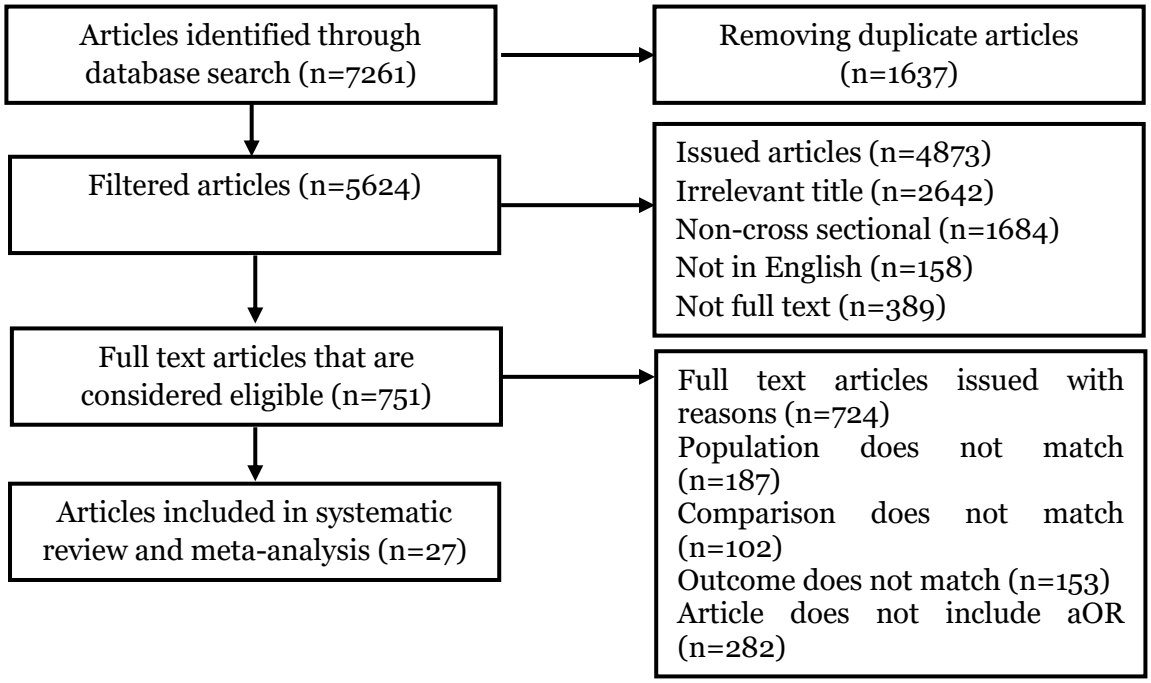

Figure 1. PRISMA Flow Diagram

Figure 2. Primary Study Distribution Map

RESULTS

The process of searching for articles in the database based on the PRISMA flow diagram can be seen in Figure 1. Figure 2 shows articles that fulfill the research inclusion criteria from four continents, namely Asia (South Korea, China, Lebanon, Thailand), Africa (Cameroon, Uganda, Ethiopia, Sudan), Europe (Poland, France, Portugal, Spain), and America (United States).

