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A Study on the Consumption Patterns of Dairy Products and other Foods of the Residents of Beijing

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Abstract

In this study, we carried out surveys on dietary behaviors of residents in Beijing, China, adopting a household survey. The results of this study indicated that rice and its products were the most popular staple food in Beijing, which were consumed by 98.5% of the residents. Vegetables with the highest consumption rate were tomatoes (92.4%), cucumber (90.6%) and eggplant (87.5%). Approximate 90% of the participants consumed fresh/frozen pork, and 97.6% of the population consumed fresh eggs. Over 80% of the participants consumed tofu, making it the most popular bean product. Apple is the most frequently eaten fruit of all ages, with a consumption rate of 92.0%. Yogurt (62.1%) and whole-fat liquid milk (55.7%) are the most popular dairy foods, with adolescents and middle-aged groups as the main consumers. The mostly consumed snacks were bread, biscuits and sunflower seeds, among which bread (118.3 times/year) and sunflower seeds (80.4 times/year) have the highest frequency. Carbonated drinks (44.8%) and tea (46.2%) were the most popular drinks for the participants. This investigation provides us solid and comprehensive dietary pattern data of Beijing residents, and helps with making scientific evaluation of their nutritional status and providing a rational improvement on their eating behaviors.

Keywords: Dietary pattern, Dairy products, Eating habit, Beijing

Introduction

Dietary pattern, also known as dietary structure, refers to the variety, quantity, and proportion of food in diet, as well as the consumption frequency[1, 2]. A rational dietary structure can provide essential information for the adjustment and optimization of the local food production structure, effectively avoiding price increases either due to insufficient cultivation of certain crops or excessive planting which causes oversupply.

Studies have shown that chronic and non-communicable diseases caused by unbalanced diet structure are negatively affecting the health status of people as well as the public health development [3-6]. A thorough understanding of the food consumption situation and nutritional status of the residents is of great significance to guide the enhancement of the food consumption structure, the reasonable agricultural planting plan, the improvement of the nutritional status and promotion of the food safety.

Ensuring the adequacy, safety, and nutritional value of food involves a progressive relationship. To maintain the nutritional value of the food obtained, it is necessary to ensure that the dietary pattern conforms to the reasonable proportions of all kinds of food needed by the human body [7, 8]. In order to provide reference for the adjustment of the regional crop planting and grain production structures, it is of practical importance that the study on the nutrition and dietary structure of the residents is carried out. This investigation of dietary behavior and nutrition structure was carried out in 16 districts and counties of Beijing to collect the data of all kinds of food consumption for all age groups and find out the nutrition and dietary structure of residents. In the survey areas, our team conducted a sample of household visits to investigate the dietary habits and the overall food consumption, which included the types and components of food intake.

This investigation will have a positive effect on the improvement of the comprehensive risk assessment of food safety in Beijing. At the same time, it can also provide a more scientific evaluation of the dietary structure and nutritional status of the residents in Beijing, thereby providing practical advice for rational diet choices and further improving the overall level of nutritional status of the residents.

Materials and Methods

Study population

The residents over six years old who lived locally for one year or more were interviewed and asked to complete the "Overall Food Frequency Questionnaire" (including 11 types, totally 129 kinds of food), from which the information on food consumption was obtained. At the same time, the food safety attitude, overall health status, and the number of family dinners in three days were also assessed. As for the participants who were too young or had physical/cognitive communication problems and were unable to answer questions effectively, the survey was completed by their primary caregivers or other family members who could help with providing the information.

Questionnaire design [9]

The questionnaire mainly aimed at the dietary habits and the frequency of intake of food for different age groups, as stated, and included vegetables and meat. The food intake was recorded continuously for 24 hours a day, along with the type, quantity and the source of the food as well as the dining place across three consecutive days. For most people, as there might be a great difference in the eating habits between weekends and workdays, the three consecutive days mentioned here were required to include at least one weekend day.

Interview quality control

The on-site implementation ensuring quality control of this investigation was conducted through multiple supervision and review procedures to ensure the scientificity and accuracy of the questionnaire data.

The accuracy of the data was ensured by: trial visit, supervision and training of visitors, simulation visits, system of accompanying visits, questioning methods, triple-review system of questionnaire, questionnaire review, input automatic error checking and analytical error checking.

Data analysis

After questionnaire collecting and screening, all the data from the remaining valid questionnaires was entered into the computer using EpiData software, and the database of the final SPSS format was formed through logical error checking.

Results and Discussion

Sample size and basic information of the participants

The total successful population size was 3,369, including 3052 households. Male accounted for 44.4% and female accounted for 55.5% of the study population. Referring to the National Sixth Census, the participants were divided into four age groups on the basis of the age standard and physiological characteristics: age 6 up to 19 years old teenagers (7.8%), 20 to 34 years old younger generations (36.4%), 35 to 49 years old middle-aged people (29.5%), and 50 years old and above elderly people (26.2%). Because of the great difference between youth and juveniles under 19 years old, for this study, the age groups were divided into two, namely, 6 to 14 years old and 15 to 19 years old. Compared with the distribution of Beijing's residents in the national population census published in 2010, the sex ratio and age proportion of this survey were in agreement with the census data.

