Age-related changes in preference for mineral rich water

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Abstract

Age-related changes in preference for mineral rich water

Aim The purpose of the present study is to investigate whether the preference for mineral rich water changes by aging. **Methods** Eleven Japanese older adults and eleven Japanese young adults drank three kinds of water with different mineral contents (at normal temperature) twice and expressed the degree of preference from 1 to 100 and impression for each mineral water. **Results** Among older adults, the degree of preference for mineral very rich water was significantly lower than for mineral rich water and Japanese mineral water ($p < 0.05$), but there were no significant differences for mineral rich water and Japanese mineral water ($p > 0.05$). Among young adults, the degree of preference for mineral very rich water was significantly lower than for mineral rich water and Japanese water and that for mineral rich water was lower than for Japanese mineral water ($p < 0.05$). **Conclusion** These results suggest that older adults tend to like mineral rich water and young adults tend to prefer Japanese mineral water to mineral rich water.

加齢によるミネラル豊富な水に対する嗜好性の変化

目的：ミネラルが豊富な飲料水に対する評価が加齢によって変化することを検証することを目的とした。方法: 日本の高齢者と若齢者の人それぞれ１１人に常温の３種類のミネラルウォーターを二回ずつ飲用させ、それらの味に対する評価（1 から 100）と印象を質問紙によって調査した。結果: 高齢者では、ミネラルが非常に豊富な飲料水に対する評価は、ミネラルが豊富な飲料水と日本の飲料水よりも有意に低かったが ($p < 0.05$)、ミネラルが豊富な飲料水と日本の飲料水では有意な差は見られなかった ($P > 0.05$)。若齢者では、ミネラルが非常に豊富な飲料水に対する評価はミネラルが豊富な飲料水と日本の飲料水よりも有意に低く、ミネラルが豊富な飲料水の評価は日本の飲料水よりも有意に低くなった($p < 0.05$)。結論: これらの結果は、高齢者の人はミネラルが豊富な飲料水を好む傾向にあり、若齢者の人はミネラルが豊富な飲料水よりも日本の飲料水を好む傾向にある。

Edad-relacionada cambia en la preferencia pare el agua mineral rica

Objectivo El propósito del presente estudio es investigar si la preferencia por el agua mineral rica. Métodos once adultos mayores japóneses y once adultos jóvenes japóneses bebieron tres aguas minerales (temperatura normal) dos veses y expresaron el grado de preferencia de 1 a 100 y la impresión cada aguas minerales. Resultados Entre los adultos mayores, el grado de prefrencia por el agua mineral muy rica fue significativamente menor que para el agua mineral rica y el agua mineral japonesa($p < 0.05$), pero no hubo diferencias significativas para el agua mineral rica y el agua mineral japonesa($p > 0.05$). Entre los adultos jóvenes, el grado de preferencia por el agua mineral muy rica fue significativamente menor que para el agua mineral rica y el agua mineral japonesa y para el agua mineral rica fue significativamente menor que para el agua mineral japonesa($p < 0.05$). Conclusión Estos resultados sugieren que muchos adultos mayores les gusta el agua mineral rica y muchos adultos jóvenes tienden a preferir el agua mineral Japonesa al agua mineral rica

Introduction

It is well known that calcium and magnesium are essential for human body (Kožíšek,2003). Over 99% of total body calcium is found in bones and teeth, where it functions as key structural element. The remaining body calcium plays a key role in metabolism, serving as a signal for vital physiology processes, including vascular contraction, blood clotting, muscle contraction and nerve transmission. Inadequate intake of calcium increases risk of osteoporosis, nephrolithiasis, colorectal cancer, hypertension and stroke, coronary artery disease insulin resistance and obesity. Most of these disorders have treatments, but not cures (WHO, 2011). Magnesium is the fourth most abundant cation in the body and the second most abundant cation in intracellular fluid. It is a cofactor for some 350 cellular enzymes, many of which are involved in energy metabolism. It is also involved in protein and nucleic acid synthesis and is needed for normal vascular tone and insulin sensitivity. Inadequate intake of magnesium is associated with endothelial dysfunction, increased vascular reaction, elevated circulating levels of C-reaction protein and decreased insulin sensitivity. Low magnesium status has been implicated in hypertension, coronary heart disease, type 2 diabetes mellitus and metabolic syndrome (WHO, 2011).

According to the statistics of ministry of health, Labor and Welfare, many Japanese people are inadequate intake of calcium and magnesium. There is about 150mg lack of calcium and about 100mg lack of magnesium on a day (ministry of health, Labor and Welfare, 2018). This is a problem that we need to solve to live healthier.

