Relationship between alcohol consumption and cancer in rural Chinese adults: 1 5- year follow-up cohort study

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Abstract

BackgroundWe aimed to evaluate the association between alcohol consumption and risk of cancer incidence among rural Chinese adults.

Methods: We utilized data from a community-based cohort study in rural China enrolled in 2003 and followed up prospectively up to 2018. Generalized estimating equation models were used to obtain odds ratios (OR) and 95% confidence intervals (CI) to analyze the relationship between alcohol consumption and cancer incidence.

Results: After an average of 15 years of follow-up, a total of 9870 adult participants were included in this study. The results of the regression analysis for males showed that former drinkers had a significantly increased risk of cancer compared to never drinkers ([OR]2.46,95%[CI](1.43-4.23)). The cancer risk for current drinkers with heavy alcohol consumption(>400g/week) significantly increased ([OR]1.66,95% [CI](1.18-2.34))compared to never drinkers. Among current drinkers, for every 100g of alcohol consumed per week, the risk of cancer increased by 15%. Among current drinkers, those aged 53.5 years or older , had a significant increase in the risk of cancer ([OR]1.26,95% [CI](1.12-1.42), for those with triglycerides ≥150 mg/dL, the risk of cancer was even higher ([OR]1.50,95%[CI](1.20-1.88), P for interaction 0.018), and for those with high density lipoprotein cholesterol (HDLC)<40 mg/dL, the risk of cancer increased the greatest ([OR]2.03,95%[CI](1.36-3.04), P for interaction 0.005).

Conclusions: Among middle-aged and elderly males in rural China, the risk of cancer significantly increased among former and heavy current drinkers compared with never drinkers. Age, triglycerides, and HDLC may increase the risk of cancer along with alcohol consumption.

Introduction

The cancer incidence and mortality rates in China are the highest in the world[1]. In a 2018 report that used nation-wide, population-based cancer registry data, Chen et al. showed that China's cancer incidence and mortality rates have increased annually from 2000–2011. In 2014, a total of 3,804,000 new cancers were diagnosed with a crude incidence rate of 278.07/100,000. However, the age-standardized incidence rate based on the world standard population is 186.53 / 100,000. Concurrently, the Chinese cancer mortality rate is also significantly higher than the world standard (the Chinese crude cancer mortality rate:167.89/100,000; the age-standardized mortality rate based on the world standard population:106.09/100,000)[2]. These results are very close to the Chinese cancer mortality rates estimated in a report from 2015, which showed that about 10,000 people per day (380.4 / 365 days) are diagnosed with cancer, and about 5 people die of cancer every minute [3]. The circumstances regarding cancer prevention and control in China are very grim. A large national prospective cohort study showed that there are clear differences in the burden of cancer between urban and rural areas in China. The ratio of mortality to incidence of all cancers in rural areas is 0.54, which is about one third higher than 0.39 reported in urban areas. There are also differences in types of cancer. Esophageal cancer, liver cancer and

cervical cancer are more common in rural areas, and the prognosis of these cancers is often very poor [4]. The occurrence of cancer is closely related to poor lifestyle factors. For example, heavy alcohol intake is associated with malignant tumors of the mouth, throat, and esophagus [5]. Consumption of high-energy, high-fat foods has been shown to increase the incidence of breast cancer, endometrial cancer, prostate cancer, and colon cancer[5, 6]. We propose that unhealthy living habits may have contributed to the increased rates of cancer found in the Chinese population. Therefore, it is particularly important to study the impact of the lifestyle choices of the Chinese rural population in an effort to address the risk factors for cancer within these populations and to increase cancer prevention and control in the rural areas of China.

