The First Hong Kong Total Diet Study Report No. 9

The First Hong Kong Total Diet Study: Minerals

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KEY FINDINGS

The First Hong Kong Total Diet Study: Minerals

Key findings of the Study

- The current report presents the levels of minerals in food and the dietary intake assessment of the local adult population to thirteen types of minerals, namely boron, calcium, cobalt, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium and zinc.

- The dietary intakes of calcium, iron and potassium of the general adult population were inadequate when compared to the respective recommended intakes.

- The dietary intake of sodium of the general adult population was in excess when compared to the recommended intake.

- The dietary intakes of copper, magnesium, manganese, molybdenum and phosphorus of more than 20% of the adult population were inadequate when compared to the respective recommended intakes. Nonetheless, development of adverse health effect from deficiency of these five minerals is very uncommon.

- The dietary intakes of cobalt, boron, selenium and zinc of the adult population were within the respective recommended intakes.

- The study suggested that the general adult population might experience certain health risks due to inadequate dietary intakes of calcium, iron and potassium, and excessive dietary intake of sodium.

EXECUTIVE SUMMARY

The First Hong Kong Total Diet Study: Minerals

The Centre for Food Safety (CFS) is conducting the First Hong Kong Total Diet Study (the 1st HKTDS) to estimate dietary exposures of the Hong Kong general population and various population subgroups to a range of substances, including contaminants and nutrients, and to assess any associated potential health risks. The 1st HKTDS comprises food sampling and preparation, laboratory analysis and dietary exposure estimation. A total of 1,800 samples, comprising 150 different TDS food items with three purchases on each of the four occasions from March 2010 to February 2011, were collected and prepared, and then combined into 600 composite samples for testing of various selected substances.

2. This is the ninth report of the TDS series. It presents the dietary intake assessment to thirteen minerals, namely, boron, calcium, cobalt, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium and zinc.

3. Minerals are important nutrients for growth, development and normal body functions. Inadequate intake of minerals poses health concern. However, like other chemical substances, minerals may have adverse health effects if consume at high levels for a long period of time. Therefore, adverse health consequence on the human body can arise from inadequate or excessive intakes of minerals, but it may not lead to clinical symptoms. The dietary intakes of the Hong Kong population to the thirteen minerals and the associated potential health risks due to inadequate or excessive intake of these minerals have been assessed.

Results

4. The dietary intakes of calcium, iron and potassium of the general adult population were inadequate when compared to the respective recommended intakes while the dietary intake of sodium of the general adult population was in excess when compared to the recommended intake.

5. The dietary intake of calcium of more than 90% of the adult population was below the recommended intake. Inadequate dietary intake of calcium is one of the important factors causing osteoporosis. The finding suggested that current intake of calcium might increase the risk of developing osteoporosis in the general adult population.

6. The dietary intake of iron of more than 80% of the adult population was below the recommended intake. The finding suggested that current intake of iron of the general adult population might pose certain health risks such as anaemia and reduced immune function. Young women and pregnant women are more vulnerable to iron deficiency as their requirement of iron is much higher.

7. The dietary intake of sodium of more than 60% of the adult population was above the recommended intake. The dietary intake of potassium of about 60% of the adult population was below the recommended intake. The findings suggested that current intake of sodium and potassium might increase the risk of developing high blood pressure, coronary heart disease and stroke in the general adult population.

8. The dietary intakes of copper, magnesium, manganese, molybdenum and phosphorus of more than 20% of the adult population were inadequate when

compared to the respective recommended intakes. Nonetheless, development of adverse health effect from deficiency of these five minerals is very uncommon.

9. The dietary intakes of cobalt, boron, selenium and zinc of the adult population were within the respective recommended intakes.

Advice to the Public

- Achieve a balanced and varied diet so as to prevent inadequate or excessive intakes of minerals. Foods that are lower in fat, sodium and sugar, and higher in dietary fibre are better choices.
- Increase dietary intake of calcium. Dairy products, beans and dark green vegetables are rich in calcium.
- Increase dietary intake of iron. Dark green vegetables, beans and nuts are rich in iron.
- Increase dietary intakes of potassium. Vegetables, fruits, beans and nuts are rich in potassium.
- Reduce dietary intake of sodium. Consumers are recommended to reduce the use of condiments and sauces such as salt, soy sauce and oyster sauce during cooking, order food with less salt when eating out and choose prepackaged food with low sodium content by reading nutrition label.
- Pregnant women may consult medical professionals on their requirement of nutrients including minerals (such as calcium and iron).

Advice to the Trade

- The nutrition information should be clearly declared on the nutrition label for prepackaged foods and should not be misleading.
- Declare the content of individual mineral on the nutrition label for prepackaged foods that are rich in minerals.
- Reduce sodium level in foods. Food manufacturers can make reference to the CFS's Trade Guidelines for Reducing Sodium in Foods to formulate foods with lower sodium content.

Chapter 1

Background

1.1 Total Diet Study (TDS) has been recognised internationally as one of the most cost effective way to estimate dietary exposures to food chemicals or nutrients for various population groups and to assess their associated health risks. It provides a scientific basis for assessing food safety and regulating food supply. Since 1960s, various countries including the United Kingdom (UK), the United States (USA), Canada, Australia, New Zealand, France, Ireland and Mainland China have been conducting their own TDS.

Introduction of the First Hong Kong Total Diet Study (1st HKTDS)

1.2 This was the first time a TDS was carried out in Hong Kong by the Centre for Food Safety (CFS). It aimed to estimate dietary exposures of the Hong Kong general population and various population subgroups to a range of substances including contaminants and nutrients, and to assess any associated potential health risks.

1.3 The 1st HKTDS was a large and complex project that comprised food sampling and preparation, laboratory analysis and dietary exposure estimation. It covered the majority of foods normally consumed by the Hong Kong population, with laboratory analysis of over 140 substances including contaminants and nutrients.

Minerals

1.4 Minerals are important nutrients, which are needed in small amounts for growth, development and normal body functions. Like other chemical substances, minerals may have adverse health effects if intake at high level. Therefore, adverse health consequence on the human body can arise from inadequate or excessive intakes of minerals, but it may not lead to clinical symptoms. For ordinary adult, diet is the main source of minerals intake. This report focused on thirteen minerals, namely, boron, calcium, cobalt, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium and zinc. The dietary intakes of the Hong Kong population to these minerals and their associated potential health risks due to inadequate or excessive intake of these minerals have been assessed.

Chapter 2

Methodology and Laboratory Analysis

Methodology of the 1st HKTDS

2.1 The 1st HKTDS involved purchasing samples of food commonly consumed throughout Hong Kong, preparing them as consumed, combining the foods into food composites, homogenising them, and then analysing them for a range of substances. The analytical results were then combined with food consumption information of various population groups, which were captured from the Hong Kong Population-based Food Consumption Survey (FCS) [1], in order to obtain the dietary exposures.

2.2 One hundred and fifty TDS food items were selected for the study, based on the food consumption data of the FCS. Three samples of each TDS food item were collected on four occasions from March 2010 to February 2011 and prepared in a form as normally consumed. A total of 1,800 samples were collected and combined into 600 composite samples for laboratory analysis.

2.3 Dietary exposure estimation was performed with the aid of an in-house developed web-based computer system, the Exposure Assessment System, also known as EASY in short, which involved food mapping and weighting of data. The mean and 95th percentile of the exposure levels were used to represent the dietary exposures of average and high consumers of the population respectively.

2.4 Details of the methodology are given in the same series of report on Methodology.[2]

Laboratory Analysis

2.5 Laboratory analysis of minerals was conducted by the Food Research Laboratory (FRL) of the CFS. Having taken into account their likelihood of occurrence in food, 600 composite samples of 150 TDS food items taken from the four occasions have been tested for boron, calcium, cobalt, copper, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, sodium and zinc. For analysis of elements that are readily soluble in acid including calcium, magnesium, phosphorus, potassium and sodium, the composite samples were digested in concentrated nitric acid and hydrogen peroxide at 95°C. For analysis of other elements, the composite samples were digested in concentrated nitric acid using Teflon high pressure closed vessels and microwave heating. After the digestion, the contents of calcium, magnesium, phosphorus, potassium and sodium were quantified using inductively coupled plasma-optical emission spectrometer, whereas the contents of other elements were determined by high resolution inductively coupled plasma – mass spectrometry. The limits of detection (LODs) and limits of quantitation (LOQs) in general food as well as in water and tea samples are tabulated as follows:

Minerals	General Food		Water and Tea	
	LOD	LOQ	LOD	LOQ
Boron (μg/kg)	25	125	5	25
Calcium (mg/kg)	4	10	0.8	2
Cobalt (μg/kg)	1	5	0.2	1
Copper (μg/kg)	5	25	1	5
Iron (μg/kg)	50	250	10	50
Magnesium (mg/kg)	1	3	0.2	0.6
Manganese (μg/kg)	5	25	1	5
Molybdenum (μg/kg)	2	10	0.4	2
Phosphorus (mg/kg)	5	20	1	4
Potassium (mg/kg)	4	10	0.8	2
Selenium (μg/kg)	5	25	1	5
Sodium (mg/kg)	4	10	0.8	2
Zinc (μg/kg)	10	50	2	10

Treatment of Analytical Values below LOD

2.6 In this study, recommendation from the World Health Organization (WHO) regarding evaluation of low-level of contamination of food was followed when treating analytical value below LOD.[3] As less than or equal to 60% of results of the concentrations of all thirteen minerals in food were below LOD, the medium bound dietary exposure estimations (a value of 1/2 LOD was assigned to all analytical values below LOD) for the overall population were presented.

Dietary Reference Intakes

2.7 Dietary Reference Intakes (DRIs) is a collective term of the four different sets of reference values, namely Estimated Average Requirement (EAR), Recommended Nutrient Intake (RNI), Adequate Intake (AI) and Tolerable Upper Intake Level (UL).

2.8 Estimated Average Requirement (EAR) is the average daily nutrient intake level that meets the needs of 50% of the healthy individuals in a particular age and gender group.[4]

2.9 Recommended Nutrient Intake (RNI) is the daily intake, set at the EAR plus 2 standard deviations, which meets the nutrient requirements of almost all apparently healthy individuals in an age- and sex-specific population group.[4]

2.10 Adequate Intake (AI) is the recommended average daily intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate; used when an RNI cannot be determined.[5]

2.11 Tolerable Upper Intake Level (UL) is the maximum intake that is unlikely to pose risk of adverse health effects from excess in almost all apparently healthy individuals in an age- and sex-specific population group.[4] The UL is established when strong evidence supporting the relationship between a nutrient and the adverse effects is available.

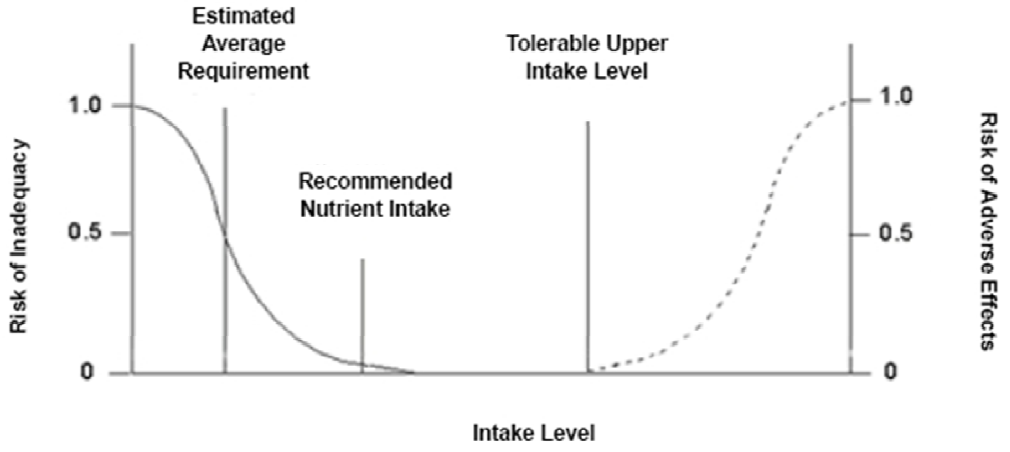

Figure 2.1 Relationship of DRIs to Risk of Nutrient Inadequacy and Risk of Adverse Health Effects

2.12 In this TDS, the DRIs including RNI, Adequate AI and UL established by the World Health Organization, if available, were used to assess the health risk of the mineral intakes. It is because WHO is the directing and coordinating authority for health within the United Nations system and is responsible for setting norms and standards, and monitoring and assessing health trends in international level. Normative Requirement, the level of intake that serves to maintain a level of tissue storage or other reserve,[6] is also established by WHO for some minerals such as copper and zinc, and were used for the assessment of the intakes of these two elements. On the other hand, the recommended maximum level of intake from WHO was used to assess the sodium intake.

2.13 If DRIs or other nutrient reference values of a mineral is not available in WHO, the DRIs established by the China Nutrition Society (CNS) were used for assessment as the physique and dietary habit of the Chinese population is close to that of the population in Hong Kong and these values setting for the Chinese population are deemed to be applicable to the population in Hong Kong to a certain extent.

2.14 As DRIs for cobalt is not available from WHO and CNS, reference values from the Expert Group on Vitamins and Minerals in the UK was used for assessment.

2.15 For certain minerals, such as calcium, iron, magnesium, phosphorus and selenium, WHO and CNS established different DRIs for different age groups. As the classification of the age groups from WHO and CNS may be different from that of TDS, an age group in TDS may have two different DRIs. For instance, male aged at or below 65 and above 65 in the age group 60-69 in TDS have different

RNI for calcium as WHO established different RNI for male aged between 19-65 (i.e. 1000mg/day) and aged above 65 (i.e. 1300mg/day). In such scenario, the more stringent DRIs would be used for the assessment of nutrient intakes (i.e. RNI from WHO for male aged above 65, 1300mg/day will be used for the assessment of calcium intake of male aged between 60-69 in the aforesaid situation).

Table 2.1 DRIs selected for assessment of dietary intakes of minerals

Minerals	**DRIs chosen for assessment (Source)**	
Boron	-	Acceptable safe range (WHO)
Calcium	RNI (WHO)	UL (WHO)
Cobalt	-	Guidance level (Expert Group on Vitamins and Minerals)
Copper	Normative Requirement (WHO)	UL (WHO)
Iron	RNI (CNS)	UL (CNS)
Magnesium	RNI(WHO)	UL(WHO)
Manganese	AI (CNS)	UL (CNS)
Molybdenum	RNI (CNS)	UL (CNS)
Phosphorus	RNI (CNS)	UL (CNS)
Potassium	AI (CNS)	-
Selenium	RNI (WHO)	UL (WHO)
Sodium	-	Recommendation (WHO)
Zinc	Normative Requirement (WHO)	UL (WHO)

International Comparison

2.16 The dietary intakes of the minerals found in current study were compared to those obtained from other countries, if available. However, direct comparison of the data has to be done with caution due to the difference in time when the studies were carried out, research methodology, methods of collection of consumption data, methods of analysis and methods of treating results below detection limits.

Chapter 3

Boron

3.1 Boron is a naturally occurring element that is found in the form of borates in the oceans, sedimentary, rocks, coal, shale, and some soils. It occurs in foods as borate and boric acid. Food of plant origin especially fruits, leafy vegetables, nuts and legumes are rich sources of boron. Little is known of the biochemical function of boron in human. Some studies suggested that boron intake may influence the metabolism and utilisation of other nutrients, particularly calcium, and may have a beneficial effect on bone calcification and maintenance.[6,7]

Health effects

3.2 Health effect on boron deficiency is not well-known. Some studies showed that deficiency of boron in human will lower serum calcium concentration and affect the brain function.[6] Studies of dietary deprivation of boron in animals have reported adverse effects on growth, serum steroid hormone concentrations and bone calcification.[7]

3.3 Boron has a low toxicity when administered orally.[6] Some case reports of boron intoxication in humans with excess intake of boric acid (over 25mg/kg body weight) over periods ranging from days to weeks resulted in gastrointestinal effects such as vomiting, diarrhoea and abdominal pain.[7]

Results and Discussions

Concentrations of Boron in TDS Foods

3.4 A total of 600 composite samples on four occasions were tested for boron and the results in 15 TDS food groups are summarised in Table 3.1 and the results in 150 TDS food items are shown in Table A in Appendix I.

Table 3.1 Boron Content (µg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	660	61 - 4100
Vegetables and their products	140	1800	120 - 4000
Legumes, nuts and seeds and their products	24	8900	ND - 26000
Fruits	68	2800	710 - 14000
Meat, poultry and game and their products	48	300	27 - 1200
Egg and their products	12	220	150 - 330
Fish and seafood and their products	76	720	ND - 5400
Dairy products	20	370	130 - 1200
Fats and oils	8	48	32 - 68
Beverages, alcoholic	8	4500	83 - 9300
Beverages, non-alcoholic	40	400	ND - 1900
Mixed dishes	48	460	74 - 1800
Snack foods	4	3900	3500 - 4700
Sugars and confectionery	8	2600	25 - 8900
Condiments, sauces and herbs	20	1700	52 - 6400
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

3.5 In this study, only about 2% of the test results were not detected with boron. The highest mean level was detected in food group “legumes, nuts and seeds and their products” (mean: 8900 µg/kg), followed by “beverages, alcoholic” (mean: 4500 µg/kg), “snack foods” (mean: 3900 µg/kg) and “fruits” (mean: 2800 µg/kg). By comparing the mean levels in 150 food items, peanut was found to

contain the highest level (mean: 22000 µg/kg) followed by peanuts butter (mean: 21000 µg/kg), red wine (mean: 8800 µg/kg) and plum (mean: 8800 µg/kg).

Dietary Intake of Boron

3.6 Dietary intakes of boron of average and high consumers of the population were 1.5mg/day and 2.8mg/day respectively. The dietary intake of the whole population did not exceed the upper level of the acceptable safe range of population intakes for boron for adult established by WHO, i.e. 13 mg/day.[6]

3.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table A in Appendix II.

Major Food Contributors

3.8 The percentage contribution to the dietary source of boron intake of an average consumer by food group is shown in Figure 3.1. The main dietary source of boron intake was “fruits” which contributed to 31 % of the total intake. “Vegetables and their products” was the next major source of boron intake, contributing to 24% of the total intake.

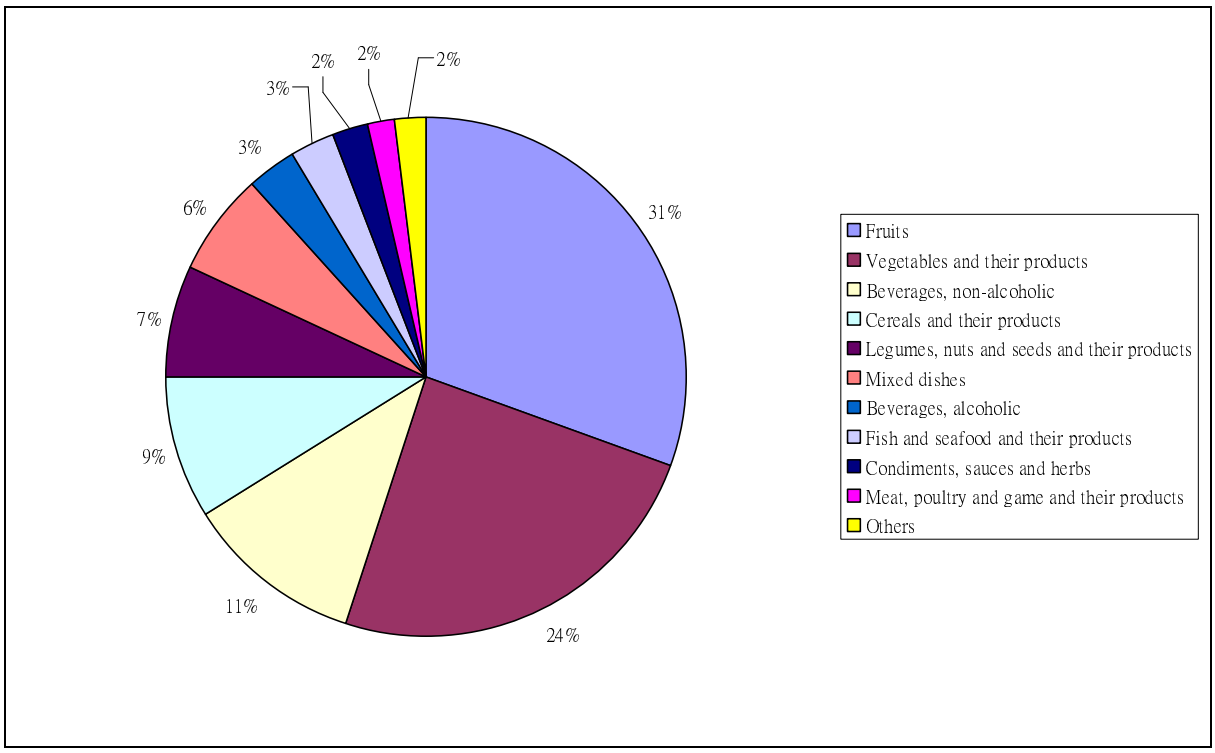

Figure 3.1 Percentage Contribution to Dietary Intake of Boron by Food Groups

International Comparison

3.9 Dietary intake of boron from other countries was not available for comparison.

Summary

3.10 The dietary intake of the whole population did not exceed the upper level of the acceptable safe range of population intakes for boron for adult established by WHO. On this basis, the current intake of boron is unlikely to present a human health and safety risk.