1. The result of relationship between physical activity and hypertension

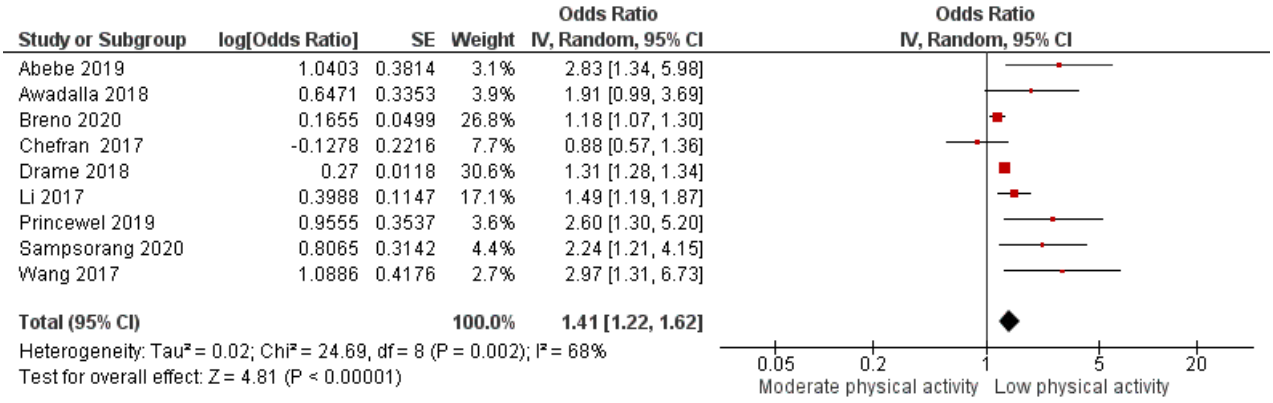

Figure 3. Forest plot of relationship between physical activity and hypertension

Based on the results of the forest plot (Figure 3). The results of a meta-analysis of a cross-sectional study showed that low physical activity increased the incidence of hypertension in adults by 1.41 times higher compared to people who did moderate physical activity (aOR = 1.41; 95% CI = 1.22 to 1.62), and the results were statistically significant (p<0.001). The heterogeneity of the research data shows I^2 = 68%, so that the distribution of the data is stated to be heterogeneous (random effect model).

Table 1. Quality Assessment of Physical Activity Articles: Cross-Sectional

No	Item of Evaluation	Publication (Author and Year)								
		Chefran et al. (2017)	Li et al. (2017)	Wang et al. (2017)	Awadalla et al. (2018)	Drame et al. (2018)	Abebe et al. (2019)	Princewel et al. (2019)	Breno et al. (2020)	Sampso-rang et al. (2020)
1	Does the study address a clearly focused question / issue?	1	1	1	1	1	1	1	1	1
2	Is the research method (study design) appropriate for answering the research question?	1	1	1	1	1	1	1	1	1
3	Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?	1	1	1	1	1	1	1	1	1
4	Could the way the sample was obtained introduce (selection) bias?	1	1	1	0	1	1	0	1	1
5	Is the sample of subjects representative with regard to the population to which the findings will be referred?	1	1	1	1	1	1	1	1	1
6	Is the sample size based on pre-study considerations of statistical power?	0	1	1	0	1	1	1	0	1
7	Is a satisfactory response rate achieved?	1	1	1	1	1	1	1	1	1
8	Are objective and validated measurement methods used to measure the outcome?	1	1	1	1	1	1	1	1	1
9	Is the size effect practically relevant?	1	1	1	1	1	1	1	1	1
10	How precise is the estimate of the effect? Were confidence intervals given?	1	1	1	1	1	1	1	1	1
11	Could there be confounding factors that haven't been accounted for?	1	1	1	1	0	0	1	1	0
12	Can the results be applied to your organization?	1	1	1	1	1	1	1	1	1
Total		**11**	**12**	**12**	**10**	**11**	**11**	**11**	**11**	**11**

Answer: 1 = Yes and 0 = No

Table 2. Quality Assessment of Sleep Duration Article: Cross-Sectional

No	Item of Evaluation	Publication (Author and Year)								
		Grandner et al. (2014)	Bathgate et al. (2016)	Sun et al. (2016)	Faraut et al. (2017)	Lu et al. (2017)	Wang et al. (2017)	Kim et al. (2018)	Li et al. (2019)	Zhao et al. (2019)
1	Does the study address a clearly focused question / issue?	1	1	1	1	1	1	1	1	1
2	Is the research method (study design) appropriate for answering the research question?	1	1	1	1	1	1	1	1	1
3	Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?	1	1	1	1	1	1	1	1	1
4	Could the way the sample was obtained introduce (selection) bias?	1	0	1	1	1	0	1	0	0
5	Is the sample of subjects representative with regard to the population to which the findings will be referred?	1	1	1	1	1	1	1	1	1
6	Is the sample size based on pre-study considerations of statistical power?	0	0	1	1	0	0	1	1	1
7	Is a satisfactory response rate achieved?	1	1	1	1	1	1	1	1	1
8	Are objective and validated measurement methods used to measure the outcome?	1	1	1	1	1	1	1	1	1
9	Is the size effect practically relevant?	1	1	1	1	1	1	1	1	1
10	How precise is the estimate of the effect? Were confidence intervals given?	1	1	1	1	1	1	1	1	1
11	Could there be confounding factors that haven't been accounted for?	1	1	1	1	1	1	0	1	1
12	Can the results be applied to your organization?	1	1	1	1	1	1	1	1	1
	Total	11	10	12	12	11	10	11	11	11