Consumption of staple food

As shown in Table 1, rice and its products (rice and rice flour) were the most popular category of the ten staple foods included in this survey, with a consumption rate at 98.5%, followed by wheat flour and its products such as steamed bread and noodles (93.4%). The average consumption frequency of rice and its products by male was 386.8 times/year, and the frequency by female was 370 times/year, indicating that rice was consumed once or more per day on average by both genders (Table 1).

There was a significant difference in consumption frequency of rice and its products (rice, rice flour) and wheat flour and its products (steamed bread and noodles) between different age groups ($p < 0.05$). As shown in Table 2, except for wheat flour and its products (steamed bread and noodles), the consumption frequency of other kinds of staple food for teenagers under 14 years old was higher than the average frequency of the total population. In addition, the consumption frequency of rice and rice products (rice, rice flour) and potatoes decreased with the increase of age.

Table 1 Consumption statistics: staple food

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Rice and its products (rice, rice flour)	98.5	386.8	370.0	126.9	108.6
Wheat flour and its products (steamed bread, noodles)	93.4	276.9	275.1	99.5	85.0
Deep-Fried dough stick, deep-fried dough cake	67.5	96.6	81.0	101.7	89.1
Other fried dough (fried cake, fried glutinous rice balls with sesame)	32.9	60.0	53.9	133.3	113.6
Instant noodles	49.3	54.2	53.4	107.1	104.3
Potato	77.3	104.4	105.8	143.7	134.9
Sweet potato	54.5	49.8	49.0	130.8	125.5
Taro	27.1	32.3	29.6	125.4	116.2
Corn flour (corn ballast, steamed corn-bread)	55.8	71.4	73.6	104.8	98.9
Quick frozen cooked rice noodle products (quick-frozen dumplings)	42.6	44.9	42.8	271.0	220.9

Note: 1) The consumption rate refers to the proportion of people who have consumed a certain kind of food in the past year. Consumption frequency refers to the times of foods that were consumed in the past year. Average consumption per time is the average weight of each type of food consumed per time.

2) In this survey, for the consumption frequency, we provided four units (times/day, times/week, times/month, times/year) for the participants to use according to their actual situation. All units are converted into times/year during the statistical analysis.

Table 2 The consumption frequency of staple food (times/ year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Rice and its products (rice, rice flour)	450.6	437.1	394.7	370.1	354.8	377.8
Wheat flour and its products (steamed bread, noodles)	201.9	234.9	277.9	258.9	301.6	276.3
Deep-Fried dough stick, deep-fried dough cake	114.2	128.2	91.7	95.7	71.6	88.3
Other fried dough (fried cake, fried glutinous rice balls with sesame)	99.7	70.1	56.0	62.1	46.1	56.6
Instant noodles	71.4	81.8	57.1	54.8	41.7	53.7
Potatoes	121.5	97.5	113.5	101.9	98.6	105.3
Sweet potatoes	63.3	38.2	48.3	43.8	51.4	49.4
Taro	87.2	47.9	27.3	36.3	23.8	30.8
Corn flour (corn ballast, steamed corn-bread)	76.6	80.1	58.7	77.8	80.2	72.6
Quick frozen cooked rice noodle products (quick-frozen dumplings)	65.7	46.6	48.8	41.8	35.2	43.6

Consumption of vegetables

In this study, a total of 27 vegetables were investigated. The results showed that the vegetable with the highest consumption rate was tomato (92.4%), followed by cucumber (90.6%) and eggplant (87.5%). The vegetable with the highest consumption frequency was green onions (217.0 times), followed by tomatoes (163.7 times) and cucumbers (152.8 times). The complete data can be found in Table 3.

There was no significant difference in the consumption frequency of the vegetables among all age groups. The consumption frequency of eggplant was significantly different between different age groups (Table 4). There was no significant difference in the consumption frequency of cucumbers and squash between different age groups.

Consumption of meat

A total of 15 kinds of meat were included in this study. As for the highest consumption rate, 89.9% of the participants consumed fresh (frozen) pork, with an average consumption frequency of 235.4 times a year. Besides, 70.5% of the participants consumed fresh (frozen) beef, and 60.9% consumed fresh (frozen) mutton, as shown in Table 5.

The consumption frequency of the 10 kinds of meat by male was higher than that of female, most of which were fresh/ frozen meat. In addition to the cooked beef and cooked pork liver, the amount of other kinds of meat consumed by male was more than that by females. In general, men were more likely to consume meat than women. In general, the consumption frequency of meat by 6-14 years old people were more than that of any other age groups, as shown in Table 6.

