Tea consumption and cognitive impairment and decline in older Chinese adults

Tze-Pin Ng, Lei Feng, Mathew Niti, Ee-Heok Kua, and Keng-Bee Yap

ABSTRACT

Background: Laboratory research suggests that tea has potential neurocognitive protective effects, but this is not established in humans.

Objective: We aimed to examine the relation between tea intake and cognitive impairment and decline.

Design: Among community-living Chinese adults aged ≥55 y in the Singapore Longitudinal Ageing Studies cohort, we measured tea consumption at baseline and 1–2 y later. Cognitive impairment was defined as an MMSE score ≤ 23 and cognitive decline as a drop in MMSE score of ≥1 point. We performed cross-sectional analysis of baseline data from 2501 participants and longitudinal analysis of data from 1438 cognitively intact participants. Odds ratios (ORs) of association were calculated in logistic regression models that adjusted for potential confounders.

Results: Total tea intake was significantly associated with a lower prevalence of cognitive impairment, independent of other risk factors. Compared with the ORs for rare or no tea intake, the ORs for low, medium, and high levels of tea intake were 0.56 (95% CI: 0.40, 0.78), 0.45 (95% CI: 0.27, 0.72), and 0.37 (95% CI: 0.14, 0.98), respectively (P for trend < 0.001). For cognitive decline, the corresponding ORs were 0.74 (95% CI: 0.54, 1.00), 0.78 (95% CI: 0.55, 1.11), and 0.57 (95% CI: 0.32, 1.03), respectively (P for trend = 0.042). These effects were most evident for black (fermented) and oolong (semi-fermented) teas, the predominant types consumed by this population. In contrast, no association between coffee intake and cognitive status was found.

Conclusion: Regular tea consumption was associated with lower risks of cognitive impairment and decline.

INTRODUCTION

Tea drinking originated in China around 4000–5000 y ago. Today, 3 billion cups of tea are consumed every day by millions of people all over the world. All varieties and cultivars of the tea plant belong to a single species, Camellia sinensis (1). The most widely used classification of tea of biological and health relevance is based on the degree of fermentation and oxidation of polyphenols in fresh tea leaves. Although 6 types of teas are distinguished, including flower-scented and reprocessed tea (2), the 3 main types of tea are black tea (fully fermented), oolong tea (semi-fermented), and green tea (nonfermented). Black tea accounts for ≈72% of the world’s total tea production.

During the fermentation process, 2 groups of polyphenol compounds, theaflavins and thearubigins, are formed as a result of enzymatic oxidation by polyphenol oxidase of catechins (2). Therefore, the content of tea polyphenols differs for each tea because of the different degrees of fermentation during manufacture, as well as differences in place of origin and plant cultivars. Besides tea polyphenols, tea leaf contains theanine, caffeine, and other chemical components.

In recent decades, experimental and epidemiologic studies have associated tea with a wide variety of health benefits, such as the prevention of cardiovascular diseases (3–5), cancer (6–8), and mortality (9). Although the findings are somewhat inconsistent, most appear to support tea’s favorable effects. Nonhuman experimental data suggest that tea has neuroprotective effects (10–12). Recently, a cross-sectional study in an elderly Japanese population observed that higher consumption of green tea but not of black or oolong tea was associated with a lower prevalence of cognitive impairment (13). No study has yet supported or refuted this finding. In the present study, we analyzed cross-sectional and longitudinal data of a population cohort of older Chinese adults in the Singapore Longitudinal Ageing Studies (SLAS) to determine the association between the levels of tea intake and cognitive impairment and cognitive decline and to explore possible differential effects of specific types of tea.
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Cognitive function was assessed by the MMSE (14), which measures global cognitive functioning in domains that included memory, attention, language, praxis, and visuospatial ability; we used the Chinese version of the MMSE that was externally validated for local use in another study population of older Singaporean adults (15). The MMSE was coded according to previous conventions: items were coded as zero if the subjects refused or were unable to complete. Summed scores from the MMSE ranged from 0 to 30; higher values denote better cognitive functioning. Cognitive impairment was defined by an MMSE total score of ≤23, which was previously shown to have high sensitivity (95.5%) and specificity (83.5%) for detecting cases of dementia in older Singaporean Chinese adults. Cognitive decline was defined as a drop of ≥1 point in the MMSE total score during the interval between baseline assessment and follow-up reassessment.

