Regional Trends in Dietary Intake in Japan: the 2003~2017 National Health and Nutrition Survey

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ABSTRACT

Objective: There are regional health disparities in Japan regarding the physical condition and lifestyle as demonstrated in the gaps among prefectures. However, no regional annual trends have been reported. This study investigated the regional trends in dietary intake among Japanese adults.

Methods: Overall, 140,817 Japanese participants (64,773 men and 76,044 women) aged ≥ 20 years, registered in the 2003~2017 National Health and Nutrition Survey were included. The dietary survey was conducted with a semi-weighted household-based dietary record on a single day. The 47 prefectures were regrouped into 12 regions. Age-adjusted mean intakes of energy, carbohydrate, fat, protein, salt, vegetables, and fruits by region were estimated using a regression model, according to the survey years. Trend analyses from 2003 to 2017 were performed using the Joinpoint Regression Program.

Results: Significant decreases in carbohydrate and salt intake were noted in all regions, whereas fat intake showed a significant change in trend with annual increases. Protein intake decreased in approximately half and fruit intake decreased in two thirds of the regions. No changes in trend in energy and vegetable intake were observed in most regions, although a declining annual trend was observed in some regions.

Conclusions: In Japan, annual trend in intakes of energy, protein, vegetables, and fruits differed among regions from 2003 to 2017. These results may be attributed to the differences in health and nutrition policies between local governments. Regional trends in dietary intake among Japanese need to be monitored continuously to develop health and nutrition policies for local governments.

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Key words: National Health and Nutrition Survey, dietary intake, dietary assessment, Japan

1. Introduction

The National Health and Nutrition Survey (NHNS) in Japan reports annual trends in dietary intake, physical condition, and lifestyle¹⁾. Nutrient and food intake among the Japanese have changed with changes in lifestyle including dietary habits in Japan²⁾. In the Japanese national health policy, Health Japan 21 (second term), decreasing the salt intake and increasing the vegetable and fruit intake are among the goals for improving nutrition and dietary habits³⁾. To achieve these goals, the efforts of both the national and local governments are important. The 1947~1956 surveys were conducted in urban and rural area, or urban and district by population size, and the results were compared by regions⁴⁾. A report

on the regional annual trends in dietary intake in Japan from 1966 to 1988 have shown that the salt intake in the Tohoku region was greatly decreased⁵⁾. In recent years, dietary intake status among the different prefectures have been reported in the 2012 and 2016 surveys^{6, 7)}. Dietary intake values were adjusted for age in each prefecture, then divided into quartiles and compared between the highest and the lowest quartile⁷⁾. In the 2016 survey, significant differences in the vegetable intake and salt intake between the highest and lowest groups were observed⁷⁾. In the 2016 survey, there were significant differences in vegetable intake and salt intake between the highest and lowest groups⁷⁾. There are regional health disparities in Japan, as demonstrated in the gap among prefectures regarding dietary intake. Based on the 2016 survey, pre-

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fectures in the highest quartile of vegetable intake belonged to the north-eastern part of Honshu island. However, no regional annual trends have been reported in recent years. To formulate a regional health promotion plan, it is necessary to assess annual trends in dietary intake by region.

The present study aimed to investigate the regional trends in dietary intake among Japanese adults using nationwide data from the 2003–2017 NHNS. In this study, we focused on changes in the intake of macronutrients such as energy, carbohydrate, fat, and protein and intake of salt, vegetable, and fruit according to regions.

II. Subjects and Methods

National Health and Nutrition Survey data

The NHNS is a cross-sectional survey that has been conducted annually since 1947 (between October and December each year) by the Ministry of Health, Labour and Welfare in Japan. Details of the survey design have been provided elsewhere^{2, 8)}. Briefly, the NHNS uses a stratified cluster sampling design across 47 prefectures. Iwate, Miyagi, and Fukushima Prefectures were excluded from the 2011 survey due to the Great East Japan Earthquake while Kumamoto Prefecture was excluded from the 2016 survey due to the Kumamoto Earthquake. Census enumeration areas were drawn from each prefecture and residents aged ≥ 1 year in all households were selected from 300 selected census enumeration areas from 2003–2017. The exceptions were the 2004, 2012, and 2016 surveys, which were conducted in 298 areas (2 areas in Niigata Prefecture were excluded due to the Mid Niigata Prefecture Earthquake), 475 areas, and 462 areas, respectively, out of the survey areas eligible for inclusion. Household response rate for each survey year was approximately 43.1–83.2% from 2003 to 2017, and the mean response rate for households was 63.8%. The NHNS comprises three surveys: the dietary intake survey (a self-administered questionnaire including questions on the household members, meal patterns, daily step counts, and dietary records); the lifestyle survey (a self-administered questionnaire including questions on smoking status, alcohol intake, and sleep time); and a physical examination (measurement of height, weight, abdominal circumference, and blood pressure; blood tests; and a medical

interview). Based on official application procedures under Article 33 of the Statistics Act, we obtained approval from the Ministry of Health, Labour and Welfare, Japan to use individual-level data from the NHNS for this study. In accordance with the Ethical Guidelines for Epidemiological Research⁹⁾, our study was exempted from the application of these guidelines as only anonymized data were used.

