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Association between the Consumption of Carbonated Beverages and Out-of-Hospital Cardiac Arrests of Cardiac Origin in Japan

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Abstract

Background: The consumption of carbonated beverages has been shown to increase the risk of developing metabolic syndrome. The associations between the consumption of carbonated beverages and left arterial dimension or left ventricular mass are believed to be likely related to the greater body weight of carbonated beverage drinkers relative to non-drinkers. Nonetheless, little is known about the association between the consumption of carbonated beverages and out-of-hospital cardiac arrests (OHCAs) in Japan. Methods: We compared the age-adjusted incidence of OHCAs to the expenditures on various beverages per person between 2005 and 2011 in the 47 prefectures of Japan. Patients who suffered from OHCAs of cardiac and non-cardiac origin were enrolled in All-Japan Utstein Registry of the Fire and Disaster Management Agency. The expenditures on various beverages per person in the 47 prefectures in Japan were obtained from data published by the Ministry of Health, Labour and Welfare of Japan. Results: There were 797,422 cases of OHCA in the All-Japan Utstein registry between 2005 and 2011, including 11,831 cases who did not receive resuscitation. Among these 785,591 cases of OHCA, 435,064 (55.4%) were classified as cardiac origin and 350,527 (44.6%) were non-cardiac origin. Non-cardiac origin in-

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cluded cerebrovascular disease, respiratory disease, malignant tumor, and exogenous disease (4.8%, 6.1%, 3.5%, and 18.9%, respectively). The expenditures on carbonated beverages were significantly associated with OHCAs of cardiac origin (r = 0.30, p = 0.04), but not non-cardiac origin (r = −0.03, p = 0.8). Expenditures on other beverages, including green tea, tea, coffee, cocoa, fruit or vegetable juice, fermented milk beverage, milk beverage, and mineral water, were not significantly associated with OHCAs of cardiac origin. Conclusion: Carbonated beverage consumption was significantly and positively associated with OHCAs of cardiac origin in Japan, indicating that beverage habits might play a role in OHCAs of cardiac origin.

Keywords

Out-of-Hospital Cardiac Arrest, Utstein Registry, Carbonated Beverage, Ecological Study

1. Introduction

Several reports have shown that the consumption of soft drinks has been increasing worldwide [1] [2]. The consumption of large quantities of soft drinks has been shown to not only lead to hypertension and diabetes, but also to promote atherosclerosis [3]-[8]. Furthermore, these drinks contain large amounts of advanced glycation end-products which accelerate the progression of atherosclerosis [9]. Some epidemiologic studies have shown a positive correlation between the consumption of these drinks and the incidence of cardiovascular disease (CVD) and stroke [10]-[12], while other reports have demonstrated that the intake of green tea and coffee reduces the risk and mortality of CVD in Japan [13]-[15]. Carbonated beverages, or sodas, have frequently been demonstrated to increase the risk of metabolic syndrome and CVD, such as subclinical cardiac remodeling and stroke [16] [17].

The Fire and Disaster Management Agency of Japan launched a prospective, nationwide, population-based, cohort study in subjects who had an OHCA to evaluate the effect of the nationwide dissemination of public-access Automated External Defibrillators (AEDs) on the rate of survival among patients who had an OHCA, and the Japanese Circulation Society (JCS) Resuscitation Science Study (JCS-ReSS) Group had a suitable database in January 2005 [18]. These data showed that in Japan, over 100,000 people experienced OHCA annually, and their survival rate within the first month thereafter was only 5%. Thus, OHCA is still a major public health problem in Japan. As for OHCA of cardiac origin, several studies have demonstrated that some factors (e.g., seafood consumption) reduce the risk of OHCA of cardiac origin [19]. However, the association between the consumption of large amounts of carbonated beverages and fatal CVD, or out-of-hospital cardiac arrests (OHCA) of cardiac origin, is not clear.

In the present study, we used an ecological method, which referred to a geographical and temporal study of risk-modifying factors on health outcomes based on populations. We hypothesized that the consumption of large amounts of carbonated beverages might be related to the incidence of OHCA of cardiac origin. Therefore, we considered that the kinds of soft drinks, especially carbonated beverages, consumed in each prefecture, in addition to the total consumption of soft drinks per se in each prefecture, would be associated with OHCA of cardiac origin. We looked for associations between the average consumption of different kinds of soft drinks and the average incidence of OHCA between 2005 and 2011 in the 47 prefectures of Japan.

