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Alcohol preference and health behaviors in patients with cardiometabolic diseases: Insights from the multi-center IACT cross-sectional study

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Abstract. BACKGROUND: Recognizing the influence of alcohol preference on health behaviors is essential for developing tailored interventions that effectively promote healthier lifestyles and optimize disease management strategies in the vulnerable population of patients with cardiometabolic diseases. Alcohol consumption, particularly in the context of dietary habits and medication adherence, has emerged as an area of interest in cardiometabolic health research. **AIM**: The present study aims to provide valuable insights into how alcohol preference relates to dietary habits, medication adherence, and other health-related behaviors among individuals with cardiometabolic diseases in the Mediterranean region. **MATERIAL AND METHODS**: The current study represents a secondary analysis within the framework of the multi-center IACT cross-sectional study conducted in Greece between 2022 and 2023. A total of 1,988 patients diagnosed with cardiometabolic diseases (e.g., cardiovascular disease including coronary heart disease and stroke, hypertension, type 1 and type 2 diabetes, hypercholesterolemia, elevated triglycerides, obesity, and non-alcoholic fatty liver disease) participated in the IACT study, with 1,180 being females and an average age of 64 years. Participants completed validated questionnaires covering socioeconomic and demographic characteristics, alcohol consumption patterns, adherence to the Mediterranean diet (MedDietScore), and adherence to prescribed medication (4-item Morisky Medication Scale). Based on the median value of the MedDietScore patients were categorized as low and high adherers to the Mediterranean diet, while based on their score in the 4-item Morisky scale, patients were categorized as non- adherers and perfect adherers to the prescribed medication. Additionally, utilizing the FFQ employed, patients were also classified into four groups: (i) abstainers (no alcohol consumption); (ii) those who predominantly consumed beer (> 50% of alcohol intake from beer); (iii) those who predominantly consumed wine (> 50% of alcohol intake from red/white wine); and (iv) consumers of other spirits. Multivariable logistic regression analysis was employed to explore the relationship between alcohol preference and adherence to the Mediterranean diet, medication adherence. Multivariable logistic regression analysis was employed in order to evaluate the association between alcohol preference and the level of adherence to the Mediterranean diet and to prescribed medication. **RESULTS**: The outcomes of this investigation unveiled that 40.5% of patients (N=805) diagnosed with cardiometabolic conditions disclosed alcohol consumption, with a notable portion (N=411) opting to consume alcohol alongside meals. Regarding their weekly alcohol intake, 49.2% of alcohol consumers favoured wine, 29.9% favoured beer, while the remaining 20.9% favoured other spirits such as ouzo, and tsipouro. In addition, among alcohol consumers, 57.1% of women and 42.9% of men indicated a preference for wine, whereas 26.6% of women and 32.6% of men favoured beer ($p< 0.001$). It is also worth noting the fact that the majority of the patients living in rural areas preferred wine (59.2%) followed by ouzo/ tsipouro (32.8%), while among patients living in urban areas, the highest proportion preferred beer (48.0%) followed by wine (41.0%) ($p<0.001$). Notably, individuals favouring wine were significantly older compared to those favouring beer and other alcoholic beverages ($p< 0.05$ in both genders). Among both men and women, beer consumers exhibited the highest socioeconomic status, evidenced by their higher educational attainment ($p< 0.05$ in both genders) and income level ($p< 0.05$ in both genders) compared to consumers of other alcoholic beverages. Following adjustments for demographic, socioeconomic, and clinical variables, wine consumers were

approximately 10% and 26% more likely to adhere to the Mediterranean diet compared to beer consumers and consumers of other alcoholic beverages, respectively ($p< 0.05$ in both instances). Conversely, beer consumers were 1.4 times more likely to adhere to medication than wine consumers (OR= 1.4; 95% CI= 1.1-1.8) and 1.5 times more likely than consumers of other alcoholic spirits (OR= 1.5; 95% CI= 1.1-2.0). **CONCLUSIONS**: Overall, the study contributes valuable insights into the intricate relationships between alcohol preference, dietary habits, medication adherence, and socioeconomic factors among individuals with cardiometabolic diseases in Greece. These findings have implications for the development of tailored interventions and public health strategies to promote healthier behaviors and improve outcomes in this vulnerable population, yet further research is warranted to explore the underlying mechanisms and assess the long-term impact of interventions targeting alcohol preference and health behaviors in this patient population.