Study participants

A total of 140,817 participants (64,773 men and 76,044 women) aged ≥ 20 years were included in the analysis, excluding those who did not complete the dietary intake survey. We analyzed the results of the present study using the NHNS as a simple random sample.

Dietary assessment

The dietary intake survey, which applies a semi-weighted household-based dietary record, was conducted on a single day excluding Sundays and public holidays. The dietary intake survey was annually conducted in November, except for 2012 (between October 25 and December 7) and 2016 (between October 1 and November 30). Trained interviewers visited each household to explain the method for generating the dietary records before the survey. Dietary records were weighed by taking an inventory of all the foods and beverages consumed, food waste, leftovers, and foods consumed away from home, in the household. For shared dishes within the household, the approximate proportions of each food were assigned to individual household members to estimate food intake for individuals. Interviewers checked for any missing information and errors during household visits to collect the dietary records. Nutrient intakes were calculated on the basis of the Standard Tables of Food Composition in Japan (5th edition for the 2003–2004 survey, 5th revised and enlarged edition for the 2005–2010 survey, and the 2010 edition for the 2011–2017 survey).

Statistical analysis

All statistical analyses were performed for the following 12 regions: Hokkaido, Tohoku, Kanto I, Kanto II, Hokuriku, Tokai, Kinki I, Kinki II, Chugoku, Shikoku, Kita-Kyusyu, and Minami-Kyusyu were listed in order of their locations in Japan from north to south. Kanto I includes the Tokyo metropolitan area, and Kinki I includes Osaka. Age-adjusted means and standard errors of energy, carbohydrate, fat, protein, salt, vegetable, and fruit intakes were

estimated using the regression model according to the survey years. Carbohydrate (not including alcohol), fat, and protein (%energy) values were calculated using the following formulae:

$$\text{Carbohydrate (\%energy)} = \frac{\text{carbohydrate intake (g)} \times 4 \text{ (kcal/g)}}{\text{total energy intake (kcal)}} \times 100$$

$$\text{Fat (\%energy)} = \frac{\text{fat intake (g)} \times 9 \text{ (kcal/g)}}{\text{total energy intake (kcal)}} \times 100$$

$$\text{Protein (\%energy)} = \frac{\text{protein intake (g)} \times 4 \text{ (kcal/g)}}{\text{total energy intake (kcal)}} \times 100$$

Salt, vegetable, and fruit (g/1,000 kcal) was calculated by the following formula using the density method:

$$\text{Salt, vegetable, or fruit (g/1,000 kcal)} = \frac{\text{salt, vegetable, or fruit intake (g)}}{\text{total energy intake (kcal)}} \times 1,000$$

Age adjustment was performed according to six age categories (20–29, 30–39, 40–49, 50–59, 60–69, and ≥70 years), and the standard population on the 2010 census was used¹⁰. The weight for participants in each prefecture was calculated by dividing the total number of households during the prior 3 years in each prefecture by that in the 2012 and 2016 surveys. The details of weighing has been described elsewhere⁶. The trend analyses were performed using the Joinpoint Regression Program (Joinpoint Regression software, version 4.2; National Cancer Institute, USA [https://www-surveillance.cancer.gov/joinpoint]). Joinpoint regression analysis uses statistical criteria

to determine the minimum number of linear segments needed to describe a trend and to determine the annual percentage change (APC) in each segment. The Monte Carlo permutation method was used to test if a change in the trend is statistically significant¹¹. Differences were considered statistically significant at $p < 0.05$.

III. Results

The trends in energy intake (kcal), carbohydrate (%energy), fat (%energy), and protein (%energy) intake, adjusted for age category are shown in Supplement Tables 1. Supplement Tables 2 shows the trends in intake of salt, vegetable, and fruit (g/1,000 kcal) adjusted for age category. Figure 1–7 shows some regions with characteristic by the trends in dietary intake. Joinpoint regression analysis identified a change in the trend from 2003 to 2017. No change in the trend of energy intake was observed in most regions; however, Kanto II, Hokuriku, and Minami-Kyusyu showed significant decreases in APC of 0.2%, 0.3%, and 0.3% from 2003 to 2017, respectively. Between 2008 and 2015, there was a year when carbohydrate intake decreased in all regions, with APC decreasing significantly by 0.2–2.7%. There was a significant change in the trend of fat intake, with annual increases of 0.8–1.2% from 2003 to 2017. In Hokkaido, Tohoku, Kanto I, Kanto II, Tokai, and Kinki I, there were significant decreases in the APC of protein intake of 0.5% (from 2003 to 2017), 0.6% (from 2003 to 2010), 0.5% (from 2003 to 2011), 0.8% (from 2003 to 2010), 0.2% (from 2003 to 2017), and 0.2% (from 2003 to

Figure 1 Trends in energy intake (kcal) adjusted for age category in Kanto II, Hokuriku and Minami-Kyusyu from 2003 to 2017. * $p < 0.05$.