2. Methods

2.1. Subjects

Patients who suffered from OHCA of cardiac or non-cardiac origin (n = 435,064 and 350,527, respectively) and who were enrolled in the All-Japan Utstein Registry of the Fire and Disaster Management Agency between 2005 and 2011 were included in this analysis. Cardiac arrest was considered the cessation of cardiac mechanical activity, and was confirmed by the absence of a detectable pulse, unresponsiveness, and apnea. It included all patients who had an out-of-hospital cardiac arrest before the arrival of emergency medical services (EMS) personnel, were treated by EMS personnel, and were then transported to medical institutions. This reporting system has

been implemented in all of the fire stations in Japan and includes all cases of OHCA. The data were registered by the Fire and Disaster Management Agency (FDMA) of Japan and changed to a suitable database by the Japanese Circulation Society Resuscitation Science Study (JCS-ReSS) Group. Whether the arrest was of cardiac or non-cardiac origin was determined clinically by the physician in charge, in collaboration with the EMS personnel, and was confirmed by a staff member at the FDMA. Patients were followed-up at 1 month, and 1 month survival, Cerebral Performance Category (CPC) score, and Overall Performance Category (OPC) score were checked by the EMS personnel and physicians. CPC scores are used to describe "good (1-2)" and "poor (3-4)" outcomes. The 1 is conscious and alert with normal function or only slight disability, the 2 is conscious and alert with moderate disability, the 3 is conscious with severe disability, the 4 is comatose or persistent vegetative state, and the 5 is brain dead or death from other causes. OPC scores are used to describe "good (1-2)" and "poor (3-4)" outcomes. The 1 is healthy, alert, capable of normal life, the 2 is moderate overall disability, the 3 is severe overall disability, the 4 is coma or vegetative state, and the 5 is death, certified brain dead or dead by traditional criteria. Data regarding the expenditures on beverages in the 47 municipalities were obtained from the Family Income and Expenditure Survey published by the Ministry of Internal Affairs and Communications of Japan [20]. The populations in the 47 prefectures of Japan were obtained from the Annual Report on Current Population Estimates (2005-2011) published by the Ministry of Internal Affairs and Communications of Japan [21]. The study protocol for analyses was approved by the Ethics Committee of Fukuoka University (FU-#00000403), Japan.

2.2. Age-Adjusted Incidence of OHCA

Using the Utstein Registry, we calculated the crude incidence of OHCA by determining the raw number of cases of OHCA by prefecture and then dividing these numbers by the population of the prefecture from 2005 to 2011 [21]. The Japanese Model Population in 1985 was used as a standard population, and age-standardization was performed by a direct method. We used a popular method to adjust for age. The Japanese Model Population in 1985 is a standard population (**Supplementary Table 1**), similar to the World Standard Population reported by Doll and Segi. First, we calculated the age-specific incidence for five-year age groups per person-year by dividing the number of OHCA cases in each age group by the population in each age group in the 47 prefectures. Second, age-standardized incidences were calculated to allow comparison with the Japanese Model Population in 1985, with age-standardization conducted by a direct method. Age-adjusted incidence was calculated as Σ (the incidence of OHCA in the five-year age group x the size of the standard population in the five-year age group)/total standard population. Finally, we determined the average yearly age-adjusted incidence of OHCA by prefecture from 2005 to 2011.

2.3. Expenditures on Beverages

Data regarding the expenditures on beverages in the 47 municipalities were obtained from the Family Income and Expenditure Survey published by the Ministry of Internal Affairs and Communications of Japan [20]. The survey unit was the household throughout the entire area of Japan. Data were obtained with four different questionnaires: Household Schedule, Family Account Book, Yearly Income Schedule and Savings Schedule. Enumerators filled in the Household Schedule with the number of household members, occupation and industry of earners, type of dwelling, etc. We considered 9 kinds of beverages: carbonated beverages, green tea, tea, coffee, cocoa, juice, fermented milk beverage, milk, and mineral water. Yearly average expenditures per household by prefectural capital city were obtained from this Survey. We calculated the expenditures on these drinks per person by dividing by the number of household members, and determined the averages from 2005 to 2011.