Chapter 4

Calcium

4.1 Calcium is a divalent cation, which is the fifth most abundant element in human body. Nearly all (99%) the total body calcium is located in the bones. The remaining is distributed between the teeth, soft tissues and extracellular fluid. The best sources of calcium from food are milk and milk products. Some dark green vegetables such as kale, collards, Chinese flowering cabbage and Chinese spinach are also good sources of calcium. Calcium is necessary for providing rigidity to the skeleton. It also plays roles in many metabolic processes such as nerve transmission, muscle contraction, and blood clotting.[4,7]

Health effects

4.2 Inadequate dietary calcium intake is associated with a number of common, chronic medical disorders, including osteoporosis, osteoarthritis, cardiovascular disease, diabetes, dyslipidaemias, hypertensive disorders of pregnancy, obesity and cancer of the colon.[8]

4.3 Calcium levels in the body are under control of genetic and hormonal factors. Therefore an excessive accumulation of calcium in blood or tissue solely through excessive calcium consumption should not occur in the absence of diseases such as bone cancer or in the absence of excessive vitamin D intake. Adverse effects which have been reported due to high calcium intakes include the so-called milk-alkali syndrome, the formation of kidney stone and interference with the absorption of other minerals.[7]

Results and Discussions

Concentrations of Calcium in TDS Foods

4.4 A total of 600 composite samples on four occasions were tested for calcium and the results in 15 TDS food groups are summarised in Table 4.1 and the results in 150 TDS food items are shown in Table A in Appendix I.

Table 4.1 Calcium Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	320	14 - 2200
Vegetables and their products	140	490	14 - 2300
Legumes, nuts and seeds and their products	24	740	13 - 3300
Fruits	68	110	29 - 520
Meat, poultry and game and their products	48	160	32 - 1100
Egg and their products	12	680	560 - 860
Fish and seafood and their products	76	410	38 - 2300
Dairy products	20	2600	910 - 10000
Fats and oils	8	67	ND - 160
Beverages, alcoholic	8	58	41 - 71
Beverages, non-alcoholic	40	230	ND - 1500
Mixed dishes	48	190	23 - 950
Snack foods	4	300	170 - 390
Sugars and confectionery	8	970	6.0 - 2300
Condiments, sauces and herbs	20	130	19 - 340
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

4.5 In this study, only about 1% of the test results were not detected with calcium. The highest mean level was detected in food group “dairy products”

(mean: 2600 mg/kg), followed by "sugars and confectionery" (mean: 970 mg/kg), "legumes, nuts and seeds and their products" (mean: 740 mg/kg) and "egg and their products" (mean: 680 mg/kg). By comparing the mean levels in 150 food items, cheese was found to contain the highest level (mean: 7500 mg/kg) followed by yoghurt (mean: 2000 mg/kg), chocolate (mean: 1900 mg/kg) and Chinese spinach (mean: 1900 mg/kg).

Dietary Intake of Calcium

4.6 Dietary intakes of calcium of average and high male consumers aged between 20-59 were 430mg/day and 830mg/day respectively, and aged between 60-84 were 410mg/day and 850mg/day respectively. The dietary intake of more than 97% of the male population was below the RNI for calcium for adult male established by WHO[4] i.e. 1000mg/day for aged between 19-65 and 1300mg/day for aged above 65.

4.7 Dietary intakes of calcium of average and high female consumers aged between 20-59 were 440mg/day and 840mg/day respectively, and aged between 60-84 were 420mg/day and 860mg/day respectively. The dietary intake of more than 97% of female population was below RNI for calcium for adult female established by WHO[4] i.e. 1000mg/day for aged between 19 to menopause and 1300mg/day for postmenopause.

4.8 Dietary intake of calcium of less than 1% of the population exceeded the UL for adult established by WHO, i.e. 3000mg/day.[4]

4.9 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table B in Appendix II.

Major Food Contributors

4.10 The percentage contribution to the dietary source of calcium intake of an average consumer by food group is shown in Figure 4.1. The main dietary sources of calcium intake were "vegetables and their products", "dairy products" and "beverages, non-alcoholic" which contributed to 28%, 18% and 15% respectively. However, in Australia, France and USA, dairy products were reported as the major food contributor of calcium while vegetables were not.

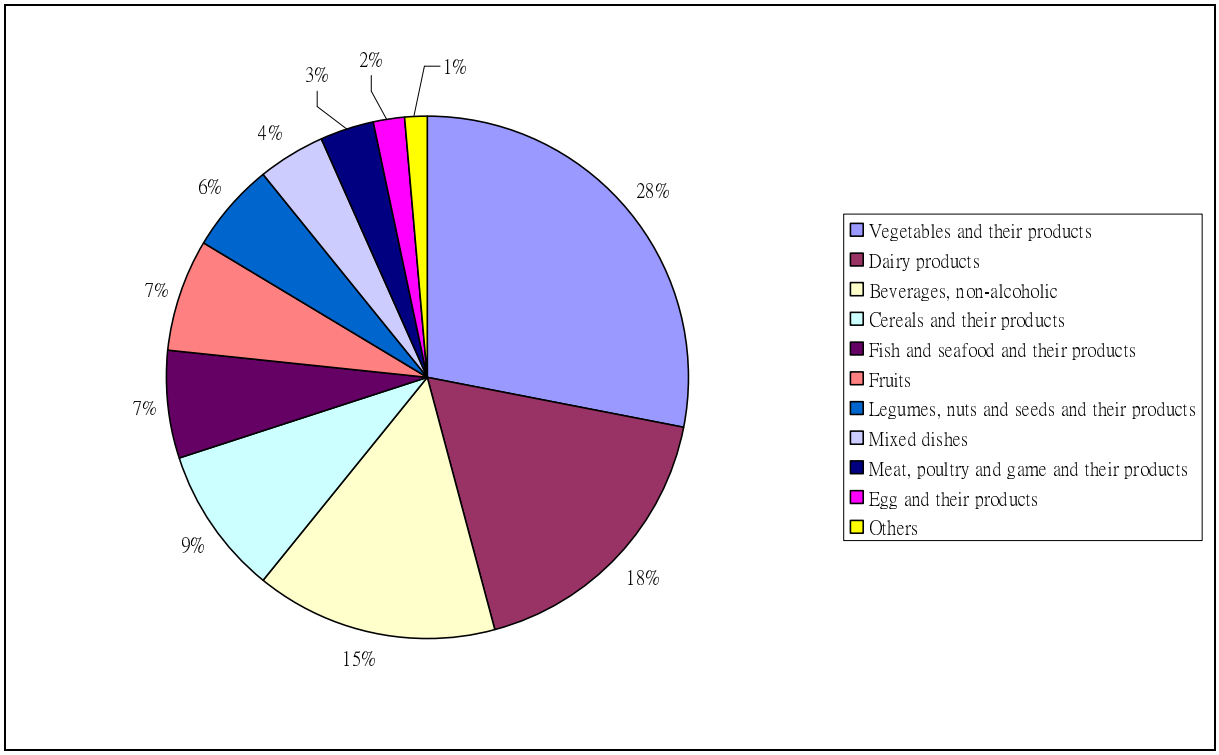

Figure 4.1 Percentage Contribution to Dietary Intake of Calcium by Food Groups

International Comparison

4.11 The dietary intakes of calcium found in current study were compared to those obtained from other places and are summarised in Table 4.2

4.12 The dietary intake estimated in our study were comparable with those reported by the studies of USA and China. It can be seen that the dietary intake in our study are lower than those reported by the studies of France and Australia. Part of the reasons may be due to lower consumption of dairy products of Hong Kong adult population comparing to adult from France and Australia.

Table 4.2 A Comparison of Dietary Intake of Calcium

	Dietary Intake of Calcium (mg/day)	
	Average	**High Consumer**
China 2002[9]	390[a]	-
The 1st HKTDS	430	840 (95th percentile)
USA 1991-96[10]	510-800[b]	-
France 2006-07[11]	790[c]	1,400[c] (95th percentile)
Australia 2008[12]	700-1,200[d]	1,200-2,100[d] (95th percentile)

Notes:

[a] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.
[b] The above data covers adult from aged 25 and above and were presented in range.
[c] The above data covers adult aged 18 - 79.
[d] The above data covers adult from aged 19 and above and were presented in range.

Summary

4.13 The dietary intake of calcium of more than 97% of population was below the RNI for calcium for adult established by WHO. The dietary intake of calcium of less than 1% of the population exceeded the UL for adult established by WHO.

4.14 Consumers are recommended to increase the dietary intakes of calcium to lower the risk of developing osteoporosis. Pregnant women should pay attention to their dietary intake of calcium as WHO established a higher RNI for them in the last trimester (i.e. 1200mg/day).[4]

Chapter 5

Cobalt

5.1 Cobalt is a transition metal which is widely distributed in the environment, accounting for 0.001% of the earth's crust. High concentrations of cobalt are found in fish, nuts and green leafy vegetables. It is an essential trace element being an integral part of vitamin B_{12}, which is essential for folate and fatty acid metabolism.[13]

Health Effect

5.2 Cobalt deficiency has not been reported in humans. A wasting disease in cattle, of which a key feature is anaemia, has been demonstrated to be due to cobalt deficiency in pastures.[13]

5.3 Some case studies reported that ingestion of excess cobalt for the treatment of anaemia resulted in gastrointestinal upset, skin rashes, hot flushes, goitre and hypothyroidism. Features of chronic toxicity include effects on the heart, thyroid and possibly the kidney.[13]

Results and Discussions

Concentrations of Cobalt in TDS Foods

5.4 A total of 600 composite samples on four occasions were tested for cobalt and the results in 15 TDS food groups are summarised in Table 5.1 and the results in 150 TDS food items are shown in Table A in Appendix I.

Table 5.1 Cobalt Content (µg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	7	ND - 32
Vegetables and their products	140	12	ND - 100
Legumes, nuts and seeds and their products	24	37	ND - 150
Fruits	68	7	ND - 100
Meat, poultry and game and their products	48	5	ND - 23
Egg and their products	12	3	1 - 5
Fish and seafood and their products	76	10	ND - 69
Dairy products	20	3	ND - 28
Fats and oils	8	2	ND - 9
Beverages, alcoholic	8	3	ND - 7
Beverages, non-alcoholic	40	3	ND - 11
Mixed dishes	48	5	1 - 12
Snack foods	4	52	28 - 83
Sugars and confectionery	8	61	ND - 180
Condiments, sauces and herbs	20	9	ND - 26
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

5.5 In this study, 10% of the test results were not detected with cobalt. The highest mean level was detected in food group “sugars and confectionery” (mean: 61 µg/kg), followed by “snack foods” (mean: 52 µg/kg) and “legumes, nuts and seeds and their products” (mean: 37 µg /kg). By comparing the mean levels in 150 food items, chocolate was found to contain the highest level (mean: 120 µg /kg) followed by peanut (mean: 89 µg /kg) and fermented bean products (mean: 71 µg /kg).

Dietary Intake of Cobalt

5.6 Dietary intakes of cobalt of average and high consumers of the population were 9.4µg/day and 17µg/day. The dietary intake of the whole population did not exceed the guidance upper level for intake of cobalt that would not be expected to result in any adverse effects, established by the Expert Group on Vitamins and Minerals in the UK, i.e. 23µg/kg bw/day (about 1410µg/day for a 61.3-kg adult).[13]

5.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table C in Appendix II.

Major Food Contributors

5.8 The percentage contribution to the dietary source of cobalt intake of an average consumer by food group is shown in Figure 5.1. The main dietary sources of cobalt intake were "vegetables and their products", "cereals and their products" and "beverages, non-alcoholic" which contributed to 22%, 21% and 19% of the total intake respectively. Similar to our findings, cereal products, vegetables, non-alcoholic beverages and dairy products were the major food contributors of cobalt in Australia and France.

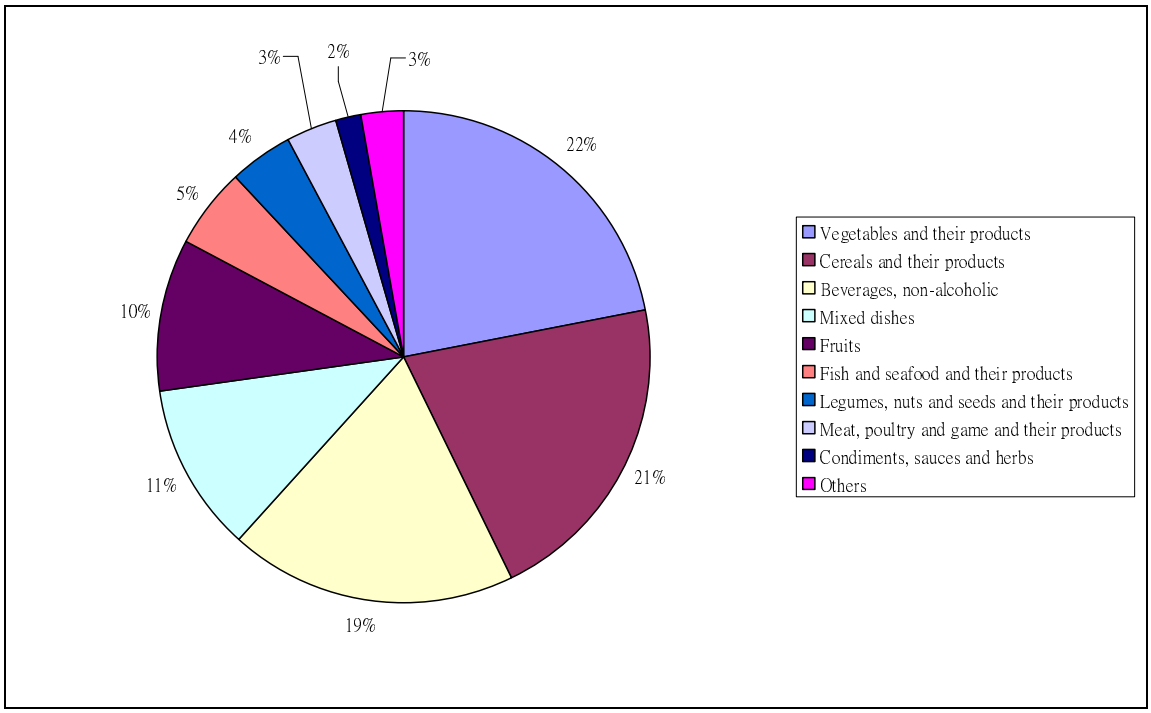

Figure 5.1 Percentage Contribution to Dietary Intake of Cobalt by Food Groups

International Comparison

5.9 The dietary intake estimated in our study were comparable with those reported by the studies of France and Canada (Table 5.2).

Table 5.2 A Comparison of Dietary Intake of Cobalt

	Dietary Intake of Cobalt (µg/day)	
	Average	**High Consumer**
Canada 2007[14]	9.0-15[a,b]	-
The 1st HKTDS	9.4	17 (95th percentile)
France 2006-07[11]	13[c,d]	22[c,d] (95th percentile)
Australia 2008[12]	21-33[e]	32-53 [e] (95th percentile)

Notes:

[a] The above data covers adult from aged 20 and above and were presented in range.

[b] Dietary intake of the average adult was 0.15-0.25µg/kg bw/day (i.e. about 9.0-15µg/day for a 60-kg adult).

[c] The above data covers adult aged 18 - 79.

[d] Dietary intake of the average adult was 0.18µg/kg bw/day (i.e. about 13µg/day for a 71-kg adult) and dietary intake of the high consumer was 0.31µg/kg bw/day (i.e. about 22µg/day for a 71-kg adult).

[e] The above data covers adult from aged 19 and above and were presented in range.

Summary

5.10 The dietary intake of cobalt of the whole population did not exceed the guidance upper level established by the Expert Group on Vitamins and Minerals in UK. On this basis, it is unlikely that current intake of cobalt is a human health and safety risk.

Chapter 6

Copper

6.1 Copper is a transition metal which widely distributed in biological tissues. It is also widely distributed in plants and animals. Good dietary sources of copper include seafood, organ meats, legumes and nuts. Copper enzymes are involved in a variety of metabolic reaction such as the utilisation of oxygen during cell respiration and energy utilization.[6] Studies have also shown that copper is required for infant growth, host defence mechanisms, bone strength, red and white blood cell maturation, iron transport, cholesterol and glucose metabolism.[7]

Health effect

6.2 A variety of symptoms have been associated with copper deficiency in humans, including anaemia, neutropenia, hypopigmentation of hair and skin, abnormal bone formation and osteoporosis, vascular abnormalities and steely hair.[6] However, clinically defined copper deficiency in humans is rare and has been observed under a variety of different clinical conditions such as patients on long term total parenteral nutrition.[7]

6.3 Copper toxicity from food consumption is considered impossible, but toxicity from excessive supplementation or copper salts used in agriculture has been reported. Acute copper poisoning is rare in human, with symptoms including salivation, epigastric pain, nausea, vomiting and diarrhoea. Chronic copper toxicity may lead to hepatitis, liver cirrhosis and jaundice.[6] There are data to suggest that chronic copper exposure may cause gastrointestinal irritation due to copper

concentration in water and acute liver failure from high consumption of copper (over 30mg/day) for years.[7]

Results and Discussions

Concentrations of Copper in TDS Foods

6.4 A total of 600 composite samples on four occasions were tested for copper and the results in 15 TDS food groups are summarised in Table 6.1 and the results in 150 TDS food items are shown in Table B in Appendix I.

Table 6.1 Copper Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	0.92	0.33 - 2.6
Vegetables and their products	140	0.62	0.079 - 2.5
Legumes, nuts and seeds and their products	24	3.3	0.011 - 9.2
Fruits	68	0.67	0.18 - 1.9
Meat, poultry and game and their products	48	2.1	0.35 - 26
Egg and their products	12	2.4	0.65 - 6.2
Fish and seafood and their products	76	6.0	0.10 - 140
Dairy products	20	0.21	0.023 - 1.3
Fats and oils	8	0.024	0.017 - 0.035
Beverages, alcoholic	8	0.093	0.025 - 0.21
Beverages, non-alcoholic	40	0.15	0.001 - 0.81
Mixed dishes	48	0.52	0.065 - 1.3
Snack foods	4	2.0	1.8 - 2.2
Sugars and confectionery	8	2.8	0.010 - 7.8
Condiments, sauces and herbs	20	0.38	ND - 1.9
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

6.5 In this study, only about 1% of the test results were not detected with copper. The highest mean level was detected in food group "fish and seafood and their products" (mean: 6.0 mg/kg), followed by "legumes, nuts and seeds and their products" (mean: 3.3 mg/kg), "sugars and confectionery" (mean: 2.8 mg/kg) and "egg and their products" (mean: 2.4 mg /kg). By comparing the mean levels in 150 food items, oyster was found to contain the highest level (mean: 75 mg /kg) followed by crab (mean: 27 mg /kg) and pig liver (mean: 15 mg /kg).

Dietary Intake of Copper

6.6 Dietary intake of copper of average and high consumers of the population was 920µg/day and 1700µg/day respectively. The dietary intake of about half (45%) of the population was below the normative requirement for copper for adult established by WHO, i.e. 12.5µg/kg bw/day (about 770µg/day for a 61.3-kg adult).[6] The dietary intake of the whole population did not exceed the UL for adult established by WHO (12mg/day for male and 10mg/day for female).[6]

6.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table D in Appendix II.

Major Food Contributors

6.8 The percentage contribution to the dietary source of copper intake of an average consumer by food group is shown in Figure 6.1. The main dietary source of copper intake was "cereals and their products" which contributed to 34 % of the total intake, followed by "fish and seafood and their products" and "meat, poultry and game and their products", contributing to 15% and 11% of the total intake

respectively. Similar findings were revealed in TDS of Australia and UK where cereal and grain-based products was the major food contributor of copper.

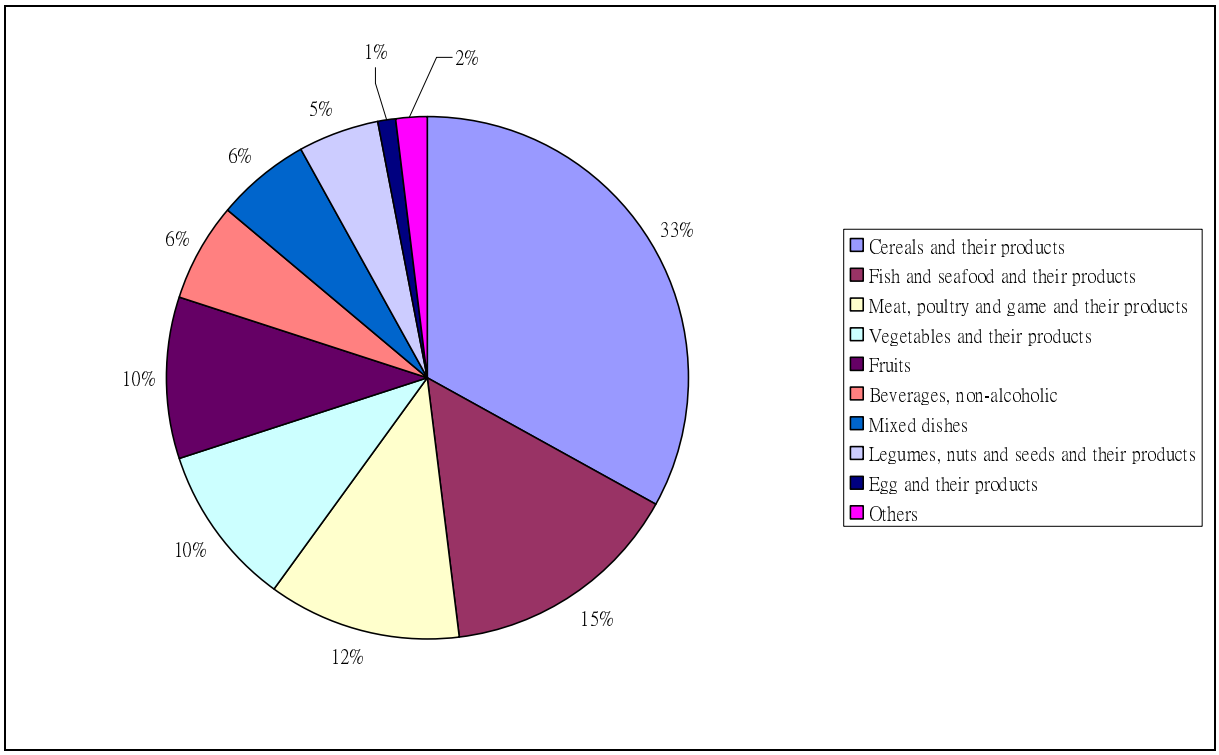

Figure 6.1 Percentage Contribution to Dietary Intake of Copper by Food Groups

International Comparison

6.9 The dietary intakes estimated in our study were comparable with those reported by the studies of Australia, USA, Canada and UK (Table 6.2).

