

Associations of Binge Drinking and Smoking with Type 2 Diabetes among Adults in California: Age and Race Differences

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Research Article

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Abstract

Objective: The incidence of type 2 diabetes (T2D) is rising rapidly in the world. Findings focusing on the impact of two main lifestyle factors, smoking and alcohol consumption, on T2D were mixed. We aimed to estimate the prevalence of T2D and to examine the association of lifestyle factors including smoking and binge drinking with T2D.

Materials and Methods: 4046 adults with T2D and 38234 controls were selected from the 2011-2012 California Health Interview Survey (CHIS). Weighted univariate and multiple logistic regression analyses were used to estimate the odds ratios (ORs) with 95% confidence intervals (CIs).

Results: The overall prevalence of T2D was 7.0% (7.2% for males and 6.8% for females). The prevalence increased with age (1.7%, 10.3% and 17.2% for age group 18-44, 45-64 and 65+ years, respectively). Multiple logistic regression analysis showed that past smoking (OR = 1.28, 95% CI = 1.13-1.45), middle-aged adults (OR = 6.23, 95% CI = 5.09-7.62) and elderly adults (OR = 10.38, 95% CI = 8.28-13.0), nonwhite (Latino, Asian, and Africa American), obesity and poor poverty were positively associated with T2D. Furthermore, being female (OR = 0.76, 95% CI = 0.67-0.86), binge drinking (OR = 0.67, 95% CI = 0.57-0.80), and employment were negatively associated with T2D. Stratified by age and race, obesity was positively associated with T2D in all age and race groups. Past smoking was positively associated with T2D in middle-aged Asian and Whites groups only. Binge drinking showed negative association with T2D in the middle-aged and elderly Whites and in the elderly Asians.

Conclusion: Lifestyle factors (binge drinking and smoking) were associated with T2D. There were age and race differences in the associations of binge drinking and smoking with T2D.

Key Words: Type 2 Diabetes; Binge Drinking; Smoking; Age Difference; Race Difference.

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Introduction

As a predominant form of diabetes, type 2 diabetes (T2D) has been a major public health issue that threatens health and economies [1]. According to the international diabetes federation (IDF) estimation, there were 284.6 million of patients with diabetes in 2010 in the world [2] and it was predicted that there would be

438.4 million in 2025, with about 90%-95% being T2D. The overall prevalence of T2D in United States (US) was 7.7% based on the 2003-2004 National Health and Nutrition Examination Survey (NHANES) [3], while the prevalence was 6.8% based on the 1997-2004 NHANES and varied by race (5.5%, 11% and 11% for non-Hispanic White, non-Hispanic Black and Mexican American, respectively) [4]. The health expenditure for diabetes will rise from 418 USD billion to 490 USD billion from 2010 to 2030 [5]. As a highly preventable disease, the epidemic of T2D can be relieved through updating public policies, treatments, and living environments which target specific risks. The disparity of T2D in diverse racial/ethnic groups has been proven from studies that have been conducted in the US [4,6], yet limited studies have investigated age and race differences in multiple factors of T2D. T2D risk factors include family history, ethnic background, age, being overweight and lack of physical activity [7-9]. However, the pathogenesis of this disease is very complex and remains unknown. In particular, the impact of two main lifestyle factors, smoking and alcohol consumption, on T2D has inconsistent findings and has not been compared in different age and racial/ethnic groups [4,7],[10-12]. In order to decrease the disparity of T2D among different races/ethnicities and to have the effective prevention and treatment of T2D, we investigated the age and race differences in the associations between lifestyle factors including smoking and alcohol consumption and T2D using a large population-based sample.

Materials and Methods

Study population

The California Health Interview Survey (CHIS) is a collaborative population-based telephone survey which is conducted by the University of California, Los Angeles (UCLA) Center for Health Policy Research, the California Department of Health Services, and the Public Health Institute. The 2011-2012 CHIS is the sixth CHIS data collection cycle since 2001. The cross-sectional survey consisted of two stages: (1) a sample of telephone numbers selected by use of a list-assisted random-digit-dial method, (2) one adult who was 18 years of age or older was randomly selected among all adults in the household as the respondent. Extensive information for all age groups on health status, health conditions, health-related behaviors, health insurance coverage, access to health care services, and other health and health related issues were collected by CHIS. Details about the sampling design, data collection methods, data processing procedures, response rate and weighting and variance estimation could be found at elsewhere [13]. Procedures for data collection and analysis were approved by the Institutional Review Boards (IRBs) at the participant universities and agencies. The current study was approved by the IRB of authors' university.