2.4. Statistical Analysis

The statistical analysis was performed using SAS software, version 9.4 (SAS Institute, Cary, NC, USA) at Fukuoka University. We used a t-test for continuous variables and chi-squared tests for categorical variables. The Spearman Rank Correlation Coefficient was used to evaluate associations between groups. The values are expressed as the mean ± standard deviation (SD). Statistical significance was defined as a p-value of less than 0.05.

3. Results

3.1. Patient Characteristics in the All-Japan Utstein Registry

There were 797,422 cases of OHCA in the All-Japan Utstein registry between 2005 and 2011, including 11,831 cases who did not receive resuscitation. **Table 1** shows the patient characteristics in the All-Japan Utstein Registry between 2005 and 2011, excluding the 11,831 in the no-resuscitation group: 785,591 cases of OHCA: 435,064 (55.4%) of cardiac origin and 350,527 (44.6%) of non-cardiac origin. Non-cardiac origin included cerebrovascular disease, respiratory disease, malignant tumor, and exogenous disease (4.8%, 6.1%, 3.5%, and 18.9%, respectively). Patients with OHCA of cardiac origin were significantly older, and had a lower incidence of male and a higher incidence of 1-month survival, cerebral performance category 1 or 2, and overall performance category 1 or 2 compared to OHCA of non-cardiac origin. The initial rhythms in OHCA of cardiac origin were significantly more likely to be ventricular fibrillation and pulseless ventricular tachycardia, and less likely to be pulseless electrical activity and asystole. We showed the data aggregated by prefecture (**Supplementary Table 2**).

3.2. Time Trends for the Incidence of OHCA and Expenditures on Carbonated Beverages

Figure 1 shows the yearly changes in the expenditures on carbonated beverages and the crude incidence of OHCA (total, cardiac and non-cardiac origin) in the 47 prefectures of Japan from 2005 to 2011. We performed a Spearman rank correlation coefficient analysis on the yearly increase in expenditures on carbonated beverages and the crude incidence of total OHCA, OHCA of cardiac origin, and OHCA of non-cardiac origin. The incidence of OHCA of both total and cardiac origin and the expenditures on carbonated beverages have been increasing yearly since 2005. We also investigated the associations between the yearly increase in the expenditures on carbonated beverages and the yearly increase in the crude incidence of total OHCA ($p = 0.02$), OHCA of cardiac origin ($p = 0.005$), and OHCA of non-cardiac origin ($p = 0.3$).

3.3. Incidence of OHCA of Cardiac and Non-Cardiac Origin and the Expenditures on Carbonated Beverages in the 47 Prefectures of Japan

Figure 2 shows the mean age-adjusted incidence of OHCA of cardiac and non-cardiac origin and the mean expenditures on carbonated beverages in the 47 prefectures of Japan between 2005 and 2011. Northern Japan might tend to show a high incidence of OHCA of cardiac origin and high expenditures on carbonated beverages. There was no certification using statistical analysis.

Table 1. Patient characteristics.

	Total (n = 785,591)	Cardiac origin (n = 435,064)	Non-cardiac origin (n = 350,527)
Age, years.	72 ± 18	75 ± 16*	69 ± 21
Male, n (%)	458,105 (58.3)	251,554 (57.8)*	206,551 (58.9)
ROSC, n (%)	52,955 (6.7)	29,214 (6.7)	23,741 (6.8)
1-month survival, n (%)	37,912 (4.8)	23,553 (5.4)*	14,359 (4.1)
CPC1 or 2, n (%)	17,410 (2.2)	13,230 (3.0)*	4180 (1.2)
OPC1 or 2, n (%)	17,223 (2.2)	13,109 (3.0)*	4114 (1.2)
Initial rhythm			
VF	55,192 (7.0)	47,606 (10.9)*	7586 (2.2)
pulseless VT	1862 (0.2)	1219 (0.3)*	643 (0.2)
PEA	166,976 (21.3)	87,158 (20.0)*	79,818 (22.8)
Asystole	528,193 (67.2)	282,336 (64.9)*	245,857 (70.1)

ROSC: Return of spontaneous circulation; CPC: Cerebral performance category; OPC: Overall performance category; VF: Ventricular fibrillation; VT: Ventricular tachycardia; PEA: Pulseless electrical activity. *$p < 0.05$ vs. non-cardiac origin.