1. Introduction

Alcohol consumption is a common behaviour in many cultures, particularly in the Mediterranean region, where wine, in particular, is often integrated into dietary habits (Campanella et al., 2023; Santos- Buelga et al., 2021). It is generally recognized that light to moderate alcohol consumption offers some protection against future cardiovascular disease (CVD). However, the extent of this protective effect can differ depending on the specific subtype of CVD. For instance, the incidence of coronary artery disease (CAD) steadily declined across various levels of alcohol consumption (beginning at more than 2.5 g/day). In contrast, U- or J-shaped dose-response patterns were noted for both CVD mortality and stroke incidence (Wood et al., 2018). However, alcohol consumption is not a fixed behavior as it is influenced by the type and quantity of alcohol consumed, drinking patterns, and the individual's competing health risks. Examining isolated foods and beverages in relation to health outcomes may have some advantages in terms of defining mechanistic relations. However, taking into account the whole consumption pattern as well as the intermediate behaviours related with the consumption pattern of a food or beverage is rather important to draw recommendations for the general population. To this issue, the existence of alcohol in the typical diet may be accompanied with a couple of healthy or unhealthy behaviours which need to be investigated.

For instance, paucity of data exploring how specific alcohol preferences (e.g., beer, wine, or spirits) are related with other health behaviours, particularly in populations with existing cardiometabolic diseases. The Mediterranean region, with its distinct dietary patterns and cultural practices related to alcohol consumption, provides a unique context for examining these relationships (Barbería-Latasa et al., 2022a). Insights into these associations could inform more targeted public health strategies and clinical recommendations.

The present study aims to address this gap by exploring the relationship between alcohol preference and health behaviours among individuals with cardiometabolic diseases in Greece. Specifically, this study examines how different types of alcoholic beverages (beer, wine, and spirits) relate to dietary adherence, particularly to the Mediterranean diet, and medication adherence—both of which are pivotal in the management of cardiometabolic diseases. By analysing these associations, the study seeks to provide evidence that could inform the development of tailor-made interventions aimed at improving health outcomes in this high-risk population.

2. Material and methods

2.1. Study design and scope

The Integrated Assessment of Adherence to Treatment Questionnaire for Cardiometabolic Diseases (IACT) is a cross-sectional study conducted in Greece between 2022 and 2023.

2.2. Study setting

The study was carried out across seven regions of Greece (Attica, Thessaly, Aegean, Crete, Epirus and West Macedonia, Peloponnese and West Greece, East Macedonia, and Thrace), where participants had received treatment from Primary Care settings. Recruitment also took place in various municipal clinics and medical centers in Athens (e.g., Solonos, Neos Kosmos, Petralona, Kolonou, Kypseli), as well as in medical centers located in Thessaly (Trikala, Pyli, Farkadona, Kalambaka). Thessaly's areas were considered rural or semi-urban, given the predominance of agrarian and semi-urban populations.

2.3. Sample size

A total of n=1,988 participants diagnosed with cardiovascular diseases (CVDs) defined as coronary heart disease (CHD), and stroke, or other cardiometabolic conditions (e.g., hypertension, type 1 and type 2 diabetes, hypercholesterolemia, elevated triglycerides, obesity, and non-alcoholic fatty liver disease) were enrolled in this study. Of these participants, 1,180 were females. Recruitment utilized a convenience sampling method in different urban and semi-urban areas to capture a wide range of socioeconomic and demographic profiles. A response rate of over 70% was achieved, with the main reasons for non-participation being conflicts with medical appointments and the lack of formal affiliation between the research team and medical centers.

