Association of the Waist-to-Hip Ratio Is Different with Wine than with Beer or Hard Liquor Consumption

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Specific alcoholic beverage associations with the waist-to-hip ratio were characterized in 12,145 African-American and white men and women ages 45–64 years. Estimated waist-to-hip ratios of those consuming more than six nonwine alcohol drinks/week and more than six wine drinks/week (vs. nondrinkers) were 0.007 larger ($p < 0.001$) and 0.009 smaller ($p < 0.05$), respectively. In similar comparisons, the odds ratios for a large waist-to-hip ratio were 1.4 (95% confidence interval 1.1–1.7) for nonwine and 0.45 (95% confidence interval 0.21–0.95) for wine intake. The opposite direction in adjusted associations for wine and nonwine (mainly beer) drinking supports the popular concept of the "beer belly." *Am J Epidemiol* 1995;142:1034–8.

alcohol, ethyl; beer; cardiovascular diseases; epidemiologic factors; obesity; wine

Body fat distribution is an important risk factor for all-cause (1) and cardiovascular mortality (2–5) as well as several noncardiovascular diseases (6–8). The term "beer belly" (9) has been used for decades to characterize a large, protruding abdomen. Current recognition of the role of visceral fat in such protrusion raises the question of an association between beer consumption and central adiposity. Alcohol consumption associated positively with central adiposity in some cross-sectional studies (10, 11) but not in others (12–15). The only study of specific beverages found positive associations with beer and hard liquor, and varied and less significant associations with wine (16). The Atherosclerosis Risk in Communities (ARIC) Study provides an excellent opportunity to study in detail the association of the consumption of different alcoholic beverages with central adiposity.

MATERIALS AND METHODS

ARIC investigated 15,800 US African-American and white men and women ages 45–64 years between 1987 and 1989, as has been previously described in detail (17, 18). Of those enrolled, 56 nonwhite non-African-Americans, 54 African-Americans in two centers, 12 individuals outside the permitted age range, four individuals with improbable waist-to-hip ratio values, 712 individuals with missing information, and 2,817 former drinkers were excluded, leaving 12,145 for these analyses.

Current drinking status and information on the usual quantity of beer, wine, and hard liquor consumed among current drinkers was queried. The ethanol content of standard drinks was considered to be 12 oz (12.70 g) for beer, 4 oz (11.46 g) for wine, and 1.5 oz (12.76 g) for hard liquor. In modeling, intake was primarily expressed as total alcohol consumption in drinks/week (redefined by dividing total grams of ethanol/week by 12) and percent consumption as wine (wine grams divided by total grams of ethanol). Additional models investigated associations with wine and nonwine alcohol consumption when each consumption was compared with nondrinkers of that category. Waist and hip girth were measured at the levels of the umbilicus and maximal gluteal muscle protrusion, respectively. Intrareader and interreader correlations between repeated waist-to-hip ratio measures

(taken approximately 1 hour apart) were 0.94 and 0.91.

Adjusted differences in the waist-to-hip ratio between drinkers of varying quantities and nondrinkers (including self-declared current drinkers who reported average weekly intake of less than one drink/week) were estimated through multiple linear regression. Statistically significant heterogeneity in associations across levels of body mass index was evaluated through t test comparison of beta coefficients of level-specific models. Logistic regression was used to estimate the association of specific beverage consumption with large waist-to-hip ratios (sex-specific 90th percentile values of ≥ 1.00 for women, ≥ 1.02 for men).

RESULTS

Table 1 describes the sample, showing waist-to-hip ratio means and standard deviations by categories of alcoholic beverage consumption and important covariates. Of those studied, 3,729 (31 percent) were nondrinkers, 2,611 (21 percent) were current drinkers reporting less than one drink/week, and 5,805 (48 percent) drinkers reported at least one drink/week.

Consumption of more than six drinks/week was uncommon (20 percent of the sample). This intake level of beer or hard liquor was considerably more frequent than of wine. Fourteen percent of all alcohol consumed was taken as wine, 48 percent as beer, and 38 percent as hard liquor. Those consuming more than six drinks/week of beer had mean waist-to-hip ratios 0.041 larger than those consuming less than one drink/week of that beverage. The similar comparison for hard liquor revealed a mean ratio 0.030 larger and for wine, a mean ratio 0.029 smaller.

After adjustment for ARIC field center, age, sex, race, sex/race interaction, educational attainment, body mass index, percent of weight gained after 25 years of age, cigarette smoking, and physical activity, the estimated differences associated with greater wine (100 percent wine, table 2) and nonwine (0 percent wine) alcohol consumption, though statistically significant, were considerably smaller than these crude differences.