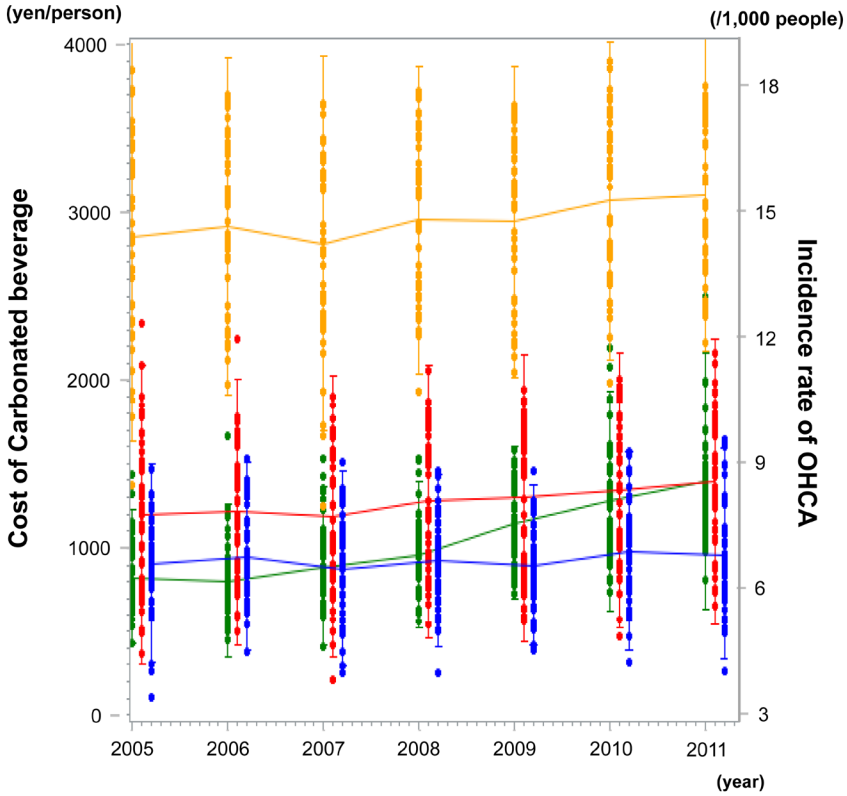

Figure 1. Yearly changes in the expenditures on carbonated beverages and the incidence of OHCA in the 47 prefectures of Japan from 2005 to 2011. The green line (left vertical axis) indicates the annual expenditures on carbonated beverages per person in the 47 prefectures between 2005 and 2011. The orange, red, and blue lines (right vertical axis) indicate the annual crude incidence of OHCA in the 47 prefectures in all patients and in those of cardiac and non-cardiac origin between 2005 and 2011, respectively.