2.4. Eligibility criteria

Participants were eligible if they met the following criteria: (1) Greek nationality, (2) age 18 or older, (3) received treatment in Primary Health Care settings, (4) had a medical diagnosis for one or more of the following conditions—hypertension, type 1 or 2 diabetes, hypercholesterolemia, elevated triglycerides, obesity, CHD, stroke, non-alcoholic fatty liver disease, and (5) had been prescribed and were taking medication for cardiometabolic diseases for over a year.

2.5. Bioethics

The study complied with the ethical standards of the Declaration of Helsinki and received approval from the Ethics Committee of the University of Thessaly, Department of Nutrition and Dietetics (Ethics 11-14/07/2022). All participants provided written consent after being informed about the study's objectives and procedures.

2.6. Research tool

The study utilized the Integrated Assessment of Adherence to Treatment Questionnaire for Cardiometabolic Diseases (IAATQ-CMD), a reliable and repeatable tool developed by Belitsi et al. (2023) The questionnaire was administered by trained healthcare professionals to ensure participants' full understanding and accurate responses. The tool was pilot-tested with 10 healthcare professionals, and modifications were made accordingly. Additional details are available in Belitsi et al. (2023).

2.7. Anthropometric and socio-demographic data

Socio-demographic data were collected, including education level, occupation, income, marital status, age, gender, nationality, and residence. Education was categorized into three groups: Group I (Primary), Group II (Secondary), and Group III (Higher Education). Occupational status was classified as Employed/Freelance (Group I) or Unemployed/Retired (Group II). Income was classified as low (< €18,000/year) or moderate (≥ €18,000/year) based on OECD guidelines for Greece. Height and weight were self-reported, with BMI calculated; individuals with a BMI exceeding 29.9 kg/m² were classified as obese. Detailed medical history, including cardiovascular risk factors, was also captured through a questionnaire.

2.8. Medical history

Participants' medical history was gathered through questions related to cardiometabolic diseases and risk factors that had been diagnosed and treated for over a year, as well as other pre-existing conditions.

2.9. Dietary and lifestyle data

Adherence to the Mediterranean diet was assessed using the MedDietScore, ranging from 0 to 55, which evaluated the frequency of consumption of 11 essential components such as cereals, fruits, vegetables, olive oil, fish, and meat. Scores were assigned based on frequency of consumption, with reverse scoring applied for items not aligned with the diet. Alcohol consumption was scored differently, with 5 points for less than 300 ml/day and 0 points for more than 700 ml/day or no alcohol consumption. Higher total scores indicated greater adherence to the Mediterranean diet, with participants classified as high or low adherers based on a median score of 31. In terms of lifestyle, participants were asked about physical activity (yes/no), the frequency of exercise (1-2 times per week, 3-4 times per week, 5+ times per week), and types of exercise (e.g., walking, yoga, jogging). Smoking status (current, past, or passive) was also recorded.

2.10. Alcohol consumption classification

Patients' alcohol consumption was assessed using a Food Frequency Questionnaire (FFQ). Based on their reported alcohol intake, participants were categorized into four distinct groups: (i) Abstainers, who reported no alcohol consumption; (ii) Predominant beer consumers, defined as individuals obtaining more than 50% of their alcohol intake from beer; (iii) Predominant wine consumers, defined as those deriving more than 50% of their alcohol intake from red or white wine; and (iv) Consumers of other spirits, which included individuals whose alcohol intake was mainly from liquors or spirits other than beer or wine. This classification allowed for a detailed analysis of alcohol consumption patterns in relation to other study variables

2.11. Medication adherence

This study used the four-item Morisky Medication Adherence Scale (MMAS) (Morisky et al., 2011; Fernadez- Lazaro et al., 2019), which includes four yes/no questions. The scale produces a score between 0 and 4, with the original developers categorizing adherence into three levels: high adherence (0 points), medium adherence (1–2 points), and low adherence (3–4 points) (Fernadez-Lazaro et al. 2019; Beyhagi et al., 2016). Additionally, a binary classification of adherence is commonly applied, where a score of 0 indicates perfect adherence, while a score of 1 or higher suggests some level of nonadherence (Fernadez- Lazaro et al. 2019; Beyhagi et al., 2016). Permission to use the scale was obtained, as noted by Fernandez-Lazaro et al (2019).