Measurements

Assessment of T2D: T2D was determined by the question "Were you told that you have Type 1 or Type 2 diabetes?" Only adults with T2D were included in this study. Controls were defined to those who responded "No" to the question.

Lifestyle factors: Smoking behavior was classified as never smoking, current smoking, or past smoking. Other behavioral factors were dichotomized into either yes or no, including binge drinking and obesity. Binge drinking was defined as five or more drinks for males, and four or more drinks for females in one occasion at least once a year. Obesity was identified with a Body Mass Index (BMI) of 30.0 or above, which was calculated as weight in kilograms divided by squared height in meters.

Social-demographic factors: Gender was self-reported as male or female. The age was classified as young (18-44 years), middle aged (45-64 years), and elderly (65 years or above). Employment status was dichotomized into either yes or no. The categories of race were White, Latino, Asian, and African American (AA) and other. Socioeconomic status (SES) was captured by annual income as a categorical variable in four levels using Federal Poverty Level (FPL), including 0-99 % FPL, 100-199 % FPL, 200-299 % FPL, and 300% FPL or above.

Severe Psychological Distress (SPD): SPD is a nonspecific measure of psychological distress that has been psychometrically validated and shown to be able to discriminate community Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) cases from non-cases [14,15]. SPD is determined using the Kessler 6 (K6) scale, which comprises 6 questions asking how often during the past 30 days a person felt "so sad that nothing could cheer them up," "nervous," "restless," "hopeless," "worthless," or that "everything was an effort." Responses are scored from 0 (none of time) to 4 (all the time) and summed to produce a total score (0 to 24), with a score of 13 or above used to define SPD [14]. The K6 has been used widely to screen for DSM-IV mood and anxiety disorders in the general population [16,17].

Statistical Analysis

The SAS PROC SURVEYFREQ procedure was used to weight and estimate population proportions in cases and controls. SAS PROC SURVEYMEANS was used to estimate the overall prevalence while SAS PROC SURVEYFREQ was used to determine the prevalence of demographic factors. The Chi-square test was used to compare the prevalence of T2D across age, gender, and races. Then, SAS PROC SURVEYLOGISTIC was used to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for the association between potential factors and T2D.

Two models were conducted. In model one, simple logistic regression was used to examine the role of potential risk factors in T2D; then multiple logistic regression was used to adjust for all potential risk factors of T2D (full model). In model two, the full model was stratified by age and race. All the analyses were conducted with SAS statistical software, version 9.2 (SAS Institute, Cary, NC, USA).

Results

Subjects characteristics and prevalence of T2D

Table 1 presents characteristics of participants by cases and controls. For the subjects who were 45-64, 65 years or older, the percentage was higher in cases than controls (49% vs. 32%, 38% vs. 14%, respectively). The majority were whites in both groups (41% vs. 46%), followed by Latinos, Asians, and AAs (26% vs. 24%, 11% vs. 14%, 8% vs. 6%). The percentage of current smoking was similar in each group (12% vs. 14%). Diabetic group had higher percentage of past smoking, obesity, SPD, or unemployment than nondiabetic group (36% vs. 22%, 49% vs. 23%, 6% vs. 4%, 62% vs. 36%, respectively), and lower percentage of binge drinking or physical activity (16% vs. 32%, 59% vs. 64%, respectively). Around half of the participants were above 300% FPL. The overall prevalence of T2D was 7.0% (7.2% for males and 6.8 % for females) (Table 2). The prevalence increased with age (1.7%, 10.3% and 17.2% for age groups 18-44, 45-64 and 65+ years, respectively). The prevalence in Whites (6.4%) was higher than Asians (5.5%) but lower than Latinos (7.5%) and AAs (9.7%).

