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Incidence of Chronic Kidney Failure and Alcohol Consumption: Meta Analysis

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ABSTRACT

One of the main risk factors for chronic kidney disease (CKD) is excessive alcohol consumption. Alcohol consumption can damage the kidneys and disrupt their function because the kidneys filter toxins and waste products from the blood. This study aims to estimate the magnitude of the relationship between alcohol consumption and the incidence of chronic kidney failure. This research is a systematic review and meta analysis with PICO as follows, population: Adults. Intervention: alcohol consumption, Comparison: no alcohol consumption. Outcome: chronic failure events. The articles used in this research were obtained from three databases, namely Google Scholar, Pubmed, and Science Direct. Keywords to search for articles are "Alcohol" AND "Chronic Kidney Disease" OR CKD AND Multivariate. Articles used from 2018 – 2023. Article selection was carried out using the PRISMA flow diagram. Articles were analyzed using the Review Manager 5.3 application. A total of 6 cohort studies, namely Asia and Europe, were selected for systematic review and meta analysis. Cohort studies show that alcohol consumption influences the incidence of CKD. Patients who consume alcohol have a risk of experiencing CKD that is 1.05 times compared to those who do not consume alcohol, but the resulting increase in risk is not statistically significant (aHR= 1.04 95% CI= 0.85 to 1.27; p= 0.710). Forest Plot also shows heterogeneity of effect estimates between primary studies I2= 84%; p= 0.040, which means that the estimated effect between primary studies in this meta-analysis varies. Thus, the calculation of the average effect estimate was carried out using a random effect model approach.

Keywords: Alcohol, Chronic kidney failure, Non-communicable diseases

INTRODUCTION

Diseases are categorized into communicable and non-communicable diseases. Of the 56.4 million deaths worldwide, 39.5 million were caused by non-communicable diseases, according to 2015 World Health Organization (WHO) data. This shows that non-communicable diseases accounted for 70% of deaths. Asthma, chronic kidney failure, heart failure, etc. are some types of this non-communicable disease.(RISKESDAS, 2013).

Decreased or damaged renal glomerular function is known as chronic renal failure (Infodatin, 2017). In the United States, there are 30 million people, or about 15 percent of the population, who suffer from chronic kidney failure. In addition, 48 percent of people have low kidney function, but they do not realize that it is chronic kidney failure. As many as 118,000 people in the United States started End Stage Renal Disease (ESRD) therapy in 2014, and 662,000 of them have lived their daily lives using dialysis or a kidney transplant. Additionally, one in seven people in the United States has chronic kidney failure.(Centers for Disease Control and Prevention, 2017).

In Indonesia, there is an increase in the number of new sufferers of chronic kidney failure. In 2012, there were 19621 sufferers, an increase from 15353 sufferers in 2011. However, in 2014, the number of sufferers was not as high or the same as in 2012, with 17193 sufferers. In 2014, West Java recorded the highest number of chronic kidney failure sufferers with 5029 new cases, followed by East Java with 3621 cases, and Central Java with 2192 new cases. (Infodatin, 2017). In Indonesia, chronic kidney failure sufferers are 0.2 percent and kidney stones are 0.6 percent. Kidney failure increases at every age, with the highest prevalence in the 35-44 year age group, 0.3 percent, and the 45-54 year age group, 0.4 percent. Kidney failure is also increasing in the highest age group, namely the group over 75 years, with a prevalence of 0.6 percent(RISKESDAS, 2013). Chronic kidney disease occurs when the kidneys become damaged so they cannot filter the blood. This condition is called chronic kidney disease because this condition lasts for a long time.(Centers for Disease Control and Prevention, 2017).

