

Association between Tub Bathing Frequency and Onset of Depression in Older Adults: A Six-Year Cohort Study from the JAGES Project

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Abstract

Background: The traditional Japanese style of soaking in a hot bath is a lifestyle custom for many citizens, no study had ever investigated the association between bathing as a lifestyle practice and the onset of long-term depression. Through a large-scale six-year longitudinal study, we aimed to determine whether tub bathing as a lifestyle custom plays a role in preventing the onset of long-term depression.

Methods: Of 11,882 individuals who responded to surveys conducted in 2010 and 2016 as part of the Japan Gerontological Evaluation Study (the JAGES) project, we analyzed 6,452 and 6,465 individuals for whom information was available regarding summer bathing frequency and winter bathing frequency, respectively; all of these individuals were independent, had a Geriatric Depression Scale (hereafter, "GDS") score of ≤ 4 , and did not suffer from depression. The cohort study involved dividing participants into a group of those who bathed 0–6 times a week and a group of those who bathed ≥ 7 times a week and determining the percentages of individuals who developed depression based on their GDS scores six years later. Multiple logistic regression analysis was performed to determine odds ratios for the association between depression onset and tub bathing.

Results: For individuals who tub bathed ≥ 7 times a week, the odds ratios for depression onset versus individuals who bathed 0–6 times a week in summer and winter were 0.84 (95% confidence interval, 0.64–1.10) and 0.76 (95% confidence interval, 0.59–0.98), respectively. Tub bathing ≥ 7 times a week in winter significantly reduced the risk of depression onset.

Conclusions: New-onset depression was shown to be infrequent in older adults who bathe in a tub frequently. Tub bathing was suggested to potentially contribute to the prevention of depression in the elderly.

Key words: bathing, depression, older adults, cohort study, JAGES

I Introduction

In older adults, depression is known not only to di-

minish vital functions but also to be a risk factor for dementia and cardiovascular disease^{1),2)}. These results of depression not only reduce quality of life but also

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increase outcomes such as the need for long-term care as well as death³. Therefore, preventing depression in older adults is a major public health concern.

Japanese-style bathing, which involves soaking one's entire body thoroughly in hot water in a bathtub, is a traditional Japanese lifestyle practice that many Japanese people continue to enjoy^{4,5}. However, research has not yet sufficiently determined how bathing as a lifestyle practice affects health. Although previous studies have reported that frequent tub bathing is associated with high self-rated health⁶ and that older adults who tub bathe frequently are less likely to subsequently require long-term care insurance⁷, the underlying mechanism has not been determined. In a cross-sectional study, tub bathing frequency was reported to be negatively associated with depression⁸. A small-scale interventional study has also reported that hyperthermic baths improve depression⁹.

As part of the Japan Gerontological Evaluation Study (JAGES)¹⁰, the present large-scale six-year longitudinal study was conducted to assess the association between tub bathing frequency and subsequent onset of depression in older adults.

II Material and Methods

1. Participants

The initial pool of participants consisted of 11,882 community-dwelling adults aged ≥ 65 years living in 14 municipalities in seven prefectures throughout Japan who had not been certified as requiring long-term care and had provided valid responses to the JAGES 2010 and 2016 surveys, the former of which included questions regarding bathing habits. Of these 11,882 individuals, those who met the following criteria were included in the present study: 1) independent in activities of daily living as of the 2010 survey, 2) Geriatric Depression Scale (GDS)¹¹ score ≤ 4 as of the 2010 survey, and 3) no missing data on questions regarding bathing frequency as of the 2010 survey. A total of 6,452 individuals (mean age (standard deviation, SD) 73.4 (5.8) years; 3,129 men and 3,323 women) and 6,465 individuals (73.4 (5.8) years; 3,126 men and 3,339 women) were included in the analyses for summer bathing and winter bathing, respectively.

2. Survey method

Panel data were prepared via linkage of the 2010 survey (hereafter, the primary survey) and the 2016 survey (hereafter, the secondary survey) and used to examine new-onset depression.

3. Objective variable

Participants with an overall GDS score of ≥ 5 on the secondary survey were defined as having developed depressive tendencies (hereafter, "depression"). In the event of missing responses on the GDS, a total score of ≥ 5 on questions without missing responses was defined as depression.

4. Explanatory variables

On the primary survey, participants were asked about their weekly tub bathing frequency in summer and winter. For summer and winter, respectively, participants were divided into two groups: those who responded 0–6 times a week (low-frequency group) and those who responded ≥ 7 times a week (high-frequency group). These groups were used as the explanatory variables.