Figure 2 Trends in carbohydrate intake (%energy) adjusted for age category in Hokkaido, Tokai and Minami-Kyusyu from 2003 to 2017. * $p < 0.05$.

Figure 3 Trends in fat intake (%energy) adjusted for age category in Hokuriku, Shikoku and Minami-Kyusyu from 2003 to 2017. * $p < 0.05$.

Figure 4 Trends in protein intake (%energy) adjusted for age category in Hokkaido, Kanto II and Chugoku from 2003 to 2017. * $p < 0.05$.

Figure 5 Trends in salt intake (g/1,000 kcal) adjusted for age category in Tohoku, Kanto II and Kita-Kyusyu from 2003 to 2017. * $p < 0.05$.

Figure 6 Trends in vegetable intake (g/1,000 kcal) adjusted for age category in Hokuriku, Kinki II and Shikoku from 2003 to 2017. * $p < 0.05$.

Figure 7 Trends in fruit intake (g/1,000 kcal) adjusted for age category in Hokkaido, Kanto I and Minami-Kyusyu from 2003 to 2017. * $p < 0.05$.

2017), respectively. There was a significant change in the trend of salt intake, with annual decreases in APC of 0.9~1.4% in all regions from 2003 to 2017. No change in the trend of vegetable intake was observed in most regions; however, Hokuriku and Kanto II showed significant decreases of 0.7% in APC in each year from 2003 to 2017, respectively. There were significant decreases in the APC of fruit intake of 1.2~1.9% in two-thirds of the regions except for Kanto II, Hokuriku, Kinki II, and Kita-Kyusyu. As the result of stratified analysis by sex, similar increasing or decreasing trends of dietary intake according to regions in Japan were observed (data not shown).

IV. Discussion

We investigated the regional trends in dietary intake among Japanese adults using the nationwide NHNS data from 2003 to 2017. To our knowledge, this study is the first to investigate the regional trends in dietary intake in Japan in recent years.

No change in trend in energy intake was observed in most regions in the last 15 years (from 2003 to 2017), but slight decreases in trend were observed in Kanto II, Hokuriku, and Minami-Kyusyu. The energy intake has decreased nationwide from 1966 to 1988⁵⁾, and the trend in energy intake has changed in recent years. There was a decreasing trend in carbohydrate intake in all regions, with a point of change between 2008 and 2015 in each region. In Japan, there is a declining trend in grain intake, especially the intake of rice and rice products, while the intake of wheat and wheat products is increasing¹⁾. The intake of grains has a higher contribution than intake of other foods to energy intake and carbohydrate intake (energy intake: 760 kcal/1,914 kcal and carbohydrate intake: 157.9 g/256.9 g)¹⁾. The contribution to carbohydrate intake is higher in rice and rice products than in wheat and wheat products (rice and rice products: 513 kcal/1,914 kcal and wheat and wheat products: 229 kcal/1,914 kcal for energy intake, and rice and rice products: 113.3 g/256.9 g and wheat and wheat products: 41.2 g/256.9 g for carbohydrate intake)¹⁾. Therefore, decreases in energy intake may have been observed in some regions due to a decrease in grain intake, especially due to the decrease in the intake of rice and rice products. Moreover, due to a decrease in intake of rice and rice products that

contribute largely to carbohydrate intake, there may have been points of change in carbohydrate intake throughout Japan between 2008 and 2015. In contrast, the annual trend in fat intake increased in all regions. This increasing trend appears to reflect an increase in the intake of meats and milk that contributed to fat intake in the last 15 years from 2003 to 2017¹⁾. Protein intake significantly decreased in the eastern region from Hokkaido to Kinki I in Japan, but did not show a significant annual change in trend in the west from Kinki II to Minami-Kyusyu. The contributions of grain, meat and fish, and milk and dairy products to the protein intake (70.5 g) were 15.2 g, 15.3 g, 13.1 g, and 4.5 g, respectively¹⁾. Our previous study that investigated the long-term trends from 1995 to 2016 across Japan has shown that the protein intake is decreasing²⁾. There is a need for continued monitoring as regional trends from the present study may be due to local characteristics such as the differences in the changes in intake of fish, meat, and grain that contribute to animal- and plant-based protein intake. The annual trend in salt intake decreased in all regions from 2003 to 2017. In East Asia, particularly in Japan, higher salt intake (compared to those in Western countries) is a public health problem¹²⁾. Population based projects aimed at reducing salt intake at the national level, local government regions, and food companies in Japan may have led to a decreasing trend in salt intake¹³⁾. No change in trend in vegetable intake was observed, except for the decreasing trend in Hokuriku and Kanto II. The annual trend in fruit intake greatly decreased in many regions from 2003 to 2017. In the Health Japan 21 (second term), the target of vegetable intake for adults was set at 350 g/day³⁾. In addition, this policy aims to reduce the proportion of people who consume less than 100 g of fruit to 30%³⁾. However, the mean vegetable and fruit intake in most regions does not meet the target amounts at present; thus, a more sophisticated approach is needed to increase vegetable intake in the current population.

