Alcohol, body weight, and weight gain in middle-aged men[1–3]

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ABSTRACT

Background: There is uncertainty as to whether regular alcohol consumption contributes directly to weight gain and the risk of obesity.

Objective: We examined the relation between alcohol intake and body weight and the association between changes in alcohol intake and in body weight over 5 y of follow-up.

Design: This was a prospective study of 7608 men aged 40–59 y drawn from general practices in 24 British towns, excluding persons with known diabetes. Five years after screening, 6832 men then aged 45–64 y and without diabetes completed a postal questionnaire on changes in alcohol intake and body weight.

Results: Mean body mass index (BMI; in kg/m^2) and the prevalence of men with a high BMI ($\geq$28; top quintile of the BMI distribution) increased significantly from the light-moderate to the very heavy alcohol intake group even after adjustment for potential confounders. Similar patterns were seen for all types and combinations of alcohol. After 5 y of follow-up, stable and new heavy drinkers (including very heavy drinkers of $\geq$30 g/d) showed the greatest weight gain and had the highest prevalence rates of high BMI. Weight change patterns in heavy drinkers at baseline who reduced their intake were not significantly different from those in the stable none-occasional group but showed more weight loss and less weight gain than in the stable or new heavy drinkers.

Conclusion: Heavy alcohol intake ($\geq$30 g/d) contributes directly to weight gain and obesity, irrespective of the type of alcohol consumed. *Am J Clin Nutr* 2003;77:1312–7.

KEY WORDS Alcohol intake, body mass index, weight gain, men

INTRODUCTION

In many developed countries, the average alcohol intake of those who drink is ≈10–30 g/d, or 3–9% of total energy intake (1). Moderate alcohol consumers usually add alcohol to their daily energy intake rather than substituting it for food, thus increasing positive energy balance (2). It would seem surprising if the consumption of alcohol did not contribute directly to body weight. However, the relation between "alcohol consumption and body weight remains an enigma to nutritionists" (3). The epidemiologic evidence is inconsistent, with numerous studies suggesting absent or weak positive relations in men and strong inverse associations in women (1, 2, 4, 5). It has been suggested that the inconsistencies may be explained to some degree by confounding factors (2). A recent review concluded that "there is no consensus on the relationship between moderate alcohol intake and body weight" (1), and the issue "whether or not alcohol calories count" has been the topic of recent editorials (3, 6). Given the strong statement that "alcohol intake does not increase the risk of obesity" (7), it is not surprising that popular scientific opinion holds that "people who enjoy their booze may be thinner than their teetotal friends" and labels such people "skinny drinkers" (8).

Most epidemiologic studies of this issue have been cross-sectional in nature. There have been relatively few prospective studies of the relation between alcohol and weight gain, and most of these did not take changes in alcohol intake into account. This paper examines the relation between alcohol intake, including types of alcohol consumed, and body weight in middle-aged British men. It also examines the association between change in alcohol intake and change in body weight over the first 5 y of follow-up.

SUBJECTS AND METHODS

The British Regional Heart Study (BRHS) is a prospective study of cardiovascular disease involving 7735 men aged 40–59 y selected from the age-sex registers of one group general practice in each of 24 towns in England, Wales, and Scotland and examined in January 1978 through July 1980. Men with preexisting cardiovascular disease or receiving regular medical treatment were not excluded. The overall response rate was 78%. The criteria for selecting the town, the general practice, and the subjects as well as the methods of data collection have been reported (9). Research nurses administered to each man a standard questionnaire (Q1) that included questions on smoking habits, alcohol intake, and medical history. Several physical measurements were made and blood samples (nonfasting) were taken. Five years after the initial examination (1983–1985), a postal questionnaire (Q5) similar to the one administered at screening was sent to all surviving men and detailed information was obtained on medical history, changes in smoking and drinking behavior, and other risk factors. The fifth

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[2] The British Regional Heart Study is a British Heart Foundation Research Group and receives support from the Department of Health, England. The views expressed in this publication are those of the authors and not necessarily those of the Department of Health (England).

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Received July 29, 2002.

Accepted for publication November 1, 2002.

year questionnaire was completed by 7275 men, 98% of the available survivors. Ethical approval was obtained from all relevant research ethics committees.