Tea intake

Detailed information on tea consumption was collected at baseline. The questions were designed according to habitual intake of common types of teas among local elderly by using indigenous references and terms: Ceylon or English tea, Chinese tea, and green tea. Ceylon or English tea is black tea from South Asia (India and Sri Lanka). These black teas are usually consumed with sugar and milk. Chinese tea includes both Chinese black tea and Chinese oolong tea, and it is almost always drunk without sugar or milk.

The frequency of consumption of each type of tea was coded as 0 through 6: never or rarely, <1 cup/wk, ≥1 cup/wk but <1 cup/d, 1–2 cups/d, 3–5 cups/d, 6–9 cups/d, and ≥10 cups/d, respectively. One cup was defined as ≈215 mL, the standard serving size in local cafes. A subject was classified as tea non-drinker if the sum of the 3 scores equalled zero. Low, medium, and high intakes were defined as summed scores from 1 to 3, from 4 to 6, and ≥7, respectively. For example, if a subject drank <1 cup English (black) tea /wk (coded as 1) or 1–2 cups Chinese black or oolong tea /d (coded as 3), and never drank green tea (coded as 0), the summed score was 1 + 3 + 0 = 4, and the respondent was classified in the medium tea intake group.

Other data

Related data collected at baseline included sociodemographic variables (ie, age, sex, and education), substance use (ie, cigarette smoking and alcohol consumption), coffee consumption, vegetable and fruit consumption (“Do you eat a lot of vegetables and fruits—at least one serving a day?”), fish consumption (“Do you eat a lot of fish—>3 times a week”), medical conditions, weight, height, blood pressure, and fasting blood glucose. The Geriatric Depression Scale (GDS) (16), which was validated locally (17), was administered as a measure of depression. APOE genotyping was identified by polymerase chain reaction (PCR) amplification followed by restriction endonuclease digestion of the PCR product (PCR–RFLP) (18).

Physical activities were measured by the frequency (0 = never, 1 = sometimes, or 2 = often) with which the respondents engaged in fitness activities such as physical exercise routines, walking, active sports or swimming, and tai chi. Social and productive activities were measured by the frequency (0 = never, 1 = sometimes, or 2 = often) with which the respondents engaged in social activities and productive activities. Social activities included attending religious services, visiting cinemas, restaurants, and sports events, day or excursion trips, playing cards or games, joining in senior citizen club activities, and participating in social group activities, including karaoke and line dancing. Productive activities included hobbies such as gardening, painting, preparing meals, shopping, paid or unpaid community work, and other employment or business. Both the continuous variable (the summed score) and the categorical variable (low, medium, and high level) were created for physical activities and social or productive activities.

Statistical analysis

Differences in characteristics among 4 groups defined by levels of tea intake were evaluated by using a chi-square test (for dichotomous variables) or analysis of variance (for continuous variables). We used hierarchical logistic regression modeling techniques to examine the relation between tea intake and cognitive impairment. The base model (model 1) included levels of tea intake (never, low, medium, or high) as the sole variable. Subsequent models accumulated additional covariates: age, sex, and education (model 2); smoking, alcohol consumption, BMI (continuous), and hypertension, diabetes, heart diseases, and stroke (model 3); and depression, APOE ε4, physical activities (as categorical variable), social and productive activities (as categorical variable), vegetable and fruit consumption (≥1 serving/d), fish consumption (>3 times/wk), and daily coffee consumption (model 4). Hypertension was defined as systolic blood pressure of >140 mm Hg or diastolic blood pressure of >90 mm Hg or a history of treatment for hypertension. Diabetes mellitus was defined as a fasting blood glucose concentration of ≥7.0 mmol/L or a history of treatment for diabetes mellitus. Depression was defined as a GDS total score ≥5.

In the longitudinal data analysis, participants with an MMSE score ≤23 at baseline were excluded. In multiple logistic regression models for cognitive decline (defined as a drop of ≥1 point in the MMSE total score), we also adjusted for baseline MMSE total score and the interval between baseline and follow-up.

To explore the differential effects of types of tea on cognitive status, we created 3 categories of tea consumption (tea non-drinker, black or oolong tea drinker, and green tea drinker) and repeated multiple logistic regressions with control for all covariates as above. Because only a small number of participants drank purely green tea (n = 10), a green tea drinker was defined as a
participant who consumed green tea with or without black or oolong tea, whereas a black or oolong tea drinker was defined as a participant who consumed black or oolong tea but no green tea.