V. Conclusions

In Japan, annual trends in intakes of energy, protein, vegetables, and fruits differed among regions from 2003 to 2017. Our finding may be attributed to the differences in health and nutrition policies between the local governments. The NHNS continuously monitors the people's

health status, nutritional intake, and lifestyle habits. In addition, the NHNS contributes to monitoring the status of health policies such as the Health Japan 21 (second term)³⁾ and the Basic Plan for Promotion of Shokuiku¹⁴⁾, and provides basic data for the development of Dietary Reference Intakes for the Japanese¹⁵⁾. Regional trends in dietary intake among the Japanese need to be monitored continuously, so that the local governments can use the data from the regional annual trends, and make effective plans for health promotion measures by comparing the results of the trends in Japan.

Conflict of Interest

There exist no items constituting a conflict of interest.

References

- 1) National Institutes of Biomedical Innovation, Health and Nutrition: The National Health and Nutrition Survey Japan, 2017 (2019) Dai-ichi Shuppan Co. Ltd., Tokyo
- 2) Saito, A., Imai, S., Htun, N.C., et al.: The trends in total energy, macronutrients and sodium intake among Japanese: findings from the 1995-2016 National Health and Nutrition Survey, *Br. J. Nutr.*, **120**, 424–434 (2018)
- 3) Ministry of Health, Labour and Welfare: Health Japan 21 (second term) (2012) Ministry of Health, Labour and Welfare, Tokyo
- 4) Ministry of Health and Welfare: The National Nutrition Survey Japan, 1956 (1957) Ministry of Health and Welfare, Tokyo
- 5) The Japan Dietetic Association and Kenko Eiyo Joho Kenkyukai: Nutrition Trends in the Showa Period after the Second World War: A Review of 40 Years of the National Nutrition Survey (1998) Dai-ichi Shuppan Co. Ltd., Tokyo
- 6) National Institutes of Biomedical Innovation, Health and Nutrition: The National Health and Nutrition Survey Japan, 2012 (2016) Dai-ichi Shuppan Co. Ltd., Tokyo
- 7) National Institutes of Biomedical Innovation, Health and Nutrition: The National Health and Nutrition Survey Japan, 2016 (2018) Dai-ichi Shuppan Co. Ltd., Tokyo
- 8) Ikeda, N., Takimoto, H., Imai, S., et al.: Data Resource Profile: The Japan National Health and Nutrition Survey (NHNS), *Int. J. Epidemiol.*, **44**, 1842–1849 (2015)
- 9) Ministry of Health, Labour and Welfare: Ethical Guidelines for Medical and Health Research Involving Human Subjects (2015) Ministry of Health, Labour and Welfare, Tokyo
- 10) Ministry of Health, Labour and Welfare: Vital Statistics, 2010 (2011) Ministry of Health, Labour and Welfare, Tokyo
- 11) Kim, H.J., Fay, M.P., Feuer, E.J., et al.: Permutation tests for joinpoint regression with applications to cancer rates, *Stat. Med.*, **19**, 335–351 (2000)
- 12) Powles, J., Fahimi, S., Micha, R., et al.: Global, regional and national sodium intakes in 1990 and 2010: a systematic analysis of 24h urinary sodium excretion and dietary surveys worldwide, *BMJ Open*, **3**, e003733 (2013)
- 13) National Institute of Biomedical Innovation, Health and Nutrition: Health Japan 21 (second term) analysis and assessment project (2012) National Institute of Biomedical Innovation, Health and Nutrition, Tokyo
- 14) Ministry of Agriculture, Forestry and Fisheries: Basic Plan for Promotion of Shokuiku (2016) Ministry of Agriculture, Forestry and Fisheries, Tokyo
- 15) Ministry of Health, Labour and Welfare: Dietary Reference Intakes for Japanese, 2020 (2019) Ministry of Health, Labour and Welfare, Tokyo

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Supplement Table 1 Trends in energy and macronutrient intake (/day) adjusted for age category from 2003 to 2017, according to region in Japan