Preexisting disease

At the initial screening (Q1) and 5 y later (Q5) men were asked whether a doctor had ever told them that they had angina or myocardial infarction (heart attack or coronary thrombosis), stroke, diabetes, or several other disorders. Because of the strong relation between body mass index (BMI) and diabetes and because men with diabetes may be advised to abstain from alcohol, all men with diagnosed diabetes at Q1 were excluded ($n = 118$).

Lifestyle characteristics

Information on smoking habits was obtained at Q1 and Q5. The men were classified as current smokers, as ex-cigarette-smokers, and as those who had never smoked cigarettes. In the analysis involving Q5, smoking categories were derived from the combined information collected at Q1 and Q5. The men were classified as those who had never smoked, exsmokers at both Q1 and Q5, exsmokers at Q5 only (recent exsmokers), and 2 groups of current cigarette smokers at Q5 (1–19 and ≥ 20 cigarettes/d).

The longest held occupation of each man was recorded at screening and the men were grouped into 1 of 6 social classes: I, II, III nonmanual, III manual, IV, and V. Those whose longest occupation was in the Armed Forces formed a separate group (10).

At screening the men were asked to indicate their usual frequency and type of physical activity, and a physical activity score was derived for each man. The men were grouped into 6 broad categories: none, occasional, light, moderate, moderately vigorous, and vigorous (11). Information on physical activity was not available at Q5, and adjustment for physical activity is based on the physical activity data collected at screening.

Body mass index

At screening, weight and height were measured, and BMI calculated as weight/height^2 (kg/m^2) was used as an index of relative weight. At Q5, the men were asked to state their weight in pounds or kilograms and BMI was calculated for each man on the basis of reported weight and on height measured at screening. We also examined the percentage of men with a high BMI, ie, ≥ 28, the upper one-fifth of the BMI distribution in all men at Q1. Data on BMI were not available for 3 men at screening.

Weight change

The percentage change in body weight since screening was calculated for each man (12). For a man in this cohort of average weight (76 kg), a loss or gain of 3.0 kg (4%) defined a change in weight (12). Thus, *weight loss* was defined as a loss of ≥ 4% of body weight; *weight gain* was defined as a gain of ≥ 4% of body weight. The stable group comprised those who had gained or lost < 4% of body weight. The men were classified into 4 weight-change categories: *1*) weight loss, *2*) stable, *3*) gain of 4 –10%, and *4*) gain of > 10% of body weight. BMI data were available at both Q1 and Q5 for 7100 men.

Alcohol intake

Alcohol consumption was recorded at Q1 and Q5 by using questions on frequency, quantity, and type (13). The men were questioned about their frequency and quantity of alcohol intake, resulting in 8 drinking categories: nondrinkers, occasional drinkers (special occasions or 1–2 drinks/mo), weekend drinkers (1–2, 3–6, or > 6 drinks/d), and men drinking daily or on most days (1–2, 3–6, or > 6 drinks/d). These categories were the only choices provided and "more than 6 drinks/d" was an open-ended category. One UK unit of alcohol (one drink) represents one-half a pint of beer, a single measure of spirits, or a glass of wine (≈10 g alcohol). Twenty-five biochemical and hematologic measurements on a single blood sample taken at the time the questionnaire was completed indicated that the reported levels of alcohol consumption were valid on a group basis (14). Five years later (Q5), the men were asked about their past drinking habits in addition to their current alcohol consumption. Those who said they were nondrinkers at Q5 were asked whether they had been drinkers in the past and, if so, what their past alcohol consumption had been. No biochemical or hematologic validation was carried out at Q5. Complete information on alcohol consumption at both Q1 and Q5 was obtained from 7165 men.

At Q1, the men were asked to indicate which type of drink they usually consumed: *1*) beer ($n = 4270$), *2*) spirits ($n = 806$), *3*) wine or sherry ($n = 517$), *4*) mixed beer and spirits ($n = 1016$), or *5*) mixed beer, spirits, wine, and sherry ($n = 546$). Data on the type of alcohol were not available at Q5.

