Alcohol, Aging, and Cognitive Performance:: A Cross-Cultural Comparison

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Alcohol, Aging, and Cognitive Performance:

A Cross-Cultural Comparison

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Objectives: This study investigated the relationship between alcohol consumption and cognitive performance in two culturally diverse community-based populations. **Methods:** A cross-sectional analysis was used including Japanese Americans (*n* = 1,836) and Caucasians (*n* = 2,581) aged 65 and older. Cognitive performance was measured using the Cognitive Abilities Screening Instrument (CASI) (0 to 100 point scale) and reaction time. **Results:** Multivariate analysis revealed significant cultural and gender differences with cognitive performance. Compared to abstainers, Caucasian drinkers scored higher than Japanese American drinkers on the CASI (adjusted means = 93.4 versus 91.6). In contrast, Japanese American drinkers scored faster than Caucasian drinkers on choice reaction time (adjusted means = 505 versus 579 milliseconds). **Discussion:** Results showed that current drinking was associated with better cognition in both the Caucasian and Japanese American groups. Longitudinal studies are needed to support the possible protective effects of alcohol on cognition and explore whether culture may modify this apparent benefit.

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Recent findings from several studies on aging cohorts suggest that light to moderate alcohol consumption may have protective effects on cognitive performance (Edelstein, Kritz-Silverstein, & Barrett-Connor, 1998; Elwood et al., 1999; Stuck et al., 1999). Studies conducted with Caucasian samples have shown that moderate amounts of alcohol consumption (two to four drinks per day) were associated with better cognitive performance on measures of visual reproduction, word fluency, trails making, digit symbol, attention, concentration, memory, and the Mini-Mental State Examination (Dufouil, Ducimetiere, & Alperovitch, 1997; Elias, Elias, D'Agostino, Silbershatz, & Wolf, 1999). Other studies have reported a *U*-shaped dose-response effect, with men who were heavy drinkers or abstainers having the higher risk (Edelstein et al., 1998; Hendrie, Gao, Hall, Hui, & Unverzagt, 1996; Launer, Feskens, Kalmijn, & Kromhout, 1996).

These findings regarding the protective effects of alcohol on cognitive performance are controversial and have been disputed (Parsons & Nixon, 1998). Little is known about how this apparent positive relationship may be affected by the many and complex factors that influence both drinking behavior and performance on cognitive tests, such as gender, culture, genetics, and health status. Compared with other ethnic groups, Asians have the highest rates of abstinence (National Institute on Alcohol Abuse and Alcoholism, 1997; O'Hare, 1995). This may be due in part to the fact that 50% of Japanese and Chinese lack the active form of aldehyde dehydrogenase, which leads to a lowering of the alcohol elimination rate and the "flushing" sensation many Asians experience when they drink (Eckardt et al., 1998; National Institute on Alcohol Abuse and Alcoholism, 1997). It is unknown whether these interethnic variations in alcohol metabolism may also translate into significant differences in the effects of alcohol on cognitive function.

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Studies of older Japanese American men have shown that consumption of up to 1 drink per day was associated with better cognitive performance on the Cognitive Abilities Screening Instrument (CASI) and reaction time compared to abstainers (Bond, Burr, McCurry, Borenstein, & Larson, 2001; Galanis et al., 2000). For Japanese American women, up to 1 to 2 drinks per day showed a positive relationship with cognitive performance on the CASI and reaction time compared to abstainers (Bond et al., 2001). In a study of older Black residents, higher cognitive scores were seen among light drinkers (fewer than 4 drinks per week) than among abstainers or heavy drinkers (more than 10 drinks per week) (Hendrie et al., 1996).

Gender differences in drinking patterns and practices have been well documented in the literature. In almost every age group, female drinkers drink less frequently and consume smaller amounts per occasion than male drinkers (Gilbert & Collins, 1997). Women are more vulnerable than men to the adverse effects of heavy alcohol consumption in terms of brain shrinkage, hypertension, and peripheral vascular disease (Jepson, Fowkes, Donnan, & Housley, 1995; Laforge, Williams, & Dufour, 1990; Mann, Batra, Gunthner, & Schroth, 1992). There is some evidence that the positive association of alcohol with cognitive performance is more favorable for women than for men (Dufouil et al., 1997; Elias et al., 1999; Forette et al., 1998). However, there is also a large body of literature describing gender-specific differences in cognitive test performance (Hyde & Linn, 1988; Lezak, 1995; Schaie, 1990).