Table 6.2 A Comparison of Dietary Intake of Copper

	Dietary Intake of Copper (µg/day)	
	Average	**High Consumer**
USA 1991-96[10]	730-1400 [a]	-
Canada 2007[14]	900-1500 [b,c]	-
The 1st HKTDS	920	1700 (95th percentile)
UK 2006[15]	1100-1300 [d,e]	2100-3200 [d,e] (97.5th percentile)
Australia 2008[12]	1200-1900 [f]	1700-2900 [f] (95th percentile)

France 2006-07[11]	1900 [g]	4100 [g] (95th percentile)
China 2002[9]	2200 [h]	-

Notes:

[a] The above data covers adult from aged 25 and above and were presented in range.
[b] The above data covers adult from aged 20 and above and were presented in range.
[c] Dietary intake of the average adult was 15-25µg/kg bw/day (i.e. about 900-1500µg/day for a 60-kg adult).
[d] The above data covers adult aged 16-64, elderly (free living, over 64 years) and self-described vegetarians (including some who consume fish) and were presented in range.
[e] Dietary intake of the average adult was 16-18µg/kg bw/day (i.e. about 1100-1300µg/day for a 70-kg adult) and dietary intake of the high consumer was 30-46µg/kg bw/day (i.e. about 2100-3200µg/day for a 70-kg adult).
[f] The above data covers adult from aged 19 and above and were presented in range.
[g] The above data covers adult aged 18 - 79.
[h] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

6.10 Although the dietary intake of copper of about half of the population was below the normative requirement for copper for adult established by WHO, clinically defined copper deficiency in humans is rare and has been observed under certain clinical conditions. In addition, the dietary intake of the whole population did not exceed the UL for adult established by WHO. On this basis, the current intake of copper is unlikely to present a human health and safety risk.

Chapter 7

Iron

7.1 Iron, a transition metal, is ubiquitous in biological systems. It is found in certain minerals, and in nearly all soils and in mineral waters. Dietary sources rich in iron include liver, meat, poultry, beans and nuts.[13] Iron is an essential trace element. It serves as a carrier of oxygen by red blood cell haemoglobin, as a transport medium for electrons within cells and as an integrated part of important enzyme systems in various tissues. [4]

Health effect

7.2 Insufficient intake of iron results in the deficiency condition anaemia, adverse outcomes of pregnancy, impaired psychomotor development and cognitive performance and reduced immune function.[7]

7.3 Most cases of acute iron poisoning occur in children, due to accidental ingestion of iron supplements intended for adult. High doses of iron supplements are frequently associated with gastrointestinal effects, especially constipation, but also with nausea, diarrhoea and vomiting. Features of chronic toxicity resulted from parenteral administration include cirrhosis of the liver and impaired heart and endocrine function.[13]

Results and Discussions

Concentrations of Iron in TDS Foods

7.4 A total of 600 composite samples on four occasions were tested for iron and the results in 15 TDS food groups are summarised in Table 7.1 and the results in 150 TDS food items are shown in Table B in Appendix I.

Table 7.1 Iron Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	20	0.63 - 600
Vegetables and their products	140	6.7	0.85 - 26
Legumes, nuts and seeds and their products	24	23	0.41 - 130
Fruits	68	1.9	0.52 - 3.1
Meat, poultry and game and their products	48	30	5.7 - 260
Egg and their products	12	25	21 - 29
Fish and seafood and their products	76	8.9	1.3 - 70
Dairy products	20	1.9	0.15 - 10
Fats and oils	8	0.23	0.16 - 0.35
Beverages, alcoholic	8	1.7	0.056 - 3.7
Beverages, non-alcoholic	40	2.3	ND - 16
Mixed dishes	48	5.9	0.70 - 11
Snack foods	4	12	10 - 14
Sugars and confectionery	8	22	ND - 87
Condiments, sauces and herbs	20	7.6	0.48 - 23
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

7.5 In this study, only about 1% of the test results were not detected with iron. The highest mean level was detected in food group “meat, poultry and game and their products” (mean: 30 mg/kg), followed by “egg and their products” (mean: 25 mg/kg), “legumes, nuts and seeds and their products” (mean: 23 mg/kg) and

"sugars and confectionery" (mean: 22 mg/kg). By comparing the mean levels in 150 food items, pig liver was found to contain the highest level (mean: 210 mg/kg) followed by cakes (mean: 160 mg/kg), breakfast cereals (mean: 93 mg/kg) and fermented bean products (mean: 82 mg/kg).

Dietary Intakes of Iron

7.6 The dietary intake of iron of average male consumers of the population was 8.7mg/day. The dietary intake of more than 80% of the male population was below the RNI for iron for adult male established by CNS, i.e. 12mg/day.[16] The dietary intakes of iron of average female consumers of the population aged between 20-49 and 50-84 were 7.9mg/day and 6.5mg/day respectively. The dietary intake of more than 90% of the female population was below the RNI for iron for adult female established by CNS, i.e. 20 mg/day for female aged between 18-49 and 12 mg/day for female aged 50 and above.[16]

7.7 Dietary intake of iron of high consumers of the population was 17mg/day. The dietary intake of less than 1% of the population exceeded the UL for adult established by CNS, i.e. 42mg/day.[16]

7.8 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table E in Appendix II.

Major Food Contributors

7.9 The percentage contribution to the dietary source of iron intake of an average consumer by food group is shown in Figure 7.1. The main dietary source of iron intake was "cereals and their products" which contributed to 31% of the total intake, followed by "meat, poultry and game and their products", contributing

to 22% of the total intake. Similar to our findings, cereal and grain-based products was the major food contributor of iron in France, Australia and USA.

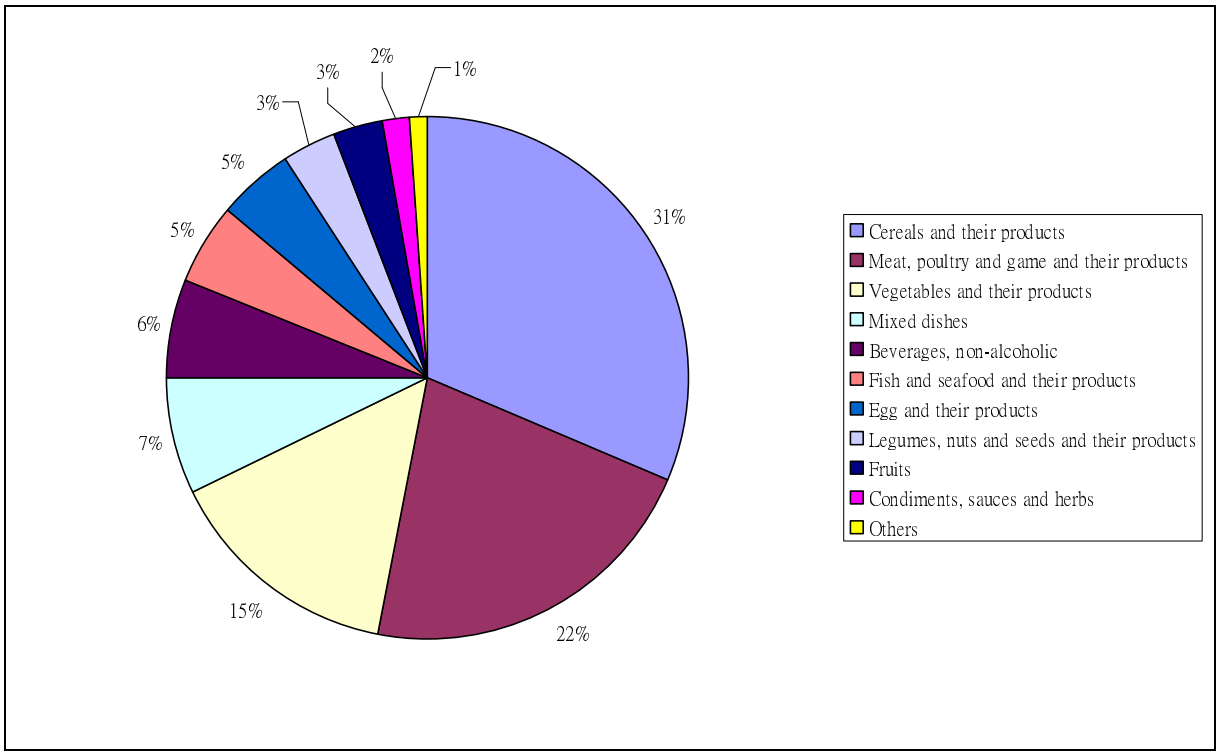

Figure 7.1 Percentage Contribution to Dietary Intake of Iron by Food Groups

International Comparison

7.10 The dietary intakes estimated in our study were comparable with those reported by the studies of France, Australia and USA (Table 7.2).

Table 7.2 A Comparison of Dietary Intake of Iron

	Dietary Intake of Iron (mg/day)	
	Average	**High Consumer**
France 2006-07[11]	7.7[a]	13 [a] (95th percentile)
The 1st HKTDS	8.0	17 (95th percentile)
Australia 2008[12]	8.7-15 [b]	13-24 [b] (95th percentile)
USA 1991-96[10]	9.0-14 [c]	-
China 2002[9]	23[d]	-

Notes:

[a] The above data covers adult aged 18 - 79.

[b] The above data covers adult from aged 19 and above and were presented in range.
[c] The above data covers adult from aged 25 and above and were presented in range.
[d] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

7.11 The dietary intakes of iron of more than 80% of the male population and more than 90% of the female population were below the RNI for iron for adult established by CNS. The dietary intake of less than 1% of the population exceeded the UL for adult established by CNS

7.12 Consumers are recommended to increase the dietary intake of iron to lower the risk of developing anaemia and reduced immune function. Eating vitamin C rich foods such as orange and kiwi fruit, together with high-iron foods can enhance the absorption of iron.

7.13 Young women and pregnant women are more vulnerable to iron deficiency as their requirement of iron is much higher. Pregnant women should pay special attention to their dietary intake of iron as CNS established higher RNI for them (i.e. 24mg/day in second trimester and 29mg/day in third trimester).[16] They are recommended to increase their dietary intake of iron to prevent adverse outcomes of pregnancy

Chapter 8

Magnesium

8.1 Magnesium is the eighth most abundant element in the earth's crust. It is ubiquitous in foods, but the content varies substantially. Leafy vegetables, as well as grains and nuts, generally have high magnesium contents. Magnesium functions as a cofactor of many enzymes involved in energy metabolism, protein synthesis, RNA and DNA synthesis, and maintenance of the electrical potential of nervous tissues and cell membranes. Magnesium is also essential for the normal function of the parathyroid gland and for vitamin D metabolism.[4,13]

Health effect

8.2 Deficiency of magnesium is less common in adult unless a relatively low magnesium intake is accompanied by prolong diarrhoea or excessive urinary magnesium losses. Magnesium deficiency has been linked to cardiovascular, skeletal, gastrointestinal and central nervous system disorders.[4,13]

8.3 No adverse effects have been associated with the ingestion of magnesium as a naturally occurring substance in foods. However, adverse effects have been seen with excessive magnesium intake as a consequence of the use of various magnesium salts for pharmacological/medicinal purposes. The primary manifestation of excessive ingestion of magnesium from non-food sources is osmotic diarrhoea, which is reversible.[13]

Results and Discussions

Concentrations of Magnesium in TDS Foods

8.4 A total of 600 composite samples on four occasions were tested for magnesium and the results in 15 TDS food groups are summarised in Table 8.1 and the results in 150 TDS food items are shown in Table B in Appendix I

Table 8.1 Magnesium Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	230	19 - 810
Vegetables and their products	140	200	37 - 1200
Legumes, nuts and seeds and their products	24	1100	2.0 - 2700
Fruits	68	130	44 - 430
Meat, poultry and game and their products	48	230	100 - 350
Egg and their products	12	100	58 - 170
Fish and seafood and their products	76	360	65 - 950
Dairy products	20	160	96 - 300
Fats and oils	8	6.4	ND - 14
Beverages, alcoholic	8	96	71 - 130
Beverages, non-alcoholic	40	46	ND - 170
Mixed dishes	48	100	16 - 240
Snack foods	4	580	560 - 600
Sugars and confectionery	8	510	1.0 - 1400
Condiments, sauces and herbs	20	170	ND - 540
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

8.5 In this study, only about 2% of the test results were not detected with magnesium. The highest mean level was detected in food group “legumes, nuts and seeds and their products” (mean: 1100 mg/kg), followed by “snack foods” (mean: 580 mg/kg), “sugars and confectionery” (mean: 510 mg/kg) and “fish and seafood

and their products" (mean: 360 mg/kg). By comparing the mean levels in 150 food items, peanut was found to contain the highest level (mean: 2600 mg/kg) followed by peanut butter (mean: 2300 mg/kg), chocolate (mean: 1000 mg/kg) and spinach (mean: 910 mg/kg).

Dietary Intake of Magnesium

8.6 The dietary intakes of magnesium of average and high male consumers aged between 20-69 were 230mg/day and 390mg/day respectively and aged between 70-84 were 200mg/day and 330mg/day respectively. The dietary intake of more than 70% of male population was below the RNI for magnesium for adult male established by WHO, i.e. 260mg/day for male aged between 19-65 and 224mg/day for male aged above 65.[4]

8.7 The dietary intakes of magnesium of average and high female consumers aged between 20-69 were 200mg/day and 330mg/day respectively and aged between 70-84 were 180mg/day and 330mg/day respectively. The dietary intake of more than 60% of female population was below the RNI for magnesium for adult female established by WHO, i.e. 220mg/day for female aged between 19-65 and 190mg/day for female aged above 65.[4]

8.8 The dietary intake of about 5% of the population exceeded the UL for adult established by WHO , i.e. 350mg/day.[4]

8.9 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table F in Appendix II.

Major Food Contributors

8.10 The percentage contribution to the dietary source of magnesium intake of an average consumer by food group is shown in Figure 8.1. The main dietary sources of magnesium intake were "cereals and their products", "vegetables and their products" and "meat, poultry and game and their products" which contributed to 19%, 18% and 14% of the total intake respectively. Similar to our findings, cereal and grain–based products and vegetables were the major food contributors of magnesium in France and USA.

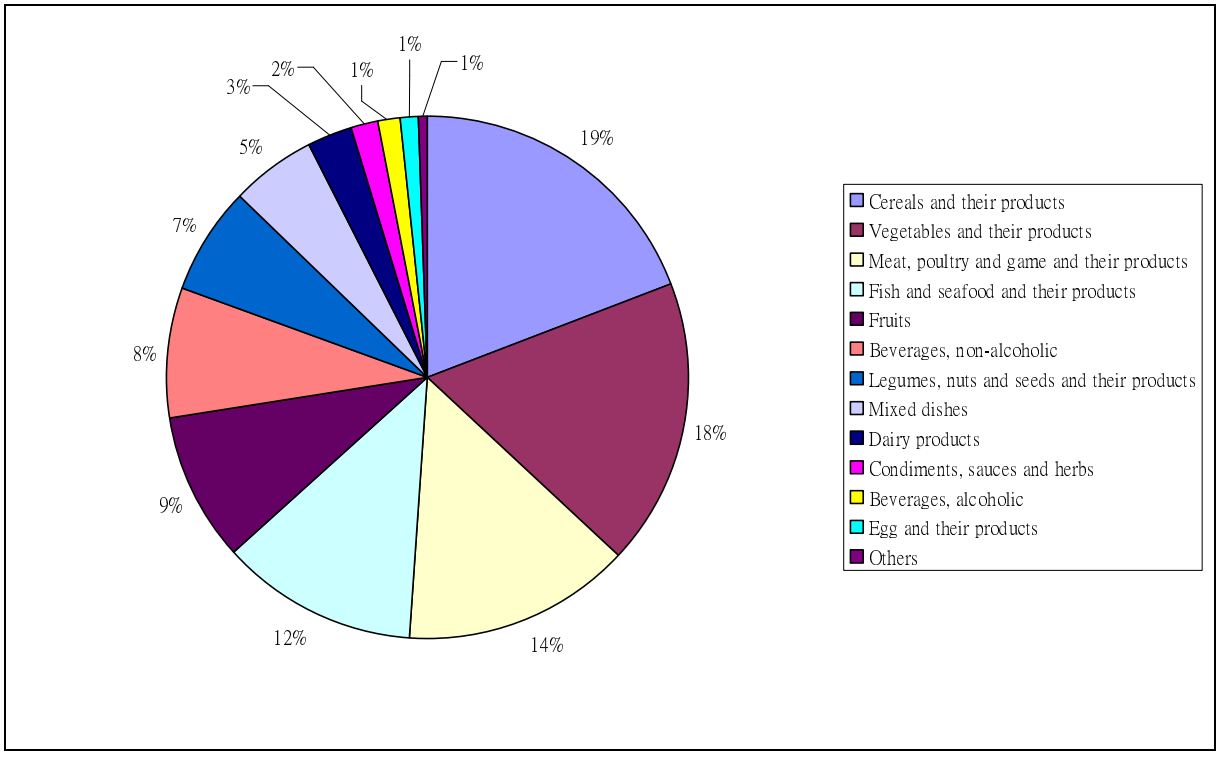

Figure 8.1 Percentage Contribution to Dietary Intake of Magnesium by Food Groups

International Comparison

8.11 The dietary intake estimated in our study were comparable with those reported by the studies of France, USA and China. (Table 8.2)

Table 8.2 A Comparison of Dietary Intake of Magnesium

	Dietary Intake of Magnesium (mg/day)	
	Average	**High Consumer**
USA 1991-96[10]	180-260 [a]	-
The 1st HKTDS	210	360 (95th percentile)
France 2006-07[11]	300 [b]	460 [b] (95th percentile)
China 2002[9]	310[c]	-

Notes:

[a] The above data covers adult from aged 25 and above and were presented in range.

[b] The above data covers adult aged 18 - 79.

[c] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

8.12 Although the dietary intake of magnesium of about two-third of the population was below the RNI for magnesium for adult established by WHO, deficiency of magnesium is less common in adult unless a relatively low magnesium intake is accompanied by prolong diarrhoea or excessive urinary magnesium losses.

8.13 Although the dietary intake of magnesium of about 5% of the population exceeded the UL for adult established by WHO, it is unlikely that the excess intake of magnesium is a human health and safety risk as the excessive level was low and no adverse effects have been associated with the ingestion of magnesium as a naturally occurring substance in foods according to the Expert Group on Vitamins and Minerals in the UK.

8.14 On this basis, the current intake of magnesium is unlikely to present a human health and safety risk.

Chapter 9

Manganese

9.1 Manganese is present both naturally and as a result of contamination in soils, sediments and water. Manganese is present in foods, particularly green vegetables, nuts, bread and cereals. Tea is also a rich source of manganese.[13] Manganese is a component of various enzymes and plays a role as co-factor of certain enzyme systems.[7]

Health effect

9.2 Manganese deficiency has been produced in many species of animals, but not so far in human. Manganese deficiency has only been observed in human under experimental conditions.[6,13]

9.3 Reported cases of human toxicity caused by oral ingestion of large amount of manganese are few. The major signs of manganese toxicity in animals are depressed growth, depressed appetite, impaired iron metabolism and altered brain function.[6]

Results and Discussions

Concentrations of Manganese in TDS Foods

9.4 A total of 600 composite samples on four occasions were tested for manganese and the results in 15 TDS food groups are summarised in Table 9.1 and the results in 150 TDS food items are shown in Table C in Appendix I.

Table 9.1 Manganese Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	4.7	0.62 - 18
Vegetables and their products	140	2.7	0.42 - 22
Legumes, nuts and seeds and their products	24	12	0.028 - 36
Fruits	68	1.8	0.17 - 16
Meat, poultry and game and their products	48	0.69	0.073 - 6.7
Egg and their products	12	0.41	0.30 - 0.55
Fish and seafood and their products	76	0.83	0.065 - 9.0
Dairy products	20	0.74	0.018 - 9.3
Fats and oils	8	0.017	ND - 0.054
Beverages, alcoholic	8	0.91	0.14 - 1.8
Beverages, non-alcoholic	40	1.4	ND - 8.7
Mixed dishes	48	1.8	0.036 - 5.6
Snack foods	4	3.7	3.3 - 4.0
Sugars and confectionery	8	3.3	ND - 9.0
Condiments, sauces and herbs	20	1.5	ND - 6.4
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

9.5 In this study, about 4% of the test results were not detected with manganese. The highest mean level was detected in food group “legumes, nuts and seeds and their products” (mean: 12 mg/kg), followed by “cereals and their products” (mean: 4.7 mg/kg), “snack foods” (mean: 3.7 mg/kg) and “sugars and confectionery” (mean: 3.3 mg/kg). By comparing the mean levels in 150 food items, peanut was found to contain the highest level (mean: 28 mg/kg) followed by peanut butter (mean: 23 mg/kg), Chinese spinach (mean: 12 mg/kg) fermented bean products (mean: 12 mg/kg) and breakfast cereals (mean: 12 mg/kg).

Dietary Intake of Manganese

9.6 The dietary intakes of manganese of average and high consumers of the population were 4.4mg/day and 8.5mg/day respectively. The dietary intake of more than 60% of the population was below the AI for manganese for adult established by CNS, i.e. 4.5mg/day.[16] The dietary intake of about 1% of the population exceeded the UL for adult established by CNS, i.e. 11mg/day.[16]

9.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table G in Appendix II.

Major Food Contributors

9.8 The percentage contribution to the dietary source of manganese intake of an average consumer by food group is shown in Figure 9.1. The main dietary source of manganese intake was "beverages, non-alcoholic" which contributed to 40% of the total intake due to the high consumption of beverage of the population, followed by "cereals and their products", contributing to 36% of the total intake. Similar findings were revealed in TDS of Australia, France, UK and USA where cereal and grain-based products and beverages were the major food contributors of manganese.