The consumption of Chinese liquor, usually a type of traditional distilled grain alcohol, has a long and distinct history that has cultural characteristics unique to each region of China. Liquor has been widely consumed in China for centuries[7]. The Global Status Report on Alcohol and Health 2018, reported that the global percentage of people who consume alcohol has decreased by almost 5% from 47.6–43.0%, since 2000. At present, global alcohol consumption is on the decline, but in China, the situation is not optimistic. The percentage of lifetime abstention prevalence decreased from 50.9% (2005) to 42.1% (2016), whereas the prevalence of former drinkers increased by only 1.2% (from 0.9–2.1%). From this, the ratio of current drinkers has increased from 48.2% (2005) to 55.8% (2016). It is clear that alcohol drinking is and most likely will continue to be a serious issue in China [8, 9]. Alcohol is an established causal factor for cirrhosis of the liver, self-harm, poisoning and some types of cancer. It has been estimated that alcohol consumption was responsible for 0.4 million cancer deaths worldwide (representing 4.2% of all cancer deaths) in 2016[8]. Many studies have found that drinking alcohol increases the risk of cancer. Even moderate drinking may increase the risk of certain cancers, and long-term heavy use can lead to greater risks [10–12].

Despite the evidence that there is a strong link between alcohol consumption and certain cancers, there are few large prospective studies on populations in rural China. Therefore, this study explores the relationship between alcohol consumption and cancer and its possible influencing factors, on an adult population in rural China to provide a reference value for identifying risk factors that can lead to improving personal lifestyle choices and reducing the risk of cancer in rural China.

Methods

Participants

The study participants were all part of the original baseline cohort of participants of a previously conducted study on osteoporosis, who were enrolled in 2003 in Anqing, Anhui province, in Eastern China. The main exclusion criteria included a history of type 1 diabetes; chronic infection or kidney failure, such as tuberculosis or other infectious diseases; malignant tumor disease or other metabolic bone diseases; long-term use of glucocorticoids; and viral cirrhosis. The study was approved by the ethics committee of Anhui Medical University. Written informed consent was obtained from each participant. A total of 18237

participants participated in the parent study and the current analysis included 9870 men and women aged 45years. The average follow-up interval of participants in the baseline study was 15 years. The original study enrolled siblings (at least three) from the same family. We excluded 341 participants who lacked data on alcohol status and the setting family number, and also excluded 22 people who had cancer previously (see Supplemental Figure 1 for the detailed screening process). Of the 4237 female participants, 97% never drink alcohol, therefore this analysis focused on the male population. The final analysis included 5270 adult males , of which 2850 were never drinkers, accounting for 54.1% of the total, 141 were former drinkers, accounting for 2.7%, and 2279 were current drinkers , accounting for 43.2%.

Assessment of alcohol consumption

Trained study investigators collected information on alcohol consumption via questionnaire where participants were asked "Do you currently drink alcohol?", if yes, "How old were you when you first started drinking?", and "How much do you drink on average per week?" Based on the survey results, participants were divided into three main categories: never drinkers, former drinkers and current drinkers. Current drinking was defined as drinking at least once a week. Those who drank previously but had not been drinking for nearly a year were defined as former drinkers. If a participant reported that he usually drank beer or red wine, then using a conversion formula, we calculated that a 500ml bottle of beer was equivalent to 50ml of 50 proof liquor, and a large 750ml bottle of red wine was equivalent to 250ml of 50 proof liquor. In this population, drinking red wine was rare, followed by beer, while most people consumed liquor, which is reflective of the typical lifestyle of rural people.

Outcome collection

Follow-up visits with interviews and data collection were conducted in 2011, 2014, 2017 and 2018. The study outcome was overall cancer. Data on cancer were obtained by telephone or face-to-face interviews with participants or a household member (if deceased).

Laboratory Assays

Morning fasting blood samples were collected from participants by trained staff at baseline. A 10 mL venous blood sample was collected and placed in anti-coagulation tubes and non-anticoagulation tubes containing K3EDTA, where they were stored at -80 ° C in aliquots and tested at a main laboratory. All laboratory technicians received rigorous laboratory training and were tested in accordance with standard operating procedures. Serum lipids and fasting blood glucose were measured enzymatically with a Cobas Integra Roche Analyzer (Roche, Indianapolis, IN).