The investigation of cognitive performance and ethnicity with older adults has found differences in performance among African American, Caucasian, Japanese American, and Hispanic cohorts (La Rue, Romero, Ortiz, Liang, & Lindeman, 1999; Manly et al., 1998; Shadlen et al., 2001) Caucasians scored higher than Japanese Americans on measures of memory, attention, verbal fluency, language, and abstract reasoning, even after controlling for age and education (Shadlen et al., 2001). Recent investigations have shown East Asians process information in a contextual fashion, whereas Western Europeans process information in an analytic, feature-based style (Park, Nisbett, & Hedden, 1999). These differences affect memory because Asians, relative to their Western counterparts, are more likely to integrate target information with contextual information and excel at observing relationships that require integrative skills. In contrast, Westerners may excel at dealing with information-processing tasks that require componential analysis and learning and the use of categorical screening (Park et al., 1999).

Based on these interethnic variations in alcohol metabolism and cognitive performance, the present study attempts to shed new light on the relationship between alcohol consumption and cognitive performance in two diverse aging community-based populations. We propose that current drinkers will have higher cognitive performance than past drinkers or abstainers and that this association will be greater for Caucasians than Japanese Americans.

Methods

The Adult Changes in Thought (ACT) study is part of the University of Washington Group Cooperative Alzheimer's Disease Patient Registry, which during the enrollment phase identified a group of community-based cognitively intact eligible participants (n = 2,581) older than 65 (with no known neuropsychiatric disease or dementia). Among these individuals, 1,523 were women, and 1,058 were men. The Kame Project (Graves et al., 1996) is a population-based study that included participants aged 65 years or older who were of at least 50% Japanese heritage (n = 1,836). Among the 1,836 participants at baseline, 1,028 were women, and 808 were men. Both the ACT and Kame studies are ongoing cohort studies of aging and dementia in Caucasian (ACT) and Japanese American (Kame) adults living in King County, Washington. The Human Subjects Review Committee at the University of Washington approved both studies. The sample for this study consisted of these 4,417 individuals, of which 2,551 were women (58%) and 1,866 were men (42%).

As part of the enrollment procedure, all participants in both the ACT and Kame studies underwent structured clinical interviews, which included baseline screening for cognitive impairment, a neurological and sensory screening examination, and questions about health history, depression, psychosocial support, functional status, and exercise habits. Details regarding the studies' sampling and procedures are described elsewhere (Graves et al., 1996; McCurry et al., 1999).

COGNITIVE MEASURES

The CASI is a cognitive screening test that was developed for use in cross-national studies of dementia in the United States and Japan (Teng et al., 1994). The CASI is a composite of the Folstein Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975), the Modified Mini-Mental State Examination (Teng & Chui, 1987), and the Hasegawa Dementia Screening Scale (Hasegawa, 1983). It consists of seven cognitive domains that assess attention/concentration, orientation, short- and long-term memory, language, mental manipulation, and abstract thinking, with the total score ranging from 0 (lowest) to 100 (highest). The CASI has been shown to be highly sensitive for detecting and monitoring dementia in Caucasian and Japanese populations (82.5% sensitivity, 98.9% specificity using a cutoff of less than 81) (Graves, Larson, Kukull, White, & Teng, 1993). Test-retest reliability of the CASI based on the intra-class correlation coefficient is .90 (Liu et al., 1994).

Reaction time was measured by the 3RT Test. This computerized reaction test was used to measure overall speed of cognitive processing (Teng, 1990b). This test contains both simple and choice reaction time tasks (measured in milliseconds) (the longer the reaction time, the slower the processing). The results of a study in which the simple reaction time task of the 3RT was administered to 118 dementia patients and 86 community controls demonstrated that the 3RT test differentiated dementia patients from the community controls better than other dementia screening tests (Teng, 1990a). The 3RT Test has been standardized by age and years of education for use by groups older than 60 and younger than 60 (Teng, Chui, & Saperia, 1990).

ALCOHOL CONSUMPTION MEASUREMENT

Alcohol consumption with the ACT cohort was assessed by asking a series of questions related to current and past drinking behaviors as opposed to "never drank." Current drinking status was determined by asking ACT study participants if they had consumed five or more drinks of beer, wine, or liquor during the past year. Consumption of alcohol in the past but not during the past year defined past drinkers, and no consumption of alcohol currently or in the past defined abstainers. Information about frequency and duration, as well as type of alcohol consumed, was available from the Kame Project, but the level of exposure detail was not standardized between studies at baseline, thus analyses were limited by these definitions.