5. Covariates

The following participant background factors in the primary survey were treated as covariates: age, sex, undergoing disease treatment (yes/no), alcohol consumption (yes/never/quit ≥ 5 years ago/quit ≤ 4 years ago/current smoker), marital status, years of education, and equivalent income. Responses for marital status consisted of "married", "divorced/widowed", and "single/other". Equivalent income was divided into three levels: 1) <JPY 2 million/year, 2) JPY 2 million to <4 million/year, 3) \geq JPY 4 million/year. Years of education was divided into five levels: 1) <6 years, 2) 6–9 years, 3) 10–12 years, 4) ≥ 13 years, and 5) other (uncountable, etc.).

6. Analysis methods

Descriptive statistics were determined for each background factor (covariate) at the time of the primary survey in the low- and high-frequency groups for both summer and winter. All background factors except for age were compared between bathing groups with the chi-square test, while age was compared with the independent-samples *t*-test. Next, following univariate analysis with the chi-square test by asymptotic significance probability (two-sided), we performed multivariate analysis with multiple logistic regression analysis to calculate the odds ratios (OR) and 95% confidence intervals (95% CI) for the onset of depression. Age, sex, undergoing disease treatment, alcohol consumption, smoking, marital status, years of education, and equivalent income were used as covariates. As for adjustment factors, age was input as a numerical value as is, while all other factors were input as categorical variables. As for equivalent income, if there were any missing data for a participant's adjustment factors, they

were classified as the “missing data group” for analysis. Differences of $P < 0.05$ (two-sided) were considered statistically significant. Odds ratios and ϕ were calculated as effect sizes. All statistical analyses were performed with SPSS ver. 28 (IBM Corp., Armonk, NY).

7. Ethical considerations

Ethical approval for the study was obtained from the Ethics Committee at Chiba University (Approval number: 2493), the National Center for Geriatrics and Gerontology (Approval number: 992), and Nihon Fukushi University (Approval number: 10-05). All individuals enrolled in the baseline survey were informed that their participation in the study was voluntary and that completion and return of the questionnaire indicated their consent to participate.

III Results

Table 1 shows the participant background factors for the summer and winter bathing frequency groups at the time of the primary survey. In the summer high-frequency group, many participants were non-smokers and married, while few were low income. In the winter high-frequency group, the mean age was lower than in the low-frequency group, many participants were married, and few were low income.

Table 2 shows the percentages of new-onset depression as well as OR and 95% CI for the summer and winter bathing frequency groups. In summer, the percentage of new-onset depression in participants analyzed was 12.9% in the low-frequency group versus 11.2% in the high frequency group. In winter, the percentage of new-onset depression in participants analyzed was 13.9% in the low-frequency group versus 10.6% in the high-frequency group; thus, the percentage of new-onset depression in winter was significantly lower in the high-frequency group. With the winter low-frequency group as a reference, the OR for new-onset depression in the high-frequency group was 0.74 (95% CI, 0.59–0.92), $P = 0.007$ and effect size $\phi = -0.047$.

Results for the multivariate analysis adjusted for covariates were as follows. Regarding summer bathing frequency, with the low frequency group as a reference, the OR for new-onset depression in the high-frequency group was 0.84 (95% CI, 0.64–1.10). Thus, although frequent bathing in summer tended to be associated with the absence of new-onset depression, the difference was not significant. As for winter bathing frequency, with the low frequency group as a reference, the OR for new-onset depression in the high-frequency group was 0.76 (95% CI, 0.59–0.98), thus

demonstrating a statistically significantly reduced risk of depression onset in the high-frequency group.

IV Discussion

The main result of this study is that older adults who frequently bathe in a tub are less likely to develop new-onset depression. In addition, comparisons of summer and winter showed that new-onset depression was less likely in older adults who bathed in a tub more frequently in winter. These results suggested that frequent tub bathing may play a role in preventing the onset of depression in older adults and that this effect is greater in winter than in summer.

There are two possible mechanisms underlying these results. The first is regulation of the autonomic nervous system by hyperthermic action. Tub bathing increases both core and surface body temperatures¹²⁾, which improves autonomic balance¹³⁾ and thereby may contribute to preventing depression. The second is improved quality of sleep associated with tub bathing. Tub bathing has been shown to improve the quality of sleep¹⁴⁾, which may contribute to preventing depression. Seasonal depression in winter has been noted as a seasonal affective disorder¹⁵⁾. Prevalence rates of 1–9% have been reported and the causes are presumed to be reduced daylight hours and disrupted circadian rhythms¹⁵⁾. Tub bathing in winter may therefore more effectively prevent depression.