Answer: 1 = Yes and 0 = No

Table 3. Study Quality Assessment of Alcohol Consumption Article: Cross-Sectional

No	Item of Evaluation	Publication (Author and Year)								
		Dzudie et al. (2012)	Son et al. (2012)	Kotwani et al. (2013)	Waskiewicz et al. (2013)	Kate et al. (2014)	Chang et al. (2017)	Du et al. (2018)	Ji et al. (2018)	Aladin et al. (2021)
1	Does the study address a clearly focused question / issue?	1	1	1	1	1	1	1	1	1
2	Is the research method (study design) appropriate for answering the research question?	1	1	1	1	1	1	1	1	1
3	Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?	1	1	1	1	1	1	1	1	1
4	Could the way the sample was obtained introduce (selection) bias?	0	1	1	1	1	0	0	1	1
5	Is the sample of subjects representative with regard to the population to which the findings will be referred?	1	1	1	1	1	1	1	1	1
6	Is the sample size based on pre-study considerations of statistical power?	0	0	1	1	0	1	0	1	1
7	Is a satisfactory response rate achieved?	1	1	1	1	1	1	1	1	1
8	Are objective and validated measurement methods used to measure the outcome?	1	1	1	1	1	1	1	1	1
9	Is the size effect practically relevant?	1	1	1	1	1	1	1	1	1
10	How precise is the estimate of the effect? Were confidence intervals given?	1	1	1	1	1	1	1	1	1
11	Could there be confounding factors that haven't been accounted for?	1	1	0	1	1	1	1	0	1
12	Can the results be applied to your organization?	1	1	1	1	1	1	1	1	1
Total		**10**	**11**	**11**	**12**	**11**	**11**	**10**	**11**	**12**

Answer: 1 = Yes and 0 = No

Table 4. Description of the primary meta-analysis study of the relationship between physical activity and hypertension

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (CI 95%)
Chefran et al. (2017)	Lebanon	Cross-sectional	2014	Adult age (> 20 years old)	Low physical activity	Moderate physical activity	Hypertension	0.88 (0.57 to 1.13)
Li et al. (2017)	China	Cross-sectional	5291	Adult age (> 30 years old)	Low physical activity	Moderate physical activity	Hypertension	1.49 (1.19 to 1.91)
Wang et al. (2017)	China	Cross-sectional	574	Adult age (30-59 years old)	Low physical activity	Moderate physical activity	Hypertension	2.97 (1.31 to 6.71)
Awadalla et al. (2018)	Sudan	Cross-sectional	323	Adult age (35-46 years old)	Low physical activity	Moderate physical activity	Hypertension	1.91 (0.99 to 3.69)
Drame et al. (2018)	Portugal	Cross-sectional	4861	Adult age (18-69 years old)	Low physical activity	Moderate physical activity	Hypertension	1.31 (1.28 to 1.33)
Abebe et al. (2019)	Ethiopia	Cross-sectional	487	Adult age (18-58 years old)	Low physical activity	Moderate physical activity	Hypertension	2.83 (1.34 to 6.01)
Princewel et al. (2019)	Kamerun	Cross-sectional	243	Adult age (> 21 years old)	Low physical activity	Moderate physical activity	Hypertension	2.60 (1.30 to 4.40)
Breno et al. (2020)	Spain	Cross-sectional	9695	Adult age (17-44 years old)	Low physical activity	Moderate physical activity	Hypertension	1.18 (1.07 to 1.30)
Sampsorang et al. (2020)	Thailand	Cross-sectional	1287	Adult age (> 35 years old)	Low physical activity	Moderate physical activity	Hypertension	2.24 (1.21 to 4.13)

Table 5. Description of the meta-analysis primary study of the relationship between sleep duration and hypertension