2.12.Statistical Analysis

Categorical variables are expressed as percentages (%), while continuous variables are presented as mean values with corresponding standard deviations (SD). The normality of the distribution of continuous variables was assessed using graphical methods (e.g., histograms, PP-

plots, QQ-plots) and the Shapiro-Wilk test. A One-way Analysis of Variance (ANOVA) was applied to analyse the relationship between patients' continuous variables and their alcohol preference (Preferably wine consumers, Preferably beer consumers, Preferably other spirits' consumers), while the Pearson chi-square test was utilized in order to assess the association of alcohol preference with the patients' categorical characteristics.

To assess the relationship between alcohol preference and level of adherence to the Mediterranean diet, as well as with the level of medication adherence, a multivariable binomial logistic regression analysis was conducted. The results are reported as Odds Ratios (OR) with 95% Confidence Intervals (CI). These models were adjusted for demographic factors (age, sex), socioeconomic factors (education level), and clinical characteristics (number of chronic conditions). In addition, the aforementioned analyses were also conducted separately according to the patients' sex. All statistical analyses were conducted using SPSS version 29.0, with a significance threshold set at a p-value of <0.05 for two-tailed tests.

3. Results

3.1. Alcohol consumption patterns

As presented in **Table 1**, among the 1,988 patients with cardiometabolic diseases who participated in the study, 40.5% (N=805) reported consuming alcohol. Among them, about 1 in 2 preferred to consume alcohol in conjunction with meals, with the proportion being significantly higher among those preferring to drink wine (p< 0.001). Regarding the type of alcohol consumed, 49% of the alcohol consumers favoured wine, followed by beer (30%) and other alcoholic spirits such as ouzo and tsipouro (21%). In addition, several statistically significant differences were observed among the different consumption profiles. More specifically, when comparing the three alcohol consumers' categories, wine seemed to be consumed more by women and patients being married or cohabitating with their partner (p< 0.001 in both cases). At the same time, beer was found to be consumed more frequently by younger patients, as well as with higher educational and income level (p< 0.001 in all cases), while other alcoholic spirits were preferred by employed patients (p= 0.017) and those living in urban areas (p< 0.001). Regarding cardiometabolic conditions, hypertension, hypercholesterolemia, and non-alcoholic fatty liver disease were significantly more prevalent among individuals who preferred beer (p < 0.05 for all comparisons). In contrast, the prevalence of CHD was significantly higher among consumers of other spirits, followed by those who preferred wine. In terms of lifestyle, beer consumers were found to be more physically active compared to both wine and other spirits consumers, but they also had a higher likelihood of being smokers.

Table 1. Demographic, socioeconomic, and clinical characteristics of the N = 1,988 cardiometabolic patients, stratified by their alcohol preference