Additional analyses controlling for income, occupational status, or differences in fat (saturated, monounsaturated, and polyunsaturated), carbohydrate, and di-

TABLE 1. Distribution of the waist-to-hip ratio by body mass index, race/sex group, and alcoholic beverage consumption in 12,145 men and women 45–64 years of age: the Atherosclerosis Risk in Communities (ARIC) Baseline Survey, 1987–1989

Category	N	%	Waist-to-hip ratio	
			Mean	SD*
Overall	12,145	100	0.922	0.078
Body mass index				
<25	4,177	34.4	0.876	0.073
25 to <30	4,805	39.6	0.934	0.068
≥30	3,163	26.1	0.963	0.069
Race/sex group				
White men	4,192	34.5	0.967	0.051
White women	5,039	41.5	0.888	0.080
African-American men	1,023	8.4	0.938	0.056
African-American women	1,891	15.6	0.900	0.083
Alcoholic beverage consumption (drinks/week)				
Wine				
<1	9,778	80.5	0.924	0.078
1–6	2,135	17.6	0.912	0.079
>6	232	1.9	0.895	0.074
Beer				
<1	8,749	72.0	0.914	0.080
1–6	2,457	20.2	0.937	0.071
>6	939	7.7	0.955	0.065
Hard liquor				
<1	8,828	72.7	0.918	0.079
1–6	2,469	20.3	0.927	0.078
>6	848	7.0	0.948	0.067

* SD, standard deviation.

TABLE 2. Adjusted average difference† (compared with nondrinkers‡) in waist-to-hip ratio for varying quantities of alcoholic beverages consumed by percent of that consumption taken as wine, overall and by level of body mass index, for 12,145 men and women 45–64 years of age: the Atherosclerosis Risk in Communities (ARIC) Baseline Survey, 1987–1989

Ingested as wine (%)	Difference (vs. nondrinkers) in waist-to-hip ratio	
	1–6 drinks/week	>6 drinks/week
Overall		
0	0.001	0.007***
50	−0.002	−0.001
100	−0.004	−0.009*
Body mass index		
<25		
0	0.003	0.011***
50	0	0.003
100	−0.003	−0.005
≥25 to <30		
0	0.002	0.008***
50	−0.001	0
100	−0.003	−0.008
≥30		
0	0	0
50	−0.004	−0.017**
100	−0.007	−0.034**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

† Obtained through multiple linear regression adjusted for the effects of center, age, race, sex, race/sex interaction, body mass index, percent of weight gained after 25 years of age, educational attainment, cigarette smoking, and physical activity.

†† Nondrinker or individual reporting consumption of less than one drink/week of any beverage.

etary fiber intake (data not shown) produced virtually unchanged results. Separate adjusted models demonstrated a reasonably graded increase (compared with nondrinkers) in the estimated waist-to-hip ratio with increased nonwine alcohol intake (−0.002, 0.003, 0.007, and 0.009 for one, two through six, seven through nine, and more than nine drinks/week) and a similar decrease with increased wine intake (0, −0.006, −0.005, and −0.011). Figure 1 shows that associations were of consistent direction for each race/sex group.

The larger waist-to-hip ratio seen with increasing consumption of nonwine alcohol was most pronounced in lean (body mass index <25) individuals and was absent in the more obese (body mass index >30, table 2). Conversely, the association with wine was most notable in obese persons. For intake of more than six drinks/week of wine, this heterogeneity across the extreme categories of body mass index was statistically significant at 0 percent (0.011 vs. 0, $p < 0.01$ for test of equal association), 50 percent (−0.003 vs.
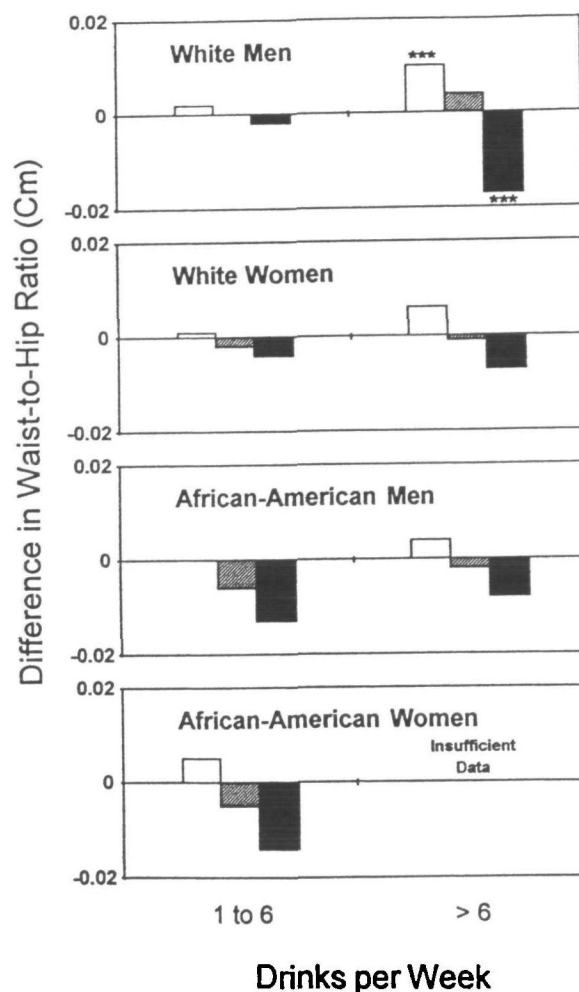