Author (Year)	Country	Study Design	Sample	P (Population)	I (Inter-vention)	C (Comparison)	O (Outcome)	aOR (95%CI)
Grandner et al. (2014)	USA	Cross-sectional	5469	Adult age (18-65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.19 (1.00 to 1.43)
Bathgate et al. (2016)	USA	Cross-sectional	255	Adult age (> 18 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	3.59 (1.58 to 8.17)
Sun et al (2016)	China	Cross-sectional	20505	Adult age (35-64 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.83 (1.19 to 2.81)
Faraut et al. (2017)	France	Cross-sectional	1046	Adult age (40-70 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.80 (1.06 to 3.05)
Lu et al. (2017)	China	Cross-sectional	4519	Adult age (> 18 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.33 (1.13 to 1.56)
Wang et al. (2017)	China	Cross-sectional	4115	Adult age (50-69 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	0.99 (0.84 to 1.18)
Kim et al. (2018)	South Korea	Cross-sectional	133608	Adult age (40-69 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.12 (1.05 to 1.19)
Li et al. (2019)	China	Cross-sectional	1300	Adult age (> 18 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	1.08 (0.99 to 1.17)
Zhao et al. (2019)	China	Cross-sectional	1518	Adult age (> 18 65 years old)	Short sleep duration	Normal sleep duration	Hypertension	0.79 (0.46 to 1.36)

Table 5. Description of the meta-analysis primary study of the relationship between alcohol consumption and hypertension

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
Dzudie et al. (2012)	Cameroon	Cross-sectional	2120	Adult age (35-55 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.05 (0.81 to 1.36)
Son et al. (2012)	South Korea	Cross-sectional	1108	Adult age (23-58 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.11 (0.55 to 2.20)
Kotwani et al. (2013)	Uganda	Cross-sectional	2282	Adult age (35-55 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.17 (0.79 to 1.71)
Waskiewicz et al. (2013)	Poland	Cross-sectional	6912	Adult age (20-70 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.37 (1.15 to 1.63)
Kate et al. (2014)	Cameroon	Cross-sectional	1702	Adult age (35-55 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	0.88 (0.68 to 1.13)
Chang et al. (2017)	China	Cross-sectional	4198	Adult age (20-59 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.55 (1.23 to 1.94)
Du et al. (2018)	China	Cross-sectional	13554	Adult age (> 18 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.19 (1.01 to 1.32)
Ji et al. (2018)	China	Cross-sectional	36157	Adult age (18-65 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.83 (1.40 to 2.41)
Aladin et al. (2021)	USA	Cross-sectional	17059	Adult age (> 18 years old)	Frequent alcohol consumption (moderate)	No alcohol consumption	Hypertension	1.51 (1.22 to 1.87)

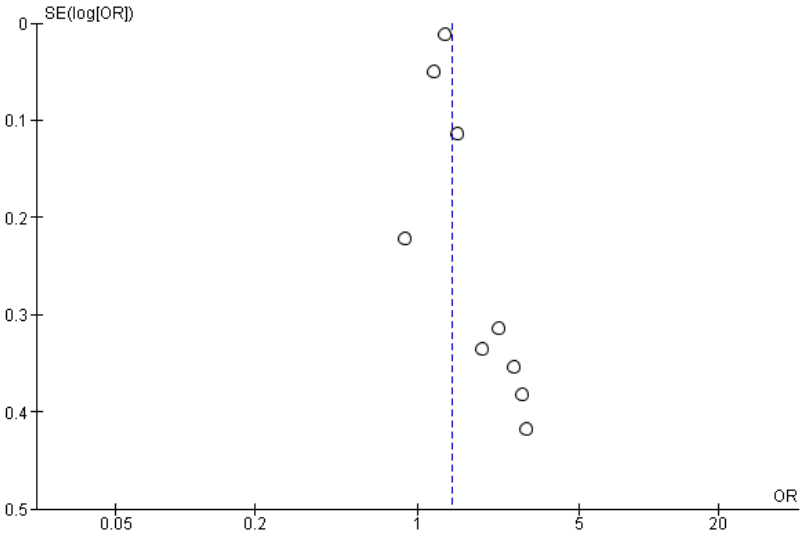

Figure 4. Funnel plot of relationship between physical activity and hypertension

The results of the funnel plot showed that there was a publication bias which was characterized by an asymmetric distribution between the right and left plots. There were six plots on the right and three plots on the left. The plot on the right side of the graph has a standard error (SE) between 0 and 0.5. The plot on the left side of the graph has a standard error (SE) between 0 and 0.3.