Statistical Analyses

Means (SD) or proportions were calculated for population characteristics by alcohol status and the differences were evaluated by Wilcoxon signed-rank tests. This study used generalized estimating equation (GEE) proportional hazards models to analyze the relationship between alcohol and cancer incidence. The multivariable model controlled for the continuous variables age, body mass index (BMI),

systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDLC), and fasting glucose (GLU), and for the categorical variables smoking status (never, former, and current),education level (illiterate, elementary school and middle or high school) and occupation (farmer, non-farmer). In addition, possible modifications of the association between alcohol consumption and cancer for current drinkers were assessed for the following variables: age (<49.4(three tertiles), ≥49.4-<53.5 and ≥53.5 years), BMI (<21.0 (median) vs. ≥21.0 kg/m2), smoking status (never, former, current), hypertension (no , yes), GLU(<96.8(median) vs. ≥96.8 mg/dL), TC (<200(clinical cut point) vs. ≥200 mg/dL), TG (<150 (clinical cut point) vs. ≥150 mg/dL) and HDLC(<40(clinical cut point) vs. ≥40mg/dL) at baseline. Potential interactions were examined by including the interaction terms into the logistic regression models. All analyses were completed using R software, version 3.5.3 (http://www.R-project.org/). A two-tailed P<0.05 was considered to be statistically significant in all analyses.

Results

Study Participants and Baseline Characteristics

Our analysis included 5,270 male individuals, 43.2% described themselves as current alcohol drinkers and 2.7% described themselves as former alcohol drinkers. **Table 1** shows the baseline characteristics of study participants stratified by alcohol drinking status. There were statistically significant differences in some of the baseline characteristics across the 3 categories of alcohol status. Former drinkers had higher baseline blood pressure levels and were more likely to be former smokers than the other two groups, and were mostly non-farmers. Compared with never drinkers, current drinkers had higher blood pressure levels and a higher proportion of them were former smokers and current smokers. The rate of cancer incidence between the three categories of alcohol status was significantly different. Former drinkers had the highest rate of cancer incidence (12.1), while never drinkers and current drinkers had lower cancer rates, at 4.8% and 5.6%, respectively. For comparison, the drinking characteristics of the female participants by drinking status are summarized in Supplemental Table S1.

Effects of Alcohol Consumption on Cancer Incidence

Compared with never drinkers (**Table 2**), former drinkers had a higher risk of cancer (OR 2.46, 95% CI [1.43,4.23]), after adjustment for age, systolic blood pressure, diastolic blood pressure, body mass index, fasting glucose, total cholesterol, triglycerides, high density lipoprotein cholesterol, smoking status, education and occupation. Current drinkers had a non-significant increased risk for cancer in both the crude model (OR 1.17, 95%CI [0.92, 1.49]) and the adjusted model (OR 1.12, 95%CI [0.87, 1.45]). Among current drinkers, those who drank more than 400g/week had a significantly increased risk of cancer (([OR] 1.66, 95% [CI] (1.18-2.34)), while the risk was reduced in the other categories of consumption amount in the adjusted model (≤200g / week: [OR] 0.87, 95% [CI] (0.59,1.28);> 200-≤400g / week : [OR] 0.99, 95% [CI] (0.68, 1.44); P for trend across the three categories of intake=0.032).In the female population (Supplemental Table S2), compared with never drinkers, the cancer risk associated with drinking still

increased but was not significant, probably due to the low number of female drinkers in this Chinese rural population.

Effects of Alcohol Consumption on Cancer Incidence Among Current Drinkers

For current drinkers, the unadjusted covariate model showed that (**Table 3 and figure 1**), for every 100g / week increase in alcohol consumption, the risk of cancer increased by 15% ([OR] 1.15, 95% [CI] (1.07, 1.25)). With low alcohol consumption (≤200g/week) as the reference, for moderate alcohol consumption (>200-≤400g/week), the incidence of cancer showed an upward trend, while for heavy alcohol consumption (>400g/week), the cancer incidence increased significantly ([OR] 2.01, 95% [CI] (1.30, 3.11)). In the adjusted covariate model, the results obtained were similar to the unadjusted model. For every 100g / week increase in alcohol consumption, the risk of cancer increased ([OR] 1.15, 95% [CI] (1.06, 1.25)). With low alcohol consumption as the reference, moderate drinking had no significant increase in cancer risk, while heavy alcohol consumption showed a significant increase in cancer risk. (>200-≤400g/week: [OR] 1.14, 95% [CI] (0.70,1.86); >400g/week: [OR] 1.94, 95% [CI] (1.21,3.10)). The analogous analyses for females was not completed due to the low number of current female drinkers.