	Survey year																Lower endpoint	Upper endpoint	APC (%)	p value
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017					
Energy intake (kcal)	Hokkaido	1891	1855	1896	1850	1828	1858	1945	1757	1758	1862	1796	1851	1924	1886	1815	-	-	-0.1	0.7
	Tohoku	1995	1835	1954	1863	1950	1905	1859	1859	1880	1897	1922	1820	1939	1877	1870	-	-	-0.2	0.1
	Kanto I	1912	1937	1887	1899	1893	1876	1859	1886	1853	1908	1906	1889	1888	1867	1925	-	-	-0.1	0.3
	Kanto II	1942	1927	1949	1908	1933	1917	1902	1897	1899	1902	1992	1919	1866	1881	1929	-	-	-0.2	<0.001
	Hokuriku	1971	1794	1981	1944	1903	1979	1893	1929	1939	1902	1895	1855	1966	1875	1908	-	-	-0.3	<0.001
	Tokai	1901	1901	1878	1869	1883	1854	1884	1813	1799	1880	1810	1883	1936	1854	1948	-	-	0	0.7
	Kinki I	1963	1911	1940	1950	1906	1901	1911	1896	1844	1909	1905	1902	1924	1907	1938	-	-	-0.1	0.2
	Kinki II	1962	1893	2006	1955	2068	1912	1820	1825	1896	1914	1907	1907	1951	1927	1938	-	-	0	1
	Chugoku	1916	1898	1897	1922	1945	1907	1948	1865	1870	1904	1888	1883	1866	1880	1935	-	-	-0.1	0.1
Carbohydrate intake (%energy)	Shikoku	1970	1934	1955	1913	1936	1902	1842	1773	1869	1880	1853	1844	1923	1883	1934	-	-	-0.2	0.1
	Kita-Kyusyu	1895	1870	1866	1881	1917	1808	1846	1817	1846	1860	1894	1878	1880	1925	1847	-	-	0	0.9
	Minami-Kyusyu	1921	1967	1866	1886	1852	1844	1839	1844	1824	1838	1842	1812	1864	1826	1926	-	-	-0.3	<0.001
	Hokkaido	61.3	59.7	60.0	59.6	60.0	60.0	60.0	59.6	59.8	60.1	59.7	60.6	58.8	58.7	57.0	2003	2014	-0.1	0.5
	Tohoku	61.6	61.1	61.8	61.5	60.8	61.8	61.2	61.4	59.1	60.5	61.0	60.7	59.5	58.9	58.8	2014	2017	-1.4	<0.001
	Kanto I	59.2	59.6	59.1	59.0	59.0	59.9	59.3	58.9	58.4	58.4	58.2	58.0	57.4	57.0	56.7	2003	2008	0.1	0.3
	Kanto II	60.7	60.8	60.1	61.5	60.8	61.5	60.3	61.0	60.8	60.3	60.0	59.6	59.8	58.6	57.9	2008	2017	-0.5	<0.001
	Hokuriku	62.1	62.2	61.3	62.8	61.7	61.7	60.9	60.9	60.4	60.3	60.3	60.2	60.1	59.1	59.1	-	-	-0.4	<0.001
	Tokai	60.2	60.8	60.1	60.2	59.8	60.7	59.6	59.7	59.5	59.2	58.7	58.5	58.3	57.5	56.9	2003	2011	-0.2	0.1
	Kinki I	60.0	59.5	59.2	59.3	59.0	60.3	59.2	59.0	58.6	59.1	57.8	58.2	57.7	57.2	56.0	-	-	-0.3	<0.001
	Kinki II	60.8	60.3	61.2	59.4	60.1	61.2	60.2	57.4	58.7	59.7	58.8	58.9	57.7	56.6	55.2	2003	2014	-0.3	<0.001
	Chugoku	61.4	60.0	61.4	60.6	61.2	61.2	61.5	59.7	60.9	59.8	59.5	58.4	60.0	58.2	59.1	-	-	-0.3	<0.001
	Shikoku	62.3	61.4	60.2	62.4	60.4	61.7	62.0	59.1	59.6	60.5	60.3	59.5	58.4	58.4	59.1	-	-	-0.4	<0.001
	Kita-Kyusyu	61.1	61.6	61.3	59.5	58.9	61.0	60.7	59.8	59.7	59.8	59.1	58.8	58.1	57.0	58.1	-	-	-0.4	<0.001
	Minami-Kyusyu	61.4	60.3	60.4	60.7	60.2	60.4	60.4	60.4	59.0	59.2	59.6	59.6	58.9	56.8	56.5	2003	2015	-0.3	<0.001
																	2015	2017	-2.7	<0.001

Supplement Table 1 (continued)