In many countries, it's the custom to drink mineral rich water. For example, Berlin's water contains about 11.0mg calcium and 1.4mg per 100ml (Berlinar Wasserbetriebe, 2015). On the other hand, Tokyo's Water contains about 2.3mg Calcium and 0.5mg magnesium per 100ml (Bureau of Waterworks Tokyo Metropolitan

Government, 2019). In Japan, domestic mineral water tends to have less minerals than imported mineral water (ministry of health, Labor & Welfare, 2018). It is well known that domestic water is related to a country's topography and stratum (Esumi & Ohara, 1999). However, Japanese recently can easily reach mineral rich water in supermarket. Drinking mineral rich water is one of good way to increase calcium and magnesium intake because it is said that mineral rich water may important supplementary contribution to total calcium and magnesium intake (Galan, et al., 2002; Kožíšek, 2003).

Calcium chloride, magnesium chloride and magnesium sulfate were characterized by bitter taste (Lawless, et al., 2003). There is a possibility that many Japanese people doesn't favor a bitterness of mineral rich water, because Domestic mineral water have less minerals and bitterness (Esumi & Ohara, 1999). However, loss of the sense of taste with aging is well known (Toffanello, 2013). Thus, Japanese older adults may not dislike mineral rich water because of aged-related changes in sense of taste. If older adults have lower sensibility to bitterness of mineral water and they like mineral rich water, drinking it may be one of the strategies to increase calcium and magnesium intake in older adults.

The objective of this study is to investigate whether the preference for mineral rich water changes by aging. Loss in taste perception as well as distortions of gustatory function occur with greater frequency in older individuals (Schiffman, 2009). Therefore, I hypothesized that 1) older adults tend to like both Japanese mineral water and mineral rich water because it's hard to feel bitterness. 2) young adults tend to prefer Japanese mineral water to mineral rich water because they feel bitterness.

Materials and Methods

Participants

Eleven Japanese older adults (age: 79.0 ± 5.6 years) and eleven Japanese young adults(age: 21.5 ± 1.0 years) participated in this study. Experiment was conducted a few hours after meal to avoid any effect from it. All subject gave written informed consent for the study after receiving detailed explanation of the purpose, potential benefits and risks associated with participation. The major cause of hypermagnesemia is renal insufficiency associated with a significantly decreased ability to excrete magnesium. Increased intake of magnesium salts may cause a temporary adaptable change in bowel habits, but seldom causes hypermagnesemia in persons with normal kidney function (WHO,2011). They were healthy with no history of kidney disease.

Study design

This study was conducted about 30 min in the laboratory of Chukyo university. Participants drank three kinds of water with different mineral contents twice per one kind of water (total: 6 times). After drinking each water, they expressed the degree of preference and impression for each mineral water. Three kind of water was offered randomly and the order changed between first trial and second trial. They drank 30ml at one time (total: 180ml). There were at least 3-minute intervals to avoid any effect from other mineral water.

Mineral water

This study used three kinds of mineral water with different mineral contents. We selected Japanese mineral water (I LOHAS, Coca-Cola Japan Ltd., Tokyo, Japan), mineral rich water (Evian, Danone Japan Ltd., Tokyo, Japan) and Mineral very rich water (Contrex, Nestle Japan Ltd., Hyogo, Japan) that are able to buy in

general Japanese supermarket. Detailed mineral contents are shown in Table1.

Measurement

The degree of preference for each mineral water was measured by visual analog scale (VAS). Subjects marked the degree of preference for each mineral water on the 100mm line. A range of score is from 0-100 (Figure 1). 0 means dislike and 100 means really like. Also, subjects wrote the impression for each mineral water. (Figure 1)

Statistics

Each result is given as the mean and Standard deviation. The non-parametric analysis was used in this study. The degree of preference for each mineral water was confirmed using Friedman test. When there was a significant effect of types of water, degree of preference was compared between different types of mineral water by using Wilcoxon test. The level of statistical significance was set at $p < 0.05$. Statistical analyses were performed using SPSS software (version 15.0; SPSS, Tokyo, Japan).

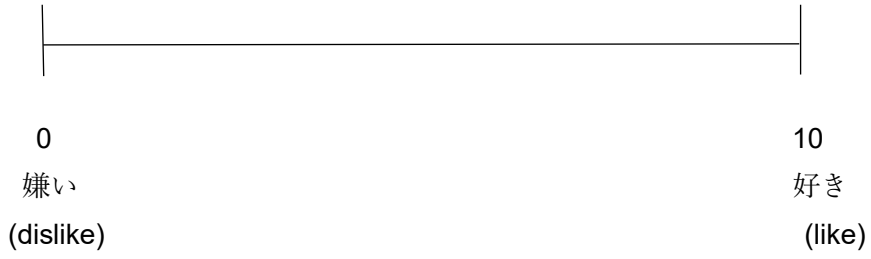
Results

Among older adults and young adults, there were no significant differences between first trial and second trial.