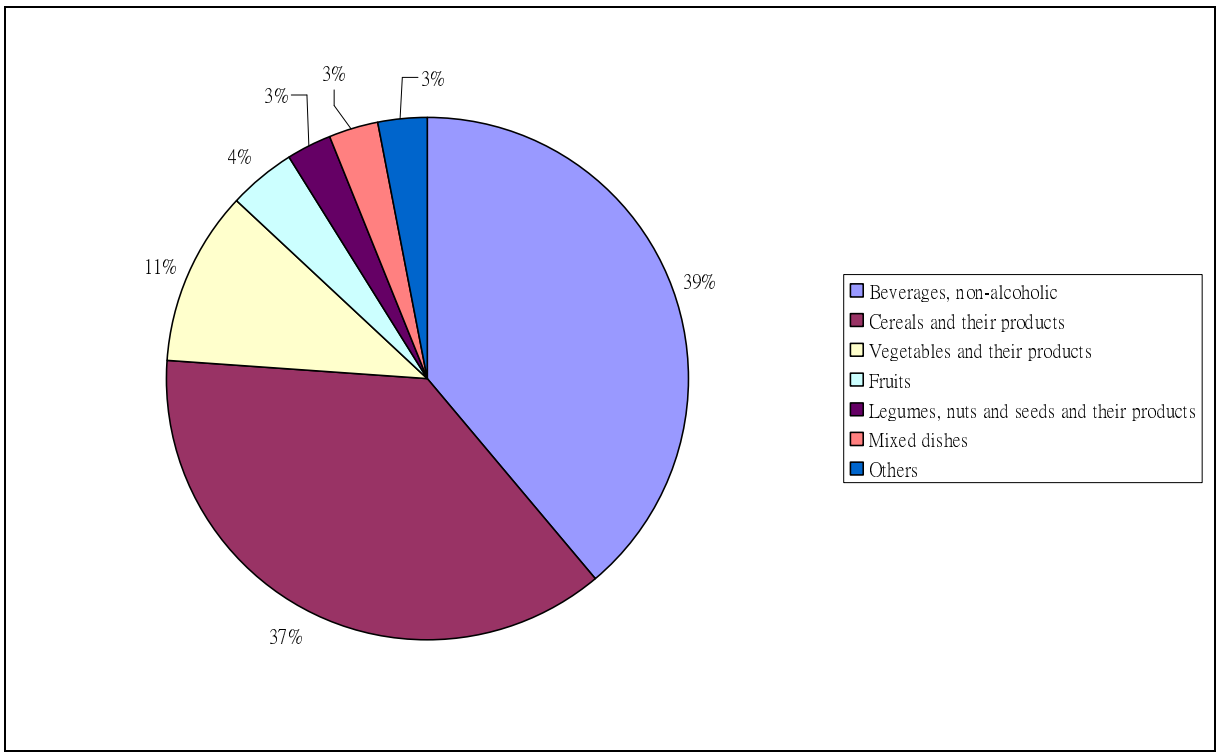

Figure 9.1 Percentage Contribution to Dietary Intake of Manganese by Food Groups

International Comparison

9.9 The dietary intake estimated in our study were comparable with those reported by the studies of Australia, Canada and UK. (Table 9.2)

Table 9.2 A Comparison of Dietary Intake of Manganese

	Dietary Intake of Manganese (mg/day)	
	Average	**High Consumer**
USA 1991-96[10]	1.9-2.9 [a]	-
France 2006-07[11]	2.2[b]	3.5 [b] (95th percentile)
Canada 2007[14]	2.6-3.8 [c,d]	-
Australia 2008[12]	3.9-5.4 [e]	6.4-8.8 [e] (95th percentile)
UK 2006[15]	3.9-5.5 [f,g]	7.7-9.8 [f,g] (97.5th percentile)
The 1st HKTDS	4.4	8.5 (95th percentile)
China 2002[9]	6.8[h]	-

Notes:

[a] The above data covers adult from aged 25 and above and were presented in range.
[b] The above data covers adult aged 18 - 79.

[c] The above data covers adult from aged 20 and above and were presented in range.
[d] Dietary intake of the average adult was 44-64µg/kg bw/day (i.e. about 2.6-3.8mg/day for a 60-kg adult).
[e] The above data covers adult from aged 19 and above and were presented in range.
[f] The above data covers adult aged 16-64, elderly (free living, over 64 years) and self-described vegetarians (including some who consume fish) and were presented in range.
[g] Dietary intake of the average adult were 56-78µg/kg bw/day (i.e. about 3.9-5.5mg/day for a 70-kg adult) and of the high consumer were 110-140µg/kg bw/day (i.e. about 7.7-9.8mg/day for a 70-kg adult).
[h] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

9.10 Although the dietary intake of manganese of about two-third of the population was below the AI for manganese for adult established by CNS, adverse health effect from manganese deficiency has not been produced in human. In addition, the dietary intake of manganese of less than 2% of the population exceeded the UL for adult established by CNS. On this basis, the current intake of manganese is unlikely to present a human health and safety risk.

Chapter 10

Molybdenum

10.1 Molybdenum does not exist naturally in the metallic state, but occurs in association with other elements. The predominant form of molybdenum occurring in soil and natural waters is the molybdate anion (MoO_4^{-2}). Molybdenum is ubiquitous in food and water as soluble molybdates. Good food sources of molybdenum are leafy vegetables, legumes, grains and organ meats. Molybdenum is an essential component of several enzymes in human tissues, including xanthine dehydrogenase/oxidase, aldehyde oxidase and sulfite oxidase. [7,13]

Health effect

10.2 Molybdenum deficiency in humans is unknown under normal dietary conditions. A human syndrome suggestive of molybdenum deficiency occurs in prolonged total parenteral feeding, manifested by irritability, tachycardia, tachypnoea, night blindness, and coma.[6,7]

10.3 Few data are available on human toxicity following ingestion of molybdenum. Food or water must contain more than 100mg/kg molybdenum to produce signs of toxicity including, diarrhoea, anaemia, immaturity of erythrocytes and uricaemia.[7,13]

Results and Discussions

Concentrations of Molybdenum in TDS Foods

10.4 A total of 600 composite samples on four occasions were tested for molybdenum and the results in 15 TDS food groups are summarised in Table 10.1 and the results in 150 TDS food items are shown in Table C in Appendix I.

Table 10.1 Molybdenum Content (µg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	120	27 - 450
Vegetables and their products	140	54	ND - 550
Legumes, nuts and seeds and their products	24	720	ND - 2300
Fruits	68	13	ND - 82
Meat, poultry and game and their products	48	180	5 - 2400
Egg and their products	12	150	24 - 420
Fish and seafood and their products	76	18	ND - 310
Dairy products	20	62	24 - 200
Fats and oils	8	7	ND - 20
Beverages, alcoholic	8	6	4 - 10
Beverages, non-alcoholic	40	30	ND - 330
Mixed dishes	48	79	8 - 550
Snack foods	4	150	97 - 180
Sugars and confectionery	8	68	ND - 150
Condiments, sauces and herbs	20	75	ND - 260
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

10.5 In this study, about 10% of the test results were not detected with molybdenum. The highest mean level was detected in food group “legumes, nuts and seeds and their products” (mean: 720 µg/kg), followed by “meat, poultry and game and their products” (mean: 180 µg/kg), “egg and their products” (mean: 150

µg/kg) and "snack foods" (mean: 150 µg/kg). By comparing the mean levels in 150 food items, pig liver was found to contain the highest level (mean: 1900 µg/kg) followed by fermented bean products (mean: 1500 µg/kg), peanut (mean: 1200 µg/kg) and peanut butter (mean: 910 µg/kg).

Dietary Intake of Molybdenum

10.6 The dietary intakes of molybdenum of average and high consumers of the population were 110µg/day and 190µg/day respectively. The dietary intake of half of the population was below the RNI for molybdenum for adult established by CNS, i.e. 100 µg/day.[16] The dietary intake of the whole population did not exceed the UL for adult established by CNS, i.e. 900 µg/day.[16]

10.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table H in Appendix II.

Major Food Contributors

10.8 The percentage contribution to the dietary source of molybdenum intake of an average consumer by food group is shown in Figure 10.1. The main dietary source of molybdenum intake was "cereals and their products" which contributed to 54% of the total intake. Other major sources were "legumes, nuts and seeds and their products" and "vegetables and their products" which contributed to 10% and 9% of the total intake respectively. Similar to our findings, cereal and grain–based products and vegetables were the major food contributors of molybdenum in Australia, France and UK.

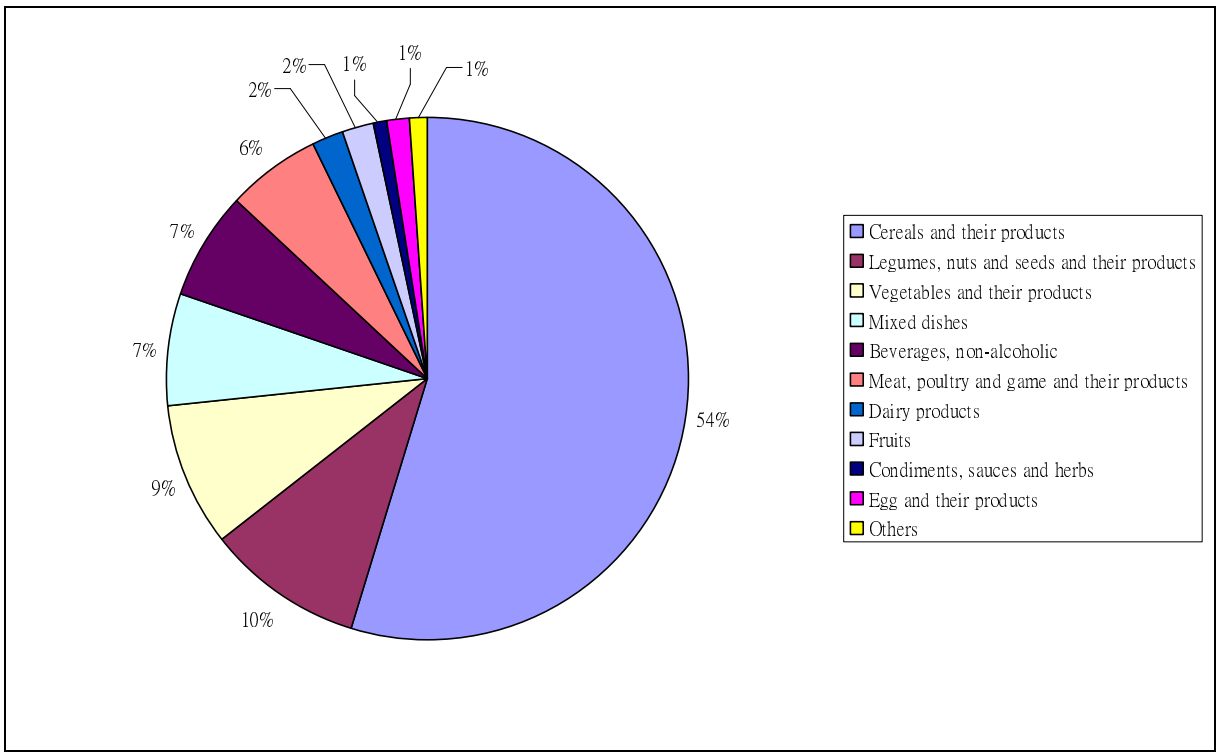

Figure 10.1 Percentage Contribution to Dietary Intake of Molybdenum by Food Groups

International Comparison

10.9 The dietary intake estimated in our study were comparable with those reported by the studies of France, Australia and UK. (Table 10.2)

Table 10.2 A Comparison of Dietary Intake of Molybdenum

	Dietary Intake of Molybdenum (µg/day)	
	Average	**High Consumer**
Australia 2008[12]	76-120 [a]	110-200 [a] (95th percentile)
France 2006-07[11]	94 [b]	160 [b] (95th percentile)
UK 2006[15]	98-150 [c,d]	210-240 [c,d] (97.5th percentile)
The 1st HKTDS	110	190 (95th percentile)

Notes:

[a] The above data covers adult from aged 19 and above and were presented in range.

[b] The above data covers adult aged 18 - 79.

[c] The above data covers adult aged 16-64, elderly (free living, over 64 years) and self-described vegetarians (including some who consume fish) and were presented in range.

[d] Dietary intake of the average adult were 1.4-2.1µg/kg bw/day (i.e. about 98-150µg/day for a 70-kg adult) and of the high consumer were 3.0-3.4µg/kg bw/day (i.e. about 210-240µg /day for a 70-kg adult).

Summary

10.10 Although the dietary intake of molybdenum of half of the population was below the RNI for molybdenum for adult established by CNS, molybdenum deficiency in humans is unknown under normal dietary conditions and there was only a suggestive syndrome of molybdenum deficiency in human occurring in prolonged total parenteral feeding. In addition, the dietary intake of molybdenum of the whole population did not exceed the UL for adult established by CNS. On this basis, the current intake of molybdenum is unlikely to present a human health and safety risk.

Chapter 11

Phosphorus

11.1 Phosphorus is a group 5 element of the periodic table, which is most commonly found in nature in its pentavalent form in combination with oxygen, as phosphate (PO_4^{3-}). Foods rich in protein are usually high in phosphorus, such as dairy products, meats, fish and grain products. Phosphorus as phosphate is an essential nutrient involved in many physiological processes, such as the cell's energy cycle, carbohydrate, fat and protein metabolism, regulation of the whole body acid-base balance, as a component of the cell structure (as phospholipids), in cell regulation and signalling, and in the mineralisation of bones and teeth.[7,13]

Health effect

11.2 The development of a dietary-induced phosphorus deficiency is very unlikely due to its ubiquitous presence in foods. Phosphorus deficiency can occur in patients and infants receiving poorly managed parenteral nutrition, and in patients suffering from liver disease. Symptoms include anorexia, anaemia, muscle weakness, bone pain, rickets, and ataxia.[7]

11.3 Adverse effects of bone mineral density and skeletal integrity has been observed in phosphorus intoxication in animal studies. In some supplementation studies using high phosphorus dosages, osmotic diarrhoea and mild gastrointestinal symptoms have been reported in human.[7]

Results and Discussions

Concentrations of Phosphorus in TDS Foods

11.4 A total of 600 composite samples on four occasions were tested for phosphorus and the results in 15 TDS food groups are summarised in Table 11.1 and the results in 150 TDS food items are shown in Table C in Appendix I.

Table 11.1 Phosphorus Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	910	180 - 2300
Vegetables and their products	140	450	73 - 1700
Legumes, nuts and seeds and their products	24	2200	11 - 4800
Fruits	68	190	58 - 380
Meat, poultry and game and their products	48	2400	1300 - 4800
Egg and their products	12	2300	1900 - 2600
Fish and seafood and their products	76	2300	650 - 3900
Dairy products	20	2200	730 - 7100
Fats and oils	8	94	ND - 220
Beverages, alcoholic	8	220	120 - 310
Beverages, non-alcoholic	40	190	ND - 610
Mixed dishes	48	670	55 - 1700
Snack foods	4	1600	1500 - 1800
Sugars and confectionery	8	1300	ND - 2900
Condiments, sauces and herbs	20	360	ND - 1300
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

11.5 In this study, only about 3% of the test results were not detected with phosphorus. The highest mean level was detected in food group “meat, poultry and game and their products” (mean: 2400 mg/kg), followed by “egg and their products” (mean: 2300 mg/kg) and “fish and seafood and their products” (mean:

2300 mg/kg). By comparing the mean levels in 150 food items, cheese was found to contain the highest level (mean: 6300 mg/kg) followed by peanut (mean: 4800 mg/kg), pig liver (mean: 4500 mg/kg) and peanut butter (mean: 4300 mg/kg).

Dietary Intake of Phosphorus

11.6 The dietary intakes of phosphorus of average and high consumers of the population aged between 20-69 were 1000mg/day and 1700mg/day respectively. The dietary intakes of phosphorus of average and high consumers of the population aged between 70-84 were 850mg/day and 1500mg/day respectively. The dietary intake of more than 20% of the population was below the RNI for phosphorus for adult established by CNS, i.e. 720mg/day for aged between 18-64 and 700mg/day for aged between 65-79.[16] The dietary intake of less than 1% of the population exceeded the UL for adult established by CNS, i.e. 3500mg/day for aged between 18-64 and 3000mg/day for aged at or above 65.[16]

11.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table I in Appendix II.

Major Food Contributors

11.8 The percentage contribution to the dietary source of phosphorus intake of an average consumer by food group is shown in Figure 11.1. The main dietary sources of phosphorus intake were “meat, poultry and game and their products”, “cereals and their products” and “fish and seafood and their products” which contributed to 26%, 19% and 17% of the total intake respectively. Similar to our findings, meat, poultry and fish were the major food contributors of phosphorus in USA.

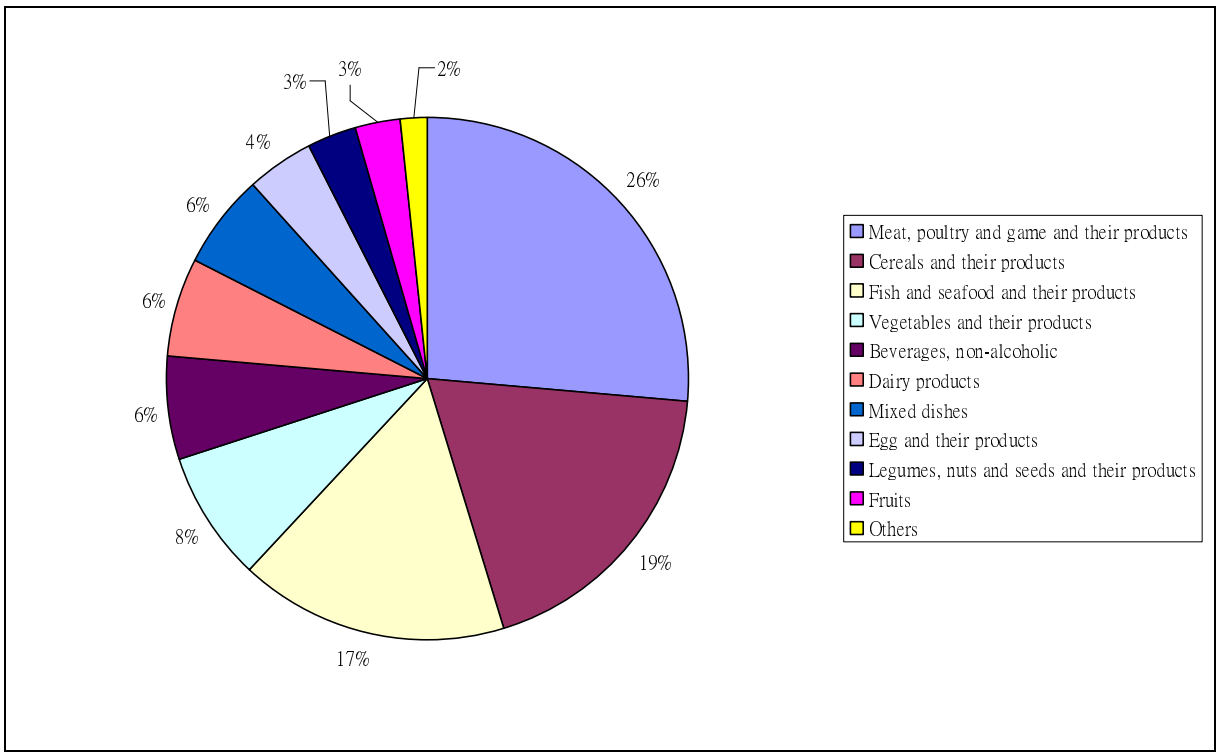

Figure 11.1 Percentage Contribution to Dietary Intake of Phosphorus by Food Groups

International Comparison

11.9 The dietary intake estimated in our study were comparable with those reported by the studies of USA and China. (Table 11.2)

Table 11.2 A Comparison of Dietary Intake of Phosphorus

	Dietary Intake of Phosphorus (mg/day)	
	Average	**High Consumer**
USA 1991-96[10]	890-1,400 [a]	-
China 2002[9]	980[b]	-
The 1st HKTDS	1,000	1,700 (95th percentile)

Notes:

[a] The above data covers adult from aged 25 and above and were presented in range.

[b] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

11.10 Although the dietary intake of phosphorus of more than 20% of the population was below the RNI for phosphorus for adult established by CNS, the development of a dietary-induced phosphorus deficiency is very unlikely due to its ubiquitous presence in foods and phosphorus deficiency may only occur in patients and infants receiving poorly managed parenteral nutrition, and in patients suffering from liver disease. In addition, the dietary intake of phosphorus of less than 1% of the population exceeded the UL for adult established by CNS. On this basis, the current intake of phosphorus is unlikely to present a human health and safety risk.

Chapter 12

Potassium

12.1 Potassium is an alkaline, metallic element. It is not found in the elemental form in nature and is always found combined with other substances, most commonly as the chloride salt (KCl).[13] Important potassium sources include potatoes, fruit and berries, vegetables, milk products and nuts. Potassium is an essential nutrient involved in fluid, acid and electrolyte balance and is required for normal cellular function.[7]

Health effect

12.2 Potassium deficiency can cause rapid and irregular heart rhythm, muscle weakness and irritability, occasional paralysis, nausea and vomiting, diarrhoea and low muscle tone in the gut, and has been reported to predispose to hypertension.[13]

12.3 Ingestion of high doses of potassium chloride tablets has been associated with acute poisoning in humans with heart failure, cyanosis and cardiac arrest. Gastrointestinal toxicity characterised by abdominal pain, nausea and vomiting, diarrhoea, and ulceration of the oesophagus, stomach and duodenum and ileum has also been described after chronic ingestion of potassium chloride in case studies and supplementation studies.[7,13]

Results and Discussions

Concentrations of Potassium in TDS Foods

12.4 A total of 600 composite samples on four occasions were tested for potassium and the results in 15 TDS food groups are summarised in Table 12.1 and the results in 150 TDS food items are shown in Table D in Appendix I.