	Total (N= 1,988)	**Preferably wine consumers (N= 396)**	**Preferably beer consumers (N= 241)**	**Preferably other spirits' consumers (N= 168)**	*p-value*
Demographic characteristics					
Sex (% Female)	59.4	51.5	39.4	34.5	*<0.001*
Age [years; Mean (SD)]	63.9 (13.4)	65.0 (13.1)	55.7 (14.7)	65.6 (10.3)	*<0.001*
Marital status (% Married/ Cohabitation)	66.8	74.2	59.8	65.5	*<0.001*
Socioeconomic characteristics					
Level of education (% Primary)	17.7	15.4	7.9	14.9	*<0.001*
Occupational status (% Employed/ Freelance)	61.6	67.4	66.8	78.6	0.017
Annual Income level (% More than 18,000 €)	29.5	31.3	47.3	31.5	*<0.001*
Area of residence (% Urban)	41.9	54.3	12.0	70.8	*<0.001*
Anthropometric and clinical characteristics					
Body Mass Index [kg/m2; Mean (SD)]	27.8 (4.0)	27.7 (3.9)	27.8 (4.3)	27.9 (3.1)	0.767
Hypertension	57.4	55.1	66.8	46.4	*<0.001*
Type II diabetes mellitus	18.6	19.2	19.1	15.5	0.549
Type I diabetes mellitus	3.2	2.3	3.7	0.6	0.119
Hypercholesterolaemia	37.0	29.8	48.5	26.8	*<0.001*
Elevated triglyceride levels	17.8	17.4	16.6	19.0	0.812
Non- Alcoholic Fatty Liver Disease	5.8	3.3	9.5	4.2	0.002
Coronary Heart Disease	17.7	22.0	11.2	22.6	*<0.001*
Level of medication adherence [% Poor]	48.8	46.0	45.2	66.0	*<0.001*
Lifestyle characteristics					
MedDietScore [units; Mean (SD)]	30.8 (3.8)	33.3 (3.4)	32.7 (3.5)	32.1 (3.0)	*<0.001*
Level of adherence to MD [% Low]	45.9	17.9	22.6	25.3	*<0.001*
Physical activity (% Yes)	61.0	64.6	73.0	57.1	0.002
Smoking status (% Smoker)	31.6	35.9	48.5	47.0	0.003
Frequency of alcohol consumption (% During meals)	51.1	67.9	37.3	31	*<0.001*

Notes: p-value is based on the Pearson chi- square test (categorical characteristics) and on the one- way ANOVA (continuous characteristics

3.2. Alcohol preference and adherence to the Mediterranean diet

Adherence to the Mediterranean diet (MD), as evaluated using the MedDietScore, was significantly associated with alcohol preference. As detailed in Table 1, the highest adherence to the MD was observed among wine consumers (82.1%), followed by beer consumers (77.4%) and those who preferred other spirits (74.7%; p < 0.001). After adjusting for demographic, socioeconomic, and clinical variables (**Table 2**), it was determined that individuals who consumed wine were approximately 10% more likely to adhere to the Mediterranean diet compared to those who consumed beer (OR = 1.10; 95% CI = 1.02-1.18), and 26% more likely than those who consumed other alcoholic beverages (OR = 1.26; 95% CI = 1.12-1.41) (p < 0.05 for both comparisons). Notably, these associations were even more pronounced among male patients. Specifically, males who preferred wine had approximately 2.5 times higher odds of adhering to the

Mediterranean diet compared to males who preferred beer (OR = 2.56; 95% CI = 1.56-4.17), and they were also about 67% more likely to adhere to the Mediterranean diet compared to males who consumed other alcoholic beverages (OR = 1.67; 95% CI = 1.04-2.94). In contrast, among females, the difference between wine and beer consumers was of borderline significance, with females preferring beer having at least two times higher odds of adhering to the Mediterranean diet compared to males who preferred wine (OR = 2.12; 95% CI = 0.98-4.59).

Table 2. Odds ratio (OR) and 95% Confidence Interval (95%CI) evaluating the association between alcohol preference and level of adherence to the Mediterranean diet.

Dependent Variable: Adherence level to MD (High Vs Low)	**Odd Ratio (OR)**	**95% Cofidence Interval (95% CI)**
Total sample		
Alcohol Preference		
Ref: Preferably wine consumers	1.00	
Preferably beer consumers	0.90	0.85-0.98**
Preferably other spirits' consumers	0.79	0.71-0.89**
Women		
Alcohol Preference		
Ref: Preferably wine consumers	1.00	
Preferably beer consumers	2.12	0.98-4.59*
Preferably other spirits' consumers	1.21	0.55-2.67
Men		
Alcohol Preference		
Ref: Preferably wine consumers	1.00	
Preferably beer consumers	0.39	0.24-0.64**
Preferably other spirits' consumers	0.60	0.34-0.96**

Notes: Results are based on the multivariable logistic regression analysis and are adjusted for cardiometabolic patients' demographic (age, sex), socioeconomic(educational level), and clinical characteristics (number of chronic conditions they suffer from); The results are presented in such a way that explain the association of the patients' alcohol preference with their likelihood of being high adherers to the Mediterranean diet; Level of adherence to the Mediterranean diet was evaluated with the MedDietScore

