Quantifying nitrate content in the Japanese food pattern

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Introduction

- Hypertension or higher blood pressure (> 120/80 mm of Hg) affects health of millions of people worldwide and is a major risk factor for cardiovascular disease (CVD).
- CVD occurrence is lower in the Japanese population than that is in the United States of America (USA) and other Western populations, which is partly attributed to the Japanese traditional diet (JTD) [1, 2].
- Recent research demonstrates that dietary nitrate lowers blood pressure and, therefore, nitrate-rich foods, in particular that of plant origin, or dietary patterns may have therapeutic value in the treatment and prevention of hypertension and CVD [3-5].
- Consumption of vegetables contribute to ≈ 80% of the daily dietary nitrate exposure in average adult population [3-5].
- The JTD is based on a great variety of vegetables [1, 2], suggesting that nitrate may be responsible for lower occurrence of CVD in Japanese population.
- However, with the exception of one study [1], the amount of nitrate present in the JTD is not fully quantified.
- Thus, we attempted to quantify nitrate and nitrite content present in a hypothetical 1-day meal of Japanese population and compare it with that reported previously in the USA population.

Study Design/Methods

- A hypothetical 1-day meal of Japanese population (presented in Table 1) was constructed by pooling the data obtained from various online resources including the Japanese Dietetics Association [6], California Agriculture Magazine [10], and from consulting individuals of Japanese heritage.
- The nitrate and nitrite content of the selected foods was analyzed using Siever's NOA280i nitric oxide analyzer. (Fig 1 and Fig 2) [7]

Figure 1: Diagram depicting the process of nitrate analysis from injection to quantification.
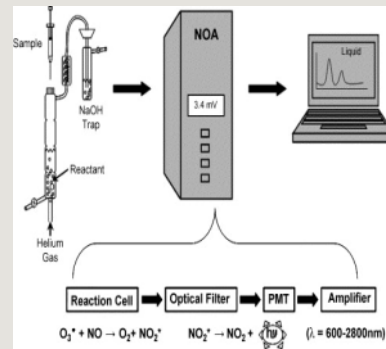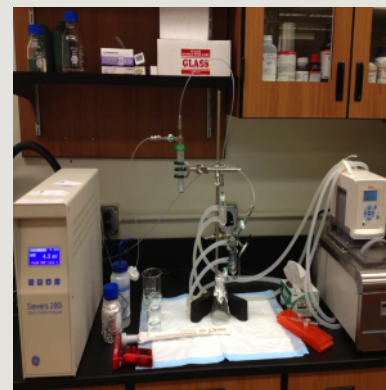

$$O_3{}^* + NO \rightarrow O_2 + NO_2{}^* \qquad NO_2{}^* \rightarrow NO_2 + h\nu \quad (\lambda = 600\text{-}2800nm)$$

Figure 2: Sievers NOA 280i

Results

Table 1: Nitrate content of foods representing typical 1-day Japanese diet.

	Serving size (g)	Nitrate (mg/ Serving)
Breakfast		
Broiled Mackerel	75	0.1
Tuna Sashimi	30	0.2
Miso Soup	175	2.0
White Rice	150	0.2
Dried Nori	5	4.9
Pickled Ginger	10	6.1
Green Tea	2 (in 150 mL)	1.0
Lunch		
Unagi Nigiri	75	0.8
Pickled Daikon Roll	100	0.0
White Rice	150	0.2
Salad with Ginger Dressing	150	73.6
Wasabi	5	1.1
Green Tea	2 (in 150 mL)	1.0
Snack		
Edamame	100	0.7
Dried Nori Snacks	5	4.9
Fuji Apple	100	0.0
Green Tea	2 (in 150 mL)	1.0
Dinner		
Udon Noodle Soup	150	0.7
Tuna Maki Roll	125	1.7
Salmon Sashimi	25	0.3
Miso Soup	175	2.0
White Rice	150	0.2
Pickled Ginger	10	6.1
Green Tea	2 (in 150 mL)	1.0
Water	2000 mL/ d	*18.2
Total Nitrate (mg/d)		127.8

*Calculated from ground water nitrate levels in Japan [8]

Discussion

- A typical USA diet provides 75-100 mg of nitrate ion per day whereas ingestion of up to 250 mg per day of nitrate has been reported for populations whose diets are rich in foods from vegetable sources [9].
- Our findings indicate that a typical 1-day meal of the Japanese population contains approximately 127.8 mg of nitrate ion.

Conclusion

- Daily dietary nitrate ingestion in Japanese population consuming JTD exceeds the amount of nitrate present in a typical USA diet at least by 27 %.
- The high nitrate in the JTD compared to nitrate intake in the US diet may be partially responsible for the lower risk of CVD and longer life span present in the Japanese population.

References

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Acknowledgements

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