At both Q1 and Q5, the men were classified into 5 groups according to their estimated reported weekly intake as follows (13): *1*) none; *2*) occasional (< 1 unit/wk); *3*) light-moderate (1–20 units/wk), including weekend drinkers of 1–2 or 3–6 units/d and daily drinkers of 1–2 units/d; *4*) heavy (21–42 units/wk), including weekend drinkers of > 6 units/d and daily drinkers of 3–6 units/d; and *5*) very heavy (> 42 units/wk), comprising daily drinkers of > 6 units/d.

Changes in alcohol intake

To take into account the major changes in alcohol intake over the first 5 y of follow-up, the men were classified into stable and changed groups on the basis of their reported intake at Q1 and Q5. Of the 7165 men who responded to alcohol questions at both Q1 and Q5, data on body weight were incomplete for 169, diabetes at Q1 was recalled by 99, and a diagnosis of diabetes between Q1 and Q5 was recorded for 65, leaving 6832 men for analysis.

The stable groups were as follows: *1*) stable none-occasional ($n = 1733$): nondrinkers or occasional drinkers at Q1 who remained nondrinkers or occasional drinkers at Q5; *2*) stable light-moderate ($n = 1354$): light-moderate drinkers at Q1 and Q5; and *3*) stable heavy ($n = 1341$): heavy or very heavy drinkers at Q1 and Q5.

The changed groups were as follows: *4*) light-moderate to none-occasional ($n = 292$): light-moderate drinkers at Q1 who reported being nondrinkers or occasional drinkers at Q5; *5*) none-occasional to light-moderate ($n = 669$): nondrinkers or occasional drinkers at Q1 who reported light-moderate drinking at Q5; *6*) exheavy ($n = 1171$): heavy or very heavy drinkers at Q1 who reported being nondrinkers, occasional drinkers, or light-moderate drinkers at Q5 [at Q1, 83% of these men were heavy drinkers (21–42 units/wk); at Q5, 77% were light-moderate and 19% were occasional drinkers]; and *7*) new heavy ($n = 272$): none-occasional and light-moderate drinkers at Q1 who reported heavy or very heavy drinking at Q5 [at Q1, 88% were light-moderate drinkers; at Q5, 93% were heavy drinkers (21–42 units/wk)].

Statistical methods

Analysis of covariance was used to obtain adjusted means by alcohol categories with the PROC GLM procedures of SAS (version 6.12; SAS Institute Inc, Cary, NC). Logistic regression

TABLE 1
Alcohol intake, adjusted mean BMI, adjusted percentage of men with a high BMI (≥28), and adjusted odds ratios (ORs) for a high BMI at baseline[1]

Alcohol categories	Age-adjusted mean BMI	Age-adjusted high BMI	Adjusted[2] mean BMI	Adjusted[2] OR for high BMI (95% CI)
	kg/m²	*%*	*kg/m²*	
None (n = 452)	25.35 ± 0.15[3]	19.0	25.28 ± 0.15	1.00
Occasional (n = 1819)	25.35 ± 0.08	17.7	25.33 ± 0.07	0.95 (0.73, 1.24)
Light-moderate (n = 2502)	25.33 ± 0.06	16.8	25.29 ± 0.06	0.92 (0.71, 1.19)
Heavy (n = 2013)	25.68 ± 0.07[4]	21.7	25.70 ± 0.07[4]	1.24 (0.95, 1.61)
Very heavy (n = 822)	25.83 ± 0.11[4]	23.9[4]	25.95 ± 0.11[4]	1.42 (1.07, 1.90)[4]
P for trend	<0.0001	<0.0001	<0.0001	<0.0001

[1] n = 7608.
[2] Adjusted for age, social class, physical activity, and cigarette smoking.
[3] $\bar{x}$ ± SE.
[4] Significantly different from none, $P < 0.05$.

was used to obtain adjusted relative odds (odds ratio) of weight gain and high BMI (≥ 28) for the alcohol categories, with adjustment for potential confounders with the PROC LOGISTIC procedure in SAS. In the adjustment, smoking (4 groups), social class (7 groups), and physical activity (6 groups) were fitted as categorical variables. Age and initial BMI were fitted as continuous variables. Tests for trends were assessed by fitting alcohol as a quantitative variable (1–5). Direct standardization was used to obtain age-adjusted rates, and tests for trends of age-adjusted rates were performed with the PROC LOGIST procedure of SAS.