Consumption of aquatic product

Of the 8 aquatic products included in this study, more than 3/4 of the urban residents (76.9%) indicated that they consumed cold/fresh freshwater fish (carp, crucian carp, grass carp), while 66.2% consumed cold/fresh saltwater fish (hairtail, cod, and yellow croaker). In addition, 63.3% of the participants consumed shrimp. All the remaining categories had consumption rates less than one-third. (Table 7) In terms of consumption frequency, males and females have four foods each being eaten more frequently than each other, respectively. Consumption of all aquatic products per time by women was greater than that of men. As shown in Table 8, people from 6 to 14 years of age had the highest consumption frequency of 5 types of aquatic products, while people from 35 to 49 years old had the highest average consumption amount per time of seven types of aquatic products.

Table 4 The consumption frequency of vegetables (times/ year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Lentils	89	83.1	64.4	66.7	57.9	63.8
Beans	86.8	60.0	81.9	76.5	79.4	79.3
Green Beans	75.5	46.1	50.9	59.9	43.2	52.0
Cowpeas	99.3	99.1	52.0	56.8	46.4	53.5
Eggplant	92.6	59.5	81.2	74.7	78.0	77.7
Tomatoes	164.6	131.6	162.0	160.0	171.2	163.4
Green peppers	91.6	91.6	82.6	89.9	80.6	83.7
Cucumber	140.9	135.9	152.6	151.8	159.0	152.7
Squash	77.4	51.5	61.3	62.2	56.7	60.1
Garlic bolt	67.7	51.5	59.0	60.5	50.1	56.3
Leeks	58.1	54.3	52.8	59.2	55.7	55.7
Green onions	160.3	191.2	191.0	231.8	237.0	217.3
Shallots	104.8	112.7	99.2	104.0	100.2	99.5
Celery	69.9	70.8	74.7	70.9	82.4	76.4
Lettuce	78.3	50.3	48.5	51.3	45.6	49.5
Turnips	59	49.8	54.3	55.1	61.0	56.6
Carrots	80.2	65.0	68.9	70.5	71.4	70.1
Lotus root	64.6	54.8	48.8	48.7	37.7	46.0
Yams	62.4	35.0	41.6	35.8	42.1	40.9
Cauliflower	65.8	60.9	78.7	73.3	67.4	72.2
Cabbage	61.4	58.2	59.9	62.1	61.7	61.2
Spinach	81	74.9	72.5	64.0	68.1	69.1
Rape	66.4	65.1	70.8	66.1	69.5	68.6
Chinese cabbage	74.9	45.5	52.2	50.7	55.9	53.2
Celery cabbage	73.2	79.9	73.0	79.4	91.0	80.5
Pickled vegetables (bulk)	93.2	63.0	77.2	113.5	116.2	101.6
Pickled vegetables (pre-packaged)	81.4	85.3	67.4	64.3	69.5	69.0

The statistical test showed that the consumption frequency of fresh/cold freshwater fish (carp, crucian carp and grass carp) had significant differences between different ages, with a p value far less than 0.05.

Consumption of eggs

This study included 4 kinds of egg foods. The results showed that, similar to rice products, almost all the participants consumed fresh eggs (eggs and duck eggs), with a consumption rate of 97.6%. Men consumed fresh eggs 242.7 times a year, and women consumed 261.4 times a year on average. The consumption frequency of both gender was much higher than that of salted duck eggs (55.0 times/year for male and 50.1 times/year for female), quail eggs (40.9 times/year for male and 34.4times/year for female) and preserved eggs (42.7 times/year for male and 34.0 times/year for female). The complete data can be found in Table 9.

As shown in Table 10, people aged 6-14 consumed fresh eggs 257.7 times a year on average, with a consumption amount of 79.6g per time on average, which is close to the weight of an egg.

After statistical tests, there was no significant difference in the consumption frequency of fresh eggs (eggs and duck eggs) among different age groups (p=0.636).

Consumption of beans and bean products

As shown in Table 11, tofu is the most popular bean products among the total seven categories, with a consumption rate of 82.6%, followed by soymilk (non-homemade), , with a consumption rate of 67.7%.

Table 5 Consumption statistics: meat

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Fresh (frozen) pork	89.9	241.6	230.4	132.2	105.2
Fresh (frozen) beef	70.5	62.8	58.5	187.7	152.6
Fresh (frozen) mutton	60.9	49.4	43.5	203.1	156.6
Fresh (frozen) poultry meat	55.3	61.8	58.0	151.6	127.0
Other fresh (frozen) meat (donkey meat, horse meat, dove meat)	11.4	31.8	27.1	170.6	131.6
Cooked pork	46.4	55.6	53.9	146.9	120.6
Cooked beef	45.5	41.3	40.7	121.3	112.7
Cooked mutton	24.8	45.2	40.5	146.3	127.7
Cooked poultry meat	33.0	47.0	45.3	125.8	108.3
Other cooked livestock and poultry meat (donkey meat, horse meat, dove meat)	12.8	50.9	46.7	149.2	134.1
Cooked pork liver	28.9	31.6	29.3	114.1	111.5
Cooked pork kidney	8.8	37.1	28.6	142.6	125.1
Other cooked animal viscera (liver, intestines, etc.)	18.6	54.2	50.7	143.3	127.9
Barbecue (mutton string, chicken string, etc.)	46.1	40.6	32.6	250.6	193.3
Meat products (sausages, ham sausages, luncheon meat)	49.4	66.5	58.9	99.7	91.7

Overall, the frequency of eating beans and bean products and the average consumption amount per time by people under 19 years old was slightly higher than that of other age groups (Table 12). After statistical tests, there was no significant difference in the consumption frequency of tofu among different age groups (p=0.815).