Among older adults, the degree of preference for mineral very rich water was significantly lower than for Japanese mineral water and mineral rich water, ($p < 0.05$) but there were no significant differences between Japanese mineral water and mineral rich water ($p > 0.05$) (Figure 2). Same results were observed in second trial.

Table 1 | Ca, Mg contents of three mineral water (per 100ml)

	I LOHAS	Evian	Contrex
Ca	0.95mg	8.00mg	46.80mg
Mg	0.30mg	2.60mg	7.45mg



コメント(impression):

Fig. 1　Visual analogue scale for measure the degree of preference.

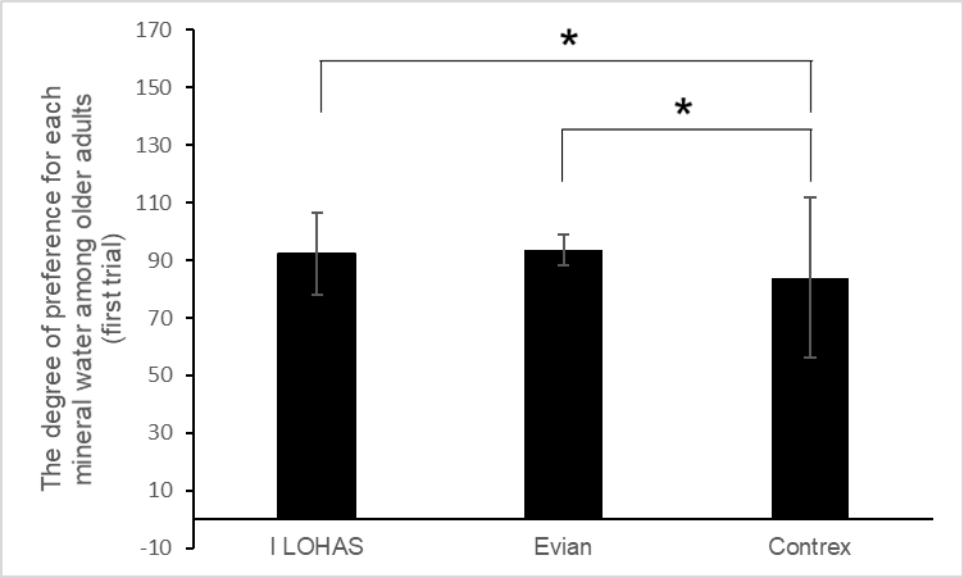


Fig. 2 The degree of preference for each mineral water among older adults (Frist trial). *$p < 0.05$

The degree of preference for all mineral water was high.

Among young adults, the degree of preference for mineral very rich water was significantly lower than for mineral rich water and Japanese water and that for mineral rich water was lower than for Japanese mineral water ($p < 0.05$) (Figure 3). There were no significant differences between first trial and second trial ($p > 0.05$) (Figure 3).

Discussion

We investigated whether the preference for mineral rich water changes by aging. The findings of present study were that in older adults the degree of preference for mineral very rich water was significant lower than for mineral rich water and Japanese mineral water ($p < 0.05$), but there were no significantly differences for mineral rich water and Japanese mineral water ($p > 0.05$) and the degree of preference for all mineral water was high (Figure 2). These results support the hypothesis 1 that many older adults tend to like both Japanese mineral water and mineral rich water. The findings of present study about young adults were the degree of preference for mineral very rich water was significantly lower than for mineral rich water and Japanese water and that for mineral rich water was lower than for Japanese mineral water ($p < 0.05$) (Figure 3). These results support the hypothesis 2 that many young adults tend to prefer to Japanese mineral water to mineral rich water.

As shown in the present study (Figure 2, 3), the degree of preference for Japanese mineral water was high both older adults and young adults. According to their impression for Japanese mineral water, they felt tasty and clean (supplementary date). These results are reasonable since Japanese mineral water have less mineral and bitterness (Esumi & Ohara, 1999), and they are accustomed to drinking it. Thus, we suggest that Japanese older