Stratified Analysis of Alcohol Consumption and Cancer Incidence Among Current Drinkers

Additional stratified analyses were conducted to assess any effect modification of risk factors on the relationship between alcohol drinking and cancer risk. Age was divided into three categories: <49.4 years old, ≥49.4 -<53.5 and ≥53.5 years old. After adjusting for relevant covariates, among males younger than 53.5 years old, alcohol consumption and cancer risk had no statistically significant correlation. However, among males aged 53.5 years and older , alcohol consumption was negatively correlated with cancer risk ([OR] 1.26, 95% [CI] (1.12,1.42)), and cancer incidence increased with increasing age (p for interaction= 0.032) (Table 4).

Triglycerides were divided into two categories according to the clinical cut point (150mg / dL). It was found that among current drinkers, the risk of cancer increased in participants with higher triglycerides (<150mg/dL: [OR] 1.10, 95% [CI] (1.01, 1.20); ≥150mg/dL: [OR] 1.50, 95% [CI] (1.20, 1.88), p for interaction = 0.018). High-density lipoprotein cholesterol was divided into two groups according to its clinical cut point (40 mg/dL). Among current drinkers with HDLC <40 mg/dL, cancer risk increased the most ([OR] 2.03, 95% [CI] (1.36, 3.04)), while for those with HDLC ≥40 mg/dL, the increase in cancer incidence risk was relatively low ([OR] 1.10, 95% [CI] (1.01, 1.20)), and the difference was statistically significant (P for interaction = 0.006).

Discussion

The current study is one of the largest prospective studies of the relationship between alcohol and cancer incidence in China. In this analysis, we observed that heavy drinkers had a significantly increased risk of

cancer incidence and that former drinkers had a higher risk than current drinkers. Most prior studies have reported drinking to be harmful to human health, showing a positive association between amount of consumption and adverse health effects [13–15]. In China, a representative prospective study of 220,000 men with 15 years of follow-up showed a strong positive association between alcohol drinking with mortality from cancer (amount consumed > 420 g/week, HR:1.22, 95%CI: 1.08–1.38) [16]. Another Chinese prospective study of 0.5 million participants indicated that heavy, but not light to moderate, alcohol drinking (i.e. ≥420 g/week) was associated with significant excess risk of pancreatic cancer (HR: 1.69,95%CI: [1.21–2.37]) [17]. As the living conditions in rural and urban areas in China are quite different, we surmise that it is valuable to study these populations separately. In our analysis, we found that former drinkers were at a higher risk than current drinkers, which may mainly reflect the fact that former drinkers are routinely encouraged to quit drinking because of poor health. Indeed, studies have suggested that many people perceive alcohol use as harmless and only consider quitting drinking when they encounter health problems [18, 19]. We also found a positive association between current drinking and cancer, especially in the case of heavy alcohol consumption.