STATISTICAL METHODS

Univariate relations were tested with chi-square for categorical variables and analysis of variance for continuous outcomes. A between-participants MANOVA was conducted to examine the cross-sectional association between CASI and reaction time (simple and choice reaction) (dependent variables), with three indicator variables: drink category (current drinkers, past drinkers, and abstainers), gender, and group differences (Caucasian versus Japanese American). Missing data ($n = 165$) for either the predicator variables or covariates were compared with nonmissing data. Because the findings showed significant differences on CASI, choice and simple reaction time, we repeated the analysis using regression imputation procedures to account for possible bias from the missing data. All analyses were adjusted for age, body mass index, education, smoking, and history of diagnosed stroke, hypertension, coronary heart disease, depression, and diabetes because of their known association with cognitive performance (Blazer, 1982; Elwood et al., 1999; Lezak, 1995; Massman, Delis, Butters, Dupont, & Gillin, 1992) Consistent evidence of the relationship between smoking and cognitive performance, however, has proven difficult to establish (Broe et al., 1998; Graves et al., 1991; Launer et al., 1996). Because alcohol may be metabolized differently between Japanese American groups, we included an interaction term for Alcohol × Group differences (Eckardt et al., 1998). Age was modeled as a nonlinear term because of its curvilinear relationship with CASI and reaction time. Education was modeled as a linear term. Because the distribution for CASI and reaction time (choice and simple) was highly skewed toward better performance, we did a transformation using the percentage rank score. Analysis conducted with the transformed and not-transformed CASI and reaction time variables showed no differences. Therefore, the not-transformed data were used in our model.

Results

The mean age of the participants for the Kame sample was 72 years, ranging from 65 to 101 (*Mdn* = 71.0, *SD* = 5.8), and for the ACT sample 75 years, ranging from 65 to 101 (*Mdn* = 74.5, *SD* = 6.2). Of the sample, 4% was older than age 85 for the Kame cohort and 9% for the ACT cohort. Mean education level for the Kame study participants was 12.8 years (*Mdn* = 12.0, *SD* = 2.9) and for ACT participants 13.4 years (*Mdn* = 13.0, *SD* = 2.9). Of the Kame sample, 68% was married, compared to 58% for the ACT sample.

Among drinking categories, 51% of the ACT cohort, as compared with 25% of the Kame cohort, were current drinkers. Past drinkers included 28% of the ACT sample and 19% of the Kame sample. Of the ACT group, 21% reported being lifetime abstainers, as did 56% of the Kame group (Table 1).

FACTORS ASSOCIATED WITH ALCOHOL CONSUMPTION

Increased alcohol consumption was associated with younger age, higher education, lower Center for Epidemiologic Studies–Depression Scale scores, and current smoking for both groups (Table 1). Self-reported, physician-diagnosed history of coronary heart disease or stroke was significantly lower among current drinkers than abstainers or past drinkers for both the ACT and Kame samples. Significant group differences were seen for history of hypertension, angina, and diabetes among current drinkers. Among current drinkers, the rates of diabetes and hypertension were higher for the Japanese American cohort than the Caucasian cohort. In contrast, a history of angina was less frequent among current drinkers in the Kame sample versus the ACT sample.

Table 1
Correlates of Alcohol Drinking Patterns in the Adult Changes in Thought (ACT) and Kame Samples