3.3. Alcohol Preference and Medication Adherence

Medication adherence, as measured by the 4-item Morisky Medication Adherence Scale, also varied according to the alcohol preference. Beer consumers exhibited higher medication adherence (54.8%) compared to both wine consumers (54.0%) and those who preferred other spirits (33.0%; p< 0.001). Specifically, after controlling for potential confounders (**Table 3**), beer consumers were 1.4 times more likely to adhere to their prescribed medication regimen than wine consumers (OR = 1.40; 95% CI = 1.10-1.80), and 1.5 times more likely to adhere than those who consumed other alcoholic spirits (OR = 1.50; 95% CI = 1.10-2.00) (p < 0.05 for both comparisons).

Table 3. Odds ratio (OR) and 95% Confidence Interval (95%CI) evaluating the association between alcohol preference and level of medication adherence.

Dependent Variable: Medication adherence (Perfect Vs Poor)	**Odd Ratio (OR)**	**95% Cofidence Interval (95% CI)**
Total sample		
Alcohol Preference		
Ref: Preferably beer consumers	1.00	
Preferably wine consumers	0.71	0.55-0.91
Preferably other spirits' consumers	0.67	0.50-0.90
Women		
Alcohol Preference		
Ref: Preferably beer consumers	1.00	
Preferably wine consumers	0.49	0.30-0.80
Preferably other spirits' consumers	0.47	0.31-0.71
Men		
Alcohol Preference		
Ref: Preferably beer consumers	1.00	
Preferably wine consumers	0.83	0.77-0.98
Preferably other spirits' consumers	1.08	0.67-1.72

Notes: Results are based on the multivariable logistic regression analysis and are adjusted for cardiometabolic patients' demographic (age, sex), socioeconomic(educational level), and clinical characteristics (number of chronic conditions they suffer from); The results are presented in such a way that explain the association of the patients' beliefs/ views with their likelihood of being poor adherers to their prescribed medication; The four-item Morisky Medication Adherence General Scale was used in order to evaluate the level of adherence to medication (Perfect adherence: 0 points, Poor adherence: 1+ points)

4. Discussion

The present study provides valuable insights into the relationship between alcohol preference, dietary habits, and medication adherence in patients with cardiometabolic diseases. The findings reveal distinct health behaviors and outcomes associated with different types of alcohol consumption, contributing to the broader understanding of how lifestyle factors intersect with cardiometabolic health.

The differentiation in alcohol consumption patterns observed in this study aligns with previous research emphasizing the cultural and social influences on drinking behaviors, particularly in the Mediterranean region. Studies have consistently shown that wine, especially when consumed with meals, is integrated into the Mediterranean diet, a dietary pattern widely recognized for its cardioprotective effects (Santos- Buelga et al., 2021; Campanella et al., 2023; Godos et al., 2024). Previous studies have already highlighted the beneficial impact of moderate wine consumption as part of the Mediterranean diet on cardiovascular health, reinforcing our finding that wine consumers exhibited the highest adherence to this dietary pattern (Hrelia et al., 2022; Ditano- Vázquez et al., 2019; Minzer et al., 2020).

In our study, wine consumers were 10% more likely to adhere to the Mediterranean diet compared to beer consumers and 26% more likely than those consuming other spirits.Similar observations were also made by previous studies, who found that wine drinkers had better overall diet quality compared to consumers of other alcoholic beverages, further supporting the hypothesis that wine consumption is often part of a healthier lifestyle

(Breslow et al., 2010; Kosti et al., 2021; Holahan et al., 2012).

Conversely, beer consumers in our study, who were generally younger and had higher educational and income levels, displayed a different health behavior profile. Despite their lower adherence to the Mediterranean diet, beer consumers demonstrated better medication adherence compared to wine and other spirits consumers. This finding is intriguing and contrasts with some studies that suggest higher alcohol consumption, is often associated with poorer health behaviors, including diet quality and medication adherence (Valencia-Martín et al., 2011; Grodensly et al., 2012).