Decreased kidney function indicates hospitalization, cognitive problems, and poor quality of life. Chronic kidney disease affects 8 to 16 percent of the population worldwide and is the most common cause of death(Gansevoort et al., 2013). The above-mentioned concept of risk factors was confirmed by studies conducted in Saudi hospitals. Studies show that lifestyle, diet, hypertension and family history are important factors in the development of the disease and are closely related to chronic kidney failure.(Alzamanan et al., 2018). Another study at a hospital in Manado supports the risk factors for chronic kidney disease. Research shows that a patient's lifestyle has an impact on chronic kidney disease, including smoking, consuming foods high in salt, consuming excessive sugar, and lack of exercise(Logani et al., 2017). Several studies show that smoking, drinking alcohol, and frequently consuming meat are some of the factors that increase the chance of suffering from chronic kidney failure. Where various chemicals absorbed by the body by cigarettes can cause a decrease in the GFR rate(Hidayati & Kushadiwijaya, 2008).

METHOD

Study Design

This study is a systematic review and meta-analysis. Between 2018 and 2023, articles used in this research were obtained from various databases, including Google Scholar, Pubmed, and Science Direct. A PRISMA flow diagram was used to select articles. “Alcohol” AND “Chronic Kidney Disease” AND Multivariate are the keywords used in the article search.

Inclusion Criteria

The inclusion criteria in this research article are: full-text article using a cohort study design, research subjects are the general public, outcome research on the incidence of chronic kidney failure, multivariate analysis with adjusted Odds Ratio (aOR) to measure the estimated effect.

Exclusion Criteria

The exclusion criteria in this research article are: articles published in languages other than English, statistical results reported in the form of bivariate analysis.

Variable Definition

The article search was carried out taking into account the eligibility criteria determined using the PICO model. Population: Adults. Intervention: Alcohol Consumption, Comparison: No Alcohol Consumption. Outcome: Chronic Kidney Failure

.**Alcohol Consumption** Definition: Alcohol consumption is classified into users, abusers, and dependents. Users are individuals who consume no more than 14 alcoholic drinks per week or 4 times per month. Instruments: health records/medical records and officers' data collection records regarding alcohol consumption

Measurement Scale: categorical

Chronic kidney disease Definition: Chronic kidney disease, also known as kidney damage, is a condition in which kidney function begins to gradually decline. Symptoms may include changes in tissue, blood and urine composition, or kidney imaging tests performed for more than three months. Instrument: document describing chronic kidney failure.

Measurement Scale: categorical

Data analysis

The data in the research were analyzed using the Review Manager application (RevMan 5.3). Forest plots and funnel plots are used to determine the size of the relationship and heterogeneity of the data. Fixed effect models were used for homogeneous data, while random effect models were used for heterogeneous data across studies.

RESULTS

Several journal databases, such as Google Scholar, Pubmed, and Science Direct, were used to search for articles. This process yielded 1,490 articles from the initial search process, and 1,440 articles were subsequently removed from publication, with 50 articles eligible for full review. A total of six articles that met the quality assessment were included in a quantitative synthesis using meta-analysis.

Figure 2 shows that research articles come from two continents: Asia (South Korea, Taiwan, Japan), and Europe (Sweden). Table 2 shows that six cohort study articles demonstrated an association between alcohol consumption and kidney failure, while Table 1 shows an assessment of study quality.

Based on the results of the forest plot of the cohort study, it shows that alcohol consumption influences the incidence of CKD. Patients who consume alcohol have a risk of experiencing CKD that is 1.05 times compared to those who do not consume alcohol, but the resulting increase in risk is not statistically significant (aHR= 1.04 95% CI= 0.85 to 1.27; p= 0.710). Forest Plot also shows heterogeneity of effect estimates between primary studies I2= 84%; p= 0.040, which means that the estimated effect between primary studies in this meta-analysis varies. Thus, the calculation of the average effect estimate was carried out using a random effect model approach. The Funnel Plot results show a fairly balanced distribution of effect estimates to the right and left of the vertical line of average estimates. Thus, the funnel plot does not indicate publication bias.