	ACT			*Kame*				
	Abstainer (n = 553)	*Past Drinker (n = 709)*	*Current Drinker (n = 1,317)*	*Abstainer (n = 1,038)*	*Past Drinker (n = 168)*	*Current Drinker (n = 466)*	p *Value for Drink Group*[a]	p *Value for Ethnic Group*[a]
Mean age (*SD*)	77.0 (6.7)	75.7 (6.0)	74.5 (5.9)	72.3 (6.3)	72.0 (5.5)	70.5 (4.8)	< .001	< .001
Median age	76.0	75.2	73.5	71.0	71.0	71.0		
Mean education (*SD*) (in years)	13.3 (3.0)	13.1 (2.8)	14.0 (2.9)	12.5 (2.7)	12.7 (2.5)	13.7 (3.0)	< .001	< .001
Median education (in years)	13.0	12.0	14.0	12.0	12.0	12.0		
Yearly income (%)								
< $10,000	10	10	4	12	7	4	< .001	< .001
$10,000 to < $20,000	32	36	23	29	20	20		
$20,000 to < $30,000	31	31	26	23	23	26		
≥ $30,000	27	23	47	36	50	50		
Smoking (%)								
Current smoker	2	8	8	5	12	12	< .001	< .220
Mean number of cigarettes per day[b]	10.2	14.6	14.1	12.0	12.0	12.0	< .450	< .540
CES-D scores	3.8	4.7	3.5	3.2	3.7	2.9	< .001	< .001
History of coronary heart disease (%)	8	13	7	6	11	5	< .001	< .001
History of stroke (%)	4	5	1.4	4	3	2	< .001	< .500
History of angina (%)	14	18	11	5	9	6	< .001	< .001
History of hypertension (%)	40	43	35	48	45	47	< .001	< .001
History of diabetes (%)	12	12	7	16	30	16	< .001	< .001

Note. CES-D = Center for Epidemiologic Studies–Depression Scale.
a. Based on chi-square test for categorical variables and analysis of variance for continuous variables.
b. Only among current smokers.

COGNITIVE FUNCTION AND ALCOHOL CONSUMPTION

MANOVA with the use of Pillai's criterion to evaluate the multivariate significance of the set of three dependent variables (CASI, simple reaction time, and choice reaction time) showed a significant main effect related to drinking ($p < .001$), gender ($p < .001$), and group differences ($p < .001$). There was a significant two-way interaction between drink category and group differences ($p < .05$) but no significant two-way interaction between gender and drink category or three-way interaction between drink category, group differences, and gender. The univariate F tests obtained in the MANOVA showed a significant ($p < .05$) difference for drink, gender, and group differences for CASI and reaction time (see Table 2). For the drink by group interaction, only CASI and choice reaction time were significant ($p < .05$). Group differences revealed that Caucasians in all three drinking groups scored significantly higher ($p < .001$) on the CASI than Japanese Americans, but Japanese Americans had significantly faster ($p < .001$) reaction times than Caucasians. Gender differences showed that current drinking, compared to abstinence or past drinking, was associated with higher CASI scores and faster reaction times, but the association was stronger for women on CASI and stronger for men on reaction time (Table 2). The group by drink interaction was statistically significant, however modest in magnitude, for both CASI and choice reaction time. The three univariate F tests were followed by Tukey multiple comparison tests to determine which specific pairs of drinking conditions were significantly different. Results showed current drinkers had significantly higher ($p < .001$) CASI scores (indicating better performance) and faster choice reaction time than past drinkers or abstainers. For simple reaction time, current drinkers had significantly faster ($p < .05$) reaction times than past drinkers or abstainers. Analysis using a regression imputation technique for the missing data ($n = 165$) did not differ from the complete case analysis.

Because the overall global test for CASI was significant, we conducted an analysis on the seven cognitive domains of the CASI to further explore the impact of alcohol, gender, and culture on cognitive performance. A between-participants MANOVA with the seven cognitive domains of attention/concentration, orientation, short- and long-term memory, language, mental manipulation, and abstract

Table 2
Adjusted Descriptive Statistics[a] *and ANOVA Analysis*[b] *Comparing Cognitive Outcomes by Alcohol, Gender, and Ethnicity*

	Adult Changes in Thought						*Kame*					
	Abstainer		*Past Drinker*		*Current Drinker*		*Abstainer*		*Past Drinker*		*Current Drinker*	
	Men (n = *146)*	*Women* (n = *408)*	*Men* (n = *281)*	*Women* (n = *428)*	*Men* (n = *631)*	*Women* (n = *686)*	*Men* (n = *286)*	*Women* (n = *752)*	*Men* (n = *135)*	*Women* (n = *33)*	*Men* (n = *323)*	*Women* (n = *143)*
Cognitive Abilities Screening Instrument												
M	91.2	92.6	92.5	93.4	93.0	94.2	90.1	91.5	90.5	91.7	91.1	92.2
SD	5.5	5.2	4.9	4.6	4.0	4.3	5.1	5.3	5.7	5.2	4.3	4.8
95% confidence interval	90.5-92.1	92.3-93.3	91.9-93.0	93.0-94.3	92.5-93.3	93.5-94.4	89.2-91.0	89.7-92.9	89.9-9.0	91.3-92.0	90.5-91.6	91.5-93.0
Choice reaction Time (milliseconds)												
M	584	622	570	610	564	593	510	577	504	536	493	516
SD	97	123	102	121	92	108	75	103	105	121	69	85
95% confidence interval	566-603	611-633	558-584	600-621	556-573	585-601	486-524	542-613	492-516	528-544	482-505	499-533
Simple reaction Time (milliseconds)												
M	435	470	425	453	420	446	345	434	337	386	320	366
SD	148	165	136	146	125	155	85	137	103	171	89	102
95% confidence interval	406-453	456-485	408-442	439-467	413-436	435-460	327-359	387-481	320-362	375-398	310-362	343-389