RESULTS

Data on alcohol intake were available for 7729 of the 7735 men at baseline. After the exclusion of men with no data on BMI (n = 3) and known diabetes (n = 118), 7608 men were available for analyses.

Alcohol intake and BMI at baseline

Age-adjusted mean BMI and the percentage of men with a high BMI at baseline increased significantly with increasing levels of alcohol intake (**Table 1**). There was no significant difference in mean BMI or in the percentage of men with a high BMI between nondrinkers, occasional drinkers, and light-moderate drinkers, although light-moderate drinkers had the lowest prevalence of high BMI. Adjustment for potential confounders (age, social class, cigarette smoking, and physical activity) increased the mean BMI level in heavy drinkers slightly (Table 1). The odds ratio for high BMI increased progressively from the light-moderate group through the heavy group and to the very heavy group.

When examined by type of drink, men drinking spirits but not wine had slightly higher BMIs than did beer and wine drinkers (**Figure 1**). The adjusted mean (± SE) BMI in men reporting spirit drinking but not wine (spirit only and mixed spirit drinkers combined) was 25.64 ± 0.10 compared with 25.38 ± 0.09 in beer drinkers and 25.24 ± 0.10 in men who reported wine drinking (wine only and mixed wine drinkers combined). However, adjusted mean BMI increased with increasing intake from light-moderate to very heavy irrespective of the type of drink, and there was no significant interaction when the alcohol-BMI relation was compared between spirit drinkers, beer drinkers, and wine drinkers.

Changes in alcohol intake and weight

In the 7 groups categorized by their change in alcohol intake over the 5 y of follow-up, we examined age-adjusted mean BMI and the percentage of men with a high BMI at screening (Q1) and 5 y later (Q5), noting the mean weight change and the percentage who lost or gained weight over this period (**Table 2**). At Q5, stable (continuing) heavy drinkers and new heavy drinkers (including very heavy drinkers) had the highest mean BMIs and percentages of high BMI and showed the largest mean weight gain and the largest increase in the percentage of men with a high BMI. However, men changing from light-moderate to none-occasional drinking showed the highest frequency of weight loss and the highest frequency of substantial (> 10%) weight gain. The exheavy drinkers (mostly light-moderate drinkers at Q5) showed patterns of weight change at Q5 not significantly different from those observed in stable none-occasional or light-moderate drinkers. The alcohol categories that showed the least weight gain also showed the smallest increase in the percentage with a high BMI.

The age-adjusted relative odds of gaining weight (≥ 4% of body weight) over the 5-y period was greatest in stable and new

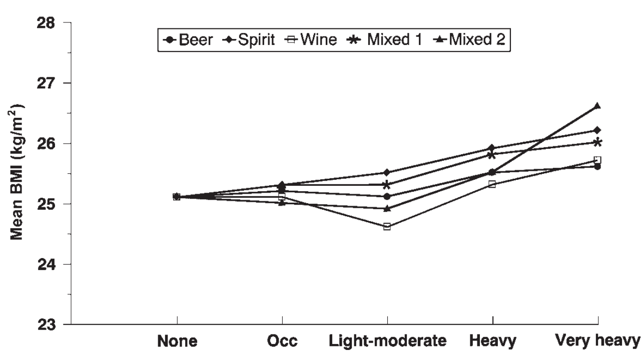

FIGURE 1. Alcohol intake and adjusted mean BMI by type of drink consumed at baseline. Adjustment was made for age, social class, physical activity, and cigarette smoking. Mixed 1, beer and spirits; mixed 2, beer, spirits, and wine; Occ, occasional. n = 4270 (beer), 806 (spirits), 517 (wine), 1016 (mixed 1), and 546 (mixed 2). Test for trend: beer, P = 0.001; spirits, P = 0.01; wine, P = 0.90; mixed 1, P = 0.004; mixed 2, P = 0.004. P for interaction between beer, wine (wine and mixed 1 combined), and spirits (spirits and mixed 2 combined) = 0.33.