In light of the evidence implicating alcohol as a factor for carcinogenesis, an explanation of its role may lie in the biochemical reactions that are sequentially catalyzed by alcohol dehydrogenase (ADH) and acetaldehyde dehydrogenase (ALDH); ethanol is eliminated from the body by its oxidation first to acetaldehyde and then to acetate. Ethanol is not mutagenic per se, but acetaldehyde certainly is carcinogenic and mutagenic, through binding to DNA and proteins [8, 20], although its specific carcinogenic mechanism is not fully understood. One study showed that the total alcohol dehydrogenase activity of cancer tissues is significantly higher than healthy organs (such as liver, stomach, esophagus, and colon). ADH activity is much higher than ALDH activity, showing that cancer cells have a stronger ability to oxidize ethanol than normal tissues, but the ability to remove acetaldehyde is weak, indicating that acetaldehyde may promote cell canceration [21]. Furthermore, in East Asian populations, there is a common loss-of-function variant of the ALDH2 gene on chromosome 12 (rs671) [22, 23]. This variant can lead to the loss of the catalytic activity of aldehyde dehydrogenase, which makes the body unable to eliminate acetaldehyde quickly and effectively. Therefore, among East Asian people, especially Chinese people, the harm caused by drinking will be greater.

In addition to the effects of alcohol consumption on cancer, in this study, we also observed that several important factors will cooperate with alcohol consumption to affect the incidence of cancer. These factors include age, triglycerides, and high-density lipoprotein cholesterol.

In 2013, the National Cancer Registry of China (NCCRC) utilizing the population-based cancer registration data of all existing cancer registration centers, updated the nationwide cancer morbidity and mortality statistics[24]. The data show that the morbidity and mortality of cancer among males over the age of 45 have risen significantly, and those aged around 60 have the highest morbidity and mortality [24]. Our research shows that participants older than 53 years who drink alcohol are at an increased risk of cancer. Another US population-based cohort study showed that middle-aged and elderly men (age > 55 years) who were lifetime heavy and very heavy drinkers were more at risk of cancer compared to non-

drinkers[25]. With the increase of age, the physical condition begins to decline, and the activity of enzymes related to drinking metabolism may change, thereby increasing the risk of cancer

A study published in 2011 that included a large cohort of 275,585 men and 256,512 women examining the association of serum triglycerides and cancer risk, illustrated that as serum triglyceride concentrations increased in the male population, the risk of cancer increased significantly [26]. In a prospective cohort conducted among 109,798 Chinese males regarding lipids and lung cancer risk, the results demonstrated that high triglycerides (TG) (TG > 2.2 mmol / L, HR = 1.27, 95% CI: 1.01 ~ 1.59) was associated with an increased risk of lung cancer [27]. A recent study reviewing the effects of alcohol on plasma triglycerides indicated that alcohol consumption and fat intake are closely related and stimulate each other through hypothalamic signals and elevated cephalic response. The relation between alcohol intake and plasma triglycerides has been described as a J-shaped relationship [28]. Our research shows that for current drinkers in the high triglyceride group, the risk of cancer increased significantly. A possible explanation is that high triglyceride levels coupled with excessive alcohol intake in the body will increase the risk of cancer. Therefore, in the case of hypertriglyceridemia, patients should be advised to reduce or stop drinking to reduce the risk of cancer.

High-density lipoprotein cholesterol (HDLC) is an anti-atherosclerotic lipoprotein whose plasma content is inversely related to the risk of cardiovascular disease and certain cancers. One study on the correlation between serum high-density lipoprotein cholesterol and the risk of non-Hodgkin's lymphoma was conducted in 27,074 healthy male smokers. It demonstrated that HDLC was associated with a reduced risk of all non-Hodgkin's lymphomas over a 10-year follow-up period (n = 148; quartile RR: 0.35; 95% CI 0.19–0.62; P (trend) < 0.0001) [29]. Lyu et al. also found that high concentrations of serum HDLC have a tendency to reduce cancer risk, but the difference observed in their study was not statistically significant [27]. Our research showed that among current drinkers the risk of cancer was increased more in the low HDLC group. Therefore, we speculate that high levels of HDLC can have a protective effect and reduce cancer risk, as reflected by the group with high levels of high-density lipoprotein levels, which had a much lower cancer risk.