Consumption of fungus and algae

For the four kinds of fungus and algae food, 75.5% and 73% of the participants, respectively, consumed mushrooms (needle mushrooms, letinous edodes, Pleurotus ostreatus, and straw mushrooms) and edible fungi non-mushrooms (Auricularia, tremella), which was far more than kelp (55.4%) and Porphyra (45.7%). According to Table 13, the consumption frequency of sea algae food by women was higher than that of men, except for kelp.

There was no significant difference in the consumption frequency and the average amount of food consumed per time of fungus and algae product among different age groups (Table 14).

Statistical tests showed that there was no significant difference in the consumption frequency of edible fungi non-mushrooms (Auricularia, tremella) among different age groups (p=0.52).

Consumption of fruit

More than 90% of the participants (92%) consumed apple in the past year, making it the first consumption rate among the total 20 fruits investigated. Except for apple, watermelon and banana were also popular among the participants, with consumption rates of 80.7% and 77.1%, respectively.

In terms of the consumption frequency, as shown in Table 15, male consumed apple 145.5 times per year, and female consumed 174.4 times per year. Bananas ranked the second place, with consumption frequencies of 101.0 times/year for male and 115.8 times/year for female. There were 13 kinds of fruits had a higher frequency for women compared to that for men. As shown in Table 15, the average consumption frequencies of apple, jujube, strawberry and banana for women were more than ten times higher than that of men.

Table 6 The consumption frequency of meat (times/year) of participants in different age groups in 2016

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Fresh (frozen) pork	251.4	264.8	229.5	242.1	232.4	235.6
Fresh (frozen) beef	97.4	56.8	62.5	65.1	50.7	60.4
Fresh (frozen) mutton	84.6	40.9	50.3	48.2	36.3	46.2
Fresh (frozen) poultry meat	69.9	112.9	63.3	64.3	48.2	59.8
Other fresh (frozen) meat (donkey meat, horse meat, dove meat)	55	33.5	38.3	65.0	32.6	49.7
Cooked pork	81.7	94.0	57.7	55.4	44.0	54.5
Cooked beef	60.4	44.1	41.4	46.4	33.0	40.8
Cooked mutton	71.5	31.2	39.2	58.9	26.9	42.7
Cooked poultry meat	80.5	55.9	41.1	53.3	39.0	45.8
Other cooked livestock and poultry meat (donkey meat, horse meat, dove meat)	99.3	37.8	46.5	60.0	27.9	48.4
Cooked pork liver	67.4	51.3	33.7	39.7	30.4	35.8
Cooked pork kidney	26.9	36.3	27.7	27.3	26.3	26.8
Other cooked animal viscera (liver, intestines, etc.)	96.7	42.3	46.5	65.4	36.2	52.0
Barbecue (mutton string, chicken string, etc.)	52	41.0	38.6	39.8	26.8	36.3
Meat products (sausages, ham sausages, luncheon meat)	100.5	96.9	56.9	60.9	60.8	62.4

Table 7 Consumption statistics: aquatic products

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Cold/fresh saltwater fish (hairtail, cod, and yellow croaker)	66.2	52.1	46.2	176.7	240.4
Cold/fresh freshwater fish (carp, crucian carp, grass carp)	76.9	47.6	46.3	202.4	266.0
Cooked saltwater fish (canned)	12.0	49.0	38.0	179.7	216.2
Cooked freshwater fish (canned)	10.8	56.3	43.5	141.8	192.4
Fillets	16.3	32.1	32.9	124.3	159.2
Shrimp	63.3	32.8	32.0	187.7	240.9
Crabs	33.8	20.8	16.0	286.0	387.6
Shellfish	25.6	26.4	22.6	248.0	300.0

Table 8 The consumption frequency of aquatic products (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Cold/fresh saltwater fish(hairtail, cod, and yellow croaker)	67.3	44.8	49.9	51.3	43.2	48.9
Cold/fresh freshwater fish (carp, crucian carp, grass carp)	80	55.3	44.2	51.4	42.0	46.9
Cooked saltwater fish (canned)	91.8	69.9	37.0	58.7	26.5	43.1
Cooked freshwater fish (canned)	83.5	37.0	43.1	64.2	36.8	49.3
Fillets	56.2	26.5	30.7	43.5	23.5	32.6
Shrimps	50.6	25.5	35.0	35.1	25.4	32.3
Crabs	42.9	20.9	17.5	25.5	9.9	18.2
Shellfish	28.4	34.3	26.1	22.1	22.5	24.3

The statistical analysis indicated that there was no significant difference in the consumption frequency of apples and bananas among different ages, but there was a significant difference in the consumption frequency of watermelon among the age groups (p=0.002) (Table 16).