In detailed analyses examining the dose-effect relation between the intake of black or oolong tea or green tea with cognitive impairment and cognitive decline, we classified the frequency of each type of tea consumption into 3 groups: never or rarely, occasionally, and daily. For example, a respondent was classified as a daily black or oolong tea drinker if he or she consumed either English black or Chinese black or oolong tea daily and as a black or oolong tea nondrinker if he or she never or rarely drank English black or Chinese black or oolong tea; the rest were grouped as occasional black or oolong tea drinkers. For contrast, we also examined the relation between coffee intake (never or rarely, occasionally, or daily) and cognitive status.

Interactions between tea intake and sex and age were tested through the addition of cross-product terms to the regression model. The results are also presented for stratified analyses by sex and age (<75 y and ≥75 y). All the statistical tests were 2-sided, and \( P < 0.05 \) was regarded as significant. All data analysis was conducted with the use of SPSS software (version 15.0; SPSS Inc, Chicago, IL).

RESULTS

Nearly one-half of the 2501 study participants consumed Chinese black or oolong tea; \( \approx 40\% \) drank English black tea. Less than 24\% of the study population habitually consumed green tea, and the proportion of daily consumers was <7\% (Table 1). There were 954 participants (38.1\%) who never or rarely consumed any tea—358 purely English black tea drinkers and 345 purely Chinese black or oolong tea drinkers—whereas the number of purely green tea drinkers was only 10. The rest had mixed tea consumption habits (Table 1). Cognitive impairment was present at baseline in 307 (12.3\%) of the participants.

Compared with those who were not assessed at follow-up, those who were assessed at follow-up were older (mean age at baseline: 64.60 and 65.26, respectively; \( P = 0.036 \)) and more likely to be female (58.1\% and 64.0\%, respectively; \( P = 0.007 \)), but there were no significant differences in education level (primary and below: 47.6\% and 47.3\%, respectively; \( P = 0.90 \)); total tea intake (summed score: 2.52 and 2.48, respectively; \( P = 0.73 \)); proportions of black or oolong tea consumption (\( P = 0.62 \)), green tea consumption (\( P = 0.93 \)), or type of tea consumption (\( P = 0.62 \)); or baseline MMSE total score (27.93 and 27.98, respectively; \( P = 0.50 \)). Among 1438 cognitively unimpaired participants who were followed up, 461 (32.1\%) showed cognitive decline as evidenced by a drop of \( \geq 1 \) point in the MMSE score (\( \bar{x} \pm SD \) drop: 1.94 \pm 1.27 points).

In univariate analysis, higher levels of total tea consumption were significantly associated with higher MMSE total scores and a lower prevalence of cognitive impairment (Table 2). However, higher tea consumption levels also were associated with younger age, lower proportions of women, higher education level, higher proportions of alcohol drinkers, and a lower prevalence of depression (Table 2). Moreover, participants who consumed more tea had higher levels of physical activities and social or productive activities, and they tended to consume more vegetables and fruit and fish.

The results of multivariate analyses after control for the confounding effects of other risk factors are shown in Table 3. A higher level of tea consumption was significantly associated with a lower risk of cognitive impairment and cognitive decline in all 4 hierarchical logistic regression models. For cognitive impairment, low, medium, and high levels of tea intake (with reference to no tea intake) showed a significant trend of lower odds ratios (ORs) of association (0.45, 0.32, and 0.14, respectively) in the base model (model 1). With sequential adjustments for potential confounders, the ORs were modified but remained statistically significant; the full model (model 4) showed a similar significant trend of lower adjusted ORs of association (0.56, 0.45, and 0.37, respectively). For cognitive decline, similar trends in the corresponding ORs in the full model (model 4) across levels of tea intake (0.74, 0.78, and 0.57, respectively) were also found (Table 3).

Compared with no tea consumption, the consumption of black or oolong tea only was significantly associated with much lower odds of association with cognitive impairment (OR: 0.55) in cross-sectional analysis and with cognitive decline (OR: 0.69) in longitudinal analysis. Notwithstanding the sparse and mixed data, the consumption of green tea (with and without black or oolong tea) was observed to be significantly associated with cognitive impairment (OR: 0.42) but not with cognitive decline (Table 4).