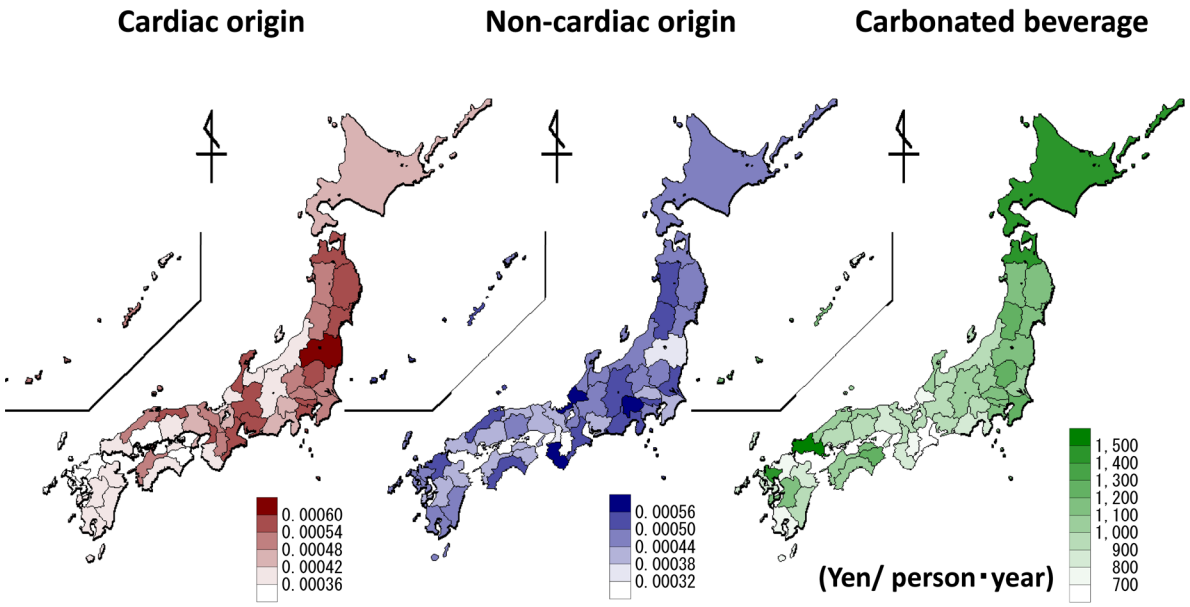

Figure 2. Mean age-adjusted incidence of OHCA of cardiac origin (red map in the left panel), non-cardiac origin (blue map in the middle panel), and expenditures on carbonated beverages (green map in the right panel) in the 47 prefectures of Japan between 2005 and 2011.

3.4. Correlations between the Nine Kinds of Beverage and the Incidence of OHCA of Cardiac and Non-Cardiac Origin in the 47 Prefectures

Table 2 shows the Spearman Rank Correlation Coefficients between the consumption of each type of beverage and the age-adjusted incidence of OHCA of cardiac origin. The expenditure on carbonated beverages was significantly associated with the age-adjusted incidence of OHCA of cardiac origin as also shown in **Figure 3** ($r = 0.302$, $p = 0.04$), but not non-cardiac origin ($r = -0.03$, $p = 0.8$). On the other hand, the expenditures on other

Table 2. Associations between the cost of kinds of drink and the age-adjusted incidence of out-of-hospital cardiac arrest of cardiac origin.

	Cost	r	p
Carbonated beverage, yen	1043 ± 198	0.302	0.04
Green tea, yen	1727 ± 617	0.010	0.94
Tea, yen	283 ± 89	0.145	0.33
Coffee, yen	1808 ± 290	0.088	0.55
Cocoa, yen	154 ± 24	0.192	0.20
Juice, yen	3359 ± 524	0.140	0.35
Fermented milk beverage, yen	1140 ± 243	0.253	0.09
Milk, yen	457 ± 99	−0.134	0.37
Mineral water, yen	973 ± 299	0.081	0.59