The relationship between potential risk factors and T2D

The results of univariate and multiple logistic regression analyses are presented in Table 3. By using univariate analysis, all factors except for gender were associated with T2D ($P < 0.05$). Multiple logistic regression analyses showed that past smoking (OR = 1.28, 95% CI = 1.13-1.45), middle-aged adults (OR = 6.23, 95% CI = 5.09-7.62) and elderly adults (OR = 10.38, 95% CI = 8.28-13.0), obesity (OR = 3.19, 95% CI = 2.82-3.61), and poor poverty were positively associated with T2D. Latinos (OR = 1.81, 95% CI = 1.52-2.16), Asians (OR = 1.58, 95% CI = 1.30-1.91), AAs (OR = 1.52, 95% CI = 1.20-1.92) were more likely to have T2D compared to Whites. Furthermore, being female (OR = 0.76, 95% CI = 0.67-0.86), and employment (OR = 0.56, 95% CI = 0.49-0.64) were associated with a reduced risk of having T2D. There was a strong inverse association between binge drinking and T2D (OR = 0.67, 95% CI = 0.57-0.80).

Risk factors of type 2 diabetes in different age and racial groups

Table 4 shows the impact of smoking, binge drinking, and obesity on T2D by age and race. Obesity was positively associated with T2D in all age and race groups. Past smoking was positively associated with T2D just in middle-aged Asians (OR = 2.00, 95% CI = 1.07-3.74) and Whites (OR = 1.47, 95% CI = 1.14-1.91). Binge drinking was negatively associated with T2D in middle-aged and elderly Whites (OR = 0.61, 95% CI = 0.45-0.83; OR = 0.60, 95% CI = 0.41-0.87, respectively) as well as in elderly Asians (OR = 0.33, 95% CI = 0.14-0.78).

Discussion

Using a large survey in the California in the US, we found that

Table 1. Subjects characteristics stratified by type 2 diabetes status

Variable	Cases (weighted %)	Control (weighted %)	p-value ^a
Gender			0.221
Male	1825(50%)	15692(49%)	
Female	2221(50%)	22542(51%)	
Age group			<0.0001
18-44 years	239(12%)	1663(54%)	
45-64 years	1645(49%)	14877(32%)	
65 + years	2162(38%)	11694(14%)	
Smoking status			<0.0001
Never	2085(52%)	22964(64%)	
Current	414(12%)	4480(14%)	
Past	1547(36%)	10790(22%)	
Binge drinking			<0.0001
No	3579(84%)	28728(68%)	
Yes	467(16%)	9506(32%)	
Activity			<0.0001
No	1803(41%)	13751(36%)	
Yes	2157(59%)	24230(64%)	
Obesity			<0.0001
No	2085(50%)	29568(77%)	
Yes	1961(49%)	8666(23%)	
SPD			<0.0001
No	3791(94%)	36823(97%)	
Yes	216(6%)	1236(4%)	
Employment			<0.0001
No	2853(62%)	18136(36%)	
Yes	1193(38%)	20098(64%)	
Race			<0.0001
White	2220(41%)	23890(46%)	
Latino	690(26%)	5605(24%)	
Asian	376(11%)	3761(14%)	
AA	294(8%)	1744(6%)	
Other	466(14%)	3234(11%)	
Poverty level			<0.0001
0-99% FPL	699(18%)	5379(16%)	
100-199% FPL	968(25%)	6747(19%)	
200-299% FPL	640(16%)	5389(14%)	
300% FPL+	1739(41%)	20719(51%)	

^a p-value is based on χ^2 test

Abbreviations:

SPD = Serious psychological distress;

AA = African American;

FPL = Federal Poverty Level

Table 2. Prevalence of type 2 diabetes by demographic characteristics (%)

Variable	Total (N)	Cases (N)	Prevalence (%)	95%CI	P-value ^a
Gender					
Male	17517	1825	7.2	6.75-7.65	0.221
Female	24763	2221	6.8	6.23-7.31	
Age group					
18-44 years	11902	239	1.7	1.37-1.95	<0.0001
45-64 years	16522	1645	10.3	9.47-11.07	
65 + years	13856	2162	17.2	16.14-18.31	
Race					
White	26110	2220	6.4	5.92-6.78	<0.0001
Latino	6295	690	7.5	6.58-8.44	
Asian	4137	376	5.5	4.63-6.37	
AA	2038	294	9.7	7.97-11.36	
Other	3700	460	8.9	7.41-10.36	
Overall	42280	4046	7	6.62-7.34	