2. The result of relationship between sleep duration and hypertension

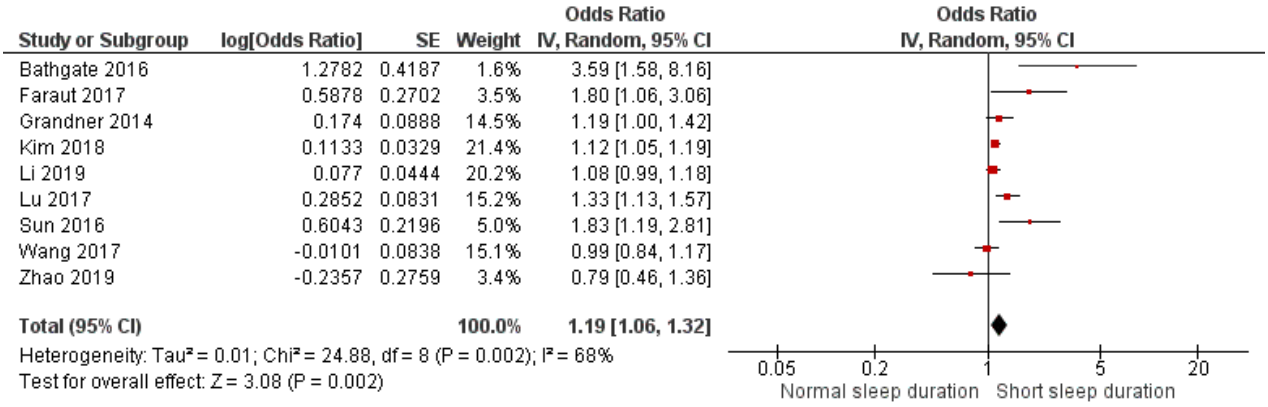

Figure 5. Forest plot of relationship between sleep duration and hypertension

Based on the results of the forest plot (Figure 5). The results of a meta-analysis of a cross-sectional study showed that short sleep duration increased the incidence of hypertension in adults by 1.19 times higher compared to people with normal sleep duration (aOR= 1.19; 95%CI= 1.06 to 1.32), and the results were statistically significant (p=0.002). The heterogeneity of the study data shows I^2= 68%, so that the distribution of the data is stated to be heterogeneous (random effect model).

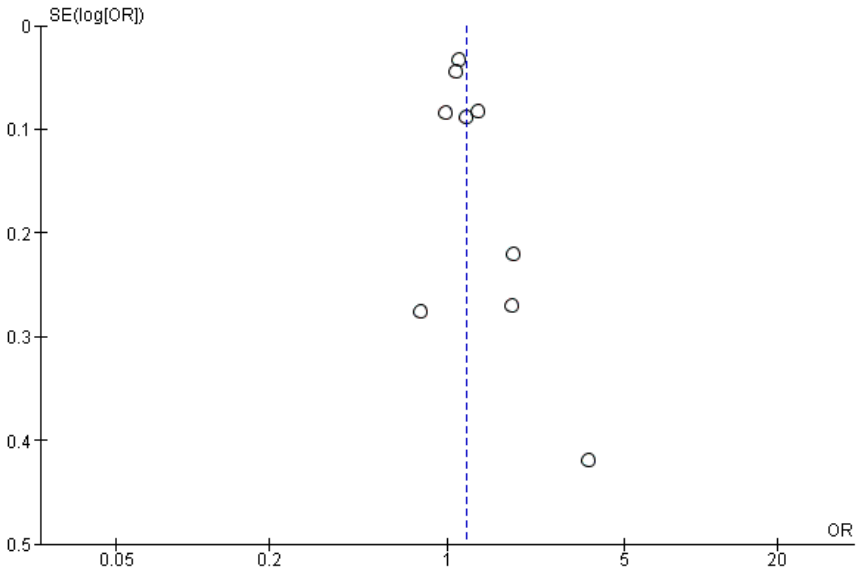

Figure 6. Funnel plot of relationship between sleep duration and hypertension

The results of the funnel plot showed that there was a publication bias which was characterized by an asymmetric distribution between the right and left plots. There were four plots on the right, four plots on the left, and one plot touching the vertical line. The plot on the right side of the chart has a standard error (SE) between 0.1 and 0.5. The plot on the left side of the chart has a standard error (SE) between 0 and 0.3.