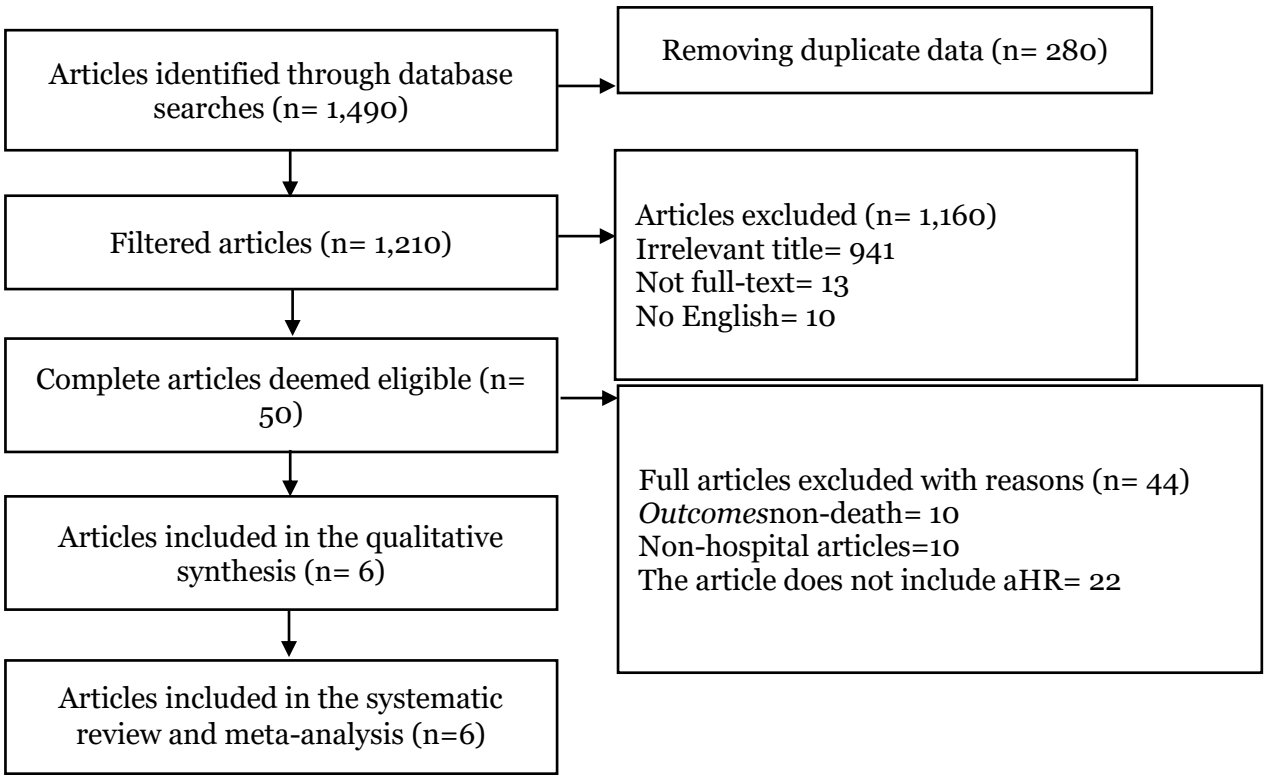

Figure 1. PRISMA flow diagram

Figure 2. Map of the research areaCKD is caused by drinking alcohol

Table 1. Results of quality assessment of research studiesCKD is caused by drinking alcohol

Author (Year)	Item Critical Appraisal													Total
	1a	1b	1c	1d	2a	2b	3a	3b	4	5	6a	6b	7	
Joo et al. (2019)	2	1	2	2	2	1	2	2	2	2	2	2	2	24
Lai et al. (2019)	2	2	2	2	2	1	2	2	2	2	2	2	2	25
Koning et al. (2020)	2	1	2	2	2	1	2	2	1	2	2	2	2	23
Lee et al.(2021)	2	2	1	2	2	2	2	1	2	2	2	2	2	24
Memarian et al. (2021)	2	1	2	2	2	2	2	2	2	2	2	2	2	25
Tanaka et al. (2022)	2	1	2	2	2	1	2	2	2	2	2	2	2	24