TABLE 2
Alcohol intake, age-adjusted mean BMI, age-adjusted percentage of men with a high BMI at baseline and 5 y later, and age-adjusted weight change over a 5-y period[1]

Alcohol categories[2]	Baseline		5 y later		Mean weight change	Weight loss (≥4%)	Weight gain (≥4%)	Weight gain of >10%
	Mean BMI	High BMI	Mean BMI	High BMI				
	kg/m²	*%*	*kg/m²*	*%*	*kg*	*%*	*%*	*%*
Stable								
None-occasional (*n* = 1733)	25.29 ± 0.08[3]	16.8	25.57 ± 0.08	19.3	0.87 ± 0.11	15.0	29.9	6.6
Light-moderate (*n* = 1354)	25.09 ± 0.09	14.3	25.43 ± 0.09	17.4	1.05 ± 0.13	11.6	28.4	5.7
Heavy (*n* = 1341)	25.69 ± 0.09[4]	20.8[4]	26.20 ± 0.09[4]	25.7[4]	1.53 ± 0.13[4]	11.3	34.8	7.5
Changed								
Light-moderate to none-occasional (*n* = 292)	25.16 ± 0.18	16.8	25.58 ± 0.19	20.5	1.26 ± 0.27	16.3	33.1	8.9
None-occasional to light-moderate (*n* = 669)	25.52 ± 0.12	18.6	25.70 ± 0.12	19.9	0.55 ± 0.18	15.7	27.2	5.3
Exheavy (*n* = 1171)	25.79 ± 0.09[4]	23.5[4]	26.12 ± 0.09[4]	26.5[4]	0.99 ± 0.14	15.4	30.7	6.9
New heavy (*n* = 272)	25.76 ± 0.19[4]	21.8[4]	26.29 ± 0.19[4]	27.2[4]	1.60 ± 0.28[4]	10.0	34.7	8.4

[1] Test for comparisons with stable none-occasional are based on the difference in age-adjusted odds ratio by using logistic regression.
[2] Heavy includes the very heavy group.
[3] $\bar{x}$ ± SE.
[4] Significantly different from the stable none-occasional group, $P < 0.05$.

heavy drinkers compared with stable none-occasional drinkers even after adjustment for age, social class, physical activity, and cigarette smoking (**Table 3**). The exheavy drinkers were not significantly different from the stable none-occasional or light-moderate drinkers.

Baseline BMI and weight change

Initial BMI was strongly related to weight change. Leaner men were more likely to gain weight than were heavier men. The percentage of men who gained weight in the 3 baseline BMI groups (< 25, 25–27.9, and ≥ 28) was 39.0%, 25.1%, and 21.5%, respectively ($P < 0.0001$ for trend). Because stable and new heavy drinkers were heavier at baseline than were stable none and occasional drinkers, further adjustment for initial BMI increased the relative odds of weight gain in the stable and new heavy drinkers (Table 3).

In all 3 baseline BMI categories (< 25, 25–27.9, and ≥ 28), stable heavy and new heavy drinkers showed the highest relative odds of weight gain of all stable or changed alcohol groups compared with stable none-occasional drinkers: 1.16, 1.44, and 1.25 for stable heavy drinkers and 1.39, 1.45, and 1.40 for new heavy drinkers.

Alcohol, smoking, and weight gain

We examined the relation between alcohol intake and weight gain at Q5 by smoking status (never smoked, long-term exsmokers, and current smokers; **Table 4**). We excluded 698 men who had given up since baseline (recent exsmokers) because smoking cessation is strongly associated with substantial weight gain soon after cessation (13). The increased relative odds of weight gain observed in stable and new heavy drinkers was seen in all smoking groups but was not significant except in the never smokers.

DISCUSSION

These cross-sectional data from middle-aged British men, representative of the socioeconomic composition of middle-aged men in Great Britain, show a clear dose-response relation between weekly alcohol intake and mean BMI and prevalence of a high BMI. In this prospective study, men who were stable heavy drinkers

TABLE 3
Changes in alcohol intake and adjusted relative odds ratios (ORs) of weight gain (≥4%) over 5 y in 6832 men with data on weight change and no history of diabetes