This research is a prospective cohort study conducted in rural adults in Anhui Province. In China, economic development, living habits, medical systems and levels of medical care in rural areas are vastly different from those of cities. Therefore, this study provides a reference for the impact of drinking alcohol on cancer in rural populations in China compared with previous studies that were mainly conducted within urban populations. The sample size of previous studies has been relatively small, but this study is a prospective cohort study with a large sample and was followed for an average of 15 years. Biochemical indicators were measured in the laboratory of the National Clinical Research Center and maintained strict quality control. However, our study also had several limitations. First, we were only able to analyze cancer as a whole, due to lack of information on cancer subtypes. Thus, we could not examine the relationship between alcohol consumption and different cancer types. Second, recall bias could exist, as we conducted household or telephone interviews at follow-up visits, and no cancer onset time was collected. Third, our study was an observational cohort study; further intervention trials are needed to validate our

results.We hope to have a more complete research program to study in depth the effects of drinking, triglycerides and high-density lipoprotein on different cancer types.

Conclusion

This study found that in a middle-aged and elderly male population in rural China, the risk of cancer was significantly increased among former drinkers and current heavy drinkers compared with never drinkers. However, among current drinkers, an increased cancer risk was found within the older age group, the high triglyceride group and the low level HDLC group. Therefore, adjusting adverse lifestyle and behavioral factors, including reducing the amount of alcohol consumption, and improving diet, is an important measure to reduce the risk of cancer among middle-aged and elderly people in rural regions. The results of this study offer important guidance for cancer prevention in rural areas of China.

Abbreviations

OR= odds ratios

CI= confidence intervals

HDLC = high-density lipoprotein cholesterol

SBP = systolic blood pressure

DBP = diastolic blood pressure

GEE = generalized estimating equations

BMI = body mass index

GLU = fasting glucose

TC = total cholesterol

TG = triglycerides

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of Anhui Medical University [The committee's reference number is 1005 2003-8-11]. Written informed consent was obtained from each participant.

Consent for publication

Not applicable.

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Competing interest:

All authors have completed the ICMJE uniform disclosure form and have declared the following:

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Availability of data and material

Data described in the manuscript, code book, and analytic code will be made available from the corresponding authors on request, after the request is submitted and formally reviewed and approved by the Ethics Committee of the Institute of Biomedicine, Anhui Medical University, Hefei, China.

Authors' contributions

All authors contributed to the study. Yue zhang performed the statistical analyses and wrote an initial draft of the paper. Xiping Xu, Binyan Wang, Xiaoshu Cheng and Genfu Tang conceptualized and designed the study, and supervised the survey. Yanfang rong gave guidance on statistical methods. Jingyi Li and Nannan Chen performed data and statistical analysis results checking. Other authors supervised and

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Tables

Table1. Baseline characteristics of male study participants by alcohol drinking status

s	Stratified by alcohol drinking status			*P value*
	Never (n=2850)	Former (n=141)	Current (n=2279)	
	52.2 ±4.7	53.3 ±4.6	52.0 ±4.5	0.003
ıHg[a]	123.0±19.4	127.8 ±21.8	127.3 ±20.1	<0.001
ıHg[a]	78.8 ±11.7	81.1 ±14.1	81.5 ±12.2	<0.001
m^{2a}	21.1 ±2.6	21.3 ±2.8	21.3 ±2.4	0.045
ory results[b]				
glucose, mg/dL	96.7(90.4-103.7)	99.4(92.0-105.5)	96.8(90.4-104.2)	0.196
olesterol, mg/dL	167.4(147.7-188.7)	163.2(146.2-186.0)	171.7(152.0-192.6)	<0.001
rides,mg/dL	85.9(66.4-116.9)	89.5(69.1-124.0)	80.6(62.0-111.6)	<0.001
olesterol, mg/dL	52.2(44.5-62.3)	49.1(40.2-56.1)	57.6(47.6-69.2)	<0.001
status, n (%)				<0.001
	668 (23.5)	17 (12.1)	299 (13.1)	
	230 (8.1)	36 (25.5)	257 (11.3)	
	1947 (68.4)	88 (62.4)	1719 (75.6)	
n level, n (%)				0.509
	658 (23.2)	33 (23.4)	560 (24.7)	
ary school	1425 (50.2)	74 (52.5)	1149 (50.6)	
r high school	756 (26.6)	34 (24.1)	561 (24.7)	
ion, n (%)				
ner	2609 (91.7)	121 (85.8)	2074 (91.1)	0.047