Table 12.1 Potassium Content (g/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	1.0	0.021 - 2.6
Vegetables and their products	140	2.3	0.43 - 5.7
Legumes, nuts and seeds and their products	24	3.4	ND - 7.1
Fruits	68	1.7	0.77 - 3.3
Meat, poultry and game and their products	48	2.6	1.7 - 3.5
Egg and their products	12	3.4	1.4 - 9.5
Fish and seafood and their products	76	2.7	0.18 - 4.2
Dairy products	20	1.6	0.86 - 2.4
Fats and oils	8	0.11	ND - 0.27
Beverages, alcoholic	8	0.57	0.22 - 0.84
Beverages, non-alcoholic	40	0.50	ND - 1.3
Mixed dishes	48	1.1	0.07 - 2.4
Snack foods	4	9.5	8.9 - 10
Sugars and confectionery	8	2.3	0.012 - 5.9
Condiments, sauces and herbs	20	1.8	0.048 - 5.7
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

12.5 In this study, only about 2% of the test results were not detected with potassium. The highest mean level was detected in food group “snack foods” (mean: 9.5 g/kg), followed by “legumes, nuts and seeds and their products” (mean: 3.4 g/kg) and “egg and their products” (mean: 3.4 g/kg). By comparing the mean levels in 150 food items, potato chips was found to contain the highest level (mean:

9.5 g/kg) followed by salted egg (mean: 7.0 g/kg), peanut (mean: 6.5 g/kg) and peanut butter (mean: 6.0 g/kg).

Dietary Intake of Potassium

12.6 The dietary intakes of potassium of average and high consumers of the population were 1.9g/day and 3.2g/day respectively. The dietary intake of about 60% of the population was below the AI for potassium for adult established by CNS i.e. 2g/day.[16]

12.7 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table J in Appendix II.

Major Food Contributors

12.8 The percentage contribution to the dietary source of potassium intake of an average consumer by food group is shown in Figure 12.1. The main dietary source of potassium intake was "vegetables and their products" which contributed to 22 % of the total intake. "Meat, poultry and game and their products" was the next major source of potassium intake, contributing to 17% of the total intake. Similar findings were revealed in TDS of Australia, France, and USA where vegetables were the major food contributor of potassium.

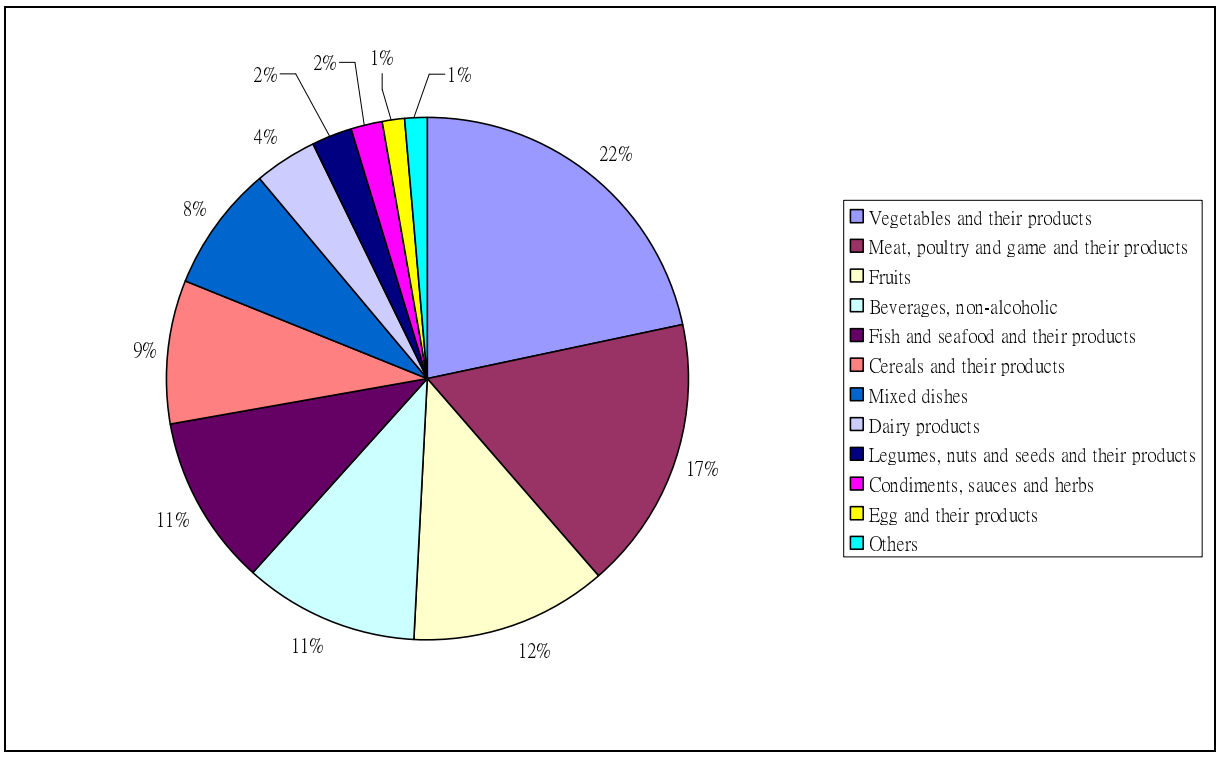

Figure 12.1 Percentage Contribution to Dietary Intake of Potassium by Food Groups

International Comparison

12.9 The dietary intake estimated in our study were comparable with those reported by the studies of France, USA and China. (Table 12.2)

Table 12.2 A Comparison of Dietary Intake of Potassium

	Dietary Intake of Potassium (g/day)	
	Average	**High Consumer**
China 2002[9]	1.7[a]	-
The 1st HKTDS	1.9	3.2 (95th percentile)
USA 1991-96[10]	1.9-2.7[b]	-
France 2006-07[11]	2.9[c]	4.3[c] (95th percentile)
Australia 2008[12]	3.0-4.4[d]	4.2-6.4[d] (95th percentile)

Notes:

[a] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

[b] The above data covers adult from aged 25 and above and were presented in range.

[c] The above data covers adult aged 18 - 79.

[d] The above data covers adult from aged 19 and above and were presented in range.

Summary

12.10 The dietary intake of potassium of about 60% of the population was below the AI for potassium for adult established by CNS. Consumers are recommended to increase the dietary intake of potassium to reduce the risk of developing high blood pressure, cardiovascular disease, stroke and coronary heart disease.[17]

Chapter 13

Selenium

13.1 Selenium is a metallic group VI element, which is found in soils and rocks and consequently may then accumulate in plants. It is present in foods particularly fish, offal, eggs and cereals.[13] Selenium is implicated in the protection of body tissue against oxidative stress, maintenance of defences against infection and modulation of growth and development.[4]

Health effect

13.2 Selenium deficiency in human is associated with Keshan disease, an endemic cardiomyopathy which particularly affects children and women of child-bearing age, and possibly also Kashin-Beck disease, a musculoskeletal disorder. [13]

13.3 Chronic and acute intoxication from selenium arising from high concentrations in food, drinking water, and the environment are characterised by hair loss and structural changes in the keratin of hair and nail, the development of icteroid skin, and gastrointestinal disturbance.[4]

Results and Discussions

Concentrations of Selenium in TDS Foods

13.4 A total of 600 composite samples on four occasions were tested for selenium and the results in 15 TDS food groups are summarised in Table 13.1 and the results in 150 TDS food items are shown in Table D in Appendix I.

Table 13.1 Selenium Content (µg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	150	ND - 450
Vegetables and their products	140	13	ND - 70
Legumes, nuts and seeds and their products	24	110	ND - 300
Fruits	68	7	ND - 35
Meat, poultry and game and their products	48	410	62 - 1500
Egg and their products	12	590	420 - 880
Fish and seafood and their products	76	700	250 - 1900
Dairy products	20	81	17 - 420
Fats and oils	8	28	14 - 37
Beverages, alcoholic	8	5	ND - 11
Beverages, non-alcoholic	40	5	ND - 19
Mixed dishes	48	96	5 - 260
Snack foods	4	68	44 - 96
Sugars and confectionery	8	86	ND - 280
Condiments, sauces and herbs	20	23	ND - 130
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

13.5 In this study, about 19% of the test results were not detected with selenium. The highest mean level was detected in food group "fish and seafood and their products" (mean: 700 µg/kg), followed by "egg and their products" (mean: 590 µg/kg) and "meat, poultry and game and their products" (mean: 410 µg/kg). By comparing the mean levels in 150 food items, pig liver was found to contain the highest level (mean: 1300 µg/kg) followed by Tuna fish (mean: 1300 µg/kg), Mandarin fish (mean: 1300 µg/kg) and Horse head fish (mean: 1000 µg/kg).

Dietary Intake of Selenium

13.6 The dietary intakes of selenium of average and high male consumers aged between 20-69 were 160µg/day and 290µg/day respectively and aged

between 70-84 were 140µg/day and 280µg/day respectively. The dietary intake of less than 3% of male population was below the RNI for selenium for adult male established by WHO, i.e. 34µg/day for male aged between 19-65 and 33µg /day for male aged above 65.[4]

13.7 The dietary intakes of selenium of average and high female consumers aged between 20-69 were 130µg/day and 240µg/day respectively and aged between 70-84 were 120µg/day and 250µg/day respectively. The dietary intake of less than 2% of female population was below the RNI for selenium for adult female established by WHO, i.e. 26µg/day for female aged between 19-65 and 25µg /day for female aged above 65.[4]

13.8 The dietary intake of less than 1% of the population exceeded the UL for adult established by WHO, i.e. 400µg /day.[4]

13.9 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table K in Appendix II.

Major Food Contributors

13.10 The percentage contribution to the dietary source of selenium intake of an average consumer by food group is shown in Figure 13.1. The main dietary source of selenium intake was "fish and seafood and their products" which contributed to 33% of the total intake. Other major sources were "meat, poultry and game and their products" and "cereals and their products" which contributed to 28% and 19% of the total intake respectively. Similar to our findings, cereal and grain–based products, meat and poultry, and fish and seafood were the major food contributors of selenium in Australia, Ireland, New Zealand and UK.

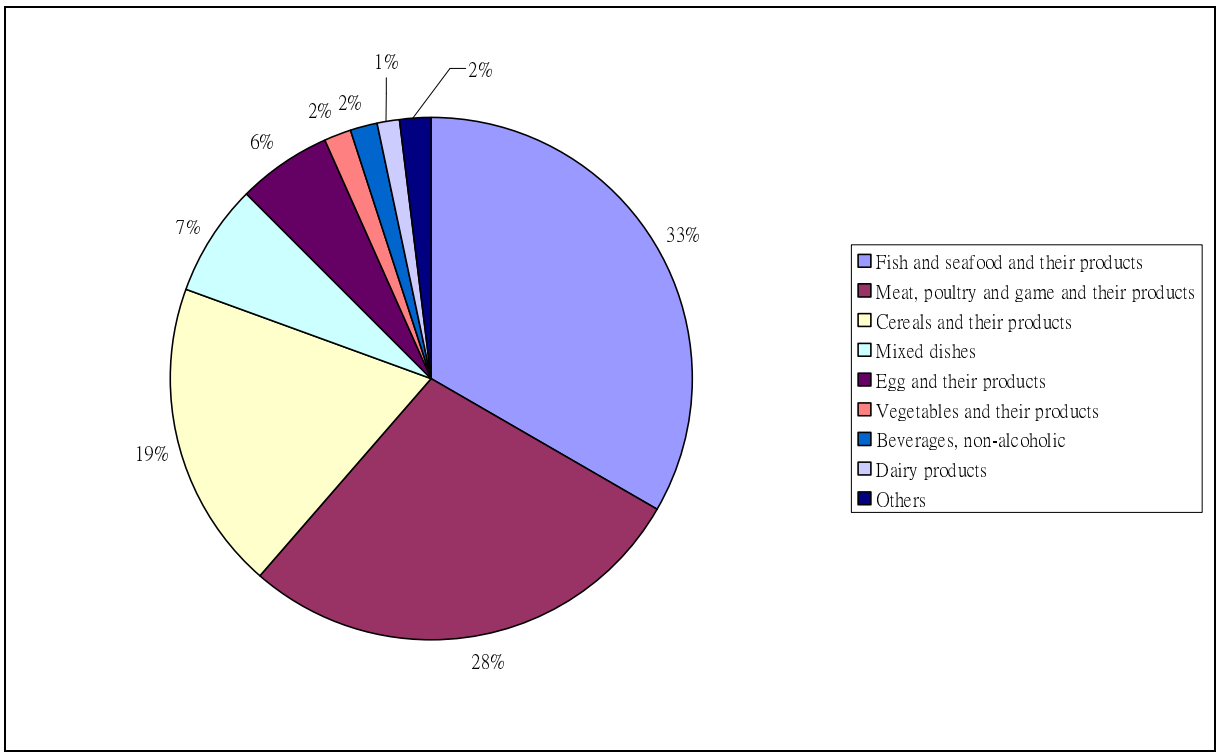

Figure 13.1 Percentage Contribution to Dietary Intake of Selenium by Food Groups

International Comparison

13.11 The dietary intake estimated in our study were comparable with those reported by the studies of Australia, USA and Canada. (Table 13.2)

Table 13.2 A Comparison of Dietary Intake of Selenium

	Dietary Intake of Selenium (µg/day)	
	Average	**High Consumer**
China 2002[9]	40[a]	-
UK 2006[15]	45-67 [b,c]	98-130 [b,c] (97.5th percentile)
Ireland 2001-05[18]	49-89[d]	90-150 [d] (97.5th percentile)
New Zealand 2009[19]	56-82[e]	-
France 2006-07[11]	64[f]	100 [f] (95th percentile)
USA 1991-96[10]	66-130 [g]	-
Australia 2008[12]	97-170 [h]	130-270 [h] (95th percentile)
Canada 2007[14]	110-220 [i,j]	-
The 1st HKTDS	140	280 (95th percentile)

Notes:

[a] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.
[b] The above data covers adult aged 16-64, elderly (free living, over 64 years) and self-described vegetarians (including some who consume fish) and were presented in range.
[c] Dietary intake of the average adult were 0.64-0.95µg/kg bw/day (i.e. about 45-67mg/day for a 70-kg adult) and of the high consumer were 1.4-1.8µg/kg bw/day (i.e. about 98-130mg/day for a 70-kg adult).

[d] The above data covers adult aged 18 - 64 and were presented in range of lower and upper bound estimates (i.e. analytical results below the limit of detection (<LOD) were set at zero (<LOD=0) and assumed to be present at the limit of detection (<LOD=LOD), respectively).

[e] The above data covers adult aged 19 and above and were presented in range of mid-bound estimates (i.e. assigning LOD/2 to non-detects).
[f] The above data covers adult aged 18 - 79.
[g] The above data covers adult from aged 25 and above and were presented in range.
[h] The above data covers adult from aged 19 and above and were presented in range.
[i] The above data covers adult from aged 20 and above and were presented in range.
[j] Dietary intake of the average adult was 1.9-3.7µg/kg bw/day (i.e. about 110-220µg /day for a 60-kg adult).

Summary

13.12 The dietary intake of selenium of less than 3% of the population was below the RNI for selenium for adult established by WHO. The dietary intake of selenium of less than 1% of the population exceeded the UL for adult established by WHO. On this basis, it is unlikely that current intakes of selenium pose human health and safety risk.

Chapter 14

Sodium

14.1 Sodium is found naturally in a variety of foods, such as milk, meat and shellfish. It is often found in high amounts in processed foods such as breads, crackers, processed meats and snack foods. The major source of sodium is sodium chloride, or common table salt, of which sodium constitutes 40% by weight. Sodium is the principal cation in extracellular fluid in the body, and is an essential nutrient necessary for maintenance of plasma volume, acid–base balance, transmission of nerve impulses and normal cell function.[20]

Health effect

14.2 Dietary deficiency of sodium is very uncommon due to the widespread occurrence of sodium in foods, but can lead to low blood pressure, dehydration and muscle cramps.[7,13]

14.3 The major adverse effect of increased sodium intake is elevated blood pressure. Higher blood pressure is an acknowledged risk factor for ischaemic heart disease, stroke and renal disease. Epidemiological studies indicate an association of increased risk of morbidity and mortality from cardiovascular diseases, including coronary heart disease and stroke, with increasing sodium intake.[7]

Results and Discussions

Concentrations of Sodium in TDS Foods

14.4 A total of 600 composite samples on four occasions were tested for sodium and the results in 15 TDS food groups are summarised in Table 14.1 and the results in 150 TDS food items are shown in Table E in Appendix I.

Table 14.1 Sodium Content (g/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	1.7	ND - 6.1
Vegetables and their products	140	1.0	ND - 33
Legumes, nuts and seeds and their products	24	5.9	ND - 29
Fruits	68	0.023	ND - 0.27
Meat, poultry and game and their products	48	5.0	0.44 - 15
Egg and their products	12	7.0	1.5 - 17
Fish and seafood and their products	76	2.1	0.26 - 7.8
Dairy products	20	2.1	0.32 - 11
Fats and oils	8	1.6	ND - 5.4
Beverages, alcoholic	8	0.033	0.021 - 0.059
Beverages, non-alcoholic	40	0.12	ND - 0.56
Mixed dishes	48	3.5	0.066 - 6.3
Snack foods	4	5.6	4.8 - 6.5
Sugars and confectionery	8	0.36	ND - 1.1
Condiments, sauces and herbs	20	97	0.033 - 380
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

14.5 In this study, about 11% of the test results were not detected with sodium. The highest mean level was detected in food group “condiments, sauces and herbs” (mean: 97 g/kg), followed by “egg and their products” (mean: 7.0 g/kg), “legumes, nuts and seeds and their products” (mean: 5.9 g/kg) and “snack foods” (mean: 5.6 g/kg). By comparing the mean levels in 150 food items, table salt was found to

contain the highest level (mean: 380 g/kg) followed by soya sauce (mean: 57 g/kg), oyster sauce (mean: 43 g/kg) and fermented bean products (mean: 28 g/kg).

Dietary Intake of Sodium

14.6 The dietary intakes of sodium of average and high consumers of the population were 2.6g/day and 4.9g/day respectively. The dietary intake of more than 60% of the population exceeded the recommended maximum level of intake for sodium for adult established by WHO, i.e. 2g/day. [20]

14.7 Due to limitations of the research methodologies of FCS, the estimated intakes of condiments and sauces are subject to larger biases. As a result, the dietary intake of sodium of the population may be under-estimated.

14.8 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table L in Appendix II.

Major Food Contributors

14.9 The percentage contribution to the dietary source of sodium intake of an average consumer by food group is shown in Figure 14.1. The main dietary source of sodium intake was “condiments, sauces and herbs” which contributed to 43% of the total intake, followed by “mixed dishes” and “meat, poultry and game and their products”, contributing to 21% and 12% of the total intake. However, condiments, sauces and herbs was not the major food contributors in other countries, like France and USA, where cereal and grain-based products and meat were the major food contributors of sodium intake. It is probably due to the local habit of adding condiments and sauces (especially salt, soy sauce and oyster sauce) which contain high concentration of sodium during cooking.

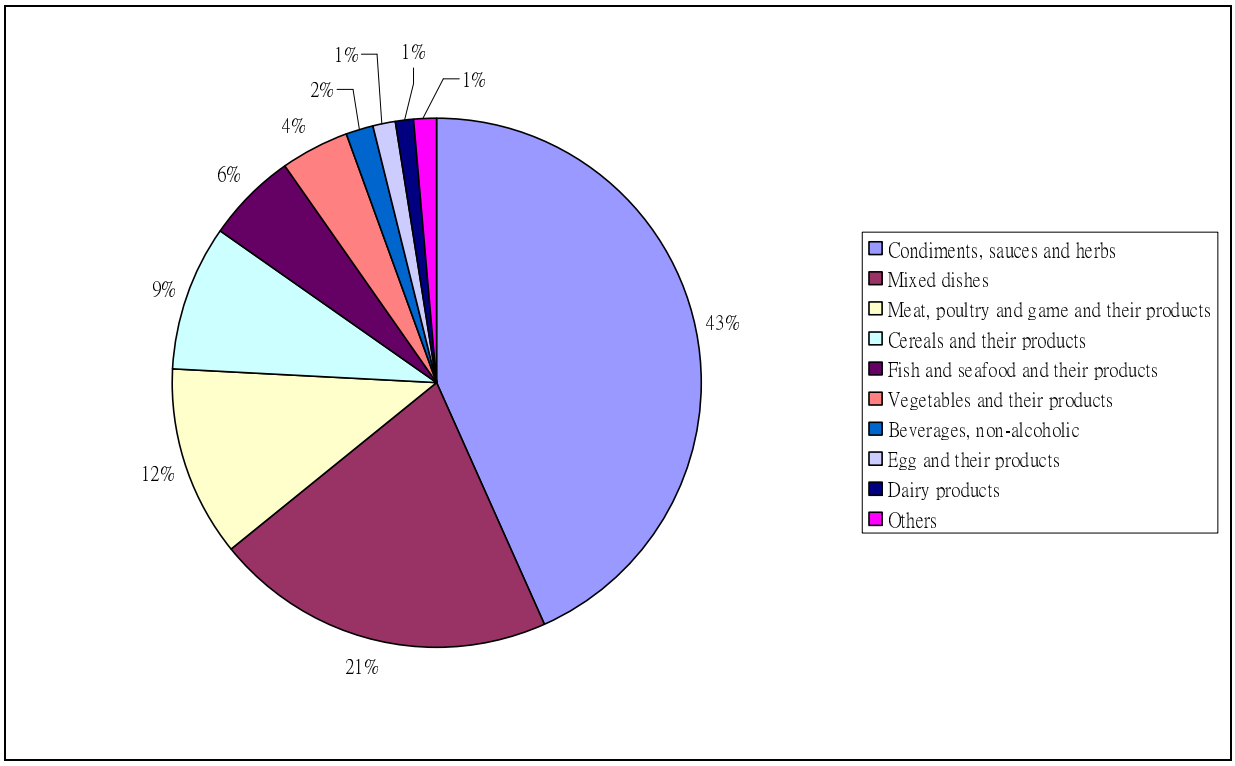

Figure 14.1 Percentage Contribution to Dietary Intake of Sodium by Food Groups

International Comparison

14.10 The dietary intakes estimated in our study were comparable with those reported by the studies of France, USA and New Zealand (Table 14.2).

Table 14.2 A Comparison of Dietary Intake of Sodium

	Dietary Intake of Sodium (g/day)	
	Average	**High Consumer**
USA 1991-96[10]	1.7-2.7 [a]	-
New Zealand 2009[19]	2.0-3.4[b]	-
The 1st HKTDS	2.6	4.9 (95th percentile)
France 2006-07[11]	2.7[c]	4.5[c] (95th percentile)
China 2002[9]	6.3[d]	-

Notes:

[a] The above data covers adult from aged 25 and above and were presented in range.