3. The result of relationship between alcohol consumption and hypertension

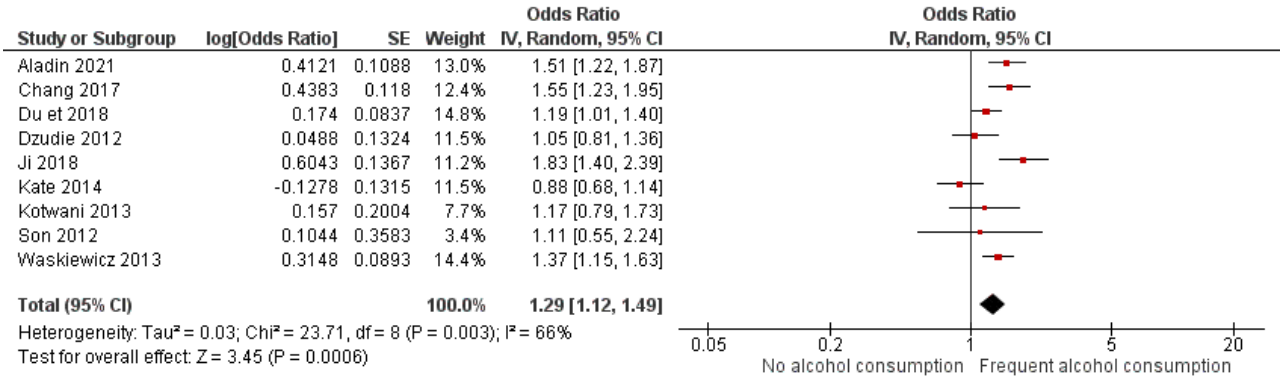

Figure 7. Forest plot of relationship between alcohol consumption and hypertension

Based on the results of the forest plot (Figure 7). The results of the meta-analysis of a cross-sectional study showed that frequent alcohol consumption increased the incidence of hypertension in adults by 1.29 times compared to people who had no alcohol consumption habits (aOR= 1.29; 95%CI= 1.12 to 1.49), and the results were statistically significant (p=0.006). The heterogeneity of the study data shows I^2= 66%, so that the distribution of the data is stated to be heterogeneous (random effect model).

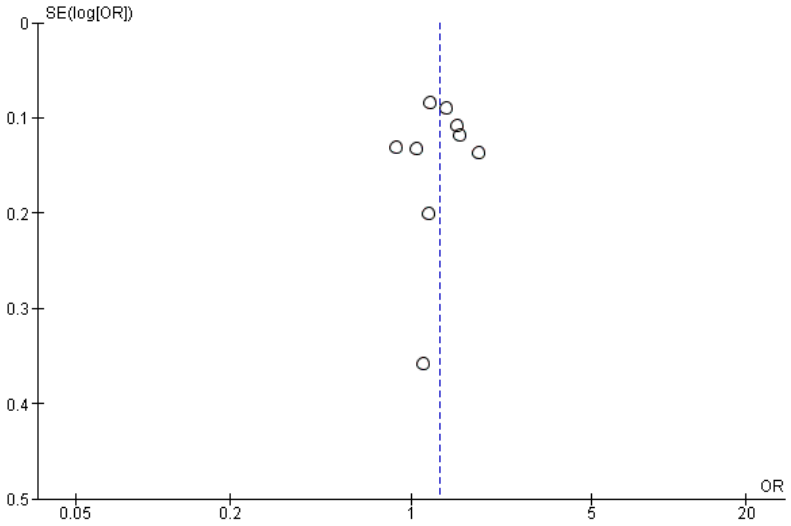

Figure 8. Funnel plot of relationship between alcohol consumption and hypertension

The results of the funnel plot show that there was a publication bias which was characterized by an asymmetric distribution between the right and left plots. There were four plots on the right and five plots on the left. The plot on the right side of the graph has a standard error (SE) between 0 and 0.2. The plot on the left side of the graph has a standard error between 0 and 0.4.

DISCUSSION

This systematic review and meta-analysis study used the theme of the relationship between physical activity, sleep duration and alcohol consumption on the incidence of hypertension in adults. This meta-analysis used studies that controlled for confounding using multivariate analysis and the statistical result reported is the adjusted odds ratio (aOR). The combined results of the relationship between physical activity, sleep duration and alcohol consumption on the incidence of hypertension in adults were processed using the RevMan 5.3 application, while the results of a systematic review and meta-analysis were presented in the form of forest plots and funnel plots.

1. The relationship between physical activity and hypertension

The forest plot results in this meta-analysis showed that people who conduct lack of physical activity increased the incidence of hypertension by 1.41 times higher compared to people who did moderate physical activity and the results were statistically significant (aOR=1.41; 95%CI= 1.22 to 1.62; p <0.001).