Abbreviations: BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL-C, high-density lipoprotein cholesterol;
[a]For continuous variables, values are presented as mean±SD.
[b]Values are presented as median (IQR)
P value,χ2 test for categorical variables

Table 2. The association between cancer and alcohol drinking status in males

	N	Cases (%)	Crude model	Adjusted model[a]	
			OR (95%CI)	OR (95%CI)	*P* value
Alcohol Drinking Status					
Never	2850	138(4.8)	ref	ref	
Former	141	17(12.1)	2.69(1.58,4.61)	2.46(1.43,4.23)	0.001
Current	2279	128(5.6)	1.17(0.92,1.49)	1.12(0.87,1.45)	0.369
Alcohol Consumption					
Low	798	34(4.3)	0.87(0.60,1.27)	0.87(0.59,1.28)	0.473
Moderate	799	38(4.8)	0.98(0.68,1.42)	0.99(0.68,1.44)	0.954
Heavy	682	56(8.2)	1.76(1.28,2.41)	1.66(1.18,2.34)	0.004
P for trend					0.030

[a]Adjusted for age, systolic blood pressure, diastolic blood pressure, body mass index, fasting glucose, total cholesterol, triglycerides, high density lipoprotein, smoking status, education level and occupation.

Table 3. The association between cancer and amount of alcohol consumption in male current drinkers

Alcohol Consumption	N	Cases (%)	Crude model	Adjusted model[a]	
			OR (95%CI)	OR (95%CI)	*P* value
Continuous, per 100g/week	2279	128(5.6)	1.15(1.07,1.25)	1.15(1.06,1.25)	0.001
Categories					
Low	798	34(4.3)	ref	ref	
Moderate	799	38(4.8)	1.12(0.70,1.80)	1.14(0.70,1.86)	0.599
Heavy	682	56(8.2)	2.01(1.30,3.11)	1.94(1.21,3.10)	0.006
P for trend					0.006

[a]Adjusted for age, systolic blood pressure, diastolic blood pressure, body mass index, fasting glucose, total cholesterol, triglycerides, high density lipoprotein, smoking status, education level and occupation.

Table 4. The association between cancer and alcohol consumption status in male current drinkers stratified by different variables.

	Alcohol Consumption per 100g/week				*P for interaction*
	N	Events (%)	OR (95%CI)	*P*	
Age, y					0.032
T1(<49.4)	760	24(3.2)	1.03(0.85,1.25)	0.749	
T2(49.4-<53.5)	759	42(5.5)	1.03(0.89,1.20)	0.676	
T3(≥53.5)	760	62(8.2)	1.26(1.12,1.42)	<0.001	
Body mass index, kg/m^2					0.300
<21.0(median)	1138	73(6.4)	1.10(0.98,1.23)	0.092	
≥21.0	1136	55(4.8)	1.21(1.07,1.37)	0.002	
Smoking status					0.319
Never	299	8(2.7)	1.30(0.91,1.86)	0.148	
Former	257	11(4.3)	1.31(0.99,1.73)	0.059	
Current	1719	109(6.3)	1.12(1.03,1.23)	0.012	
Hypertension					0.571
No	1538	77(5.0)	1.18(1.06,1.31)	0.002	
Yes	741	51(6.9)	1.10(0.97,1.26)	0.139	
Fasting glucose, mg/dL					0.267
96.8(median)	1116	64(5.7)	1.19(1.07,1.33)	0.002	
≥96.8	1160	63(5.4)	1.11(0.98,1.25)	0.108	
Total cholesterol, mg/dL					0.548
<200	1859	100(5.4)	1.16(1.06,1.28)	0.001	
≥200	417	27(6.5)	1.08(0.91,1.30)	0.374	
Triglycerides, mg/dL					0.018
<150	2014	109(5.4)	1.10(1.01,1.20)	0.037	
≥150	262	18(6.9)	1.50(1.20,1.88)	<0.001	
High density lipoprotein cholesterol, mg/dL					0.006
<40	203	11(5.4)	2.03(1.36,3.04)	0.001	
≥40	2073	116(5.6)	1.10(1.01,1.20)	0.021	

Adjusted, if not stratified, for age, systolic blood pressure, diastolic blood pressure, body mass index, fasting glucose, total cholesterol, triglycerides, high density lipoprotein, smoking status, education level and occupation.