Fat intake (%energy)	Hokkaido	22.9	24.6	24.2	25.4	25.0	24.3	24.9	25.3	25.2	25.4	25.3	24.8	26.8	26.4	28.2	-	-	0.9	<0.001
	Tohoku	23.1	23.6	22.9	23.6	23.9	23.3	24.1	24.1	26.1	24.6	23.8	24.4	25.5	25.9	26.3	-	-	0.9	<0.001
	Kanto I	25.5	25.4	25.6	26.0	26.0	25.4	26.0	26.3	27.0	27.0	27.0	27.4	27.8	28.0	28.3	-	-	0.8	<0.001
	Kanto II	24.1	24.0	24.6	23.7	24.5	24.0	25.0	24.6	24.6	25.2	25.6	25.9	25.6	26.8	27.9	2003	2015	0.6	<0.001
																	2015	2017	4.3	0.1
	Hokuriku	23.0	23.0	23.7	22.6	23.5	23.9	24.9	24.7	24.9	25.0	25.0	25.3	25.6	26.1	26.2	-	-	1.0	<0.001
	Tokai	24.5	24.2	25.0	24.9	25.4	24.7	26.0	25.7	25.7	26.2	26.5	27.1	26.7	27.9	28.2	-	-	1.0	<0.001
	Kinki I	24.9	25.2	25.6	25.7	25.9	25.0	25.8	26.2	26.4	26.3	27.3	27.0	27.4	28.0	29.3	-	-	0.9	<0.001
	Kinki II	24.1	24.5	24.0	25.4	25.6	24.1	25.5	26.8	26.5	25.8	26.2	26.7	27.9	28.6	30.1	2003	2014	0.8	<0.001
																	2014	2017	4.1	0.1
Protein intake (%energy)	Chugoku	24.0	25.0	23.9	24.4	24.4	24.2	24.1	25.4	24.5	25.7	25.7	26.6	25.5	27.0	26.2	-	-	0.8	<0.001
	Shikoku	23.0	23.8	24.5	23.2	24.7	23.8	22.8	26.1	25.4	24.9	25.2	25.3	27.0	26.8	26.5	-	-	1.1	<0.001
	Kita-Kyushu	24.1	23.8	23.7	25.1	26.4	24.7	24.5	25.6	25.7	25.5	25.8	26.4	27.2	28.0	27.4	-	-	1.0	<0.001
	Minami-Kyushu	23.5	24.6	24.7	24.2	25.3	24.8	24.9	25.0	26.3	26.1	25.6	26.4	26.3	28.2	28.4	-	-	1.2	<0.001
	Hokkaido	15.8	15.7	15.7	15.0	15.0	15.7	15.1	15.1	15.0	14.6	14.9	14.7	14.5	14.9	14.9	-	-	-0.5	<0.001
	Tohoku	15.3	15.3	15.3	14.9	15.3	14.9	14.7	14.6	14.8	14.9	15.2	14.9	15.0	15.1	14.9	2003	2010	-0.6	<0.001
																	2010	2017	0.4	0.1
	Kanto I	15.2	15.1	15.2	15.0	15.1	14.7	14.7	14.8	14.6	14.7	14.8	14.6	14.9	14.9	15.0	2003	2011	-0.5	<0.001
																	2011	2017	0.4	0.1
	Kanto II	15.2	15.2	15.3	14.8	14.7	14.6	14.7	14.5	14.6	14.5	14.3	14.6	14.6	14.6	14.3	2003	2010	-0.8	<0.001
APC, annual percentage change	Hokuriku	14.9	14.9	15.0	14.5	14.8	14.4	14.3	14.4	14.7	14.7	14.8	14.4	14.3	14.8	14.7	-	-	0	1
	Tokai	15.3	15.0	14.9	14.9	14.9	14.7	14.5	14.6	14.8	14.6	14.8	14.5	15.0	14.6	14.8	-	-	-0.2	<0.001
	Kinki I	15.1	15.3	15.3	15.0	15.1	14.7	15.0	14.8	14.9	14.7	14.9	14.8	15.0	14.8	14.7	-	-	-0.2	<0.001
	Kinki II	15.1	15.2	14.8	15.2	14.3	14.8	14.3	15.8	14.8	14.6	15.0	14.5	14.4	14.8	14.7	-	-	-0.1	0.3
	Chugoku	14.6	15.0	14.7	15.0	14.5	14.7	14.5	15.0	14.6	14.5	14.8	15.1	14.5	14.8	14.7	-	-	0	0.9
	Shikoku	14.7	14.8	15.2	14.4	14.9	14.5	15.3	14.9	15.0	14.6	14.5	15.2	14.7	14.8	14.4	-	-	0	0.8
	Kita-Kyushu	14.7	14.6	15.0	15.4	14.7	14.3	14.8	14.5	14.6	14.7	15.2	14.7	14.7	15.0	14.6	-	-	0	0.7
	Minami-Kyushu	15.1	15.0	14.9	15.1	14.5	14.8	14.8	14.6	14.7	14.7	14.8	14.0	14.8	15.1	15.1	-	-	0	0.8

APC, annual percentage change

Tohoku: Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima; Kanto I: Saitama, Chiba, Tokyo, Kanagawa; Kanto II: Ibaraki, Tochigi, Gunma, Yamanashi, Nagano; Hokuriku: Niigata, Toyama, Ishikawa, Fukui; Tokai: Gifu, Aichi, Mie, Shizuoka; Kinki I: Kyoto, Osaka, Hyogo; Kinki II: Nara, Wakayama, Shiga; Chugoku: Tottori, Shimane, Okayama, Hiroshima, Yamaguchi; Shikoku: Tokushima, Kagawa, Ehime, Kochi; Kita-Kyushu: Fukuoka, Saga, Nagasaki, Oita; Minami-Kyushu: Kumamoto, Miyazaki, Kagoshima, Okinawa.