^ap-value is based on χ^2 test

Abbreviations: AA = African American

Table 3. Univariate and multiple logistic regression analyses for the relationship between risk factors and type 2 diabetes

Variable	Crude OR	95% CI	P-value	Adjusted OR	95% CI	P-value
Gender						
Male	1			1		
Female	0.92	0.82-1.02	0.118	0.76	0.67-0.86	<0.0001
Age group						
18-44 years	1			1		
45-64 years	6.65	5.51-8.03	<0.0001	6.23	5.09-7.62	<0.0001
65 + years	12.24	10.1-14.8	<0.0001	10.38	8.28-13.0	<0.0001
Smoking status						
Never	1			1		
Current	1.01	0.82-1.24	0.94	1.04	0.83-1.31	0.728
Past	2.05	1.82-2.31	<0.0001	1.28	1.13-1.45	<0.0001
Binge drinking						
No	1			1		
Yes	0.41	0.34-0.48	<0.0001	0.67	0.57-0.80	<0.0001
Obesity						
No	1			1		
Yes	3.47	3.11-3.88	<0.0001	3.19	2.82-3.61	<0.0001
Activity						
No	1			1		
Yes	0.79	0.72-0.86	<0.0001	0.97	0.89-1.06	0.445
SPD						
No	1			1		
Yes	1.7	1.29-2.25	0.000	1.31	0.94-1.83	0.115
Employment						
No	1			1		
Yes	0.35	0.31-0.39	<0.0001	0.56	0.49-0.64	<0.0001
Race						
White	1			1		
Latino	1.18	1.02-1.36	0.026	1.81	1.52-2.16	<0.0001
Asian	0.86	0.71-1.03	0.106	1.58	1.30-1.91	<0.0001

AA	1.57	1.27-1.94	<0.0001	1.52	1.20-1.92	0.001
Other Income	1.46	1.19-1.77	0.000	2.03	1.67-2.48	<0.0001
300% FPL+	1			1		
0-99% FPL	1.3	1.11-1.54	0.002	1.09	0.89-1.33	0.397
100-199% FPL	1.61	1.40-1.85	<0.0001	1.32	1.14-1.52	0.000
200-299% FPL	1.34	1.13-1.59	0.001	1.21	1.01-1.45	0.042

Abbreviations:

SPD = Serious psychological distress;

AA = African American;

FPL = Federal Poverty Level;

OR= odds ratio;

CI= confidence interval

Table 4: Multiple logistic regression analyses for the relationship between risk factors and type 2 diabetes by gender and race

Variable	OR-r1	95% CI	P	OR-r2	95% CI	P	OR-r3	95% CI	P	OR-r4	95% CI	P
45-64 years												
Smoking status												
Never	1			1			1			1		
Current	0.81	0.44-1.49	0.504	1.99	0.79-4.99	0.141	0.72	0.31-1.64	0.428	1.06	0.70-1.59	0.791
Past	0.92	0.60-1.40	0.68	2	1.07-3.74	0.029	1.68	0.93-3.06	0.088	1.47	1.14-1.91	0.003
BINGE												
No	1			1			1			1		
Yes	0.64	0.40-1.01	0.058	0.54	0.17-1.68	0.283	1.2	0.55-2.9	0.65	0.61	0.45-0.83	0.002
Obesity												
No	1			1			1			1		
Yes	2.11	1.41-3.17	0.000	3.6	1.91-6.78	<0.0001	2.08	1.16-3.75	0.015	4.06	3.21-5.13	<0.0001
65+ years												
Smoking status												
Never	1			1			1			1		
Current	1.07	0.41-2.80	0.89	0.96	0.29-3.21	0.943	0.82	0.25-2.73	0.747	0.9	0.62-1.31	0.57
Past	0.82	0.44-1.55	0.538	0.69	0.38-1.24	0.21	1.08	0.62-1.88	0.798	1.1	0.92-1.32	0.305
BINGE												
No	1			1			1			1		
Yes	1.28	0.61-2.66	0.511	0.33	0.14-0.78	0.012	1.04	0.25-4.29	0.959	0.6	0.41-0.87	0.006
Obesity												
No	1			1			1			1		
Yes	2.95	1.87-4.66	<0.0001	2.54	1.35-4.77	0.004	2.6	1.64-4.13	<0.0001	3.37	2.81-4.04	<0.0001