FIGURE 1. Variation by race/sex group in average difference⁺ (compared with nondrinkers⁺⁺) in waist-to-hip ratio for differing quantities of alcoholic beverages consumed and percent of that consumption taken as wine for 12,145 men and women ages 45–64 years: the Atherosclerosis Risk in Communities (ARIC) Baseline Survey, 1987–1989. Percents ingested as wine: ☐, 0; ▨, 50; ■, 100. ⁺Obtained through multiple linear regression adjusting for the effects of age, race, sex, race/sex interaction, body mass index, percent of weight gained after 25 years of age, educational attainment, cigarette smoking, and physical activity. ⁺⁺Nondrinker or individual reporting consumption of less than one drink/week of any alcoholic beverage. ***$p < 0.001$.

−0.017, $p < 0.05$), and also 100 percent (−0.005 vs. −0.034, $p < 0.05$).

As estimated in multiple logistic regression adjusting for the above-mentioned covariates and for alcoholic beverage consumption of the other type, the relative odds of having a large waist-to-hip ratio for those ingesting more than six nonwine alcohol drinks/week were 1.4 times (95 percent confidence interval 1.1–1.7) those of individuals consuming less than one nonwine drink per week; and for those ingesting more than six wine drinks/week, these odds were 0.45 times (95 percent confidence interval 0.21–0.95) those of

individuals drinking less than one drink of wine per week.

DISCUSSION

The beverage/waist-to-hip associations described are independent, statistically significant, reasonably graded, consistent in direction across sex/race groups, and similar in varying analytic approaches. Despite their apparent small magnitude, if real, they may be epidemiologically important at the population level, especially given the limited number of modifiable causes of central adiposity identified to date. The difference associated with either two drinks/day more of wine or two drinks/day less of nonwine beverages was approximately 0.01, 13 percent of one standard deviation of the waist-to-hip ratio. A 0.15 difference in waist-to-hip ratio predicted, in a relatively linear fashion, a 60 percent increase in the risk of death in the Iowa Women's Health Study (1). In other words, in that study, for every 0.01 increase in the waist-to-hip ratio, mortality increased approximately 4 percent.

Moderate alcohol consumption has been consistently shown to be protective against coronary heart disease (19). Low coronary heart disease mortality in France has produced speculation that red wine may be especially protective (20). Ecologic studies support such a role for wine (21–25). The only within-population study reporting statistically significant beverage differences showed a protective effect for wine in comparison with hard liquor (26). However, other investigations have produced conflicting, non-statistically significant results (27–29).

If wine is more protective, the waist-to-hip ratio may be one of the mechanisms mediating its effect. In the Tromsø Heart Study (30), wine consumption was associated with a more favorable profile of cardiovascular risk factors associated with central adiposity.

If drinking wine is confirmed to have a stronger negative association with coronary heart disease than drinking beer or hard liquor, is the difference in the drink or in the drinker? Associations found here were reasonably graded and remained after adjustment for various socioeconomic and lifestyle factors. However, numerous additional nutritional and other differences exist between those preferring different alcoholic beverages (31), and residual confounding cannot be ruled out. Lifestyle differences between wine and nonwine drinkers should not, however, be viewed only as nuisances for which adjustment is necessary. They may provide additional insight into the etiology of central adiposity. Wine drinkers may take their alcohol more consistently (31), or more frequently, with meals. Wine, as well as the food taken with it, may be consumed more slowly. Variation across populations in the food and drink habits associated with beverage preference may explain some of the conflicting results mentioned above.

On the other hand, the opposing dose-response relations found here increase the likelihood that at least part of the difference is in the drink. Though speculative, it is possible that what is being observed is a deleterious effect of ethanol counterbalanced by a beneficial one of some substance in wine. Alcohol has been noted to decrease testosterone in men (32) and, at least in large quantities, to increase certain adrenal androgens in women (33). It may influence insulin levels (34), insulin resistance (35), and cortisol levels and the hypothalamic-pituitary-adrenal axis (7, 36, 37). Substances in red wine have been suggested to have beneficial effects with respect to atherosclerosis (38), though not specifically with respect to central adiposity. In animals, intragastric infusion of wine increased hepatic artery and portal vein flow in comparison with intragastric infusion of ethanol alone (39).

In conclusion, as the predominant nonwine beverage has historically been beer (40), and as the crude difference seen here is largest for beer drinkers, it is not surprising that astute observers would label a protruding abdomen a "beer belly." The opposite direction of adjusted waist-to-hip associations with wine and nonwine drinking supports this popular concept.

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