The results of this study are consistent with those of two previously-cited studies, one showing that tub bathing frequency is negatively associated with depression⁸⁾, and another small-scale interventional study showing that warm bathing improved depression⁹⁾. In addition, a cohort study has shown that older adults who bathe in a tub frequently are less likely to be certified as needing long-term care⁷⁾. Depression is a risk factor for new certification of needing long-term care³⁾, a finding which, combined with the results of the present study, suggests that tub bathing may prevent depression and consequently prevent the need for long-term care. In homes with bathtubs, tub bathing may be recommended to older adults to maintain their health.

This study has some limitations. The first is that the safety of bathing was not considered. Deaths during bathing are frequently reported in Japan, but the mechanism behind them remains largely unknown^{5),16)}. Safe bathing methods may be an important area of study going forward. The second limitation is that few other countries have a custom of daily tub bathing⁵⁾,

Table 1 Participant background factors by summer and winter tub bathing frequency.

| | Summer tub bathing frequency | | | Winter tub bathing frequency | | | P |
|--|--|--|----------|--|--|----------|--------|
| | 0-6 tub baths/week (low-frequency group) | ≥7 tub baths/week (high-frequency group) | n (%) | 0-6 tub baths/week (low-frequency group) | ≥7 tub baths/week (high-frequency group) | n (%) | |
| Participants | 1705 | 4747 | (73.6) | 2221 | 4244 | (65.6) | |
| Sex | | | | | | | |
| Male | 891 | 2238 | (47.1) | 1079 | 2047 | (48.2) | 0.790 |
| Female | 814 | 2509 | (52.9) | 1142 | 2197 | (51.8) | |
| Age | 73.8 | 73.2 | (5.8) | 74.2 | 72.9 | (5.7) | <0.001 |
| Mean (SD), years | | | | | | | |
| Undergoing disease treatment | | | | | | | |
| Yes | 1127 | 3212 | (72.7) | 1491 | 2845 | (71.8) | 0.475 |
| No | 460 | 1204 | (27.3) | 561 | 1118 | (28.2) | |
| Alcohol | | | | | | | |
| Yes | 647 | 1666 | (36.7) | 792 | 1524 | (37.6) | 0.051 |
| Previously | 71 | 116 | (2.6) | 81 | 109 | (2.7) | |
| No | 903 | 2759 | (60.8) | 1251 | 2424 | (59.7) | |
| Smoking | | | | | | | |
| Never | 846 | 2696 | (61.6) | 1181 | 2369 | (60.4) | 0.126 |
| Quit ≥5 years ago | 412 | 1039 | (23.7) | 505 | 946 | (24.2) | |
| Quit ≤4 years ago | 92 | 201 | (4.6) | 100 | 194 | (4.9) | |
| Currently smoking | 214 | 444 | (10.1) | 252 | 412 | (10.5) | |
| Marital status | | | | | | | |
| Married | 1204 | 3617 | (76.6) | 1508 | 3317 | (78.5) | <0.001 |
| Widowed | 367 | 932 | (19.7) | 536 | 774 | (18.3) | |
| Divorced | 60 | 100 | (2.1) | 84 | 77 | (1.8) | |
| Single | 35 | 58 | (1.2) | 47 | 44 | (1.0) | |
| Other | 14 | 12 | (0.3) | 15 | 11 | (0.3) | |
| Years of education | | | | | | | |
| <6 years | 42 | 58 | (1.2) | 51 | 50 | (1.2) | <0.001 |
| 6-9 years | 722 | 1984 | (42.1) | 945 | 1755 | (41.6) | |
| 10-12 years | 590 | 1765 | (37.4) | 759 | 1611 | (38.2) | |
| ≥13 years | 317 | 894 | (19.0) | 426 | 787 | (18.7) | |
| Other | 16 | 14 | (0.3) | 17 | 13 | (0.3) | |
| Equivalent income | | | | | | | |
| Low income (<JPY 2 million) | 715 | 1644 | (34.6) | 938 | 1414 | (33.3) | <0.001 |
| Moderate income (JPY 2 million-~4 million) | 587 | 1829 | (38.5) | 764 | 1675 | (39.5) | |
| High income (≥JPY 4 million) | 149 | 644 | (13.6) | 175 | 613 | (14.4) | |
| No response | 254 | 630 | (13.3) | 344 | 542 | (12.8) | |

SD:standard deviation.