Further confirmatory analyses of specificity and dose-response relations with cognitive impairment and decline are shown in Table 5 as contrasted to the relations with coffee intake. The analysis by tea type was restricted to the large numbers of participants who drank black or oolong tea only and omitted the

### Table 1

**Frequency of consumption of beverages in the study population**

<table>
<thead>
<tr>
<th>Frequency of consumption by coded number</th>
<th>English black tea</th>
<th>Chinese black or oolong tea</th>
<th>Green tea</th>
<th>Coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>0: ( \equiv ) never or rarely [n (%)]</td>
<td>1506 (60.2)</td>
<td>1331 (53.2)</td>
<td>1919 (76.7)</td>
<td>544 (21.7)</td>
</tr>
<tr>
<td>1: ( \equiv ) &lt;1 cup/wk [n (%)]</td>
<td>253 (10.1)</td>
<td>344 (13.7)</td>
<td>232 (9.3)</td>
<td>121 (4.8)</td>
</tr>
<tr>
<td>2: ( \equiv ) &gt;1 cup/wk but &lt;1 cup/d [n (%)]</td>
<td>301 (12.0)</td>
<td>363 (14.5)</td>
<td>194 (7.8)</td>
<td>200 (8.0)</td>
</tr>
<tr>
<td>3: 1–2 cups/d [n (%)]</td>
<td>421 (16.8)</td>
<td>371 (14.8)</td>
<td>139 (5.6)</td>
<td>1491 (59.6)</td>
</tr>
<tr>
<td>4: 3–5 cups/d [n (%)]</td>
<td>19 (0.76)</td>
<td>81 (3.24)</td>
<td>15 (0.60)</td>
<td>141 (5.6)</td>
</tr>
<tr>
<td>5: 6–9 cups/d [n (%)]</td>
<td>1 (0.04)</td>
<td>9 (0.36)</td>
<td>1 (0.04)</td>
<td>2 (0.08)</td>
</tr>
<tr>
<td>6: ( \equiv ) \geq 10 cups/d [n (%)]</td>
<td>0 (0)</td>
<td>2 (0.08)</td>
<td>1 (0.04)</td>
<td>1 (0.04)</td>
</tr>
</tbody>
</table>

1 One cup is \( \equiv 215 \) mL. The types of tea consumed (by the number and percentage of subjects) were: None (never or rarely), 954 (38.1\%); English black tea only, 358 (14.3\%); Chinese black or oolong tea only, 345 (13.8\%); green tea only, 10 (0.4\%); English black tea + Chinese black or oolong tea, 262 (10.5\%); English black tea + green tea, 9 (0.36\%); Chinese black or oolong tea + green tea, 197 (7.9\%); English black tea + Chinese black or oolong tea + green tea, 366 (14.6\%).

relation with green tea because of the very small number of participants who drank green tea only. An increasing frequency of intake of black or oolong tea was associated with lower risks of both cognitive impairment and cognitive decline. Compared with tea nondrinkers, drinkers of black or oolong tea occasionally or daily showed significantly lower ORs of association with cognitive impairment (0.55 and 0.46, respectively) and with cognitive decline. Although our cross-sectional analysis supported an association of green tea with less cognitive impairment, this association cannot be meaningfully separated from that due to black or oolong tea, given the small numbers of those who drank green tea. Most (72%) of the Japanese study participants consumed black or oolong tea, whereas, in contrast, coffee intake was not significantly associated with either cognitive impairment or cognitive decline (Table 5).

Tests for interaction between tea intake and other risk factors in the final models were not statistically significant. In stratified analyses by sex and age (<75 y and ≥75 y), the ORs of the association of tea drinking with cognitive impairment and cognitive decline appeared to be homogeneous for both men and women and for both younger and older seniors.

**DISCUSSION**

In this large population study of community-dwelling older Chinese adults aged ≥55 y, we found that more frequent tea consumption of all kinds was associated with a lower risk of both cognitive impairment and cognitive decline. The association was particularly clearly evident for black or oolong tea, which was the predominant type of tea consumed.

Although the possible cognitive protective effect of tea has been reported in experimental animal models (19–21), it was only recently that one other human study reported an association of higher green tea consumption with a lower prevalence of cognitive impairment in elderly Japanese (13). However, the cross-sectional design of that study limits inference of a temporal causal relation. The present study included both cross-sectional and longitudinal analyses and thus provides stronger support of a temporal relation.

The present study agrees with the Tsurugaya Project study (13), which reported an inverse association of green tea drinking with cognitive impairment. We found an inverse association of black or oolong tea drinking with both cognitive impairment and cognitive decline. Although our cross-sectional analysis supported an association of green tea with less cognitive impairment, this association cannot be meaningfully separated from that due to black or oolong tea, given the small numbers of those who drank green tea only.