Consumption of dairy products

As shown in Table 17, more than half of the participants consumed yogurt and full-fat liquid milk in the past year, which were the two foods with the highest consumption rate among the total 7 kinds of dairy foods (62.1% and 55.7%, respectively). The most frequently consumed dairy food was full-fat liquid milk, with a frequency of 187.8 times per year for men and 194.2 times a year for women, which were much higher than that of the other dairy foods. The dairy food with the highest average consumption amount per meal were low-fat and skimmed liquid milk (242.9 ml for male, 241.6 ml for female).

Regarding full-fat liquid milk, low-fat and skimmed liquid milk, full fat milk powder and low fat milk powder, the consumption frequency for the 15 to19 years old group was the highest, followed by that for 6 to 14 years old and 50 years old and above, all of which were higher than that for the 20 to 49 age group. The data can be found in Table 18. Teenagers, middle aged and elderly groups drank milk more frequently in urban areas.

Consumption of snacks

As shown in Table 19, 20 kinds of snacks were included in this study. The most popular snacks were bread, biscuits and sunflower seeds, with consumption rates of 66.2%, 49.5% and 50.3%, respectively. Bread and sunflower seeds were the snacks with the highest consumption frequency (118.3 times/year and 80.4 times/year, respectively). As for male, cream cake, preserved fruit, and puffed food were the snacks with the highest consumption amount (162.9g per meal, 122.0g per meal and 109.0g per meal, respectively). As for female, cream cake, preserved fruit and candied fruit were the snacks with the highest consumption amount (138.4g per meal, 103.7g per meal and 92.6g per meal, respectively).

The consumption frequencies of bread, nuts (walnuts, pistachios and hazelnuts), fried snacks (potato chips, fries), tangerine peel and sweetened roll (fruits paste, dried tangerine or orange peel, hawthorn roll) for women was significantly higher than that for men. The consumption frequency of snacks such as chocolates, puffed food, candied fruit, plum, fruit cake for women were also higher than that for men, while the consumption frequency of cream cake, other pastries, melon seeds, peanuts for men were slightly higher than that for women.

There was no significant difference in consumption frequency of bread and sunflower seeds between different ages, but the consumption frequency of biscuits was significantly different.

Consumption of drinks

As shown in Table 21, carbonated drinks and tea were the most commonly consumed drinks with consumption rates of 44.8% and 46.2, respectively. As for tea, the consumption frequency for men was 269.3 times a year on average and 214.4 times a year for women. Besides tea, men preferred carbonated drinks most frequently (123.7 times/year), and women preferred lactobacillus drinks (102.4 times/year).

In the same age group, there was a significant difference between the daily consumption frequency of carbonated drinks and tea. With the increase of age, the consumption frequency of carbonated drinks decreased while the consumption frequency

Table 9 Consumption statistics: egg products

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Fresh eggs (eggs, duck eggs)	97.6	242.7	261.4	78.6	116.6
Salted duck eggs	46.1	55.0	50.1	65.3	95.1
Preserved eggs	41.7	42.7	34.0	87.2	122.7
Quail eggs	30.7	40.9	34.4	90.0	111.4

Table 10 The consumption frequency of egg products (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Fresh eggs (eggs, duck eggs)	257.7	243.5	251.6	249.0	258.4	252.6
Salted duck eggs	98.8	81.1	47.1	62.0	42.7	52.2
Preserved eggs	77.4	44.0	36.3	45.7	27.5	38.1
Quail eggs	68.4	37.2	34.6	42.1	31.7	37.4

Table 11 Consumption statistics: beans

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Soybeans (soybeans, green beans, black beans, homemade soymilk, etc.)	50.5	94.3	96.8	60.6	67.8
Soymilk (non-homemade)	67.7	135.9	128.0	245.8	229.8
Tofu	82.6	77.0	83.9	123.3	107.8
Fermented bean curd (Stinky fermented bean curd, large chunks of fermented bean curd)	39.8	75.8	67.1	40.9	35.9
Instant bean products	29.3	51.7	47.8	104.4	94.2
Dried beancurd sticks (dried beancurd sticks, the skin of soybean milk)	44.9	47.9	42.3	58.7	55.9
Other bean products (dried bean curd, tofu silk)	47.5	59.6	52.8	102.3	91.3

Table 12 The consumption frequency of beans (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Soybeans (soybeans, green beans, black beans, homemade soymilk, etc.)	135.3	111.1	92.0	102.4	88.6	95.7
Soymilk (non-homemade)	157.5	178.8	144.7	135.2	105.5	131.6
Tofu	74	74.9	79.2	81.6	84.6	80.6
Fermented bean curd (Stinky fermented bean curd, large chunks of fermented bean curd)	98.3	85.0	70.7	77.4	62.9	71.1
Instant bean products	80.6	46.9	49.8	55.0	39.6	49.5
Dried beancurd sticks (dried beancurd sticks, the skin of soybean milk)	66.6	43.2	51.4	48.7	32.9	44.9
Other bean products (dried bean curd, tofu silk)	54.9	70.8	57.0	59.7	51.4	55.9