[b] The above data covers adult aged 19 and above and were presented in range of mid-bound estimates (i.e. assigning LOD/2 to non-detects).

[c] The above data covers adult aged 18 - 79.

[d] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

14.11 The dietary intake of sodium of more than 60% of the population exceeded the recommended maximum level of intake for sodium for adult established by WHO. Consumers are recommended to reduce the dietary intake of sodium to reduce the risk of developing high blood pressure, cardiovascular disease, stroke and coronary heart disease.[20]

Chapter 15

Zinc

15.1 Zinc is present in the earth's crust and in seawater. Zinc is found in all plant and animal tissues, particularly inside the nuclei. Meat and cereal products are rich in zinc.[13] Zinc is an essential component of many enzymes participating in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acids as well as in the metabolism of other minerals. It also contribute to the maintenance of cell and organ integrity.[4]

Health effect

15.2 Zinc deficiency results in effects including poor prenatal development, growth and mental retardation, impaired nerve conduction and nerve damage, reproductive failure, dermatitis, hair loss, diarrhoea, loss of appetite, loss of taste and smell, anaemia, susceptibility to infections, delayed wound healing and macular degeneration.[13]

15.3 The symptoms of acute zinc salt toxicity include abdominal pain, nausea and vomiting. Prolonged use of high doses of zinc can result in secondary deficiency of copper. Symptoms of this include hypocupraemia, impaired iron mobilisation, anaemia, leukopenia and neutropenia.[13]

Results and Discussions

Concentrations of Zinc in TDS Foods

15.4 A total of 600 composite samples on four occasions were tested for zinc and the results in 15 TDS food groups are summarised in Table 15.1 and the results in 150 TDS food items are shown in Table E in Appendix I.

Table 15.1 Zinc Content (mg/kg) in TDS Food Groups of the 1st HKTDS

Food Group	Number of composite samples	Mean	Range
Cereals and their products	76	7.8	1.4 - 46
Vegetables and their products	140	3.4	0.39 - 13
Legumes, nuts and seeds and their products	24	16	0.048 - 35
Fruits	68	1.1	0.16 - 3.5
Meat, poultry and game and their products	48	36	11 - 140
Egg and their products	12	20	15 - 24
Fish and seafood and their products	76	30	3.7 - 400
Dairy products	20	11	3.2 - 44
Fats and oils	8	0.43	0.094 - 1.0
Beverages, alcoholic	8	0.40	ND - 0.96
Beverages, non-alcoholic	40	1.2	ND - 7.3
Mixed dishes	48	7.4	0.3 - 19
Snack foods	4	8.1	6.3 - 9.2
Sugars and confectionery	8	8.1	0.011 - 21
Condiments, sauces and herbs	20	2.0	ND - 6.7
Total	600		

Notes: ND denotes non-detected, i.e. results less than LOD.

15.5 In this study, only about 1% of the test results were not detected with zinc. The highest mean level was detected in food group “meat, poultry and game and their products” (mean: 36 mg/kg), followed by “fish and seafood and their products” (mean: 30 mg/kg), “egg and their products” (mean: 20 mg/kg) and “legumes, nuts and seeds and their products” (mean: 16 mg/kg). By comparing

the mean levels in 150 food items, oyster was found to contain the highest level (mean: 320 mg/kg) followed by pig liver (mean: 110 mg/kg), beef (mean: 64 mg/kg) and crab (mean: 61 mg/kg).

Dietary Intakes of Zinc

15.6 The dietary intakes of zinc of average and high male consumers of the population were 11mg/day and 19mg/day respectively. The dietary intake of less than 4% of the population was below the normative requirement for adult male from diet in moderate zinc availability (i.e. mixed diet containing animal or fish protein) established by WHO, i.e. about 4.9mg/day for a 67.5-kg adult male.[6]

15.7 The dietary intakes of zinc of average and high female consumers of the population were 7.9mg/day and 14mg/day respectively. The dietary intake of less than 3% of the population was below the normative requirement for adult female from diet in moderate zinc availability (i.e. mixed diet containing animal or fish protein) established by WHO, i.e. about 3.3mg/day for a 55.7-kg adult female.[6]

15.8 The dietary intake of less than 1% of the population exceeded the UL for adult established by WHO, i.e. 45 mg/day.[6]

15.9 The breakdowns of dietary intakes of the individual age-gender population subgroups are shown in Table M in Appendix II.

Major Food Contributors

15.10 The percentage contribution to the dietary source of zinc intake of an average consumer by food group is shown in Figure 15.1. The main dietary source of zinc intake was “meat, poultry and game and their products” which contributed

to 35% of the total intake. “cereals and their products” was the next major source of zinc intake, contributing to 28% of the total intake. Similar findings were revealed in TDS of Australia, France, and UK where cereals and grain-based products and meat were the major food contributors of zinc.

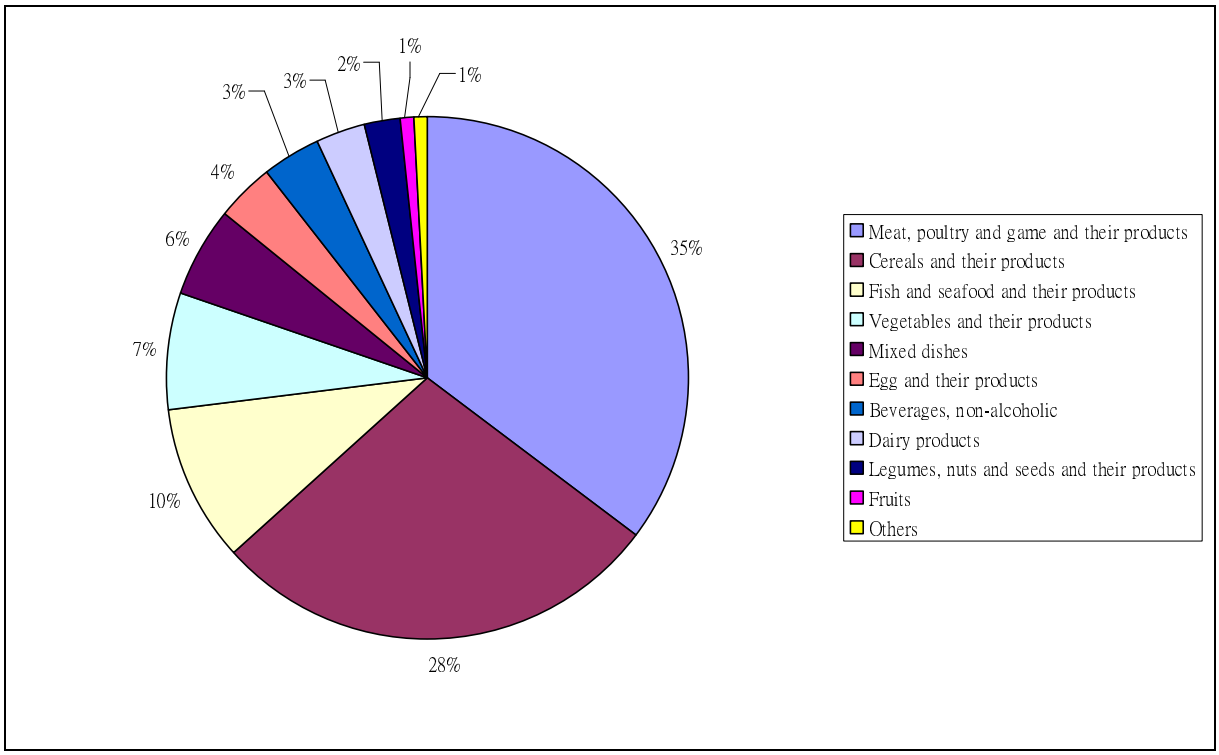

Figure 15.1 Percentage Contribution to Dietary Intake of Zinc by Food Groups

International Comparison

15.11 The dietary intakes estimated in our study were comparable with those reported by the studies of France, Australia, USA, Canada, China and UK (Table 15.2).

Table 15.2 A Comparison of Dietary Intake of Zinc

	Dietary Intake of Zinc (mg/day)	
	Average	**High Consumer**
UK 2006[15]	6.5-9.8 [a,b]	11-19 [a,b] (97.5th percentile)
Canada 2007[14]	7.2-16 [c,d]	-
USA 1991-96[10]	7.6-13 [e]	-
Australia 2008[12]	7.8-15 [f]	11-23 [f] (95th percentile)
France 2006-07[11]	7.9 [g]	13 [g] (95th percentile)
The 1st HKTDS	9.2	16 (95th percentile)
China 2002[9]	11 [h]	-

Notes:

[a] The above data covers adult aged 16-64, elderly (free living, over 64 years) and self-described vegetarians (including some who consume fish) and were presented in range.

[b] Dietary intake of the average adult was 93-140µg/kg bw/day (i.e. about 6.5-9.8mg/day for a 70-kg adult) and dietary intake of the high consumer was 160-270µg/kg bw/day (i.e. about 11-19mg/day for a 70-kg adult).

[c] The above data covers adult from aged 20 and above and were presented in range.

[d] Dietary intake of the average adult was 120-270µg/kg bw/day (i.e. about 7.2-16mg/day for a 60-kg adult).

[e] The above data covers adult from aged 25 and above and were presented in range.

[f] The above data covers adult from aged 19 and above and were presented in range.

[g] The above data covers adult aged 18 - 79.

[h] The above data covers person from aged 2 and above and were presented as per reference person per day. A reference person is an 18 years old man who performs light physical activity.

Summary

15.12 The dietary intake of zinc of less than 4% of the population was below the normative requirement for zinc for adult established by WHO. The dietary intake of zinc of less than 1% of the population exceeded the UL for adult established by WHO. On this basis, it is unlikely that current intakes of zinc pose human health and safety risk.

Chapter 16

Limitations

16.1 Of the food items captured by the FCS, only a limited number of food items have been sampled in our current study though the majority of food commonly consumed have been covered. To reflect the exposure from the whole diet, a set of food mapping was applied. However, occurrence of various minerals in food may vary from substance to substance, which may lead to inaccurate estimation of the dietary intake. In addition, adoption of a single set of food mapping may also influence the accuracy of the estimates on dietary intakes of individual minerals. Moreover, dietary supplement of mineral is not taken into account.

16.2 Due to limitations of the research methodologies of FCS, the estimated intakes of fats and oils, sugars and sweets, as well as condiments and sauces are subject to larger biases. As a result, the dietary intake of minerals, especially sodium of the population may be under-estimated.

16.3 A sensitivity assessment was conducted by increasing the population dietary intake of the inadequate minerals by 20% and compared the elevated dietary intakes with the relevant DRIs. The assessment results showed that the dietary intakes to the inadequate minerals of substantial proportion of the population were still below the relevant recommend dietary intakes, including calcium (>90%), iron (>80%) and potassium (>40%).

Chapter 17

Conclusions and Recommendations

17.1 The dietary intakes of calcium, iron and potassium of the general adult population were inadequate when compared to the respective recommended intakes while the dietary intake of sodium of the general adult population was in excess when compared to the recommended intake.

17.2 The dietary intake of calcium of more than 90% of the adult population was below the recommended intake. Inadequate dietary intake of calcium is one of the important factors causing osteoporosis. The finding suggested that current intake of calcium might increase the risk of developing osteoporosis in the general adult population.

17.3 The dietary intake of iron of more than 80% of the adult population was below the recommended intake. The finding suggested that current intake of iron of the general adult population might pose certain health risks such as anaemia and reduced immune function. Young women and pregnant women are more vulnerable to iron deficiency as their requirement of iron is much higher.

17.4 The dietary intake of sodium of more than 60% of the adult population was above the recommended intake. The dietary intake of potassium of about 60% of the adult population was below the recommended intake. The findings suggested that current intake of sodium and potassium might increase the risk of developing high blood pressure, stroke and coronary heart disease in the general adult population.

17.5 The dietary intakes of copper, magnesium, manganese, molybdenum and phosphorus of more than 20% of the adult population were inadequate when compared to the respective recommended intakes. Nonetheless, development of adverse health effect from deficiency of these five minerals is very uncommon.

17.6 The dietary intakes of cobalt, boron, selenium and zinc of the adult population were within the respective recommended intakes.

Recommendations

17.7 Based on the findings of this study, advice to the public and trade were formulated for reducing the potential risks associated with dietary intakes of minerals:

Advice to the Public

- Achieve a balanced and varied diet so as to prevent inadequate or excessive intakes of minerals. Foods that are lower in fat, sodium and sugar, and higher in dietary fibre are better choices.
- Increase dietary intake of calcium. Dairy products, beans and dark green vegetables are rich in calcium.
- Increase dietary intake of iron. Dark green vegetables, beans and nuts are rich in iron.
- Increase dietary intakes of potassium. Vegetables, fruits, beans and nuts are rich in potassium.
- Reduce dietary intake of sodium. Consumers are recommended to reduce the use of condiments and sauces such as salt, soy sauce and oyster sauce during

cooking, order food with less salt when eating out and choose prepackaged food with low sodium content by reading nutrition label.

- Pregnant women may consult medical professionals on their requirement of nutrients including minerals (such as calcium and iron).

Advice to the Trade

- The nutrition information should be clearly declared on the nutrition label for prepackaged foods and should not be misleading.

- Declare the content of individual mineral on the nutrition label for prepackaged foods that are rich in minerals.

- Reduce sodium level in foods. Food manufacturers can make reference to the CFS's Trade Guidelines for Reducing Sodium in Foods to formulate foods with lower sodium content.

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Appendix I

Table A: Boron, Calcium and Cobalt Contents in TDS Foods of the 1st HKTDS

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cereals and their products	**76**	**663**	**61 - 4100**	**323**	**14 - 2200**	**7**	**ND - 32**
Rice, white		245	220 - 260	18	14 - 21	4	2 - 6
Rice, unpolished		363	270 - 420	33	30 - 41	12	11 - 14
Corn		565	530 - 620	23	17 - 32	1	ND - 2
Noodles, Chinese or Japanese style		155	140 - 170	52	49 - 57	1	ND - 1
Pasta, Western style		135	110 - 160	105	81 - 120	1	ND - 1
Instant noodles		94	85 - 110	49	34 - 66	2	2 - 2
Noodles, rice		68	61 - 80	24	17 - 34	2	2 - 2
Bread, plain		408	380 - 460	280	160 - 400	9	7 - 10
Bread, raisin		2725	1900 - 4100	300	180 - 430	5	4 - 8
"Pineapple" bun		268	230 - 300	255	190 - 420	4	2 - 6
Sausage/ham/luncheon meat bun		345	270 - 380	690	430 - 1100	6	3 - 7
Chinese steamed bread		263	200 - 390	255	190 - 400	5	3 - 6
Biscuits		845	350 - 1200	1475	1300 - 1800	19	5 - 31
Cakes		1055	420 - 1400	468	320 - 640	13	1 - 24
Pastries		505	470 - 560	335	300 - 380	3	2 - 4
Pastries, Chinese		2250	1300 - 3400	363	200 - 460	12	8 - 16
Oatmeal		225	170 - 260	64	57 - 73	2	1 - 3
Breakfast cereals		1193	970 - 1600	1133	330 - 2200	17	3 - 32
Deep-fried dough		888	540 - 1400	225	140 - 350	12	6 - 21
Vegetables and their products	**140**	**1780**	**120 - 4000**	**489**	**14 - 2300**	**12**	**ND - 100**
Carrot/ Radish		1850	1600 - 2400	265	210 - 330	10	3 - 20
Potato		833	740 - 930	44	27 - 63	42	20 - 58
Potato, fried		1950	1800 - 2100	145	120 - 180	19	16 - 24
Broccoli		3225	2900 - 3500	365	190 - 530	13	10 - 19

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cabbage, Chinese		1850	1700 - 2200	560	490 - 610	3	ND - 8
Cabbage, Chinese flowering		2900	2100 - 3200	1180	920 - 1500	8	7 - 11
Cabbage, European variety		1650	1400 - 1900	560	390 - 650	5	3 - 7
Cabbage, Petiole Chinese		2425	2100 - 2800	1175	1100 - 1300	7	4 - 9
Celery		2000	1600 - 2300	365	270 - 540	1	ND - 3
Chinese kale		3225	2600 - 4000	1875	1600 - 2200	10	6 - 13
Chinese spinach		2300	2000 - 2600	1900	1500 - 2300	41	13 - 100
Leaf mustard		2050	1700 - 2300	943	750 - 1100	8	3 - 12
Lettuce, Chinese		1450	1300 - 1600	388	350 - 420	3	3 - 4
Lettuce, European		898	730 - 1000	208	180 - 220	8	3 - 16
Mung bean sprout		778	710 - 870	140	120 - 160	3	2 - 3
Spinach		2600	2000 - 3100	845	670 - 1000	22	14 - 32
Water spinach		2600	2400 - 2700	928	440 - 1400	10	8 - 15
Watercress		1875	1100 - 2400	1500	1200 - 1800	10	7 - 13
Bitter melon		1300	1100 - 1500	160	140 - 180	20	5 - 46
Cucumber		778	640 - 860	160	140 - 180	8	6 - 10
Hairy gourd		913	810 - 1100	130	71 - 230	51	8 - 88
Pumpkin		1250	1100 - 1400	82	55 - 120	11	6 - 18
Sponge gourd		1450	1300 - 1600	170	150 - 190	11	4 - 19
Wax gourd		578	420 - 740	96	86 - 110	13	5 - 30
Zucchini		1975	1700 - 2500	228	190 - 300	9	7 - 11
Eggplant		1950	1600 - 2300	203	160 - 260	19	5 - 57
Sweet pepper		1075	900 - 1300	107	98 - 120	24	14 - 35
Tomato		890	830 - 980	111	92 - 140	3	2 - 6
Garlic		3075	2900 - 3300	138	130 - 140	2	2 - 3
Onion		2375	2200 - 2500	213	140 - 300	3	2 - 5
Spring onion		2500	1600 - 3500	878	680 - 1100	6	2 - 9
Preserved vegetables		2300	2200 - 2600	655	500 - 730	10	9 - 11

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Mushroom, dried shiitake		2025	1800 - 2300	19	17 - 20	8	6 - 10
Mushrooms		1163	120 - 3700	32	14 - 55	2	1 - 2
Ear fungus		245	200 - 320	345	280 - 430	11	7 - 15
Legumes, nuts and seeds and their products	**24**	**8856**	**ND - 26000**	**738**	**13 - 3300**	**37**	**ND - 150**
Green string beans, with pod		2475	2400 - 2600	510	470 - 550	11	9 - 15
Mung bean vermicelli		13	ND - ND	30	13 - 47	1	ND - 1
Beancurd		2275	1900 - 2600	1763	750 - 3300	8	6 - 10
Fermented bean products		6375	3900 - 8800	828	460 - 1000	71	28 - 120
Peanut		21500	18000 - 26000	730	560 - 870	89	45 - 150
Peanut butter		20500	18000 - 22000	510	470 - 600	45	20 - 76
Fruits	**68**	**2828**	**710 - 14000**	**107**	**29 - 520**	**7**	**ND - 100**
Apple		4550	3100 - 6500	43	33 - 54	3	2 - 4
Banana		1950	1600 - 2300	36	29 - 44	1	ND - 2
Dragon fruit		1425	1300 - 1600	51	43 - 63	6	4 - 8
Grapes		6175	5600 - 6700	97	87 - 110	1	ND - 2
Kiwi fruit		2800	2400 - 3100	253	220 - 330	2	1 - 4
Longan/ Lychee		1800	1400 - 2100	75	65 - 79	12	6 - 28
Mango		1175	1000 - 1300	64	53 - 78	1	ND - 2
Melons		2500	1600 - 4100	51	34 - 70	6	2 - 8
Orange		2950	2800 - 3100	393	260 - 520	4	2 - 8
Papaya		1875	1600 - 2100	178	130 - 240	9	1 - 23
Peach		3775	2700 - 6300	50	38 - 80	2	ND - 3
Pear		3500	2700 - 4500	57	50 - 61	10	5 - 14
Persimmon		1625	1100 - 2300	79	66 - 85	3	2 - 3
Pineapple		745	710 - 830	95	67 - 120	6	4 - 10
Plum		8750	5500 - 14000	43	39 - 46	3	1 - 4
Pummelo /Grapefruit		1295	980 - 1700	210	130 - 290	3	1 - 4
Watermelon		1193	870 - 1500	56	42 - 79	42	7 - 100

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Meat, poultry and game and their products	**48**	**303**	**27 - 1200**	**155**	**32 - 1100**	**5**	**ND - 23**
Beef		60	27 - 100	47	32 - 61	2	2 - 3
Mutton		170	110 - 270	61	44 - 70	3	2 - 4
Pork		90	56 - 130	59	45 - 84	1	ND - 2
Ham		775	330 - 1200	117	86 - 140	6	5 - 6
Luncheon meat		713	570 - 820	180	110 - 240	5	4 - 6
Barbecued pork		185	150 - 250	79	64 - 99	2	1 - 2
Roasted pork		398	250 - 570	120	82 - 200	1	ND - 2
Pig liver		66	40 - 86	57	52 - 60	19	15 - 23
Chicken meat		325	180 - 460	52	44 - 56	2	2 - 3
Chicken, soy sauce		203	150 - 260	79	59 - 120	2	1 - 3
Roasted duck/goose		96	85 - 110	78	68 - 89	6	2 - 11
Meat sausage		555	420 - 680	938	820 - 1100	7	3 - 13
Egg and their products	**12**	**223**	**150 - 330**	**677**	**560 - 860**	**3**	**1 - 5**
Egg, chicken		268	190 - 330	583	560 - 620	2	1 - 3
Egg, lime preserved		163	150 - 170	665	580 - 750	4	4 - 4
Egg, salted		238	220 - 250	783	690 - 860	4	4 - 5
Fish and seafood and their products	**76**	**722**	**ND - 5400**	**413**	**38 - 2300**	**10**	**ND - 69**
Fish, Big head		52	37 - 80	228	150 - 310	15	10 - 20
Fish, Mandarin fish		59	ND - 160	635	320 - 950	2	ND - 3
Fish, Grass carp		32	ND - 50	111	80 - 160	9	7 - 10
Fish, Golden thread		363	270 - 490	330	220 - 480	4	3 - 5
Fish, Grouper		303	230 - 420	488	340 - 570	1	ND - 1
Fish, Horse head		233	190 - 290	298	270 - 330	2	2 - 2
Fish, Pomfret		475	330 - 700	423	380 - 440	3	1 - 4
Fish, Sole		91	68 - 130	80	73 - 89	3	2 - 4
Fish, Tuna		315	240 - 430	85	49 - 150	2	2 - 2
Fish, Grey mullet		47	33 - 77	157	96 - 200	14	13 - 17