a. Adjusted for age, education, body mass index, smoking, history of diagnosed stroke, hypertension, coronary heart disease, depression, and diabetes.
b. Results are based on ANOVAs obtained in the MANOVA.

thinking was conducted. Analysis controlling for age, body mass index, education, smoking, and history of diagnosed stroke, hypertension, coronary heart disease, depression, and diabetes showed a significant main effect related to drinking ($p < .001$), gender ($p < .001$), and group differences ($p < .001$). There were no significant interactions. The univariate F tests obtained in the MANOVA showed a significant ($p < .05$) difference in the drink category for the cognitive domains of abstract thinking, long-term memory, and short-term memory. Significant gender differences ($p < .05$) were seen on six of the seven cognitive domains (mental manipulation was not significant). Compared to abstaining or past drinking, current drinking was associated with higher scores on six of the CASI subscales, but the association was stronger for female drinkers than male drinkers. There were also significant group differences ($p < .05$) for the cognitive domains of abstract thinking, attention, mental manipulation, and short-term memory. Current drinkers scored higher on abstract thinking and long- and short-term memory than abstainers or past drinkers. Group differences showed Caucasians had higher scores than Japanese Americans for the cognitive domains of abstract thinking, attention, mental manipulation, and short-term memory (Table 3). The seven univariate F tests were followed by Tukey multiple comparison tests to determine which specific pairs of drinking conditions were significantly different. Results showed current drinkers had significantly ($p < .01$) higher scores on the seven subscales of attention/concentration, orientation, short- and long-term memory, language, mental manipulation, and abstract thinking than past drinkers or abstainers.

Discussion

This study, conducted with two culturally different community-based populations of older Japanese American and Caucasian adults living in King County, Washington, suggests two important points. First, the results showed a positive relationship between alcohol consumption and cognition for both groups, but the magnitude of association was stronger for the Caucasian cohort on the CASI, while being stronger on reaction time for the Japanese Americans. Second, this study provides further support regarding the effects of gender

Table 3
Adjusted Descriptive Statistics[a] *and ANOVA Analysis*[b] *Comparing the Seven Cognitive Abilities Screening Instrument Subscales by Alcohol, Gender, and Ethnicity*

	Adult Changes in Thought						*Kame*					
	Abstainer		*Past Drinker*		*Current Drinker*		*Abstainer*		*Past Drinker*		*Current Drinker*	
	Men (n = *146)*	*Women* (n = *408)*	*Men* (n = *281)*	*Women* (n = *428)*	*Men* (n = *631)*	*Women* (n = *686)*	*Men* (n = *286)*	*Women* (n = *752)*	*Men* (n = *135)*	*Women* (n = *33)*	*Men* (n = *323)*	*Women* (n = *143)*
Attention												
M	7.4	7.4	7.4	7.5	7.6	7.7	7.1	7.3	6.9	7.3	7.1	7.5
SD	0.07	0.04	0.05	0.04	0.03	0.03	0.05	0.03	0.07	0.15	0.05	0.07
95% confidence interval	7.31-7.60	7.34-7.65	7.33-7.68	7.44-7.61	7.52-7.70	7.63-7.83	7.04-7.19	7.23-7.44	6.79-7.03	6.91-7.16	6.96-7.24	7.37-7.59
Language												
M	9.5	9.7	9.6	9.8	9.7	9.9	9.4	9.7	9.5	9.7	9.6	9.8
SD	0.04	0.03	0.05	0.04	0.02	0.02	0.09	0.07	0.06	0.10	0.03	0.06
95% confidence interval	9.41-9.60	9.64-9.77	9.59-9.68	9.74-9.87	9.72-9.81	9.82-10.1	9.34-9.49	9.65-9.78	9.46-9.66	9.66-9.75	9.56-9.65	9.76-9.99
Mental manipulation												
M	8.3	8.4	8.4	8.4	8.5	8.5	8.2	8.4	8.3	8.3	8.3	8.4
SD	0.14	0.04	0.15	0.09	0.23	0.06	0.11	0.08	0.10	0.05	0.14	0.07
95% confidence interval	8.10-8.60	8.24-8.55	8.39-8.88	8.24-8.53	8.52-8.70	8.46-8.83	8.08-8.39	8.33-8.66	8.19-8.43	8.22-8.45	8.16-8.44	8.32-8.57
Orientation												
M	17.4	17.6	17.6	17.7	18.0	18.7	17.2	17.5	17.4	17.5	17.7	18.2
SD	0.04	0.05	0.12	0.03	0.13	0.06	0.06	0.06	0.12	0.04	0.11	0.02
95% confidence interval	17.3-17.4	17.4-17.7	17.5-17.7	17.6-17.8	17.9-18.2	18.5-19.4	17.0-17.4	17.4-17.9	17.2-17.6	17.3-17.8	17.5-18.2	17.5-18.9