Table 13 Consumption statistics: fungus and algae

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Edible fungi, non-mushrooms (Auricularia, tremella)	73.0	76.5	84.8	76.0	72.0
Mushrooms (needle mushrooms, letinous edodes, Pleurotus ostreatus, straw mushrooms)	75.5	59.8	66.4	144.7	136.3
Porphyra (including seaweed)	45.7	58.3	58.6	42.4	37.9
Kelp	55.4	44.6	42.8	99.2	97.3

Table14 The consumption frequency of fungus and algae of participants in different age groups (times/years)

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Edible fungi non-mushrooms (Auricularia, tremella)	90.7	69.5	88.8	73.8	76.6	81.0
Mushrooms (needle mushroom, letinous edodes, Pleurotus ostreatus, straw mushroom)	85.3	68.6	66.4	63.9	56.5	63.3
Porphyra (including seaweed)	77.1	64.4	62.6	58.9	50.6	58.5
Kelp	46.7	49.3	46.6	45.8	38.2	43.6

Table 15 Consumption statistics: fruits

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Oranges	64.7	72.5	73.1	177.8	170.6
Grapefruit	51.4	47.2	40.8	197.2	182.2
Mandarin oranges	66.6	66.8	74.8	165.7	156.7
Apples	92.0	145.5	174.4	173.0	166.3
Pears	64.2	62.6	70.6	165.0	156.4
Peaches	60.9	39.9	40.8	179.7	171.5
Plums	34.2	29.9	24.5	131.4	110.5
Loquats	18.7	24.6	22.2	184.2	154.9
Jujubes	49.7	64.2	98.6	105.5	87.4
Apricot	37.1	36.4	28.7	126.7	109.7
Strawberries	63.0	42.6	52.6	223.1	208.1
Grapes	64.0	40.4	43.5	208.2	198.0
Kiwifruit	44.1	37.7	38.3	152.9	146.4
Mangoes	44.7	34.3	39.7	155.7	144.1
Bananas	77.1	101.0	115.8	129.8	120.4
Pineapple	55.8	40.2	41.4	196.9	181.8
Litchi	43.2	28.7	24.3	149.3	140.6
Carambola	17.9	26.3	21.1	138.1	126.4
Watermelo	80.7	65.3	69.5	243.5	225.8
Muskmelon	38.2	37.1	37.1	181.6	183.6

Table 16 The consumption frequency of fruits (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Oranges	87.3	88.4	75.9	81.5	60.5	72.9
Grapefruit	64	37.7	43.4	50.4	35.7	43.5
Mandarin oranges	86.7	85.9	73.8	70.0	66.1	71.1
Apples	175.1	165.0	169.8	156.3	153.4	160.9
Pears	94.9	61.0	69.0	71.5	58.4	67.1
Peaches	55.5	38.0	42.0	42.2	36.9	40.4
Plums	53.3	29.3	25.0	30.5	22.9	26.8
Loquats	47.9	27.3	21.6	36.3	11.1	23.3
Jujubes	64	51.4	79.0	88.5	89.7	84.5
Apricots	58.8	28.1	28.1	34.3	32.0	32.1
Strawberries	76.5	51.7	47.1	51.9	43.4	48.4
Grapes	50.4	39.0	43.4	43.4	39.8	42.1
Kiwifruit	57.7	46.7	33.9	45.5	32.9	38.1
Mangoes	70.4	29.6	41.9	39.1	26.4	37.4
Bananas	127.8	88.8	112.0	106.8	108.0	109.0
Pineapples	58.6	30.8	45.7	38.1	35.4	40.9
Litchi	52.9	24.6	26.2	27.7	22.0	26.1
Carambola	48.3	29.0	22.1	35.3	11.8	23.4
Watermelon	72.7	56.9	78.3	61.4	62.5	67.7
Muskmelon	47.2	37.9	35.3	43.0	33.0	37.0

Table 17 Consumption statistics: dairy products

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Full-fat liquid milk	55.7	187.8	194.2	234.7	230.1
Low-fat and skimmed liquid milk	30.1	140.0	132.1	242.9	241.6
Full fat milk powder	10.2	119.1	90.2	68.1	71.6
Low fat milk powder	7.7	96.4	91.3	51.0	67.1
Yogurt	62.1	141.1	176.4	201.6	181.2
Cheese	11.3	53.4	46.8	63.5	63.2
Ice cream	36.9	62.9	55.8	162.5	157.5

Table 18 The consumption frequency of dairy products (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Full-fat liquid milk	251.5	285.6	179.6	188.1	190.0	191.3
low-fat and skimmed liquid milk	176.2	205.5	129.5	133.2	130.6	135.5
Full fat milk powder	176.5	192.7	82.0	110.1	97.1	104.0
Low fat milk powder	188.6	77.3	78.2	87.9	87.6	93.5
Yogurt	165.2	206.4	178.0	155.1	142.2	162.0
Cheese	92.5	48.5	39.7	64.9	25.9	49.8
Ice cream	104.1	74.8	66.1	57.1	33.3	59.0

of tea increased. In addition, the highest consumption frequency of coffee happened among the 35 to 49 year-old group, while the lowest happened among the group of 50 year-olds and above.