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Fish, Salmon		133	91 - 210	42	38 - 50	3	2 - 3
Fish, Yellow croaker		390	290 - 540	503	320 - 590	4	3 - 5
Fish, Dace, minced		98	45 - 180	588	530 - 670	8	6 - 12
Fish ball/fish cake		428	130 - 880	885	590 - 1400	5	3 - 7
Shrimp/ Prawn		788	690 - 1000	695	500 - 790	12	9 - 15
Crab		1333	930 - 1700	1700	1300 - 2300	48	38 - 69
Oyster		2225	1600 - 3200	170	140 - 190	43	38 - 48
Scallop		4325	1800 - 5400	140	98 - 240	14	7 - 20
Squid		2025	1500 - 3100	288	150 - 420	3	2 - 5
Dairy products	**20**	**369**	**130 - 1200**	**2642**	**910 - 10000**	**3**	**ND - 28**
Milk, whole		185	140 - 240	1275	1200 - 1400	1	ND - 1
Milk, skim		168	130 - 220	1475	1400 - 1600	1	ND
Cheese		543	130 - 830	7525	5700 - 10000	3	2 - 4
Yoghurt		250	190 - 280	1950	1800 - 2200	1	ND - 2
Ice-cream		700	320 - 1200	983	910 - 1100	12	1 - 28
Fats and oils	**8**	**48**	**32 - 68**	**67**	**ND - 160**	**2**	**ND - 9**
Butter		53	39 - 63	133	100 - 160	3	ND - 9
Oil, vegetable		44	32 - 68	2	ND - ND	1	ND - 1
Beverages, alcoholic	**8**	**4468**	**83 - 9300**	**58**	**41 - 71**	**3**	**ND - 7**
Beer		111	83 - 130	49	41 - 67	1	ND - 2
Red wine		8825	8600 - 9300	66	57 - 71	5	4 - 7
Beverages, non-alcoholic	**40**	**398**	**ND - 1900**	**226**	**ND - 1500**	**3**	**ND - 11**
Tea, Chinese		125	110 - 140	3	2 - 3	3	2 - 3
Tea, Milk tea		285	180 - 390	332	48 - 520	3	2 - 3
Coffee		355	240 - 440	101	45 - 130	7	5 - 8
Malt drink		305	290 - 330	1375	1300 - 1500	9	8 - 11
Soybean drink		1193	970 - 1400	338	110 - 580	6	5 - 7
Fruit and vegetable juice		1448	990 - 1900	53	37 - 60	3	2 - 5

TDS Food Item	Number of composite samples	Boron (µg/kg)		Calcium (mg/kg)		Cobalt (µg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Carbonated drink		59	47 - 73	21	19 - 21	1	ND
Tea, chrysanthemum		188	150 - 230	19	15 - 22	3	2 - 4
Water, bottled, distilled		4	ND - 7	0	ND - ND	0	ND
Water, drinking		22	15 - 26	14	13 - 15	0	ND
Mixed dishes	**48**	**465**	**74 - 1800**	**192**	**23 - 950**	**5**	**1 - 12**
Siu Mai		320	170 - 510	192	97 - 310	3	2 - 5
Dumpling, steamed		483	280 - 770	221	85 - 280	3	3 - 3
Dumpling, pan-fried		998	280 - 1800	176	82 - 260	7	4 - 11
Dumpling, including wonton		475	380 - 550	183	140 - 220	4	3 - 6
Steamed barbecued pork bun		373	330 - 430	243	180 - 310	5	4 - 5
Turnip cake		573	400 - 700	260	190 - 340	7	5 - 12
Steamed minced beef ball		250	140 - 310	97	80 - 110	4	3 - 5
Glutinous rice dumpling		825	600 - 1200	119	95 - 150	8	5 - 10
Steamed rice-rolls with filling		210	130 - 300	48	42 - 59	3	1 - 4
Steamed rice-rolls, plain		101	74 - 130	44	34 - 64	3	1 - 5
Chinese soup		413	320 - 510	41	23 - 92	5	1 - 9
Hamburger		560	440 - 760	685	540 - 950	5	3 - 7
Snack foods	**4**	**3900**	**3500 - 4700**	**300**	**170 - 390**	**52**	**28 - 83**
Potato chips		3900	3500 - 4700	300	170 - 390	52	28 - 83
Sugars and confectionery	**8**	**2615**	**25 - 8900**	**968**	**6 - 2300**	**61**	**ND - 180**
Chocolate		5200	1900 - 8900	1925	1600 - 2300	121	45 - 180
Granulated white sugar		30	25 - 38	11	6 - 15	1	ND
Condiments, sauces and herbs	**20**	**1679**	**52 - 6400**	**131**	**19 - 340**	**9**	**ND - 26**
Table salt		1650	1200 - 2900	24	19 - 31	1	ND - 2
Soya sauce		3525	2300 - 6400	225	120 - 340	18	12 - 25
Oyster sauce		693	350 - 1100	116	82 - 160	9	5 - 13
Tomato paste/ ketchup		2425	2000 - 2600	203	160 - 290	15	8 - 26
Cornstarch		102	52 - 160	86	74 - 100	2	2 - 2

Table B: Copper, Iron and Magnesium Contents in TDS Foods of the 1st HKTDS

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cereals and their products	**76**	**919**	**330 - 2600**	**20287**	**630 - 600000**	**228**	**19 - 810**
Rice, white		575	530 - 650	1253	630 - 2600	36	24 - 45
Rice, unpolished		610	520 - 700	3400	3100 - 3600	508	430 - 650
Corn		413	360 - 460	3700	3300 - 4200	215	200 - 230
Noodles, Chinese or Japanese style		420	350 - 480	3825	3200 - 4100	57	44 - 68
Pasta, Western style		1113	850 - 1300	6075	4600 - 7000	200	180 - 240
Instant noodles		443	400 - 500	3725	2700 - 4600	45	42 - 49
Noodles, rice		448	330 - 550	2000	1300 - 2900	26	19 - 32
Bread, plain		1325	1200 - 1400	12250	11000 - 15000	325	280 - 400
Bread, raisin		1250	1200 - 1300	10225	9200 - 12000	260	220 - 310
"Pineapple" bun		858	840 - 880	7525	7400 - 7600	215	190 - 230
Sausage/ham/luncheon meat bun		823	760 - 880	10825	9300 - 13000	230	220 - 250
Chinese steamed bread		635	590 - 670	4625	4400 - 4800	100	80 - 110
Biscuits		1700	1100 - 2200	29500	23000 - 48000	390	230 - 560
Cakes		763	450 - 1300	159675	7900 - 600000	161	85 - 260
Pastries		835	730 - 910	7525	7300 - 7800	163	120 - 190
Pastries, Chinese		1975	1600 - 2600	11650	9600 - 13000	333	310 - 360
Oatmeal		403	370 - 430	5550	5100 - 6600	205	180 - 240
Breakfast cereals		1655	820 - 2600	92750	45000 - 170000	533	300 - 810
Deep-fried dough		1223	990 - 1500	9375	8100 - 12000	333	250 - 390
Vegetables and their products	**140**	**622**	**79 - 2500**	**6660**	**850 - 26000**	**199**	**37 - 1200**
Carrot/ Radish		223	150 - 350	1875	1600 - 2000	91	62 - 130
Potato		748	660 - 900	3925	3700 - 4200	135	110 - 150
Potato, fried		993	830 - 1200	8775	6800 - 13000	313	260 - 380
Broccoli		423	360 - 470	6250	5800 - 7100	200	160 - 230
Cabbage, Chinese		335	290 - 380	3225	3000 - 3400	134	97 - 170

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cabbage, Chinese flowering		485	440 - 590	8650	6500 - 11000	298	180 - 400
Cabbage, European variety		173	150 - 180	3125	2500 - 4600	153	110 - 190
Cabbage, Petiole Chinese		523	460 - 630	10225	8400 - 15000	273	180 - 340
Celery		240	200 - 330	1160	850 - 1600	94	84 - 100
Chinese kale		455	370 - 550	6975	6500 - 8100	390	300 - 620
Chinese spinach		693	610 - 830	20250	15000 - 26000	548	390 - 680
Leaf mustard		480	370 - 610	6225	3800 - 9400	117	91 - 160
Lettuce, Chinese		535	440 - 590	5550	5000 - 5800	132	98 - 180
Lettuce, European		323	190 - 490	3625	2800 - 4900	66	56 - 76
Mung bean sprout		705	610 - 780	3100	3000 - 3300	76	53 - 90
Spinach		1108	910 - 1400	20250	18000 - 22000	905	680 - 1200
Water spinach		1090	760 - 1300	8525	5900 - 11000	115	89 - 160
Watercress		590	490 - 700	11725	9900 - 17000	153	120 - 170
Bitter melon		448	340 - 550	3400	2800 - 4500	160	140 - 170
Cucumber		348	300 - 430	1975	1700 - 2300	104	91 - 120
Hairy gourd		285	260 - 330	1600	1100 - 1900	97	74 - 130
Pumpkin		368	180 - 600	2475	1900 - 3300	57	45 - 65
Sponge gourd		843	740 - 890	4525	4000 - 5800	223	190 - 280
Wax gourd		130	79 - 160	1068	910 - 1200	49	37 - 65
Zucchini		660	500 - 770	4525	3600 - 5100	233	180 - 270
Eggplant		698	620 - 790	2950	2700 - 3200	158	140 - 180
Sweet pepper		668	590 - 760	4300	3300 - 6000	125	100 - 160
Tomato		405	310 - 520	1925	1500 - 2500	90	85 - 99
Garlic		1700	1600 - 1800	10500	10000 - 11000	308	280 - 340
Onion		573	460 - 770	2175	1500 - 2600	133	110 - 170
Spring onion		353	300 - 420	9525	8100 - 11000	112	96 - 140
Preserved vegetables		473	340 - 600	13475	9900 - 19000	318	220 - 420
Mushroom, dried shiitake		1225	1100 - 1400	6325	4800 - 8300	198	170 - 230

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Mushrooms		2150	1400 - 2500	7675	6800 - 9800	97	88 - 110
Ear fungus		323	290 - 350	21250	14000 - 26000	315	280 - 360
Legumes, nuts and seeds and their products	**24**	**3344**	**11 - 9200**	**22990**	**410 - 130000**	**1077**	**2 - 2700**
Green string beans, with pod		800	710 - 890	7325	6200 - 8200	350	300 - 410
Mung bean vermicelli		14	11 - 19	863	410 - 1300	6	2 - 11
Beancurd		1675	1400 - 1800	13000	11000 - 15000	440	400 - 480
Fermented bean products		4475	2000 - 5700	81500	33000 - 130000	793	450 - 930
Peanut		7900	6100 - 9200	18500	14000 - 22000	2600	2500 - 2700
Peanut butter		5200	3700 - 7100	16750	16000 - 17000	2275	2000 - 2500
Fruits	**68**	**670**	**180 - 1900**	**1915**	**520 - 3100**	**130**	**44 - 430**
Apple		375	320 - 410	1263	950 - 1900	46	44 - 50
Banana		1113	900 - 1300	2750	2500 - 3100	360	310 - 430
Dragon fruit		470	340 - 610	2725	2700 - 2800	348	320 - 380
Grapes		1120	550 - 1600	2275	1800 - 2600	69	65 - 72
Kiwi fruit		1300	1100 - 1600	2350	1900 - 2800	140	120 - 170
Longan/ Lychee		1625	1200 - 1900	2650	2500 - 2700	135	100 - 170
Mango		985	840 - 1100	1525	1200 - 1900	93	79 - 100
Melons		215	180 - 240	1895	780 - 2700	108	100 - 110
Orange		558	500 - 610	1575	1300 - 2000	110	110 - 110
Papaya		243	180 - 280	2300	2200 - 2500	170	120 - 210
Peach		455	360 - 590	1500	1200 - 1800	63	52 - 72
Pear		528	360 - 660	568	520 - 630	73	65 - 82
Persimmon		303	240 - 340	1300	1100 - 1700	67	61 - 75
Pineapple		635	540 - 700	2450	2200 - 2700	140	88 - 180
Plum		495	390 - 650	1525	1100 - 1700	74	68 - 77
Pummelo /Grapefruit		415	360 - 470	1163	950 - 1400	82	66 - 96
Watermelon		563	480 - 630	2750	2600 - 2900	127	89 - 160
Meat, poultry and game and their products	**48**	**2064**	**350 - 26000**	**30365**	**5700 - 260000**	**229**	**100 - 350**

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Beef		705	680 - 740	25750	24000 - 27000	258	220 - 290
Mutton		1143	850 - 1700	15250	14000 - 17000	185	130 - 230
Pork		670	610 - 810	9025	8200 - 11000	270	260 - 290
Ham		945	850 - 1100	12750	12000 - 14000	215	190 - 230
Luncheon meat		688	580 - 870	13000	11000 - 15000	193	190 - 200
Barbecued pork		1060	940 - 1100	14750	13000 - 17000	225	200 - 250
Roasted pork		865	820 - 900	9300	8900 - 10000	285	230 - 320
Pig liver		14550	6200 - 26000	207500	160000 - 260000	248	240 - 260
Chicken meat		458	390 - 530	6925	6300 - 7800	320	300 - 350
Chicken, soy sauce		375	350 - 420	6875	5700 - 8300	210	190 - 230
Roasted duck/goose		2700	2500 - 2800	29250	25000 - 36000	198	180 - 210
Meat sausage		610	460 - 850	14000	12000 - 17000	145	100 - 240
Egg and their products	**12**	**2440**	**650 - 6200**	**24750**	**21000 - 29000**	**101**	**58 - 170**
Egg, chicken		745	650 - 830	24500	23000 - 26000	140	110 - 170
Egg, lime preserved		5500	3900 - 6200	22750	21000 - 24000	73	58 - 92
Egg, salted		1075	1000 - 1100	27000	26000 - 29000	91	87 - 94
Fish and seafood and their products	**76**	**6048**	**100 - 140000**	**8934**	**1300 - 70000**	**361**	**65 - 950**
Fish, Big head		350	220 - 490	6600	4900 - 8200	270	240 - 280
Fish, Mandarin fish		185	100 - 250	3100	2200 - 3500	320	230 - 420
Fish, Grass carp		348	230 - 450	5050	4300 - 5700	298	250 - 390
Fish, Golden thread		355	260 - 570	4300	3100 - 6300	378	320 - 420
Fish, Grouper		220	190 - 260	2600	2000 - 3100	330	300 - 350
Fish, Horse head		223	180 - 240	3150	2900 - 3300	370	350 - 400
Fish, Pomfret		373	330 - 410	4325	4000 - 5000	348	310 - 390
Fish, Sole		128	100 - 170	1550	1400 - 1600	293	260 - 320
Fish, Tuna		435	410 - 470	10100	8800 - 12000	365	320 - 390
Fish, Grey mullet		333	270 - 370	9350	8800 - 9800	313	300 - 320
Fish, Salmon		243	200 - 280	1925	1500 - 2200	305	290 - 320

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Fish, Yellow croaker		393	200 - 560	3725	3400 - 4100	408	380 - 450
Fish, Dace, minced		295	250 - 400	8175	4400 - 18000	270	240 - 290
Fish ball/fish cake		673	430 - 1100	6100	4800 - 8800	88	65 - 100
Shrimp/ Prawn		6225	4300 - 10000	10725	2500 - 18000	470	410 - 530
Crab		26750	23000 - 33000	17500	13000 - 23000	655	500 - 900
Oyster		74750	32000 - 140000	62000	49000 - 70000	310	270 - 410
Scallop		383	230 - 540	7975	4600 - 12000	380	250 - 480
Squid		2250	1400 - 3800	1500	1300 - 2000	695	530 - 950
Dairy products	**20**	**205**	**23 - 1300**	**1927**	**150 - 10000**	**164**	**96 - 300**
Milk, whole		39	30 - 47	240	150 - 320	102	99 - 110
Milk, skim		40	23 - 61	213	170 - 310	104	96 - 110
Cheese		300	290 - 320	3075	1800 - 4500	278	250 - 300
Yoghurt		62	42 - 85	535	410 - 740	158	120 - 180
Ice-cream		586	93 - 1300	5570	880 - 10000	177	99 - 280
Fats and oils	**8**	**24**	**17 - 35**	**233**	**160 - 350**	**6**	**ND - 14**
Butter		22	17 - 28	22	17 - 28	12	11 - 14
Oil, vegetable		26	19 - 35	26	19 - 35	1	ND
Beverages, alcoholic	**8**	**93**	**25 - 210**	**1712**	**56 - 3700**	**96**	**71 - 130**
Beer		35	25 - 41	199	56 - 330	80	71 - 91
Red wine		152	98 - 210	3225	3000 - 3700	113	90 - 130
Beverages, non-alcoholic	**40**	**155**	**1 - 810**	**2283**	**ND - 16000**	**46**	**ND - 170**
Tea, Chinese		38	29 - 50	243	210 - 260	10	8 - 12
Tea, Milk tea		123	100 - 150	605	210 - 1100	52	19 - 68
Coffee		28	26 - 29	913	440 - 2000	50	37 - 64
Malt drink		293	280 - 310	15000	14000 - 16000	135	120 - 170
Soybean drink		723	590 - 810	4125	3400 - 4400	145	110 - 170
Fruit and vegetable juice		270	180 - 330	1193	800 - 2000	58	41 - 79
Carbonated drink		18	10 - 34	190	100 - 360	2	2 - 3

TDS Food Item	Number of composite samples	Copper (µg/kg)		Iron (µg/kg)		Magnesium (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Tea, chrysanthemum		47	37 - 53	543	260 - 690	11	9 - 14
Water, bottled, distilled		2	1 - 2	5	ND	0.1	ND
Water, drinking		8	4 - 14	17	10 - 30	2	1 - 2
Mixed dishes	**48**	**520**	**65 - 1300**	**5866**	**700 - 11000**	**101**	**16 - 240**
Siu Mai		595	470 - 730	6175	4700 - 8800	147	96 - 210
Dumpling, steamed		523	420 - 720	6375	4300 - 8700	102	62 - 160
Dumpling, pan-fried		698	530 - 970	7150	6400 - 8100	129	75 - 230
Dumpling, including wonton		588	500 - 700	6425	5700 - 7200	110	88 - 160
Steamed barbecued pork bun		518	510 - 520	5775	5500 - 6000	93	85 - 100
Turnip cake		428	290 - 530	5900	4100 - 8200	73	47 - 92
Steamed minced beef ball		375	350 - 400	9500	8900 - 10000	98	85 - 110
Glutinous rice dumpling		1068	770 - 1300	8450	6500 - 11000	138	100 - 190
Steamed rice-rolls with filling		338	240 - 410	3050	2900 - 3200	44	31 - 60
Steamed rice-rolls, plain		283	170 - 390	1725	1200 - 2900	28	22 - 33
Chinese soup		109	65 - 150	1363	700 - 3300	29	16 - 47
Hamburger		723	680 - 780	8500	7800 - 9100	228	220 - 240
Snack foods	**4**	**1975**	**1800 - 2200**	**12250**	**10000 - 14000**	**580**	**560 - 600**
Potato chips		1975	1800 - 2200	12250	10000 - 14000	580	560 - 600
Sugars and confectionery	**8**	**2774**	**10 - 7800**	**21638**	**ND - 87000**	**511**	**1 - 1400**
Chocolate		5525	2300 - 7800	43250	14000 - 87000	1020	540 - 1400
Granulated white sugar		22	10 - 36	25	ND - ND	2	1 - 3
Condiments, sauces and herbs	**20**	**383**	**ND - 1900**	**7579**	**480 - 23000**	**174**	**ND - 540**
Table salt		3	ND	695	480 - 890	8	ND - 15
Soya sauce		104	70 - 130	14100	7700 - 23000	448	320 - 540
Oyster sauce		260	190 - 320	7125	5300 - 10000	115	41 - 240
Tomato paste/ ketchup		1500	1300 - 1900	10225	7500 - 14000	268	220 - 300
Cornstarch		47	34 - 59	5750	3900 - 7100	31	29 - 34

Table C: Manganese, Molybdenum and Phosphorus Contents in TDS Foods of the 1st HKTDS

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cereals and their products	**76**	**4661**	**620 - 18000**	**120**	**27 - 450**	**909**	**180 - 2300**
Rice, white		3325	2800 - 4300	140	130 - 160	260	180 - 310
Rice, unpolished		8225	6300 - 10000	133	93 - 190	1213	950 - 1600
Corn		1400	1200 - 1600	34	27 - 42	688	620 - 750
Noodles, Chinese or Japanese style		1675	1300 - 2000	40	33 - 50	295	250 - 350
Pasta, Western style		4100	2800 - 6400	123	62 - 180	623	540 - 700
Instant noodles		2025	1700 - 2500	45	43 - 47	308	260 - 330
Noodles, rice		1180	620 - 1700	105	71 - 150	220	190 - 240
Bread, plain		7450	6300 - 9200	175	160 - 200	1090	960 - 1400
Bread, raisin		4125	3800 - 4500	148	140 - 160	963	880 - 1100
"Pineapple" bun		3700	3500 - 3800	135	120 - 150	873	800 - 1000
Sausage/ham/luncheon meat bun		3025	2300 - 3800	125	120 - 130	1525	1400 - 1700
Chinese steamed bread		3350	3100 - 3900	84	75 - 94	870	780 - 1100
Biscuits		9050	5800 - 14000	143	130 - 160	1415	960 - 2100
Cakes		2450	1600 - 2900	63	51 - 80	1400	1100 - 1700
Pastries		2925	2500 - 3400	63	57 - 75	1010	850 - 1200
Pastries, Chinese		6550	5900 - 7300	212	59 - 340	1323	890 - 1700
Oatmeal		6250	5600 - 7500	84	67 - 100	525	470 - 570
Breakfast cereals		11975	5900 - 18000	268	160 - 450	1650	1100 - 2300
Deep-fried dough		5775	4500 - 7100	168	150 - 190	1018	820 - 1300
Vegetables and their products	**140**	**2677**	**420 - 22000**	**54**	**ND - 550**	**451**	**73 - 1700**
Carrot/ Radish		1800	1300 - 2000	8	6 - 12	240	190 - 320
Potato		2025	1700 - 2800	16	7 - 20	475	410 - 530
Potato, fried		2000	1800 - 2200	68	49 - 82	1275	1200 - 1400
Broccoli		1975	1600 - 2300	47	25 - 92	665	570 - 790
Cabbage, Chinese		1650	1300 - 2100	51	34 - 67	475	440 - 510

