Preliminary communication

Soft drink consumption is associated with depressive symptoms among adults in China

Bin Yu [a,c,1], Haiyan He [a,d,1], Qing Zhang [b], Hongmei Wu [a], Huanmin Du [a], Li Liu [b], Chongjin Wang [b], Hongbin Shi [b], Yang Xia [a], Xiaoyan Guo [a], Xing Liu [a], Chunlei Li [a], Xue Bao [a], Qian Su [a], Ge Meng [a,e], Jiaqi Chu [a,f], Yan Mei [a,g], Shaomei Sun [b], Xing Wang [b], Ming Zhou [b], Qiyu Jia [b], Honglin Zhao [b], Kun Song [b], Kaijun Niu [a,*]

[a] Nutritional Epidemiology Institute and School of Public Health, Tianjin Medical University, Tianjin, China
[b] Health Management Centre, Tianjin Medical University General Hospital, Tianjin, China
[c] Institute of Psychology, Tianjin Medical University, Tianjin, China
[d] Tianjin Binhai New Area Dagang Hospital, Tianjin, China
[e] Department of Toxicology, School of Public Health, Tianjin Medical University, Tianjin, China
[f] First Teaching Hospital of Tianjin University of Traditional Chinese Medicine, Tianjin, China
[g] Tianjin Academy of Traditional Chinese Medicine Affiliated Hospital, Tianjin, China

ARTICLE INFO

ABSTRACT

Background: Research evidence supports a positive link between soft drinks and depressive symptoms. However, data thus far are only from Caucasian populations. We investigated whether high levels of consumption of soft drinks were associated with the depressive symptoms among adults in China.

Methods: A cross-sectional survey was conducted with 3667 adults in Tianjin, China. Dietary intake was assessed using a valid self-administered food frequency questionnaire, and depressive symptoms were assessed with the Zung Self-Rating Depression Scale (SDS), cut-off point of 40, 45 or 50 indicating elevated depressive symptoms.

Results: The prevalence of elevated depressive symptoms was 7.6% (SDS ≥ 50). After adjustments for potentially confounding factors, the odds ratios (95% confidence interval) of having elevated depressive symptoms by increasing levels of soft drink consumption were 1.00, 1.43 (1.01, 2.01) and 2.00 (1.15, 3.37) (p for trend < 0.01). Similar relations were observed when SDS ≥ 40 or 45 were used as a definition of depressive symptoms.

Limitation: This is a cross-sectional study, causal relation remains unknown.

Conclusion: Our results suggested that high consumption of soft drinks was significantly related to a higher prevalence of depressive symptoms among adults in China. This is the first large cross-sectional study addressing this topic in an Asia population.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Depression is considered an important public health problem because of its relatively high prevalence in the general population (Kessler et al., 2003) and it's linked to medical morbidity and mortality (Ferrari et al., 2013; Spijker et al., 2004). The prevalence of depression increased dramatically these years due to the rapid socioeconomic transition in China (Phillips et al., 2009). Aside from being a significant public health issue, this epidemic has resulted in a high economic burden for society.

Evidence suggests the role of diet and nutrition in the development of depressive disorders. Certain nutrients such as B-vitamins (Skarupski et al., 2010), or omega-3 fatty acids (Colangelo et al., 2009) and a 'healthy' dietary pattern, such as the Mediterranean diet (Sanchez-Villegas et al., 2009), or a whole food pattern (Akbaraly et al., 2009), have been related to a lower risk of depression. In spite of this, the effects of other detrimental diet components, such as sugar and fats, on depression are still unclear. Preliminary evidences show a possible association between sugar consumption and depression. Two ecological studies suggested a positive association between sugar consumption and prevalence rates of depression (Peet, 2004; Westover and Marangell, 2002). Epidemiologic evidence also shows a

positive association between consumption of sweets and depressive symptoms (Jeffery et al., 2009; Mikolajczyk et al., 2009).

Soft drinks (also called soda or carbonated beverage) contain a large amount of sugar. It is now the leading source (47%) of added sugars (Guthrie and Morton, 2000) and accounts for 7% of total energy intake in the American diet (Bray et al., 2004). Given their popularity, an increasing number of studies have examined the association between the use of soft drinks and a variety of health outcomes. Compelling evidence supports a positive link between the consumption of soft drinks and obesity (Basu et al., 2013; Bray et al., 2004) or type 2 diabetes mellitus (Malik et al., 2010; Sturt, 2011). In recent years, the impact of the soft drinks on mental health has also drawn research interest. Although studies from Caucasians suggested a consistent link between soft drink consumption and mental health problem (Guo et al., 2014; Lien et al., 2006; Shi et al., 2010), data for Asian populations are scarce. Comparing to the North America and European countries, the consumption of the soft drink in Asia is still very low (Euromonitor Internaltional, 2011). However, given the traditional beverages consumed by Asians such as green tea or barley tea, are drunk without added sugar, in contrast to Western beverages, such as coffee and black tea, which often consumed with added sugar, the effect of sugar-sweetened soft drinks on physiological and psychological health in the Asian population may not be negligible even if the amount of soft drink consumption is small.