The dietary pattern can comprehensively reflect the dietary structure of residents, and is vital in explaining the relationship between chronic disease and nutrition derived from the diet [10]. The occurrence of a similar metabolic syndrome depends on various factors such as dietary nutrition, living habits, environment and heredity [11-17], with dietary considerations undoubtedly the most closely related. The dietary structure of residents changes constantly with socio-economic growth. The frequency of people dining out is increasing continuously, leading to a rapid decline in grain intake and higher ingestion of animal products, cooking oil and artificial flavors [18]. Unhealthy snacks are popular leisure foods and play a definitive role in dietary nutritional intake [19]. The consumption frequency of snacks for the 6-14 years old is the highest compared to the other age groups. Snacking increases the total energy intake, and can lead to weight gain, excess nutrition, and reduced appetite at mealtimes. However, snacking can alleviate hunger between meals, increasing the sense of satiety, which can serve as a beneficial supplement for balanced meals [20]. Eggs are high in nutritional value due to the consist of ideal amino acid composition and variety of other healthy ingredients [21]. This study found that 97.6 % of the participants consumed fresh eggs, and there was no significant difference in the frequency of egg consumption among different age groups. Carbonated drinks and tea were the most common drinks consumed by the participants. Besides carbon dioxide, the main components presented in carbonated drinks include acidic substances such as carbonated water and citric acid, white sugar, spices, artificial colors, and occasionally caffeine [22, 23]. These beverages are extremely popular due to its unique taste and promotion through various types of media that are mainly recognized by younger groups [24]. With an increase in the age of the participants, the frequency of the consumption of carbonated beverages steadily declines and presents a higher consumption of tea. In addition, the highest frequency in the consumption of coffee is present in the 35-49 age group, while it is the lowest in the 50 and older age groups.

Table 19 Consumption statistics: snacks

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Bread	66.2	116.5	119.7	88.2	79.1
Biscuits	49.5	75.4	73.9	79.1	68.5
Cream cake	33.6	37.0	29.6	162.9	138.4
Other pastries	30.8	59.2	51.1	67.8	66.3
White pumpkin seeds	21.5	66.1	61.0	49.7	55.7
Sunflower Seeds	50.3	83.9	77.7	73.0	62.5
Black melon seeds	30.6	60.9	55.7	79.3	72.1
Peanuts	50.0	73.5	63.8	63.8	61.3
Other nuts (walnut, pistachio, hazelnut)	45.7	61.0	70.0	55.7	52.1
Chocolates	35.9	48.1	49.1	47.3	37.9
Fried snacks (Potato chips, fries)	22.7	49.7	53.8	104.9	92.3
Puffed food	19.5	45.8	43.8	109.0	92.6
Candied fruit (myrica rubra, figs, jujubes, olives, and kumquats)	17.4	51.1	53.7	92.8	91.5
Preserved fruit (preserved prune, sugar red bayberry)	12.2	46.8	39.5	122.0	103.7
Dried fruit (preserved apple, preserved apricot, preserved fruit of prunes and preserved assorted fruit)	16.8	55.6	48.7	86.1	76.2
Preserved plum	21.0	44.1	45.8	59.1	51.5
Preserved mandarin peel	12.1	43.7	47.5	83.0	70.7
Other pickled fruits(Licorice olive, pickled plum, pickled apricot and preserved carambola)	9.8	33.8	35.5	91.7	70.0
Sweetened roll (Fruits paste, dried tangerine or orange peel, hawthorn roll)	25.0	58.0	73.6	73.7	56.2
Fruit cake (hawthorn cake, hawthorn, jujube cake)	22.7	44.6	46.8	77.5	60.8

Table 20 The consumption frequency of snacks (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Bread	152.2	158.9	128.4	112.5	99.5	118.2
Biscuits	104.4	162.5	73.6	73.0	63.8	74.6
Cream cake	59.7	33.6	29.2	40.2	22.8	32.9
Other pastries	71.5	81.9	52.5	62.6	46.7	54.9
White pumpkin seeds	100.2	40.2	47.1	68.8	69.0	63.3
Sunflower Seeds	68.9	99.3	75.6	89.0	76.5	80.5
Black melon seeds	88.3	45.2	49.6	67.0	56.1	58.0
Peanuts	103.5	49.6	62.9	64.7	75.3	68.5
Other nuts (walnut, pistachio, hazelnut)	92.1	81.8	64.3	74.0	57.5	65.9
Chocolates	85.8	51.7	42.9	51.4	49.2	48.8
Fried snacks (Potato chips, fries)	105.5	117.3	47.6	43.6	29.6	51.9
Puffed food	72.7	49.5	45.3	42.5	35.1	44.7
Candied fruit (myrica rubra, fig, jujube, olive and kumquat.)	103.3	81.7	46.0	62.1	36.9	52.9
Preserved fruit (preserved prune, sugar red bayberry)	79.4	29.4	34.8	57.8	27.2	42.7
Dried fruit (preserved apple, preserved apricot, preserved fruit of prunes and preserved assorted fruit)	88.9	63.8	49.7	65.9	32.7	51.8
Preserved plum	76.3	69.0	37.5	54.2	37.8	45.3
Preserved mandarin peel	100.4	42.5	33.6	60.7	23.1	45.4
Other pickled fruits (Licorice olive, pickled plum, pickled apricot and preserved carambola)	75.5	48.2	27.1	38.8	22.7	35.1
Sweetened roll (Fruits paste, dried tangerine or orange peel, hawthorn roll)	109.7	41.5	63.4	57.9	74.0	68.1
Fruit cake (hawthorn cake, hawthorn, jujube cake)	71.1	34.5	40.9	51.0	43.6	45.9