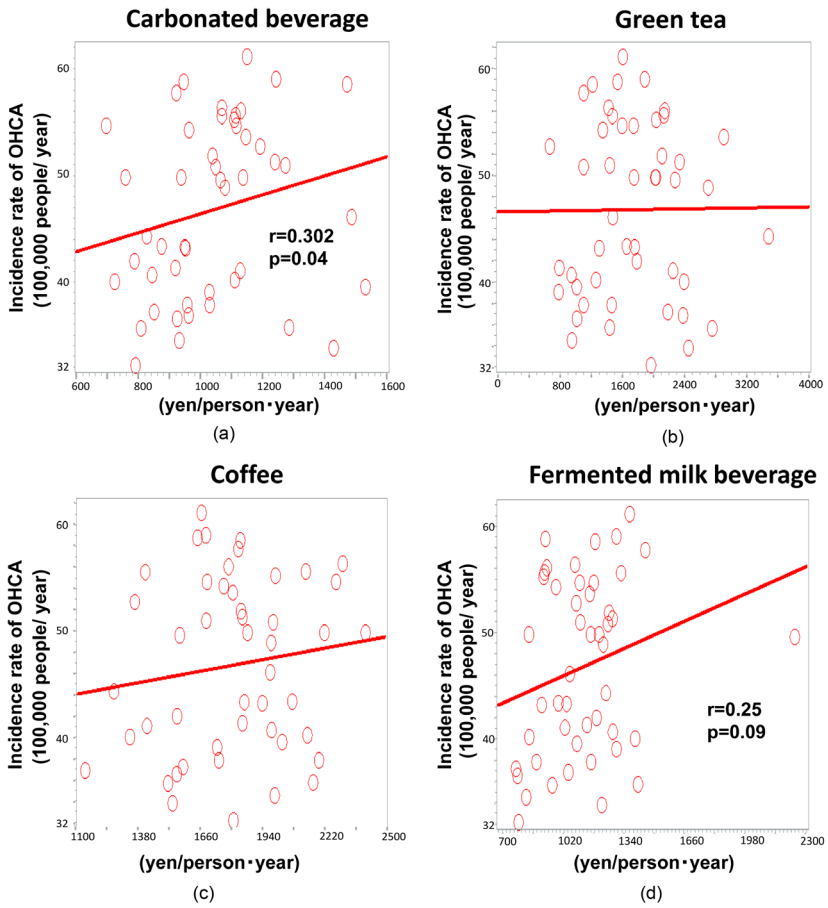

Figure 3. Correlations between the age-adjusted incidence of OHCA and the expenditures on different kinds of beverages in the 47 prefectures of Japan. Red lines and circles indicate the correlation to OHCA of cardiac origin.

beverages were not significantly associated with the age-adjusted incidence of OHCA of cardiac origin: green tea ($r = -0.010$, $p = 0.94$), tea ($r = -0.145$, $p = 0.33$), coffee ($r = -0.088$, $p = 0.55$), cocoa ($r = -0.192$, $p = 0.20$), juice ($r = -0.140$, $p = 0.35$), milk ($r = -0.134$, $p = 0.37$), and mineral water ($r = -0.081$, $p = 0.59$). The expenditure on fermented milk beverages tended to be positively associated with OHCAs of cardiac origin ($r = 0.25$, $p = 0.09$). The variability of the data was also shown in **Supplementary Table 3**.

4. Discussion

In the present study, the incidence of OHCA of cardiac origin increased, and the total number of OHCAs reached over 780,000 during the observation period in Japan. The consumption of carbonated beverages also increased from 2005 to 2011, and the population in northern Japan tended to consume more carbonated beverages. Although we found a significant positive relation between the consumption of carbonated beverages and the age-adjusted incidence of OHCA of cardiac origin, similar associations were not seen for the consumption of green tea, tea, milk, fermented milk beverages, coffee, cocoa, juice or mineral water. Epidemiological data have shown unequivocally that an increased intake of soft drinks is associated with metabolic syndrome, CVD and stroke [10]-[12]. In our study, however, only the consumption of carbonated beverages was significantly and positively correlated with the incidence of OHCA of cardiac origin. As far as we know, this study is the first to demonstrate an association between the consumption of carbonated beverages and OHCA of cardiac origin.

Previous studies have demonstrated that the consumption of carbonated beverages and other soft drinks was positively associated with increases in blood sugar, insulin, triglyceride and low-density lipoprotein cholesterol, and these metabolic abnormalities promoted CVD [3]-[8] [10]-[12]. In our study, however, only carbonated beverages, and not the other beverages, were positively correlated with the age-adjusted incidence of OHCA of cardiac origin. Thus, our results did not completely agree with the results of previous studies. Although it is still unclear why and how only the consumption of carbonated beverage was positively associated with the age-adjusted incidence of OHCA of cardiac origin, one possible explanation is that the acid contained in carbonated beverages might play an important role in this association. Some previous papers have shown that an increased risk of CVD was associated with the intake of not only soft drinks, but also diet drinks [22] [23]. In these studies, an increase in sugar intake was shown to be related to an increase in metabolic abnormalities and to promote CVD, while other factors might also play important roles in promoting CVD. In one report, carbonated drinks were associated with a reduced telomere length in leukocytes, which is related to the cell cycle and cell aging [24]. In addition, there was no association between non-carbonated soft drinks and telomere length. This suggests that carbonated acid might promote atherosclerosis through its association with cell aging. Therefore, we thought that the acid in carbonated beverages might play an important role in promoting atherosclerosis, and lead to the increase in the age-adjusted incidence of OHCA of cardiac origin observed in our study.

According to previous reports, the consumption of green tea and coffee is significantly and negatively associated with the incidence of CVD [13]-[15]. In our study, green tea and coffee did not show a significant negative correlation with the age-adjusted incidence of OHCA of cardiac origin. Thus, our results did not completely correspond with these previous reports. There are several possible explanations for this discrepancy. First, the consumption of these beverages was expressed in terms of money spent and this may not accurately reflect their actual consumption. Second, not all cases of OHCA of cardiac origin are caused by CVD based on atherosclerosis. Since the OHCA database we used included all age groups in Japan, some cases may have been due to some other heart disease, such as arrhythmia or congenital heart disease, which are often observed in younger patients [25]. In addition, some papers have reported that fermented milk beverages had a positive impact on blood pressure [26]-[28]. Inconsistent with these findings, fermented milk beverages tended to increase the age-adjusted incidence of OHCA of cardiac origin in our study. Further studies will be needed to clarify whether these drinks actually increase the risk and incidence of OHCA of cardiac origin.