Table 2 Association between tub bathing frequency and onset of depression.

| | Summer tub bathing frequency | | | Winter tub bathing frequency | | |
|------------------------------------|---|--|------------------------------|---|--|------------------------------|
| | 0–6 tub baths/week (low-frequency group) | ≥7 tub baths/week (high-frequency group) | P | 0–6 tub baths/week (low-frequency group) | ≥7 tub baths/week (high-frequency group) | P |
| | n (%) | n (%) | | n (%) | n (%) | |
| Participants analyzed | 782 | 2438 | | 992 | 2232 | |
| Depression cases | 101 (12.9) | 273 (11.2) | 0.192 | 138 (13.9) | 237 (10.6) | 0.007 |
| Univariate analysis | | | | | | |
| Odds ratio | 1 (reference) | 0.85 | 0.192 | 1 (reference) | 0.74 | 0.007 |
| (95% confidence interval) | | (0.67 – 1.09) | ϕ : -0.023 ^b | | (0.59 – 0.92) | ϕ : -0.047 ^b |
| Multivariate analysis ^a | | | | | | |
| Odds ratio | 1 (reference) | 0.84 | 0.213 | 1 (reference) | 0.76 | 0.033 |
| (95% confidence interval) | | (0.64 – 1.10) | | | (0.59 – 0.98) | |

a: adjusted for age, sex, undergoing disease treatment, alcohol consumption, smoking, marital status, years of education, and equivalent income.

b: effect size.

which hinders comparisons with other countries. Third, the influence of other unknown confounding factors needs to be considered. Our JAGES group reported that age, marital status and others are associated with the onset of depression¹⁷. It is difficult to adjust for all unknown confounders. And in this study, the participants were divided into two bathing frequency groups in summer and winter respectively on the 2010 primary survey. There is a possibility that the participant's bathing habits changed during the 6 years. This is a limitation of cohort study design. Despite these limitations, the results of the present large-scale longitudinal study conceivably provide beneficial information for preventing the onset of depression in older adults.

V Conclusions

New-onset depression was shown to be infrequent in older adults who bathe in a tub frequently. Tub bathing was suggested to potentially contribute to the prevention of depression in the elderly.

Author contributions

SH: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing-Original Draft, Funding acquisition. TO: Methodology, Software, Validation, Investigation, Writing-Review & Editing, Supervision, Funding acquisition. AY: Methodology, Software, Validation, Investigation, Writing-Review & Editing, Funding acquisition. KK: Conceptualization, Investigation, Writing-Review & Editing, Supervision, Project

administration, Funding acquisition.

Conflict of interests

The authors declare no conflict of interest.

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高齢者の浴槽入浴頻度と抑うつ発症との関連： JAGES プロジェクトによる6年間のコホート研究

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抄 録

【背景・目的】高齢者において抑うつの発症は様々な疾患のリスクとなり、要介護状態に陥るきっかけとなる。一方、日本においては浴槽の湯につかる特有の入浴法が多くの国民の生活習慣となっているが、この生活習慣としての浴槽入浴と長期的な抑うつ発症との関連は明らかではなかった。本研究は、大規模な6年間にわたる縦断研究によって生活習慣としての浴槽入浴が長期的な抑うつ発症との関連を明らかにすることを目的とした。

【方法】Japan Gerontological Evaluation Study (以下、JAGES)の一環として2010年、2016年に調査対象となった11,882人のうち、自立しておりかつGeriatric Depression Scale (以下、GDS) 4点以下で抑うつがなく、夏の入浴頻度の情報のある6,452人、および冬の入浴頻度の情報がある6,465人をそれぞれ解析した。コホート研究として週0～6回の浴槽入浴と週7回以上の浴槽入浴の各群の6年後のGDSによる抑うつ発症割合を求め、浴槽入浴との関連をロジスティック回帰分析によって年齢、性別、治療中の病気の有無、飲酒の有無、喫煙の有無、婚姻状況、教育年数、等価所得を調整して多変量解析を行いオッズ比を求めた。

【結果】週0～6回の浴槽入浴に対する週7回以上の浴槽入浴の抑うつ発症の、調整後の多変量解析によるオッズ比は夏の入浴頻度0.84 (95%信頼区間: 0.64～1.10)、冬の入浴頻度0.76 (95%信頼区間: 0.59～0.98)であり、冬に週7回以上浴槽入浴することは抑うつを発症するリスクが有意に低かった。

【結論】習慣的な浴槽入浴の温熱作用を介した自律神経のバランス調整などによる抑うつ予防作用による結果の可能性があり、健康維持のため高齢者へ浴槽入浴が勧められることが示唆された。

キーワード：浴槽入浴、抑うつ、高齢者、コホート研究、JAGES

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