Alcohol categories[1]	Age-adjusted weight gain, OR (95% CI)	Adjusted[2] weight gain, OR (95% CI)	Adjusted[3] weight gain, OR (95% CI)
Stable			
None-occasional (*n* = 1733)	1.00	1.00	1.00
Light-moderate (*n* = 1354)	0.93 (0.79, 1.08)	0.97 (0.82, 1.14)	0.96 (0.81, 1.12)
Heavy (*n* = 1341)	1.25 (1.07, 1.46)[4]	1.19 (1.02, 1.40)[4]	1.29 (1.10, 1.51)[4]
Changed			
Light-moderate to none-occasional (*n* = 292)	1.16 (0.89, 1.51)	1.14 (0.87, 1.49)	1.14 (0.86, 1.50)
None-occasional to light-moderate (*n* = 669)	0.87 (0.71, 1.06)	0.89 (0.72, 1.09)	0.91 (0.74, 1.11)
Exheavy (*n* = 1171)	1.04 (0.88, 1.21)	0.97 (0.82, 1.14)	1.04 (0.88, 1.23)
New heavy (*n* = 272)	1.24 (0.95, 1.63)	1.34 (1.02, 1.77)[4]	1.45 (1.09, 1.92)[4]

[1] Heavy includes the very heavy group.
[2] Adjusted for age, social class, physical activity, and cigarette smoking.
[3] Also adjusted for initial BMI.
[4] Significantly different from the stable none-occasional group, $P < 0.05$.

TABLE 4
Alcohol intake and adjusted relative odds ratios (ORs) of weight gain (≥4%) by smoking status, excluding 698 men who gave up smoking between baseline (Q1) and follow-up (Q5)[1]

Alcohol categories[2]	Never smoked (n = 659), OR (95% CI)	Exsmokers before Q1 (n = 2287), OR (95% CI)	Current smokers at Q5 (n = 2180), OR (95% CI)
Stable			
None-occasional	1.00	1.00	1.00
Light-moderate	1.08 (0.79, 1.48)	0.85 (0.63, 1.14)	1.02 (0.75, 1.40)
Heavy	1.75 (1.19, 2.56)[3]	1.22 (0.91, 1.63)	1.18 (0.91, 1.53)
Changed			
Light-moderate to none-occasional	1.22 (0.68, 2.19)	0.98 (0.61,1.56)	1.22 (0.73,2.04)
None-occasional to light-moderate	1.09 (0.73, 1.62)	0.79 (0.54, 1.15)	1.00 (0.69, 1.43)
Exheavy	1.55 (1.07, 2.25)[3]	0.90 (0.66, 1.24)	1.03 (0.77, 1.37)
New heavy	1.52 (0.83, 2.77)	1.44 (0.95, 2.22)	1.46 (0.85, 2.50)

[1] Adjusted for age, social class, physical activity, cigarette smoking, and initial BMI. Complete smoking data were not available for 8 men.
[2] Heavy includes the very heavy group.
[3] Significantly different from the stable none-occasional group, $P < 0.05$.

(including very heavy drinking) at screening and 5 y later and men who had been predominantly light-moderate or occasional drinkers at screening and were heavy drinkers (predominantly drinking 21–42 units/wk, or 30–60 g/d) 5 y later showed the highest relative odds of weight gain and had the greatest prevalence of high BMI both at screening and at follow-up. Overall, these cross-sectional and prospective data support the conclusion that regular alcohol intake of ≥ 30 g/d contributes directly to body weight and a high BMI, as one might expect if the energy derived from alcohol consumption is added to the usual dietary energy intake.

Confounding

Much of the inconsistency in the evidence relating to the relation between alcohol intake and body weight has arisen from the confounding effects of cigarette smoking; smoking is consistently associated with lower body weight than that observed in nonsmokers (15). An earlier cross-sectional study in this cohort of middle-aged men showed that the strongest influence of alcohol on body weight was seen in nonsmokers (16). In the present study, the increased odds of weight gain associated with heavy drinking was also most apparent in never smokers. A positive but weaker nonsignificant association was seen in exsmokers and current smokers, possibly reflecting the stronger influence of smoking on body weight. The strength of the association between alcohol and body weight or weight gain in any population study may be conditioned by the prevalence of smoking in that population. Physical activity and social class are strong determinants of overweight and obesity in this cohort, as in other studies (17). Although adjustments were made for physical activity and social class at baseline only, the changes taking place within 5 y in these factors would have been minimal. Social class was based on the longest held occupation, and few changes in social class in this age-group (40–60 y) would have taken place. Comparisons between baseline data and those 12 y later showed that most of the men (67%) did not change their levels of physical activity, 14% became more active, and 19% became less active (18). It is unlikely that important confounding effects due to changes in physical activity would have taken place in the first 5 y of follow-up.