Description of question criteria:

1. **Formulation of research questions in the acronym PICO**
    a. Is the population in the primary study the same as the population in the PICO meta-analysis?
    b. Is the operational definition of intervention, namely the exposed status in the primary study, the same as the definition intended in the meta-analysis?
    c. Is the comparison, namely the unexposed status used by the primary study, the same as the definition intended in the meta-analysis?
    d. Are the outcome variables examined in the primary studies the same as the definitions intended in the meta-analysis?
2. **Methods for selecting research subjects**

   a. In an analytical cohort study, does the researcher select samples from the population randomly (random sampling)?
   b. As an alternative, if in an analytical cohort study the sample is not selected randomly, does the researcher select the sample based on outcome status or based on intervention status?
3. **Methods for measuring exposure (intervention) and outcome variables (outcome)**
   a. Are the exposure and outcome variables measured with the same instruments (measuring tools) in all primary studies?
   b. If the variable is measured on a categorical scale, are the cutoffs or categories used the same across primary studies?
4. **Design-related bias**
   If the sample was not selected randomly, has the researcher made efforts to prevent bias in selecting research subjects? For example, selecting subjects based on outcome status is not influenced by exposure status (intervention), or selecting subjects based on exposure status (intervention) is not influenced by outcome status.
5. **Methods for controlling confusion**
   Whether the primary study investigators have made efforts to control the influence of confounding (for example, conducting a multivariate analysis to control for the influence of a number of confounding factors).
6. **Statistical analysis methods**
   a. Did the researcher analyze the data in this primary study with a multivariate analysis model (e.g., multiple linear regression analysis, multiple logistic regression analysis)
   b. Does the primary study report effect sizes or relationships resulting from multivariate analysis (e.g., adjusted OR, adjusted regression coefficient)
7. **Conflict of interest**
   Is there no possibility of a conflict of interest with the research sponsor, which could cause bias in concluding the research results?

Scoring Instructions:

1. Total number of questions = 13 questions. Answer "Yes" to each question gives a score of "2". The answer "Undecided" gives a score of "1". The answer "No" gives a score of "0".
2. Maximum total score= 13 questions x 2= 26.
3. Minimum total score = 13 questions x 0 = 0. So the range of total scores for a primary study is between 0 and 26.
4. If the total score of a primary study is >= 22, then the study can be included in the meta-analysis. If the total score of a primary study was <22, then the study was excluded from the meta-analysis.

(UNS Public Health, 2023)

Table 2. Description of primary studies included in the meta-analysis primary studies

Author (Year)	Country	Sample	P	I	C	O
Joo et al. (2019)	Korea	1,883	Adults	Alcohol Consumption	Do not consume alcohol	Kidney Failure Occurrence
Lai et al. (2019)	Taiwan	48,604	Adults	Alcohol Consumption	Do not consume alcohol	Kidney Failure Occurrence
Koning et al. (2020)	German	5,476	Adults	Alcohol Consumption	Do not consume	Kidney Failure

Author (Year)	Country	Sample	P	I	C	O
					alcohol	Occurrence
Lee et al. (2021)	Korea	10,038	Adults	Alcohol Consumption	Do not consume alcohol	Kidney Failure Occurrence
Memarian et al. (2021)	Sweden	28,800	Adults	Alcohol Consumption	Do not consume alcohol	Kidney Failure Occurrence
Tanaka et al. (2022)	Japan	42,833	Adults	Alcohol Consumption	Do not consume alcohol	Kidney Failure Occurrence