Therefore, the aim of this paper was to investigate the nature of the association between consumption of soft drinks and depressive symptoms in Chinese adults.

2. Methods

2.1. Study participants

We analyzed cross-sectional, observational epidemiological data from The Tianjin Chronic Low-grade Systemic Inflammation and Health (TCLSIH or TCLSIHealth) Cohort Study. TCLSIH is a large prospective dynamic cohort study focusing on the relationships between chronic low-grade systemic inflammation and health status of a population living in Tianjin, China (Guo et al., 2014; Song et al., 2014). Tianjin is a metropolis of approximately 10.43 million inhabitants, located in the northeastern part of the North China Plain. Participants were recruited during annual health examinations at the Health Management Center of Tianjin Medical University General Hospital-Health Management Center, the largest and most comprehensive physical examination center in Tianjin.

This cross-sectional study used baseline data from TCLSIH. During the research period there were 4178 participants who had received health examinations. We excluded participants who did not complete data collection on food frequency questionnaire ($n=123$), depression scale ($n=78$), body height and/or body weight measurements ($n=45$), physical activity ($n=8$), or those with a history of CVD ($n=224$) or cancer ($n=33$). Owing to these exclusions, the final cross-sectional study population comprised 3667 participants (mean age (standard deviation, SD): 42.5 (12.1) years; males, 60.2%). The blood sample was routinely drawn 12 ml of whole blood for 2 ml of plasma and 10 ml of serum from each subject. The protocol of this study was approved by the Institutional Review Board of the Tianjin Medical University and participants gave written informed consent prior to participation in the study.

2.2. Assessment of depressive symptoms

Depressive symptoms were assessed by the Chinese version of the Zung Self-Rating Depression Scale (SDS). There were 20 items on the scale, either positive or negative, which the study subjects were required to grade on a scale of 1–4. Sum of the 20 items produced a score ranging from 20 to 80, with greater values indicating increased severity. In the present study, 3 cut-off points (40, 45, and 50) were used to define depressive symptoms (Xu et al., 2004; Zung, 1965). Scores higher than the cut-offs is an indicator of moderate-to-severe depressive symptoms.

2.3. Assessment of dietary intake

The participants were instructed to fill out a validated self-administered food frequency questionnaire that included 88 food items with specified serving sizes described by natural portions or standard weight and volume measures of the servings commonly consumed in the study population. The mean daily intake of nutrients was calculated by using an ad hoc computer program developed to analyze the questionnaire. The valid and reliable Chinese food composition tables were used as the nutrient database. By combining the information obtained from the food frequency response with the food composition table, we were able to compute the mean total energy intake for each participant.

Participants indicated the mean frequency of consumption of soft drinks, green tea, black tea, oolong tea, coffee, fruit and vegetable juices over the previous 1 month in terms of the specified serving size by selecting 1 of the 8 frequency categories: almost never, < 1 cup/wk, 1 cup/wk, 2–3 cups/wk, 4–6 cups/wk, 1 cup/d, 2–3 cups/d, and ≥ 4 cups/d. In the study region, the volume of a typical cup of the drink is 200 ml. Drinking frequency of soft drinks (Coke, Pepsi, Sprite, or other carbonated soft drinks) was categorized as: < 1 cup/wk, 1–3 cups/wk, and ≥ 4 cups/wk, other beverage such as green tea, black tea, oolong tea, coffee, fruit and vegetable juices were similarly categorized.

2.4. Assessment of metabolic syndrome (MS) and other variables

Waist circumference was measured at the umbilical level with participants standing and breathing normally. Blood pressure (BP) was measured twice from the upper left arm using an automatic device (Andon, Tianjin, China) after 5 min of rest in a seated position. The mean of these 2 measurements was taken as the BP value. Blood samples for the analysis of fasting blood sugar (FBS) and lipids were collected in siliconized vacuum plastic tubes. FBS was measured by the glucose oxidase method, triglycerides (TG) were measured by enzymatic methods, low-density lipoprotein cholesterol (LDL) was measured by the polyvinyl sulfuric acid precipitation method, and high-density lipoprotein cholesterol (HDL) was measured by the chemical precipitation method using reagents from Roche Diagnostics on an automatic biochemistry analyzer (Roche Cobas 8000 modular analyzer, Mannheim, Germany). Metabolic syndrome was defined in accordance with the criteria of the American Heart Association scientific statements of 2009 (Alberti et al., 2009).

The anthropometric variables (height and body weight) were recorded by using a standard protocol. Body mass index (BMI) was calculated as weight in kilograms divided by height in squared meters. The sociodemographic variables, which include sex, age, education, employment, income, marital, cohabitants, and visiting friends, were also assessed. The educational level was assessed by asking the question "what is the highest degree you earned?" and was divided into 2 categories: < College graduate or ≥ College graduate. Marital status was classified as married or unmarried. The subjects were also classified as living alone or living with others. Employment status was classified as either Senior Officials and Managers or Professionals.

Information on the smoking ("never," "former," and "current smoking") and drinking ("never," "former," and "current drinking") status of the participants was obtained from a questionnaire