There is a great difference in tea drinking habits between the 2 study populations in Singapore and Japan. The elderly Chinese in this population consume vastly more black and oolong tea than green tea. Most (72%) of the Japanese study participants consumed >2 cups green tea/d (1 cup was defined as 0.215 L), whereas, of our Chinese population, only 6.28% consumed ≥1 cup green tea/d (1 cup defined as 0.215 L). The frequency of tea consumption appeared to be more heterogeneous among elderly Chinese than among elderly Japanese. Whereas it was possible in the present study to define a sizeable reference exposure group of tea nondrinkers, the reference exposure group in the Japanese study was constituted of those who consumed <3 cups tea/wk, probably because few if any Japanese were not tea drinkers. These limits direct comparisons of results between the 2 studies.

The underlying mechanisms of the neuroprotective effect of tea are complex. Possible mechanisms regarding tea catechins,
## TABLE 3
Associations of levels of consumption of tea (of all types) with cognitive impairment and cognitive decline

<table>
<thead>
<tr>
<th>Cross-sectional association with cognitive impairment by tea intake</th>
<th>Longitudinal association with cognitive decline by tea intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>None ((n = 954))</td>
<td>Low ((n = 868))</td>
</tr>
<tr>
<td>Whole sample ([n \text{ (%)}])</td>
<td>182 (19.1)</td>
</tr>
<tr>
<td>OR (95% CI) Model 1</td>
<td>1</td>
</tr>
<tr>
<td>Model 2</td>
<td>1</td>
</tr>
<tr>
<td>Model 3</td>
<td>1</td>
</tr>
<tr>
<td>Model 4</td>
<td>1</td>
</tr>
</tbody>
</table>

Stratified analyses

**Model 4**

|  | Men | None \((n = 384)\) | Low \((n = 206)\) | Medium \((n = 153)\) | High \((n = 31)\) | Whole sample \([n \text{ (%)}]\) | 43 (30.7) | 52 (28.7) | 38 (25.2) | 14 (30.4) | 0.383 |
| --- | --- | --- | --- | --- | --- | 144 (21.1) | 64 (11.8) | 23 (7.8) | 4 (5.4) | | |
| OR (95% CI) | 1 | 0.47 (0.17,0.79) | 0.64 (0.26,1.54) | 0.15 (0.02,1.17) | 0.023 | 1 | 0.73 (0.40,1.32) | 0.72 (0.38,1.36) | 0.75 (0.31,1.79) | | |
| OR (95% CI) Women | 144 (21.1) | 64 (11.8) | 23 (7.8) | 4 (5.4) | | 139 (37.3) | 105 (33.1) | 62 (33.2) | 8 (18.6) | | |
| OR (95% CI) Age < 75 y | 112 (14.0) | 54 (7.1) | 26 (5.6) | 3 (2.1) | | 162 (35.0) | 140 (31.7) | 92 (29.9) | 20 (24.7) | | |
| OR (95% CI) Age ≥ 75 y | 70 (45.5) | 30 (28.6) | 10 (17.2) | 2 (14.3) | | 20 (40.0) | 17 (29.8) | 8 (26.7) | 2 (25.0) | | |

1. OR, odds ratio. Model 1: base model; model 2: adjusted for age, sex, and education; model 3: model 2 + smoking, alcohol consumption, BMI (continuous), hypertension, diabetes, heart disease, and stroke; and model 4: model 3 + depression, APOE ε4, physical activities, social and productive activities, vegetable and fruit consumption, fish consumption, and coffee consumption.

2. \(P\) values of statistical significance are tests of linear trends using ordinal values of tea consumption levels.

3. Longitudinal analysis was further adjusted for baseline Mini-Mental State Examination score and the interval between baseline and follow-up.
especially epigallocatechin gallate (EGCG), may involve their antioxidant and iron-chelating properties, as well as modulation of cell-signaling and cell survival pathways (10, 11). EGCG also could reduce β-amyloid generation by promoting α-secretase cleavage of amyloid precursor protein (22). As for black or oolong tea, because catechins undergo enzymatic transformation during fermentation, the amount of catechins is generally lower than in green tea (23, 24). However, the conversion of catechins to theaflavins during fermentation does not significantly alter its components possess strong antioxidative properties (24). Nevertheless, we have re-analyzed the relieving effects after caffeine withdrawal (29). The results of 2 epidemiologic studies of habitual coffee drinkers also are conflicting (30, 31). In contrast, the presence of theanine in tea appears to antagonize the undesirable effects of raised blood pressure, headache, and tiredness associated with caffeine, while enhancing the positive cognitive effects (32).