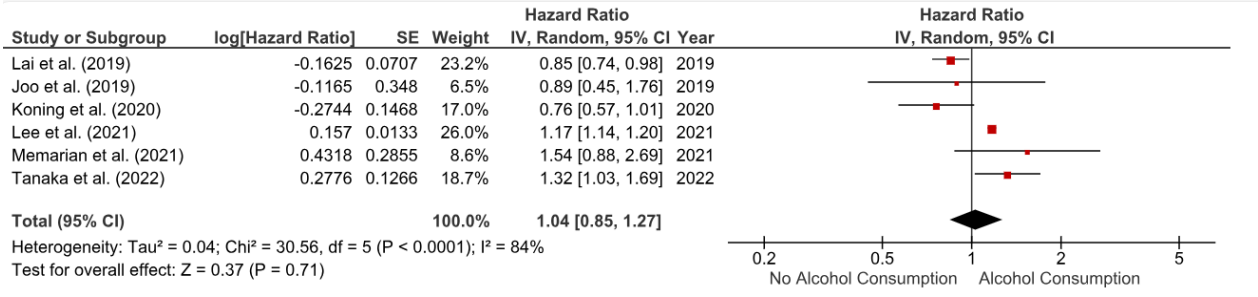

Figure 3. Forest PlotCKD is caused by drinking alcohol

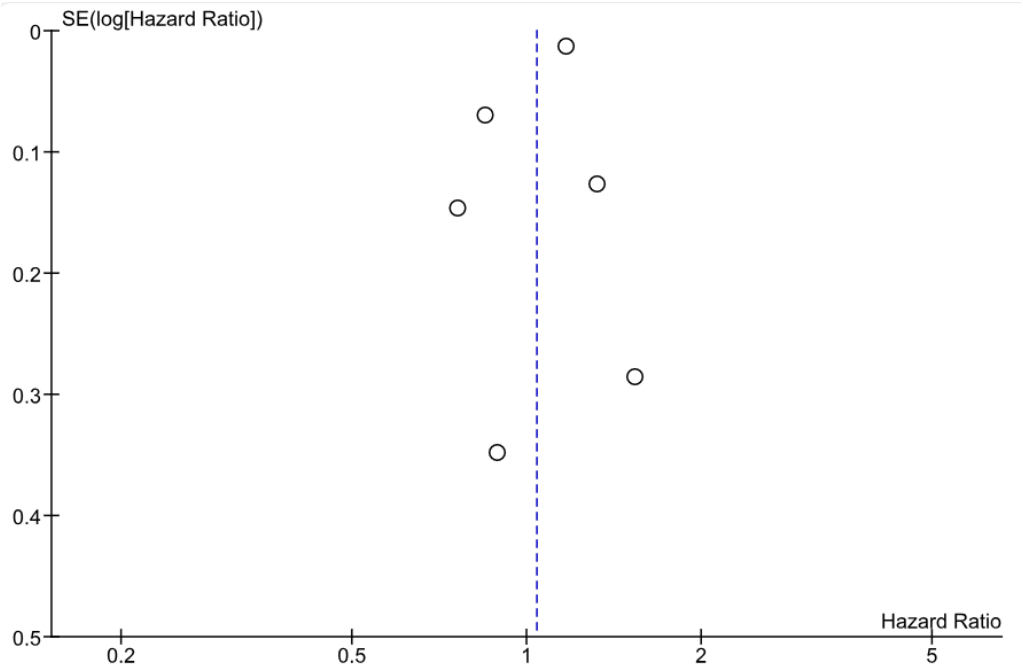

***Figure 4. Funnel Plot*CKD is caused by drinking alcohol**

DISCUSSION

Based on the results of the forest plot of the cohort study, it shows that alcohol consumption influences the incidence of CKD. Patients who consume alcohol have a risk of experiencing CKD that is 1.05 times compared to those who do not consume alcohol, but the resulting increase in risk is not statistically significant (aHR= 1.04 95% CI= 0.85 to 1.27; p= 0.710). Forest Plot also shows heterogeneity of effect estimates between primary studies I2= 84%; p= 0.040, which means that the estimated effect between primary studies in this meta-analysis varies. Thus, the calculation of the average effect estimate was carried out using a random effect model approach. The Funnel Plot results show a fairly balanced distribution of effect estimates to the right and left of the vertical line of average estimates. Thus, the funnel plot does not indicate publication bias.