5. Limitations

Since this was an ecological study and the baseline characteristics in these surveys are different, we need to consider an ecological fallacy, and thus the results may not be completely accurate. In addition, an ecological study is an epidemiologic analysis in which the units of analysis are populations or groups of people rather than individuals. The results of this group study are suggestive, and are insufficient to prove any associations. Further individual studies will be needed to check these results. The data on the average consumption of various beverages

in the 47 prefectures of Japan only included information for the respective prefectural capitals. However, this information should reflect the characteristics of the prefectures. Furthermore, the results were estimated from data on consumer spending rather than from a dietary questionnaire. Family Income and Expenditure Survey does not provide a detailed classification of carbonated beverages. Other confounding factors, such as the climate or lifestyle in the 47 prefectures, should also be considered.

6. Conclusion

In Japan, the consumption of carbonated beverages may be associated with the risk of OHCA of cardiac origin, although further individual studies will be needed to confirm this association.

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Conflict of Interest

None declared.

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Supplementary

Table 1. The Japanese model population in 1985.

age group	standard population
age	number
0 - 4	8,180,000
5 - 9	8,338,000
10 - 14	8,497,000
15 - 19	8,655,000
20 - 24	8,814,000
25 - 29	8,972,000
30 - 34	9,130,000
35 - 39	9,289,000
40 - 44	9,400,000
45 - 49	8,651,000
50 - 54	7,616,000
55 - 59	6,581,000
60 - 64	5,546,000
65 - 69	4,511,000
70 - 74	3,476,000
75 - 79	2,441,000
80 - 84	1,406,000
85 -	784,000
total	120,287,000

Table 2. The using parameters in 47 prefectures of Japan.

Prefecture	Age-adjusted incidence of OHCA of cardiac origin	Age-adjusted incidence of OHCA of non-cardiac origin	Carbonated beverage, yen/person*year	Green tea, yen/person*year	Tea, yen/person*year	Coffee, yen/person*year	Cocoa, yen/person*year	Juice, yen/person*year	Fermented milk beverage, yen/person*year	Milk, yen/person*year	Mineral water, yen/person*year
Hokkaido	0.0004606	0.0004944	1486	1477	270	1976	145	3332	1070	390	728
Aomori	0.0005856	0.0004809	1471	1215	178	1840	137	4763	1202	421	365
Iwate	0.0005466	0.0004553	1115	1745	220	2276	175	3462	1194	433	443
Miyagi	0.0005565	0.000468	1112	2133	308	2139	176	4403	939	492	1206
Akita	0.0004981	0.0005316	1136	2031	245	1873	153	3076	1180	404	681
Yamagata	0.0005091	0.0005086	1272	1437	260	1684	177	3330	1125	386	829
Hukushima	0.0006114	0.0003753	1149	1605	211	1663	149	3087	1381	456	925
Ibaraki	0.0005185	0.000504	1038	2109	370	1843	163	3490	1274	426	1332
Tochigi	0.0005905	0.0004814	1243	1888	408	1683	148	3489	1312	548	1138
Gunma	0.0004955	0.0004883	1064	2278	330	1563	186	2943	2239	409	761
Saitama	0.0005358	0.0004273	1145	2905	414	1805	192	4369	1174	591	1730
Chiba	0.0005127	0.0004345	1239	2336	317	1849	183	4349	1292	530	1484
Tokyo	0.0005608	0.0005541	1129	2143	503	1786	161	3576	951	411	1646
Kanagawa	0.0005521	0.0004861	1108	2034	476	2000	175	3846	934	428	1284
Niigata	0.0004328	0.0005743	948	1757	260	1858	168	2913	1053	435	594