Figures

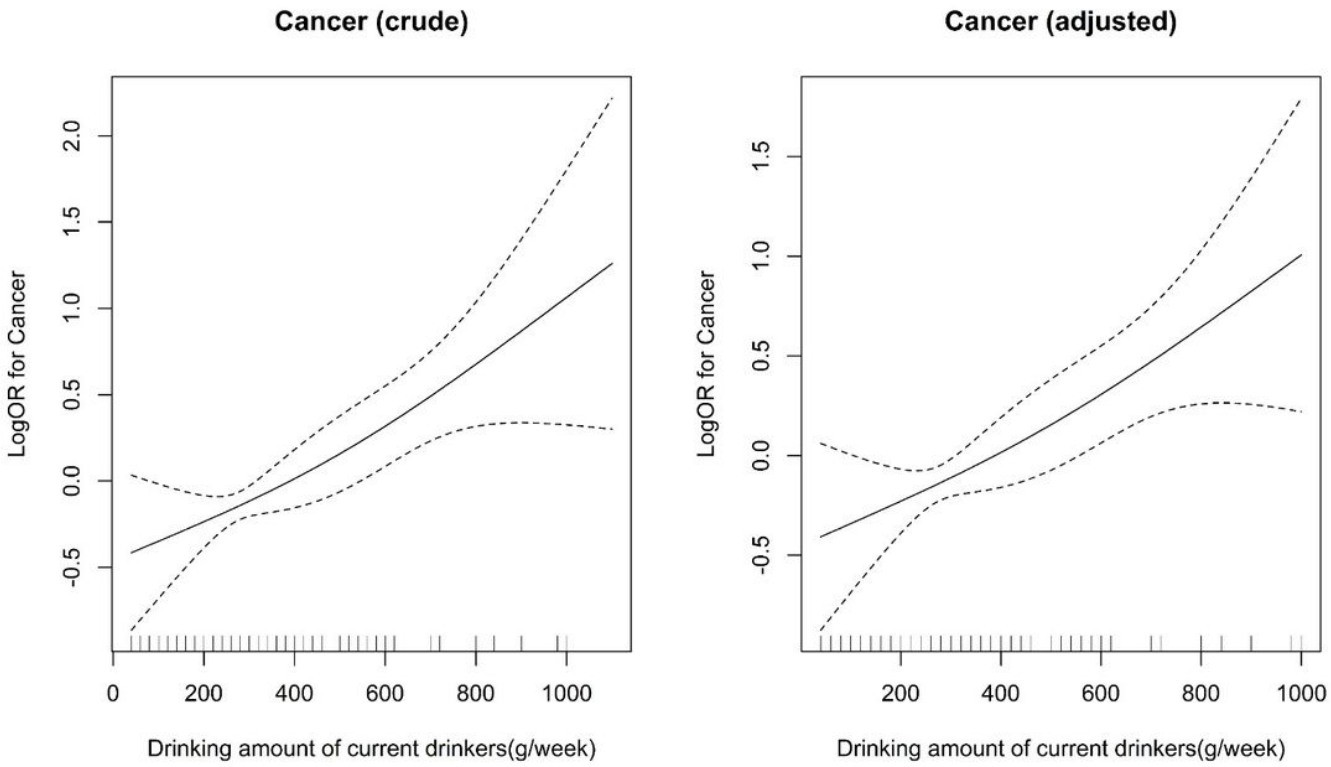

Figure 1

Smoothing curves illustrating the association between amount of alcohol consumption and cancer in male current drinkers.

Supplementary Files

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