Abstract judgment												
M	19.4	19.6	19.6	20.0	19.8	20.5	19.2	19.5	19.4	19.8	19.7	20.1
SD	0.06	0.07	0.14	0.03	0.13	0.05	0.06	0.03	0.12	0.04	0.11	0.02
95% confidence interval	19.3-19.6	19.4-19.8	19.5-19.9	19.8-21.4	19.7-20.2	19.5-20.4	19.0-19.5	19.3-19.9	19.2-19.7	19.5-20.2	19.5-19.9	19.4-20.8
Short-term memory												
M	9.7	10.5	10.0	10.7	10.8	11.3	9.4	9.9	9.7	10.2	10.0	10.8
SD	0.06	0.07	0.14	0.03	0.09	0.05	0.10	0.03	0.12	0.04	0.08	0.04
95% confidence interval	9.61-9.80	9.92-10.7	9.21-10.8	10.2-11.3	10.2-11.1	10.8-11.6	9.31-9.66	9.85-10.2	9.56-9.86	9.80-10.6	9.92-10.8	9.86-11.1
Long-term memory												
M	9.4	9.7	9.6	9.8	9.7	9.9	9.3	9.6	9.5	9.7	9.6	9.8
SD	0.07	0.04	0.08	0.04	0.06	0.12	0.09	0.06	0.06	0.10	0.06	0.08
95% confidence interval	9.32-9.60	9.62-9.78	9.55-9.68	9.72-9.88	9.64-9.81	9.82-10.2	9.25-9.49	9.56-9.78	9.46-9.66	9.64-9.75	9.54-9.68	9.74-10.4

a. Adjusted for age, education, body mass index, smoking, history of diagnosed stroke, hypertension, coronary heart disease, depression, and diabetes.
b. Results are based on ANOVAs obtained in the MANOVA.

differences on the relationship between alcohol consumption and cognitive abilities. Gender differences showed that current drinking, when compared to abstaining and past drinking, was associated with better cognition and that the strength of this association was strongest for women on CASI and strongest for men on reaction time.

Possible explanations for ethnic differences remain unclear due to the absence of cross-cultural studies investigating the association between alcohol, ethnicity, and cognitive performance. It is possible that due to the interethnic variations in alcohol metabolism, the amount of alcohol consumed may influence global cognitive domains such as memory, attention, and concentration differently than tasks that involve speed. Studies conducted with older Caucasian samples have shown that moderate amounts of alcohol (two to four drinks per day) were associated with better performance on cognitive domains assessed by the CASI (attention, concentration, word fluency, short- and long-term memory, and abstract thinking) (Dufouil et al., 1997; Elias et al., 1999). In comparison, two studies conducted with Japanese Americans aged 65 and older found that up to one drink a day for men and two drinks per day for women were associated with higher CASI scores. Consumption of greater than one to two drinks per day was negatively associated with cognitive performance (Bond et al., 2001; Galanis et al., 2000). Research has also shown that the amount of alcohol influences tasks on speed and accuracy, with lower levels of alcohol being associated with faster reaction time and heavy drinking being negatively associated with reaction time (Kokavec & Crowe, 1999; West, Wilding, French, Kemp, & Irving, 1993). Because the amounts of alcohol consumed were not available for the Caucasian cohort, we suspect, based on the literature, that the ACT cohort had higher daily rates of alcohol consumption than the Japanese American group. If this were true, the average daily rate for the ACT cohort might be similar to the rates reported in the Framingham study (Elias et al., 1999). Therefore, a higher rate of consumption for the Caucasian group might explain why Caucasians scored higher on the CASI but slower on reaction time.