In research conducted by Ariyanti (2022), he examined metabolic syndrome with a history of alcohol consumption and the risk of developing CKD. It was found from the results of bivariate analysis that people who consumed alcohol were 0.46 times more likely to develop CKD compared to those who did not consume alcohol (OR= 0.46; 95% CI= 0.2 – 0.9), in the multivariate analysis respondents who had the habit of consuming alcohol and Metabolic syndrome has a 11.6 times greater risk of developing chronic kidney failure compared to those who do not consume alcohol.

Another study that examined the relationship between alcohol consumption and the stage of chronic kidney disease was produced (p-value = 0.004)(Hasanah et al., 2023). Alcohol can damage the body directly or indirectly. Severe renal toxicity can cause renal failure and necrosis (death) of renal proximal tubule cells(Tajally Adhiatma et al., 2017).

Alcohol consumption in the past has an influence on the incidence of chronic kidney failure or CKD. Other related research shows that a history of alcohol consumption in the past will have an impact on the incidence of chronic kidney failure. Alcohol has a high ethanol content, this will of course cause kidney damage(Costa-Valle et al., 2018). In people who consume alcohol, ethanol content is associated with leukocyte infiltration and activation without oxidative ethanol catabolism by VYP2E1. Leukocyte infiltration associated with prolonged and extensive ethanol exposure plays an important role in renal structural damage and dysfunction. Alcohol consumption for more than four weeks causes kidney damage.(Hosseini et al., 2017).

Consuming alcohol can also increase blood pressure, which makes you more susceptible to kidney damage. The formation of potent nephrotoxins causes functional impairment and cell death in the proximal tubule, causing direct damage to the kidney. Renal papillary necrosis, infectious glomerulonephritis, and acute renal failure are kidney conditions associated with alcohol consumption. Based on these effects, it will have an impact on creatinine levels; in other words, people who drink alcohol have a higher risk of kidney damage(Rendy & Margaret TH., 2012).

Another study found that the number of people who answered in the case group had a history of alcohol consumption of 33.6%, while the number of people who answered in the control group had a history of alcohol consumption of 11.2%. The conclusion of this study shows that alcohol consumption does not have a significant correlation with the incidence of chronic kidney failure (CKD), and is not a confounder in the relationship between diabetes mellitus and the incidence of CKD. However, many other studies show that alcohol consumption(Ariyanti & Wdijati, 2020). A cross-sectional study analyzed the association between alcohol consumption and the risk and development of chronic kidney disease (CKD). The study found that occasional drinking significantly increased the odds of stage 3 and 4 chronic kidney failure compared with nondrinking(Moeinzadeh et al., 2023). From several explanations, it is clear that alcohol consumption has an impact on the incidence of chronic kidney failure, both directly and indirectly.

CONCLUSION

The results show that research articles come from two continents: Asia (South Korea, Taiwan, Japan) and Europe. According to forest plot results from the cohort study, alcohol consumption impacts the incidence of CKD. Patients who consumed alcohol had a 1.05 times greater risk than patients who did not consume alcohol, but this increased risk was not statistically significant (aHR= 1.04, 95% CI= 0.85–1.27; p= 0.710). In addition, the tree plot shows that the heterogeneity of effect estimates between primary studies is different, with I2= 84% and p= 0.040, indicating that the effect

estimates between primary studies in this meta-analysis are different. Therefore, the random effect model method was used to calculate the average effect estimate.

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