Supplement Table 2 Trends in salt, vegetable and fruit intake (/day) adjusted for age category from 2003 to 2017, according to region in Japan

	Survey year																p value	
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	APC (%)		
Salt intake (g/1,000 kcal)	Hokkaido	6.2	5.9	5.9	6.2	5.7	5.9	5.9	5.7	5.7	5.2	5.5	5.3	5.4	5.3	-1.0	<0.001	
	Tohoku	6.7	6.5	6.5	6.1	6.4	6.4	6.1	6.1	6.0	5.9	5.8	5.7	5.7	5.3	-1.3	<0.001	
	Kanto I	6.3	6.0	6.2	6.2	6.0	5.9	5.9	5.9	5.9	5.7	5.6	5.5	5.5	5.3	-1.1	<0.001	
	Kanto II	6.6	6.4	6.6	6.4	6.2	6.0	6.1	6.1	6.1	5.8	5.6	5.4	5.6	5.5	-1.4	<0.001	
	Hokuriku	6.4	6.1	6.3	5.8	5.9	6.0	5.7	5.8	5.7	5.7	5.6	5.4	5.2	5.5	-1.1	<0.001	
	Tokai	6.2	6.0	6.2	6.1	5.8	5.9	5.6	5.9	5.7	5.5	5.4	5.2	5.4	5.3	-1.2	<0.001	
	Kinki I	5.7	5.7	5.8	5.6	5.7	5.6	5.5	5.5	5.5	5.2	5.3	5.2	5.1	5.0	-1.0	<0.001	
	Kinki II	5.8	5.6	5.6	5.9	5.6	6.0	5.3	6.0	5.2	5.3	5.3	5.2	5.2	5.1	-1.0	<0.001	
	Chugoku	5.7	5.9	5.8	5.9	5.8	5.7	5.5	5.7	6.0	5.4	5.1	5.4	5.4	5.2	-1.0	<0.001	
	Shikoku	5.9	5.6	5.6	5.6	5.7	5.7	6.0	5.4	5.5	5.3	5.4	5.5	5.0	5.1	-1.0	<0.001	
Vegetable intake (g/1,000 kcal)	Kita-Kyusyu	6.1	6.0	6.0	6.2	5.6	5.9	5.6	5.5	5.6	6.2	5.4	5.2	5.3	5.0	-1.3	<0.001	
	Minami-Kyusyu	5.9	6.0	5.7	6.3	5.4	5.6	5.4	5.4	5.4	5.4	5.2	5.3	5.4	5.1	-0.9	<0.001	
	Hokkaido	146.3	159.2	148.9	137.1	139.3	152.9	143.4	155.7	144.0	143.1	165.9	144.1	143.4	145.9	145.8	-0.1	0.8
	Tohoku	160.9	162.1	179.7	169.0	164.0	176.3	170.7	170.0	152.8	157.7	146.9	165.8	155.1	163.2	153.6	-0.5	0.1
	Kanto I	156.7	145.9	160.2	165.1	152.0	162.6	159.3	150.6	151.2	162.0	152.3	162.8	163.5	154.8	157.0	0.2	0.5
	Kanto II	174.8	147.4	165.5	178.9	165.0	172.6	178.3	158.9	170.3	163.5	158.4	172.0	168.7	158.1	148.9	-0.5	0.1
	Hokuriku	177.3	151.8	168.7	165.7	161.9	171.0	183.4	158.1	152.8	160.5	152.5	166.8	159.9	154.0	178.6	-0.7	<0.001
	Tokai	148.0	134.9	147.3	160.3	154.9	148.6	159.5	156.6	146.7	141.9	146.0	144.8	153.6	132.9	140.2	-0.5	0.2
	Kinki I	139.9	131.6	146.9	153.6	147.6	141.5	141.7	141.4	142.3	142.2	144.7	149.2	142.5	132.3	136.1	-0.1	0.6
	Kinki II	151.2	134.0	153.6	153.5	156.6	145.0	139.8	146.0	145.4	138.5	133.9	133.0	137.4	135.4	138.7	-0.7	<0.001
Fruit intake (g/1,000 kcal)	Chugoku	150.8	134.2	141.9	159.2	149.3	157.4	148.6	146.8	162.2	157.1	149.6	155.1	154.7	145.0	154.1	0.2	0.5
	Shikoku	129.5	148.4	146.6	150.9	152.6	145.1	150.7	139.2	151.6	150.6	141.9	151.2	139.3	150.1	150.7	0.5	0.1
	Kita-Kyusyu	152.2	133.8	135.3	171.2	143.9	133.7	152.0	145.1	138.6	145.9	151.6	152.8	151.4	147.5	145.5	0.3	0.3
	Minami-Kyusyu	151.4	148.6	153.1	164.9	152.6	150.7	164.5	160.2	156.6	151.7	148.2	147.9	156.1	149.3	153.5	-0.2	0.3
	Hokkaido	66.8	65.5	64.3	63.1	61.9	60.7	59.6	58.4	57.3	56.2	55.2	54.1	53.1	52.1	51.1	-1.9	<0.001
	Tohoku	65.7	64.7	63.6	62.6	61.6	60.5	59.6	58.6	57.6	56.7	55.8	54.8	53.9	53.1	52.2	-1.6	<0.001
	Kanto I	68.1	66.8	65.6	64.4	63.3	62.1	61.0	59.9	58.8	57.7	56.7	55.7	54.7	53.7	52.7	-1.8	<0.001
	Kanto II	60.5	59.8	59.2	58.5	57.9	57.3	56.6	56.0	55.4	54.8	54.2	53.6	53.0	52.4	51.9	-1.1	0.1
	Hokuriku	62.4	62.0	61.5	61.0	60.5	60.1	59.6	59.1	58.7	58.2	57.8	57.3	56.9	56.4	56.0	-0.8	0.1
	Tokai	64.1	63.0	61.9	60.8	59.7	58.6	57.6	56.5	55.5	54.5	53.5	52.6	51.6	50.7	49.8	-1.8	<0.001
Chugoku	Kinki I	60.5	59.6	58.8	57.9	57.1	56.3	55.5	54.8	54.0	53.2	52.5	51.7	51.0	50.3	49.6	-1.4	<0.001
	Kinki II	57.7	57.1	56.4	55.8	55.2	54.5	53.9	53.3	52.7	52.1	51.5	50.9	50.4	49.8	49.2	-1.1	0.1
	Chugoku	60.5	59.5	58.6	57.8	56.9	56.0	55.2	54.3	53.5	52.7	51.9	51.1	50.4	49.6	48.8	-1.5	<0.001
	Shikoku	65.2	64.4	63.6	62.8	62.0	61.3	60.5	59.7	59.0	58.3	57.5	56.8	56.1	55.4	54.7	-1.2	<0.001
	Kita-Kyusyu	54.0	53.8	53.7	53.5	53.3	53.1	52.9	52.8	52.6	52.4	52.2	52.1	51.9	51.7	51.5	-0.3	0.6
	Minami-Kyusyu	59.3	58.2	57.1	56.1	55.1	54.0	53.1	52.1	51.1	50.2	49.3	48.4	47.5	46.6	45.8	-1.8	<0.001