This study also provides support for gender differences with regard to the influence of alcohol on cognition. The presence of estrogen-like (active phytoestrogens) substances that are naturally found in alcoholic beverages could offer one explanation for the gender differences seen in older cohorts. Recent studies now exist to support the premise that estrogen influences cognitive functioning in women (Jacobs et al., 1998; Rice et al., 2000; Sherwin, 1997). It is possible that estrogen may be more beneficial for the cognitive domains of short- and long-term memory as opposed to tasks involving speed and accuracy, because estrogen is believed to influence certain areas of the brain differently (Sherwin, 1997). Recent studies have shown that moderate alcohol consumption may increase estrogen levels in postmenopausal women (Gavaler, 1998; Ginsburg et al., 1995, 1996). The finding that estrogen is associated with better cognitive performance is well documented, but the direct role estrogen plays in the process remains questionable because women who take estrogen typically are healthier, more educated, and engage in better health habits (Barrett-Connors, 1991). Physiological differences in brain structures and function between men and women may explain differences seen by sex (Gorski, 1991).

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The data presented here are cross sectional, which limits the ability to make inferences about current drinking and cognitive performance. Second, the primary aim of the two studies was to investigate the incidence and prevalence of dementia in older Caucasian (ACT) and Japanese American (Kame) adults. The ACT and Kame studies were designed to include a large number of overlapping variables to facilitate cross-cultural comparisons between cohorts. The Kame study, however, collected more data regarding the effect of acculturation, whereas the ACT study collected greater detail on environmental exposures. Details concerning measures of alcohol exposure levels were not standardized between the studies at baseline. Consequently, our ability to determine the relationship between the amount of alcohol consumed and effects on cognitive performance was restricted, and this limits the generalizability of our findings. Third, because these two longitudinal studies only included individuals who were free of dementia, it may have created a "ceiling effect" difference in CASI and reaction time scores. In addition, some of the differences reported in this article were, although statistically significant, relatively small. Longitudinal analyses will ultimately be needed to clarify their clinical significance. Finally, although this study controlled for chronic diseases and depression, it can be difficult to achieve adequate control of disease severity and physical frailty, introducing the possibility that the outcome of our study may have been influenced by demographic differences.

Future studies need to examine whether drinking has a direct relationship to cognitive function, or whether the apparent favorable association might be due to a third factor associated with both cognition and drinking. For example, people may drink because they are healthy and able. Studies have shown that factors associated with cognitive performance, such as health-oriented lifestyles and general well-being, have been associated with alcohol because moderate drinkers enjoy better overall health than abstainers or heavy drinkers in terms of reduced cardiovascular disease, stress, anxiety, and depression (Delin & Lee, 1992; Dufouil et al., 1997; Mirand & Welte, 1996; Suh, Shaten, & Cutler, 1992). Other factors that could be influencing the relationship between drinking and cognition are education and income. People with more education are reportedly more likely to drink in some populations (Dawson, Grant, Chou, & Pickering, 1995). Because higher education is associated with higher income, affordability of alcohol may play a role (Heien, 1996). It is possible that well educated people have more sensible and healthy drinking habits (in terms of the amount and frequency in which alcohol is consumed) compared to individuals with less education. In addition, the possibility cannot be excluded that these factors or other unknown factors related to alcohol and cognition may influence men and women differently.

In conclusion, the present study found no negative effect of drinking on cognitive functioning in either the Caucasian or the Japanese American cohort. The magnitude of the association we observed between alcohol and cognitive performance differed between these two cultural groups and between men and women. Caucasians had higher cognitive scores than Japanese Americans on the cognitive measures of abstract thinking, attention, mental manipulation, and short-term memory. In contrast, Japanese Americans displayed faster reaction time. Gender differences showed women had higher CASI scores than men, regardless of drink category. On the other hand, men had faster reaction times than women. Further studies addressing specific ethnic groups and gender differences are needed to investigate the genetic and cultural factors that may influence the relationship between alcohol and cognitive performance.

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