Continued

Toyama	0.0003781	0.0005139	1029	1100	215	1742	178	3683	897	449	604
Ishikawa	0.0003782	0.0004636	956	1461	242	2198	163	2994	1181	488	755
Fukui	0.0003653	0.0004822	924	1015	160	1550	154	2912	799	395	781
Yamanashi	0.0005559	0.000459	1068	1473	221	1406	151	3216	1336	420	933
Nagano	0.0004195	0.000569	786	1786	260	1551	137	2650	1210	377	832
Gifu	0.0005773	0.0004591	921	1101	221	1830	155	2793	1462	372	815
Shizuoka	0.0004426	0.0005508	826	3481	221	1263	125	2776	1257	369	1032
Aichi	0.0005879	0.0004292	945	1536	321	1644	155	3821	943	383	1228
Mie	0.0005466	0.0005246	695	1597	256	1688	120	2681	1122	364	787
Shiga	0.0004315	0.0004709	951	1303	276	1940	162	3136	924	409	891
Kyoto	0.0004978	0.0004048	937	2021	369	2411	141	2985	858	449	903
Osaka	0.0005424	0.0003749	962	1347	266	1764	125	3448	998	451	1141
Hyogo	0.0004336	0.0004313	874	1656	573	2076	131	3565	1011	401	1140
Nara	0.0004979	0.0002862	757	1748	402	2223	144	3080	1222	424	846
Wakayama	0.0004062	0.0005817	843	946	228	1982	120	2895	1294	422	876
Tottori	0.0005636	0.000406	1068	1421	198	2306	162	3377	1097	508	680
Shimane	0.0004887	0.0005206	1078	2705	277	1980	150	3195	1243	609	798
Okayama	0.0004128	0.0004498	919	788	262	1849	175	3082	1159	504	614
Hiroshima	0.0003449	0.0004262	931	949	285	1997	162	4324	844	536	1328
Yamaguchi	0.0003955	0.0004375	1531	1012	332	2031	200	2798	1107	502	782
Tokushima	0.000357	0.0004147	1284	1437	246	2172	120	3633	1424	600	1176
Kagawa	0.0004015	0.0004306	1110	1259	351	2146	140	3544	860	511	1107
Ehime	0.0005081	0.000401	1048	1101	249	1989	153	3834	1268	401	1150
Kouchi	0.0003903	0.0005049	1028	778	243	1734	135	3334	1313	943	975
Fukuoka	0.0003212	0.0005385	790	1968	368	1808	116	3984	804	371	1124
Saga	0.0003375	0.0004964	1428	2450	177	1530	190	3349	1237	606	1005
Nagasaki	0.0003563	0.0004495	808	2756	259	1510	136	2979	979	415	1109
Kumamoto	0.0004102	0.0004214	1127	2252	203	1414	123	2332	1045	389	486
Oita	0.0003719	0.0004139	849	2184	275	1578	148	3748	790	442	965
Miyazaki	0.0003687	0.000473	961	2380	149	1132	109	3157	1063	432	1095
Kagoshima	0.0004	0.0004503	722	2393	236	1336	155	3416	1410	414	1189
Okinawa	0.000527	0.000552	1192	666	209	1358	210	2729	1103	359	1442

Table 3. The variability of using parameters in 47 prefectures of Japan.

Variability	Age-adjusted incidence of OHCA of cardiac origin	Age-adjusted incidence of OHCA of non-cardiac origin	Carbonated beverage, yen/person*year	Green tea, yen/person*year	Tea, yen/person*year	Coffee, yen/person*year	Cocoa, yen/person*year	Juice, yen/person*year	Fermented milk beverage, yen/person*year	Milk, yen/person*year	Mineral water, yen/person*year
Average	0.00046771	0.00046919	1042.62228	1726.8696	283.402047	1807.93605	153.851616	3359.11319	1139.99348	456.918416	973.087874
Median	0.00048865	0.00046801	1037.923	1655.61319	260.131206	1830.09361	153.025736	3332.24133	1124.66504	426.259499	932.648286
VAR.S	6.86E−09	3.51E−09	39228.3051	381154.072	7986.07641	84092.8392	553.336313	274215.509	59003.7174	9779.91365	89658.2569
VAR.P	6.71E−09	3.44E−09	38393.6603	373044.411	7816.15989	82303.6298	541.5632	268381.137	57748.3192	9571.83038	87750.6344
STDEVA	8.28E−05	5.92E−05	198.061367	617.376767	89.36485	289.987653	23.5231017	523.655907	242.906808	98.8934459	299.429886