A similar study was conducted by Muhammad et al. (2020) which states that people who do low physical activity have a 2.55 times higher risk of developing hypertension compared to those who do moderate physical activity (aOR= 2.55; 95% CI= 1.35 to 4.84; p=0.001). Another study conducted by Kang et al. (2020) shows that there is a significant relationship between physical activity and the incidence of hypertension, with an OR value of 4.69 (95% CI= 1.12-1967) which means that people with lack of physical activity have an opportunity or risk of 4.69 times higher to suffer from hypertension compared to those with moderate physical activity.

Physical activity can cause blood flow to increase so that the production of Nitric

Oxide also increases. NO will stimulate the formation of Endothelial Derive Relaxing Factor (EDRF) which functions for vasodilation or widening of arteries. Active and regular physical activity will cause blood vessels to tend to be more elastic so that it can reduce peripheral resistance. Regular physical activity will also cause the heart to work more efficiently so that cardiac output is reduced, resulting in a decrease in blood pressure (Norman et al., 2017).

Hypertension is an important problem in the world and its prevalence is increasing due to their lack of knowledge about the importance of doing physical activity (Muhammad et al., 2020)

2. The relationship between sleep duration and hypertension

The forest plot results in this meta-analysis showed that people who had short sleep duration increased the incidence of hypertension by 1.19 times higher compared to people who did normal sleep duration in adults and the results were statistically significant (aOR=1.19; 95%CI= 1.06 to 1.32; p= 0.002). The results of this study are supported by Bathgate et al. (2016) who stated that short sleep duration can increase the incidence of hypertension by 3.59 times compared to people who do normal sleep duration (aOR= 3.59; 95%CI= 1.58 to 8.17; p = 0.002). Research conducted by Kim et al. (2012) stated that those who have sleep duration <5 hours are more prone to the incidence of hypertension, with a value (aOR= 2.43; 95%CI= 1.36 to 4.35) which means that people with short sleep duration have a 2.43 times chance or risk of hypertension compared to those with normal sleep duration.

Chen et al. (2015) reported that sleep duration that is too short can lead to high blood pressure. Sleep has an important role in maintaining the body's immune system, metabolic system, memory, learning and other important functions. A person with sufficient sleep time and has optimal quality will affect that person's activities. People with lack of sleep will be less focused when doing activities, feel tired easily and have a bad mood. Lack of sleep that lasts for a long time will have an impact on increasing blood pressure. Sympathetic nerve activity will increase if a person has a short sleep duration so that the person is easily stressed which can result in an increase in blood pressure (Bruno et al., 2013)

3. The relationship between alcohol consumption and hypertension

The results of the forest plot in this meta-analysis showed that frequent alcohol consumption increased the incidence of hypertension in adults by 1.29 times higher compared to people who have no alcohol consumption habits and the results were statistically significant (aOR= 1.29; 95%CI= 1.12 to 1.49; p=0.006). The results of this study are supported by Zhao et al. (2020) who stated that frequent alcohol consumption can increase the incidence of hypertension by 2.13 times higher compared to no alcohol consumption (aOR= 2.13; 95% CI=1.77 to 2.56; p<0.001). Another study conducted by Yang et al. (2015) stated that those who consume moderate-intensity alcohol are more susceptible to the incidence of hypertension, with a value of aOR = 2.030 (95%CI = 1.816-2.270; p<0.001) which means that people who frequently consume alcohol have an opportunity or risk of 2.03 times higher to have hypertension compared to no alcohol consumption.

Excessive alcohol consumption in the community can have an impact on health decline which will interfere and damage the function of several organs, one of them is the liver. Liver function will be disrupted so that it affects the performance and function

of the heart. Impaired heart function that occurs can eventually lead to hypertension (Lin et al., 2021).

Hypertension can occur because alcohol stimulates epinephrine or adrenaline which makes the arteries narrow and causes the accumulation of water and sodium. Increased alcohol consumption in the long term will have an effect on increasing cortisol levels in the blood so that the Rennin Angiotensin Aldosteron System activity will increase. In addition, if a person often consumes alcohol, the volume of red blood cells in the body will increase. This increases the viscosity of the blood so that it can cause an increase in blood pressure (Roerecke et al., 2017).

AUTHORS CONTRIBUTION

Niken Putri Eka Saraspuri and Nisa Nur Kusuma are the main researchers who selected the topic, searched for, and collected the data.

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CONFLICT OF INTEREST

There was no conflict of interest in this study.

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