Prospective studies

In several reviews of studies of the alcohol and obesity relation, most of which were cross-sectional in nature, the association between alcohol intake and body weight in men was found to be almost equally positive or nonexistent, adding to the uncertainty regarding the contribution of alcohol to obesity (1, 2, 4, 5). There have been relatively few prospective studies of the relation between alcohol intake and weight gain in men, and the findings of these have been inconsistent. Early data from the Framingham study showed that after 20 y follow-up, men who were drinkers at baseline weighed more than did nondrinkers. Both men and women who took up drinking or increased their alcohol intake during follow-up experienced weight gain (19). In a study of > 12000 adult Finns, heavier drinking (> 75 g/wk) in men was associated with a significantly higher risk of a weight gain of > 5 kg than that in nondrinkers (20). In a study of > 2000 Chinese adults, alcohol consumption was associated with significant weight gain in men (21). These data support the concept of alcohol as a risk factor for obesity.

However, weak positive or no associations were reported between alcohol intake and weight change in 3 prospective studies from the United States (22–24). In these studies, data by levels of alcohol consumption are not presented, and the average intake in these populations is not known. In the first National Health and Nutrition Examination Survey of > 7000 men and women, a small but nonsignificant inverse relation was observed in men and it was concluded that alcohol is not a risk factor for obesity (7). However, it may be of importance to note that only 15% of men drank ≥ 2 drinks/d. It appears likely that greater consumption on a regular basis is required to have an effect on body weight.

Type of alcohol and body weight

It has been suggested that the type of alcohol consumed may explain the discrepant results of studies of alcohol intake and body weight. Some studies reported differing effects of the type of beverage on obesity rates (25, 26). In the present study, however, mean BMI increased with increasing alcohol intake from light to very heavy drinking irrespective of the type of drink consumed, although men who reported spirit drinking tended to be heavier than were beer and wine drinkers. This may be associated with unrecorded differences in lifestyle or nutritional characteristics between spirit and nonspirit drinkers.

Mechanisms

In a comprehensive review of the effects of alcohol on energy metabolism and body weight regulation, Suter et al (2) point out that as an energy source, unlike other sources of energy, alcohol cannot be stored in the body and appears to have absolute priority in metabolism. This takes place at the expense of other metabolic pathways, including the suppression of lipid oxidation, which appears to be a critical factor in the development of a positive energy balance (2). Even in healthy young men, low-dose alcohol consumption results in hepatic production and release into the plasma of acetate, with consequent inhibition of lipolysis in peripheral tissues of 53% and decreases in whole-body lipid oxidation of 73% (27, 28). Suter et al also note the significant positive relation between alcohol intake and fat intake and the lack of inhibitory effect of moderate alcohol intake on daily energy and fat intakes.

Limitations

Whereas most cross-sectional studies report no association or positive associations between alcohol consumption and body weight in men, inverse relations are consistently observed in women (1, 2, 4, 5). Whether these differences are due to a true sex difference in alcohol metabolism or to unmeasured social confounding remains to be determined. Relatively few prospective studies of alcohol and weight gain have been carried out in women, and we cannot generalize our findings to women.

Conclusion

In this cohort of middle-aged men, a positive relation was seen between alcohol consumption and current body weight irrespective of the type of drink consumed. In prospective analyses, heavy drinking was associated with increased weight gain, and this was most apparent in men who had never smoked. Heavy drinking in this study amounted to ≥ 30 g alcohol/d on average and included weekend drinking of > 60 g/d and daily drinking of ≥ 30 g/d. Although there is no evidence that light-to-moderate drinking (≤ 30 g alcohol) is associated with weight gain, the findings in this study support the concept that greater alcohol consumption contributes directly to weight gain and obesity in men.

SGW and AGS prepared the analyses and wrote the paper; AGS designed the original study and was responsible for data collection. The authors had no conflicts of interest.

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