Race 1 = Latino, 2 = Asian, 3= African American (AA), 4= White

Abbreviations: OR= odds ratio; CI= confidence interval

past smoking, older age, nonwhite (Latinos, Asians, and AAs), obesity and poverty were positively associated with T2D. Furthermore, being female, binge drinking and employment were negatively associated with T2D. Stratified by age and race, obesity was positively associated with T2D in all age and race groups. Past smoking was positively associated with T2D just in middle-aged Asians and Whites. Binge drinking showed negative association with T2D in middle-aged and elderly Whites as well as in elder Asians.

The overall prevalence of T2D in the California was 7.0%, which is a little lower than the national prevalence (7.7%) based on the 2003-2004 NHANES [3] but similar to the national rate (6.8%) based on 1999-2004 NHANES [4]. Furthermore, we found that

the prevalence in Whites (6.4%) was higher than Asians (5.5%) but lower than Latinos (7.5%) and AAs (9.7%). The prevalence in whites is a little higher than previously reported value (5.9%) while the prevalence in Asian is lower than those (8.1%, 7.1%, 7.0%, 6.3%, and 5.9% for Filipinos, Japanese, Vietnamese, Koreans and Chinese, respectively) using CHIS 2007 data [18]. The prevalence of T2D in AAs (9.7%) was closed to the national prevalence (10.2%) using the NHIS 1997-2005 data [19] and was a little lower than the value (11%) using NHANES 4 data [4]. The prevalence in Latinos (7.5%) was lower than that in Puerto Ricans (11.0%), Mexican Americans (10.2%) but was higher than that in Mexicans (6.2%), Dominicans (5.2%), and Central and South Americans (4.0%) [19].

An inverse association between binge drinking and T2D was observed among all participants. The Nord-Trøndelag Health Study explained the association into the improvement in insulin sensitivity which was explained by an insulin resistance research from Wilkin [20,21]. Binge drinking and high alcohol consumption may increase the risk of T2D [22] or just increase the risk in women [23]. Another study showed that total alcohol consumption and binge drinking increased the risk of pre-diabetes and T2D in men, while low consumption decreased T2D risk in women [24]. A recent study showed that moderate alcohol consumption was associated with a reduced risk of T2D in men, but not in women; no increased risk was seen in participants who reported to have binge drinking or were problem drinkers [20]. Several studies also indicated different associations for both sexes [23-25]. Stratified analysis of our research confirmed the inverse association in middle-aged and elder Whites as well as in elderly Asians. However, a non-significant association with T2D was found in Latinos, AAs, and middle-aged Asians.

As consistent with a previous study [26], past smoking was a risk factor of T2D. The increased risk may be partially explained by weight gain [26,27]. Researches also detected that the risk would peak within three years after quitting smoking [26]. However, our study revealed that past smoking was positively associated with T2D just in middle-aged Asians and Whites. No significant association of past smoking with T2D was found in elder group in all races, and middle-aged Latinos and AAs.

Some limitations of the current study should be noticed. First, subjects without phones, or did not respond to the calling were excluded from the survey. In addition, institutionalized people who were homeless or lived in group homes, nursing home, or prisons were excluded. The number of elderly and the risk factors of T2D in this age may be underestimated due to the exclusion. Second, self-report measures may be subject to recall bias. Finally, the cross-sectional study cannot determine the causal relationships between these factors and T2D risk. However, the current study provides preliminary results for the variation of risk factors of T2D in different racial groups using a large sample. Worldwide, the incidence of T2D is rising rapidly. Globally, there were 366 million people with diabetes in 2011, and the number is expected to rise to 552 million by 2030 [28]. The detection of risk factors of T2D particularly of whether there being age and race differences in such factors is important for the invention of T2D in public health implication.

Conclusion

Lifestyle factors (binge drinking and smoking) were associated with T2D. The association varied by age and race. The findings of risk factors of T2D particularly of whether there being and race differences in these factors may provide an important guild for T2D intervention.

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