APC, annual percentage change

Tohoku: Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima; Kanto I: Saitama, Chiba, Tokyo, Kanagawa; Kanto II: Ibaraki, Tochigi, Gunma, Yamanashi, Nagano; Hokuriku: Niigata, Toyama, Ishikawa, Fukui; Tokai: Gifu, Aichi, Mie, Shizuoka; Kinki I: Kyoto, Osaka, Hyogo; Kinki II: Nara, Wakayama, Shiga; Chugoku: Tottori, Shimane, Okayama, Hiroshima, Yamaguchi; Shikoku: Tokushima, Kagawa, Ehime, Kochi; Kita-Kyushu: Fukuoka, Saga, Nagasaki, Oita; Minami-Kyushu: Kumamoto, Miyazaki, Kagoshima, Okinawa

日本人の地域別栄養素および食品群別摂取量の年次推移 —2003～2017年国民健康・栄養調査—

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- 【目的】 日本では、体格や生活習慣に関する都道府県間の健康格差が報告されているが、それらの年次推移は明らかにされていない。本研究では、日本人の地域別の栄養素および食品群別摂取量の年次推移を調査することを目的とした。
- 【方法】 解析対象は2003～2017年国民健康・栄養調査に参加した20歳以上の日本人140,817人とした。半秤量式食事記録法を用いて世帯単位の日1日の食事調査が実施された。47都道府県は12の地域ブロックに区分した。エネルギー、炭水化物、脂質、たんぱく質、食塩、野菜、果物摂取量の年齢調整値は回帰分析で推定し、2003～2017年の傾向性の検定には Joinpoint Regression Program を用いた。
- 【結果】 炭水化物と食塩の摂取量は全ての地域において有意な減少傾向を認めた一方で、脂質摂取量は有意な増加傾向を示した。たんぱく質摂取量は約半分の地域で、果物摂取量は3分の2の地域で減少傾向を認めた。エネルギーと野菜摂取量は一部の地域で減少傾向を認めたが、ほとんどの地域で有意な変化はみられなかった。
- 【結論】 2003～2017年のエネルギー、たんぱく質、野菜、果物摂取量の年次推移は、地域により異なる結果を示した。これらの結果は地方自治体間の健康・栄養施策の違いによる可能性があるため、今後も日本人の地域別の栄養素および食品群別摂取量を継続的にモニタリングしていく必要がある。

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