Table 21 Consumption statistics: drinks

	Consumption rate (%)	Consumption frequency (times/year)		Average consumption per time (g)	
		Male	Female	Male	Female
Carbonated drinks	40.6	123.7	84.6	432.1	385.8
Freshly squeezed fruit and vegetable juice	31.9	74.6	69.6	318.4	302.3
Fruit and vegetable juice drink	33.8	79.7	64.0	343.6	327.3
Lactobacillus drink	21.2	104.7	102.4	243.0	229.0
Blended milk drink	14.3	51.7	50.5	420.0	408.2
Tea (without water)	39.7	269.3	214.4	21.5	24.6
Coffee	20.5	95.4	84.8	17.6 (Solid)	16.5 (Solid)
				235.1 (Liquid)	215.3(Liquid)

Note: the amount of coffee consumed per meal were divided into the amount of solid coffee and liquid coffee. A solid coffee is a self-brewed coffee bar or a coffee bean, which had itsunhydrated weight counted. Aliquid coffee is a purchased coffee, which was counted in wet case weight.

Table 22 The consumption frequency of consuming drinks (times/year) of participants in different age groups

	6-14 years old	15-19 years old	20-34 years old	35-49 years old	50 years old or above	Total
Carbonated drinks	153.6	168.2	121.6	93.3	61.0	104.1
Freshly squeezed fruit and vegetable juice	112.9	200.8	62.6	78.7	59.0	71.9
Fruit and vegetable juice drink	104.6	59.2	76.6	65.5	62.4	71.0
Lactobacillus drink	136.6	166.4	106.0	96.5	93.4	103.6
Blended milk drink	81.1	80.7	44.6	55.5	28.4	48.4
Tea (without water)	97.6	150.6	201.6	269.6	255.8	242.6
Coffee	112.9	119.5	84.6	112.8	62.3	89.5

Conclusion

This study successfully included 3,052 households with a sample size of 3,369 participants in total.

For the staple foods, 98.5% of the residents consumed rice and its products, with a significant difference in the consumption frequency of rice and its products as well as wheat flour and its products between different age groups. With the increase in age, the consumption frequency of rice and its products and potatoes decreased. The vegetable with the highest consumption rate was tomatoes, followed by cucumbers and eggplant. There was no significant difference in the consumption frequency of vegetable among all age groups. For meat, the consumption rate and frequency of eating fresh (frozen) pork were the highest. Approximately 89.9% of the participants consumed fresh (frozen) pork, and the average annual consumption frequency was 235.4 times. As for the egg categories, 97.6% of population ate fresh eggs, and there was no significant difference in the consumption frequency of fresh eggs among different age groups. When it comes to beans, Tofu was the most popular, with a consumption rate of 82.6%. For fungus and algae, 75.5% and 73% of the participants consumed mushrooms and non-mushrooms, respectively, which were far more than kelp and Porphyra. There was no significant difference in the ingestion frequency of fungus and algae food among different age groups. Apples ranked the first among the 20 fruits by consumption frequency among all age groups. In addition to apples, watermelons and bananas were also quite popular among the participants. Regarding dairy foods, yogurt and full-fat liquid milk had the highest consumption rate. The consumption frequency for 15 to19 year-old group was the highest. Teenagers, middle aged and elderly group consumed milk more frequently in urban areas compared to rural areas. As for snacks, bread, biscuits and sunflower seeds were consumed most frequently. A total of 15 kinds of snacks were at the highest consumption frequencies for people aged 6 to 14 years old. This study found no significant difference in the consumption frequency of the bread and the sunflower seeds between different ages, but when it comes to biscuits, the differences were significant. Tea and carbonated drinks were the most commonly consumed beverages. There was a significant difference in the frequency of drinking carbonated drinks and tea among different ages. The drinking frequency of carbonated drinks gradually decreased as age increased, whereas, on the contrary, the drinking frequency of tea increased gradually. In addition, the highest consumption frequency of coffee happened among the 35 to 49 years old people, and the lowest happened among the age group of 50 and above.

With the improvement of living standards in China, the demand of residents has shifted from the pursuit of satiety to nutritional diet and healthy lifestyle. Therefore, it is necessary to establish reasonable nutrition goals, advocate healthy lifestyles, and promote healthy eating habits.

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Conflict of interest

The authors declare that they have no conflict of interests.

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