The strengths of the present study include its longitudinal design and the use of multivariate analyses to control for a large number of potentially confounding risk factors. With the large sample size and the detailed information on tea intake, it was possible to examine dose–response relations. Although tea drinkers showed a more favorable risk profile for cognitive status than did nondrinkers, the inverse association of tea drinking with both cognitive impairment and decline that was consistently found after control for these risk factors suggested that the findings were robust.

The present study had some limitations. Residual and unmeasured confounding is still possible and cannot be excluded. The MMSE has been shown to be a highly reliable and valid measure of cognitive function (33). A drop of ≥1 points over 1–2 y, commensurate with a drop of ≥2 points over a longer follow-up of 3 y in other studies (34), is considered to be a substantial decline in cognitive function that is detectable only for a strong risk factor. Hence, small effects on cognitive decline may not be detected with the MMSE (33). The use of an MMSE cutoff of ≤23 to identify cognitively impaired subjects may include those with dementia, in whom tea drinking could be underestimated, which may bias the results of cross-sectional association with cognitive impairment. Nevertheless, we have re-analyzed the

### TABLE 4

<table>
<thead>
<tr>
<th>Cross-sectional association with cognitive impairment at baseline in whole sample by type of tea</th>
<th>Longitudinal association with cognitive decline among 1438 participants without baseline cognitive impairment by type of tea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No tea</strong> (n = 954)</td>
<td><strong>Black and oolong tea only</strong> (n = 965)</td>
</tr>
<tr>
<td><em>n</em> (%)</td>
<td>182 (19.1)</td>
</tr>
<tr>
<td><strong>OR (95% CI)</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

**Stratified analyses**

<table>
<thead>
<tr>
<th><strong>Men</strong></th>
<th><strong>Women</strong></th>
<th><strong>Age &lt; 75 y</strong></th>
<th><strong>Age ≥ 75 y</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n (%)</strong></td>
<td>38 (14.0)</td>
<td>144 (21.1)</td>
<td>70 (45.5)</td>
</tr>
<tr>
<td><strong>OR (95% CI)</strong></td>
<td>1</td>
<td>0.48 (0.24, 0.95)</td>
<td>0.036</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>0.001</td>
<td>0.06</td>
<td>0.036</td>
</tr>
</tbody>
</table>

1. OR, odds ratio. ORs were adjusted (model 4) for age, sex, education, smoking, alcohol consumption, BMI (continuous), hypertension, diabetes, heart disease, stroke, depression, APOE ε4, physical activities, social and productive activities, vegetable and fruit consumption, fish consumption, and coffee consumption. In the longitudinal analysis, the ORs were further adjusted for baseline Mini-Mental State Examination scores and the interval between baseline and follow-up. *P* values were based on the Wald test.

2. *n* = 461.

3. Consumption of English black tea or Chinese black and oolong tea (or both) but not of green tea.

4. Consumption of any green tea, with or without black or oolong tea.
The potential effect of tea drinking in protecting against the cognitive decline of advanced age thus has great significance, given the rapid aging of the population and the rising prevalence of vascular and Alzheimer-type dementia. Because tea is cheap, nontoxic, and widely consumed, it has a huge potential effect in promoting cognitive health and perhaps delaying the onset of dementia. Further studies should investigate whether tea consumption lessens the risk of vascular and Alzheimer-type dementia.

In conclusion, regular consumption of tea, particularly black or oolong tea, was associated with lower risks of cognitive impairment and cognitive decline. Further studies should confirm this association and investigate its potential in lessening the risk of dementia.

The authors’ responsibilities were as follows—LF: conducted the literature review and statistical data analysis and drafted and revised the manuscript; T-PN: conceptualized and designed the study, formulated the hypothesis, reviewed statistical analysis and results, and drafted and revised the
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manuscript; EHK, MN, and KBY: participated in the study design, interpretation of the results, and review of the manuscript. None of the authors had a personal or financial conflict of interest. No commercial company sponsored or played any role in the design and methods of the study, subject recruitment, data collection and analysis, or preparation of the manuscript.

REFERENCES