The finding concerning the higher physical activity levels observed among beer consumers, indicates that individuals who consume beer may be more physically active than those who abstain or prefer other types of alcohol. According to the relevant literature, the association between alcohol intake and physical activity seems to be inconclusive, however there are some studies suggesting a positive association between these two behaviors (French et al., 2009; Dunn and Wang, 2003; Gutgesell et al., 1996; Pate et al., 1996). Nonetheless, the increased likelihood of smoking among beer consumers highlights a potential area of concern, as smoking is a significant risk factor for cardiovascular diseases. This duality in behavior suggests that public health interventions targeting this group should promote further adoption of positive health behaviors while addressing harmful practices like smoking (Kvaavik et al., 2004; Serdula et al., 1996; Bien and Burge, 1990; Shiffman et al., 1995).

For consumers of other spirits, who were more likely to live in urban areas and be employed, the association with poorer adherence to both the Mediterranean diet and medication regimens points to a higher-risk profile. This group's higher prevalence of coronary heart disease, along with their lower adherence to healthy lifestyle behaviors, is concerning and mirrors findings from previous studies that link higher consumption of spirits with an increased risk of cardiovascular events and poorer health outcomes (Jani et al., 2021; Hoek et al., 2022; Barbería-Latasa et al., 2022). The lower diet and medication adherence among spirit consumers could be due to the social contexts in which these beverages are consumed, which are often less structured and more associated with binge drinking and other risky behaviors (Fontán-Vela et al., 2024; Vicente-Castro et al., 2023).

The associations identified in this study have significant implications for public health strategies aimed at improving health outcomes in patients with cardiometabolic diseases. The strong link between wine consumption and Mediterranean diet adherence suggests potential benefits in promoting moderate wine consumption within the framework of this dietary pattern (Minzer et al., 2020). This approach could be particularly effective in regions where wine consumption is culturally ingrained and associated with meals. However, the findings also highlight the need for a balanced approach, considering the importance of medication adherence, especially among wine consumers who may prioritize dietary management over pharmacological treatments. Public health messaging should emphasize the complementarity of diet and medication in managing cardiometabolic diseases, particularly for populations less likely to adhere to medication regimens.

For beer consumers, public health interventions might focus on encouraging the adoption of healthier dietary patterns, such as the Mediterranean diet, while reinforcing their already high levels of medication adherence and physical activity. Tailored interventions that acknowledge their existing behaviors and promote incremental dietary changes could be more effective in this group. The findings also suggest a need for targeted interventions among spirit consumers, who appear to be at higher risk for poor health outcomes. These individuals may benefit from culturally appropriate education and support that addresses both dietary and medication adherence, particularly in the context of reducing high-risk drinking behaviors. Given the association between spirit consumption and coronary heart disease observed in our study, public health strategies should also focus on reducing overall spirit intake and promoting healthier alternatives.

4.1. Limitations and future research

While this study provides important insights, several limitations should be acknowledged. The cross-sectional design limits the ability to establish causal relationships between alcohol preference and health behaviors. Additionally, self-reported data on alcohol consumption and adherence behaviors may be subject to recall bias and social desirability bias. The study's findings are also specific to a Mediterranean population, which may limit the generalizability of the results to other cultural contexts. Future research should explore the causal pathways linking alcohol preference to dietary and medication adherence in patients with cardiometabolic diseases. Longitudinal studies could provide more robust evidence of these relationships, while qualitative research could deepen our understanding of the cultural and psychosocial factors influencing alcohol-related health behaviors. Additionally, examining the impact of tailored interventions on improving both dietary and medication adherence across different alcohol preference groups could offer valuable insights for clinical practice.

5. Conclusions

In conclusion, this study highlights the complex relationships between alcohol preference, dietary habits, and medication adherence in patients with established cardiometabolic diseases. The findings suggest that wine consumption is associated with better adherence to the Mediterranean diet, while beer consumption is linked to higher medication adherence and physical activity levels. Further research is needed to fully understand these relationships and to optimize intervention strategies accordingly.

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