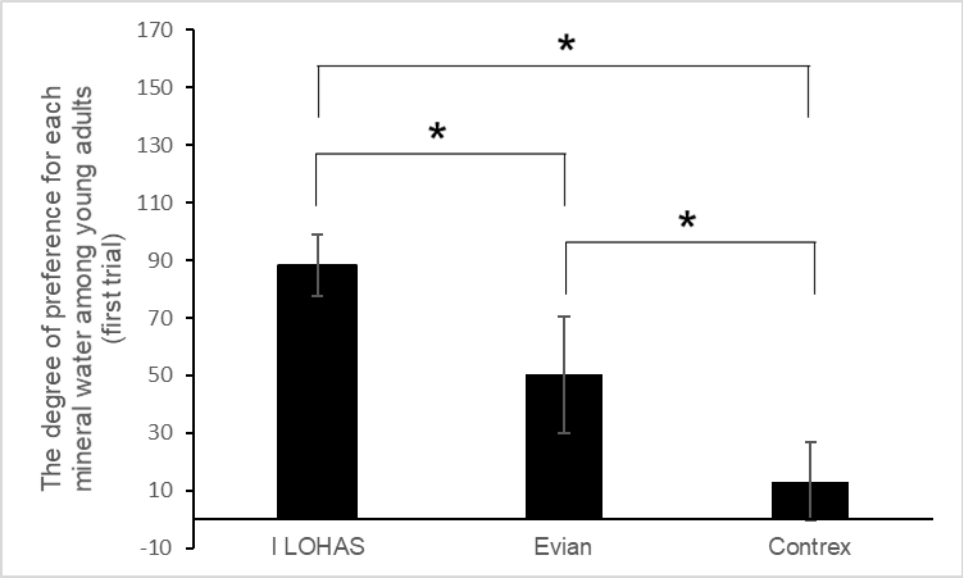


Fig. 3 The degree of preference for each mineral water among young adults (first trial). *P < 0.05

adults and young adults prefer Japanese mineral water.

The degree of preference for mineral rich water was as high as Japanese mineral water among older adults (Figure 2). According to their impression for mineral rich water, they feel tasty (supplementary date). However, it was significantly lower than Japanese mineral water among young adults ($p < 0.05$) (Figure 3). We estimated that this is related to loss of the sense of taste with aging (Toffanello, 2003). According to their impression for mineral rich water, they feel unique taste and prefer Japanese mineral water to mineral rich water. This could be due to bitterness of Calcium chloride, magnesium chloride and magnesium sulfate (Lawless, et al., 2003). Thus, our results suggest that Japanese older adults like mineral rich water as much as Japanese mineral water, but Japanese young adults prefer Japanese mineral water to mineral rich water.

The degree of preference for mineral very rich water was significantly lower than for Japanese mineral water and mineral rich water among older adults ($p < 0.05$) (Figure 2). However, it was high even if it was lower than for other two mineral water. According to their impression for mineral very rich water, many of them don't feel bitterness and discomfort, but there were also subjects who feel bitterness. On the other hand, it was significantly lower than for mineral rich water among young adults ($p < 0.05$) (Figure 3). According to their impression for mineral very rich water, they feel strong bitterness. From these results, we consider that bitterness increases in proportion to the amount of mineral.

In the present study, we selected three kinds of mineral water with different mineral contents. Berlin's water has more calcium and magnesium than Japanese mineral water, but has less calcium and magnesium than mineral water and mineral very rich water. Thus, we consider that older adults like Berlin's water because they

like mineral rich water.

We used three mineral water at normal temperature in the present study. However, a study reported that temperature has a strong influence on how we taste (Talavera, 2007). In addition to it, it is well known that loss of the sense of taste with aging (Toffanello, 2003), but it is not yet clear how old the taste loss is. In the future studies, we need to investigate whether the preference for mineral water changes by temperature and how old will it change.

The present study has demonstrated that older adults (age: 79.0 ± 5.6 years) tend to like mineral rich water because it's hard to feel bitterness. On the other hands, young people (age: 21.5 ± 1.0 years) tend to prefer to Japanese mineral water to mineral rich water because they feel bitterness of mineral rich water. These results suggest that many older adults can drink deliciously mineral rich water in daily life. Drinking mineral rich water would be good way to live healthier as many older adults because it can increase calcium and magnesium intake.

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Supplementary data

older adults

participants	I LOHAS	Evian	Contrex
1	no resistance	no sence of inconguity	no resistance
2	tasty	tasty	feel a bit bitterness
3	no resistance	no resistance	no resistance
4	not feel taste	normal	feel bitterness
5	mellow	there is a sence of inconguity	mellow
6	tasty	tasty	there are sour
7	good throat	aftertaste remains	refreshing
8	like	easy to drink	easy to drink
9	feel natural	feel sweet and thick	there is a sence of inconguity
10	better than tap water	feel sweet	tasty
11	there is refreshing and no dirt	like	mellow

young adults

participants	I LOHAS	Evian	Contrex
1	clean and easy to drink	not tasty	there are sour and habits
2	like	normal	unpalatable
3	not tasty	clear	dislike it
4	used to drinking	feel a little bitterness	feel bitterness
5	mellow	mellow	hard to drink
6	easy to drink	there are many minerals	there is a taste
7	Tasty	easy to drink	feel a little bitterness
8	I LOHAS	taste is hard	not tasty
9	used to drinking	not tasty	taste like foreign water
10	tasty	taste like foreign water	not tasty
11	easy to drink	feel a little bitterness	there is strong habit