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Cabbage, Chinese flowering		3850	2400 - 5700	79	53 - 110	590	560 - 620
Cabbage, European variety		1675	1200 - 2100	37	14 - 63	310	280 - 350
Cabbage, Petiole Chinese		2225	2100 - 2400	57	37 - 69	535	520 - 570
Celery		1173	780 - 1900	10	4 - 18	305	250 - 360
Chinese kale		4600	3500 - 7400	101	19 - 180	725	670 - 820
Chinese spinach		12450	6500 - 22000	67	51 - 80	615	570 - 650
Leaf mustard		3275	1700 - 6400	44	31 - 54	415	350 - 470
Lettuce, Chinese		2025	1600 - 2400	6	5 - 8	338	290 - 380
Lettuce, European		1535	740 - 2800	2	ND - 6	188	150 - 230
Mung bean sprout		990	910 - 1100	500	430 - 550	270	210 - 330
Spinach		5350	4700 - 6300	20	9 - 30	563	470 - 710
Water spinach		6950	4300 - 8800	198	31 - 400	435	370 - 500
Watercress		3250	2200 - 4800	175	130 - 240	500	350 - 590
Bitter melon		2825	2400 - 3600	9	6 - 12	255	220 - 280
Cucumber		983	890 - 1100	19	10 - 28	240	210 - 280
Hairy gourd		1275	1200 - 1400	27	10 - 42	213	150 - 270
Pumpkin		968	620 - 1300	15	4 - 44	258	190 - 330
Sponge gourd		3475	2400 - 5600	17	10 - 29	358	330 - 390
Wax gourd		838	420 - 1400	10	ND - 18	86	73 - 96
Zucchini		1600	1400 - 1800	22	16 - 28	435	400 - 510
Eggplant		2175	1700 - 2600	28	6 - 38	258	230 - 290
Sweet pepper		1543	870 - 2900	14	5 - 20	270	220 - 320
Tomato		920	590 - 1500	26	13 - 40	198	180 - 230
Garlic		3375	3100 - 3700	45	36 - 52	1550	1400 - 1700
Onion		1140	760 - 1500	18	9 - 30	380	300 - 420
Spring onion		3650	2900 - 5000	30	8 - 59	233	220 - 260
Preserved vegetables		2475	1800 - 3200	55	43 - 66	210	170 - 250
Mushroom, dried shiitake		3150	2900 - 3600	33	29 - 36	865	690 - 1100

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Mushrooms		670	600 - 720	16	12 - 19	845	740 - 880
Ear fungus		3825	3600 - 4200	15	12 - 19	213	190 - 260
Legumes, nuts and seeds and their products	**24**	**12026**	**28 - 36000**	**718**	**ND - 2300**	**2166**	**11 - 4800**
Green string beans, with pod		4700	3700 - 5500	175	78 - 320	505	440 - 550
Mung bean vermicelli		107	28 - 150	1	ND - 2	44	11 - 85
Beancurd		4150	3700 - 4500	530	260 - 710	1300	1100 - 1600
Fermented bean products		12450	6800 - 16000	1503	940 - 2300	2050	1400 - 2400
Peanut		28250	21000 - 36000	1193	630 - 2300	4775	4700 - 4800
Peanut butter		22500	16000 - 32000	910	640 - 1600	4325	3800 - 4600
Fruits	**68**	**1803**	**170 - 16000**	**13**	**ND - 82**	**192**	**58 - 380**
Apple		523	320 - 670	8	3 - 11	94	92 - 95
Banana		2675	1500 - 3600	56	34 - 82	225	220 - 230
Dragon fruit		3725	2400 - 6200	57	51 - 68	298	270 - 320
Grapes		688	540 - 900	14	9 - 22	235	210 - 270
Kiwi fruit		730	540 - 1100	5	3 - 6	288	280 - 300
Longan/ Lychee		1098	750 - 1400	17	12 - 25	348	320 - 380
Mango		968	520 - 1800	2	ND - 4	148	120 - 190
Melons		390	170 - 700	6	4 - 9	136	62 - 180
Orange		400	280 - 640	7	4 - 9	235	200 - 270
Papaya		828	370 - 1100	16	10 - 25	102	92 - 120
Peach		465	360 - 630	6	3 - 8	165	130 - 190
Pear		798	550 - 1400	2	ND - 3	113	110 - 120
Persimmon		4518	970 - 7300	7	3 - 12	203	140 - 260
Pineapple		10250	6700 - 16000	6	4 - 8	70	58 - 78
Plum		768	670 - 900	11	2 - 21	223	200 - 250
Pummelo /Grapefruit		238	200 - 330	4	2 - 5	218	200 - 240
Watermelon		1585	540 - 2400	7	5 - 9	160	110 - 210
Meat, poultry and game and their products	**48**	**688**	**73 - 6700**	**183**	**5 - 2400**	**2400**	**1300 - 4800**

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Beef		86	73 - 100	8	6 - 9	2075	1700 - 2300
Mutton		113	92 - 120	6	5 - 8	1550	1300 - 1800
Pork		83	75 - 89	11	9 - 13	2325	2200 - 2400
Ham		720	670 - 780	58	46 - 67	3625	3100 - 4100
Luncheon meat		710	520 - 970	37	22 - 60	2350	2000 - 2700
Barbecued pork		338	250 - 480	18	16 - 20	1750	1500 - 2000
Roasted pork		278	240 - 300	16	14 - 18	2100	1800 - 2300
Pig liver		4275	3100 - 6700	1900	1500 - 2400	4500	4300 - 4800
Chicken meat		173	150 - 200	31	28 - 33	2500	2200 - 2900
Chicken, soy sauce		245	190 - 330	22	21 - 24	1625	1600 - 1700
Roasted duck/goose		445	350 - 600	21	16 - 25	1825	1600 - 1900
Meat sausage		798	320 - 1400	73	41 - 100	2575	2200 - 2900
Egg and their products	**12**	**411**	**300 - 550**	**150**	**24 - 420**	**2308**	**1900 - 2600**
Egg, chicken		435	420 - 450	86	40 - 190	2250	2100 - 2400
Egg, lime preserved		328	300 - 380	30	24 - 37	2125	1900 - 2300
Egg, salted		470	390 - 550	335	180 - 420	2550	2500 - 2600
Fish and seafood and their products	**76**	**830**	**65 - 9000**	**18**	**ND - 310**	**2299**	**650 - 3900**
Fish, Big head		253	180 - 340	7	6 - 8	2200	2100 - 2300
Fish, Mandarin fish		228	100 - 460	4	2 - 6	2175	1500 - 2800
Fish, Grass carp		97	79 - 130	1	ND	2050	1800 - 2400
Fish, Golden thread		200	160 - 240	3	2 - 4	2725	2600 - 2900
Fish, Grouper		170	110 - 210	2	ND - 4	2125	2000 - 2400
Fish, Horse head		93	81 - 100	4	ND - 8	2475	2400 - 2500
Fish, Pomfret		140	120 - 150	1	ND	2475	2400 - 2500
Fish, Sole		110	100 - 120	2	ND - 4	2375	1900 - 2800
Fish, Tuna		82	65 - 110	2	ND - 2	2375	2100 - 2600
Fish, Grey mullet		680	190 - 1600	4	ND - 7	2200	2100 - 2300
Fish, Salmon		85	74 - 100	1	ND - 2	2575	2500 - 2700

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Fish, Yellow croaker		150	110 - 190	3	ND - 4	2950	2700 - 3300
Fish, Dace, minced		510	250 - 760	10	5 - 16	1875	1600 - 2200
Fish ball/fish cake		795	630 - 1200	18	4 - 45	930	650 - 1200
Shrimp/ Prawn		543	260 - 710	15	11 - 21	3125	2600 - 3900
Crab		2300	1100 - 3400	44	29 - 52	2525	2000 - 2900
Oyster		7600	5600 - 9000	134	47 - 310	1950	1500 - 2200
Scallop		1500	1100 - 2400	82	14 - 220	2700	2300 - 3700
Squid		240	190 - 300	6	4 - 9	1875	1300 - 2400
Dairy products	**20**	**737**	**18 - 9300**	**62**	**24 - 200**	**2181**	**730 - 7100**
Milk, whole		30	18 - 40	35	31 - 38	1048	990 - 1100
Milk, skim		32	30 - 34	29	24 - 35	1100	1000 - 1300
Cheese		310	220 - 420	103	83 - 120	6325	4900 - 7100
Yoghurt		149	46 - 260	52	42 - 57	1475	1300 - 1600
Ice-cream		3163	250 - 9300	93	38 - 200	955	730 - 1100
Fats and oils	**8**	**17**	**ND - 54**	**7**	**ND - 20**	**94**	**ND - 220**
Butter		2.5	ND	14	8 - 20	185	170 - 220
Oil, vegetable		31	14 - 54	1	ND	3	ND
Beverages, alcoholic	**8**	**905**	**140 - 1800**	**6**	**4 - 10**	**218**	**120 - 310**
Beer		160	140 - 180	6	4 - 7	183	120 - 220
Red wine		1650	1200 - 1800	7	5 - 10	253	200 - 310
Beverages, non-alcoholic	**40**	**1390**	**ND - 8700**	**30**	**ND - 330**	**189**	**ND - 610**
Tea, Chinese		3925	3600 - 4300	0.2	ND	20	15 - 24
Tea, Milk tea		6775	3900 - 8700	14	3 - 19	445	360 - 520
Coffee		308	190 - 550	4	ND - 7	243	170 - 360
Malt drink		1028	950 - 1200	22	21 - 23	565	530 - 610
Soybean drink		1300	1100 - 1400	248	150 - 330	448	400 - 540
Fruit and vegetable juice		305	180 - 440	8	5 - 14	103	79 - 150
Carbonated drink		2.5	ND	1	ND	53	48 - 54

TDS Food Item	Number of composite samples	Manganese (µg/kg)		Molybdenum (µg/kg)		Phosphorus (mg/kg)	
		Mean	Range	Mean	Range	Mean	Range
Tea, chrysanthemum		253	220 - 310	1	ND	12	7 - 14
Water, bottled, distilled		0.5	ND	0.2	ND	0.5	ND
Water, drinking		0.5	ND	0.3	ND - 1	0.5	ND
Mixed dishes	**48**	**1831**	**36 - 5600**	**79**	**8 - 550**	**674**	**55 - 1700**
Siu Mai		965	700 - 1300	32	24 - 43	1115	760 - 1500
Dumpling, steamed		1400	1000 - 1700	49	40 - 57	628	500 - 740
Dumpling, pan-fried		3000	2400 - 3600	87	50 - 140	698	550 - 880
Dumpling, including wonton		2275	1600 - 3300	48	35 - 62	633	510 - 830
Steamed barbecued pork bun		2450	1900 - 2800	62	53 - 75	910	740 - 1100
Turnip cake		1525	1100 - 2200	50	40 - 61	340	220 - 410
Steamed minced beef ball		790	590 - 1100	33	12 - 75	828	760 - 860
Glutinous rice dumpling		5300	4900 - 5600	338	220 - 550	688	560 - 930
Steamed rice-rolls with filling		778	560 - 1000	54	32 - 84	398	310 - 510
Steamed rice-rolls, plain		845	580 - 1100	81	39 - 120	213	200 - 230
Chinese soup		144	36 - 340	17	8 - 44	111	55 - 160
Hamburger		2500	2200 - 2900	96	86 - 110	1525	1300 - 1700
Snack foods	**4**	**3650**	**3300 - 4000**	**147**	**97 - 180**	**1600**	**1500 - 1800**
Potato chips		3650	3300 - 4000	147	97 - 180	1600	1500 - 1800
Sugars and confectionery	**8**	**3339**	**ND - 9000**	**68**	**ND - 150**	**1276**	**ND - 2900**
Chocolate		6675	2500 - 9000	135	120 - 150	2550	2300 - 2900
Granulated white sugar		2.5	ND	1	ND	3	ND
Condiments, sauces and herbs	**20**	**1512**	**ND - 6400**	**75**	**ND - 260**	**359**	**ND - 1300**
Table salt		62	ND - 200	26	ND - 81	3	ND
Soya sauce		4525	3000 - 6400	165	71 - 260	958	770 - 1300
Oyster sauce		1038	790 - 1400	35	17 - 48	149	94 - 220
Tomato paste/ ketchup		1750	1600 - 2100	130	68 - 170	520	460 - 580
Cornstarch		185	140 - 290	20	16 - 25	165	150 - 190

Table D: Potassium and Selenium Contents in TDS Foods of the 1st HKTDS

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Cereals and their products	**76**	**1033**	**21 - 2600**	**155**	**ND - 450**
Rice, white		200	140 - 230	14	8 - 23
Rice, unpolished		733	550 - 940	14	9 - 24
Corn		1800	1700 - 1900	3	ND - ND
Noodles, Chinese or Japanese style		228	190 - 280	56	22 - 89
Pasta, Western style		383	240 - 490	99	46 - 150
Instant noodles		210	190 - 220	24	17 - 31
Noodles, rice		37	21 - 52	9	6 - 11
Bread, plain		1300	1200 - 1400	363	210 - 450
Bread, raisin		1675	1300 - 2000	318	230 - 410
"Pineapple" bun		978	920 - 1100	335	320 - 370
Sausage/ham/luncheon meat bun		1550	1400 - 1600	348	280 - 420
Chinese steamed bread		790	740 - 840	113	56 - 180
Biscuits		1975	1600 - 2400	127	86 - 200
Cakes		1400	1000 - 1800	228	160 - 280
Pastries		1300	1200 - 1500	178	120 - 220
Pastries, Chinese		1438	950 - 1700	173	130 - 270
Oatmeal		410	390 - 460	17	10 - 24
Breakfast cereals		2075	1500 - 2600	157	47 - 290
Deep-fried dough		1148	890 - 1300	368	230 - 430
Vegetables and their products	**140**	**2256**	**430 - 5700**	**13**	**ND - 70**
Carrot/ Radish		1125	930 - 1600	12	8 - 17
Potato		2075	1800 - 2300	13	7 - 20
Potato, fried		4825	4100 - 5700	27	15 - 35
Broccoli		2200	1600 - 2900	16	9 - 24
Cabbage, Chinese		2125	2100 - 2200	18	13 - 22

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Cabbage, Chinese flowering		3175	2700 - 3700	14	6 - 23
Cabbage, European variety		1750	1500 - 2000	12	7 - 22
Cabbage, Petiole Chinese		2550	2100 - 3100	34	20 - 47
Celery		2425	2300 - 2600	7	ND - 21
Chinese kale		3175	2700 - 3500	19	10 - 24
Chinese spinach		4750	4500 - 4900	24	20 - 27
Leaf mustard		2750	2300 - 3000	6	ND - 9
Lettuce, Chinese		2125	1900 - 2400	6	ND - 10
Lettuce, European		915	730 - 1000	3	ND
Mung bean sprout		538	430 - 680	3	ND - 5
Spinach		3975	3400 - 5300	8	ND - 14
Water spinach		3900	3100 - 4500	19	11 - 23
Watercress		2975	2500 - 3200	27	15 - 47
Bitter melon		1850	1600 - 2000	3	ND
Cucumber		1375	1200 - 1700	3	ND
Hairy gourd		1258	770 - 2000	3	ND
Pumpkin		1725	1200 - 2000	5	ND - 8
Sponge gourd		1500	1400 - 1600	3	ND
Wax gourd		680	650 - 730	3	ND
Zucchini		2425	2200 - 2700	5	ND - 7
Eggplant		2150	2100 - 2300	7	6 - 8
Sweet pepper		1825	1700 - 2000	6	ND - 8
Tomato		1775	1600 - 2100	7	5 - 8
Garlic		4425	4000 - 4800	24	20 - 29
Onion		1625	1500 - 1800	12	5 - 26
Spring onion		1725	1600 - 1900	9	6 - 13
Preserved vegetables		1675	1400 - 2200	3	ND
Mushroom, dried shiitake		2350	2000 - 2900	28	21 - 45

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Mushrooms		2350	2300 - 2400	49	36 - 70
Ear fungus		905	780 - 960	20	16 - 27
Legumes, nuts and seeds and their products	**24**	**3405**	**ND - 7100**	**105**	**ND - 300**
Green string beans, with pod		1825	1700 - 2000	8	6 - 12
Mung bean vermicelli		6	ND - 12	3	ND
Beancurd		1650	1500 - 1800	44	23 - 65
Fermented bean products		4475	2300 - 5500	93	89 - 96
Peanut		6475	6100 - 7100	238	180 - 300
Peanut butter		6000	5800 - 6300	248	190 - 290
Fruits	**68**	**1674**	**770 - 3300**	**7**	**ND - 35**
Apple		980	920 - 1000	3	ND
Banana		2900	2200 - 3300	20	8 - 35
Dragon fruit		2275	2200 - 2400	10	ND - 15
Grapes		1775	1700 - 2000	5	ND - 9
Kiwi fruit		2350	2100 - 2500	13	7 - 18
Longan/ Lychee		2375	2100 - 2500	9	6 - 13
Mango		1250	1100 - 1400	7	5 - 8
Melons		2025	1700 - 2200	8	ND - 12
Orange		1550	1500 - 1600	3	ND - 6
Papaya		1825	1700 - 2200	11	6 - 19
Peach		1225	1000 - 1300	3	ND - 6
Pear		1093	970 - 1200	4	ND - 6
Persimmon		1400	1200 - 1600	8	6 - 11
Pineapple		943	770 - 1100	7	ND - 9
Plum		1675	1500 - 1800	4	ND - 8
Pummelo /Grapefruit		1700	1500 - 2000	3	ND
Watermelon		1118	970 - 1300	9	6 - 13
Meat, poultry and game and their products	**48**	**2613**	**1700 - 3500**	**411**	**62 - 1500**

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Beef		2825	2400 - 3100	123	110 - 140
Mutton		1975	1700 - 2300	82	62 - 110
Pork		3125	3000 - 3300	388	310 - 470
Ham		3000	2900 - 3100	275	240 - 310
Luncheon meat		2625	2500 - 2800	220	180 - 310
Barbecued pork		2325	2300 - 2400	410	350 - 470
Roasted pork		3250	2900 - 3500	418	330 - 560
Pig liver		2050	1900 - 2100	1300	1100 - 1500
Chicken meat		3075	2700 - 3500	325	250 - 420
Chicken, soy sauce		2150	2000 - 2400	338	320 - 370
Roasted duck/goose		2175	2100 - 2400	690	590 - 960
Meat sausage		2775	2200 - 3100	363	250 - 610
Egg and their products	**12**	**3375**	**1400 - 9500**	**585**	**420 - 880**
Egg, chicken		1500	1400 - 1600	535	420 - 670
Egg, lime preserved		1600	1400 - 1700	533	450 - 600
Egg, salted		7025	4900 - 9500	688	540 - 880
Fish and seafood and their products	**76**	**2728**	**180 - 4200**	**703**	**250 - 1900**
Fish, Big head		3075	2900 - 3200	473	330 - 600
Fish, Mandarin fish		3025	2800 - 3200	1255	420 - 1900
Fish, Grass carp		2775	2600 - 2900	480	410 - 600
Fish, Golden thread		3675	3000 - 4200	815	690 - 1000
Fish, Grouper		3200	2900 - 3500	923	660 - 1100
Fish, Horse head		3425	3200 - 3500	1005	880 - 1300
Fish, Pomfret		3425	3100 - 3600	683	580 - 860
Fish, Sole		3075	2800 - 3400	320	270 - 350
Fish, Tuna		2675	2400 - 2900	1300	1100 - 1500
Fish, Grey mullet		3000	2800 - 3100	525	450 - 700
Fish, Salmon		3325	3100 - 3400	265	250 - 270

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Fish, Yellow croaker		3600	3300 - 3900	790	630 - 1000
Fish, Dace, minced		2475	2200 - 2700	723	660 - 790
Fish ball/fish cake		380	180 - 560	373	340 - 390
Shrimp/ Prawn		2775	2300 - 3300	588	390 - 760
Crab		2625	2500 - 3000	905	620 - 1200
Oyster		1700	1100 - 2300	933	810 - 1200
Scallop		2275	1400 - 3000	483	360 - 640
Squid		1323	790 - 2200	523	350 - 780
Dairy products	**20**	**1628**	**860 - 2400**	**81**	**17 - 420**
Milk, whole		1500	1500 - 1500	30	19 - 39
Milk, skim		1475	1300 - 1600	26	20 - 33
Cheese		1490	860 - 2200	290	170 - 420
Yoghurt		2000	1700 - 2400	35	28 - 41
Ice-cream		1675	1300 - 1900	24	17 - 37
Fats and oils	**8**	**115**	**ND - 270**	**28**	**14 - 37**
Butter		228	200 - 270	29	25 - 37
Oil, vegetable		2	ND	27	14 - 36
Beverages, alcoholic	**8**	**568**	**220 - 840**	**5**	**ND - 11**
Beer		300	220 - 330	8	6 - 11
Red wine		835	830 - 840	3	ND
Beverages, non-alcoholic	**40**	**497**	**ND - 1300**	**5**	**ND - 19**
Tea, Chinese		180	140 - 200	0.5	ND
Tea, Milk tea		935	750 - 1100	8	ND - 11
Coffee		883	720 - 1200	3	ND - 5
Malt drink		1050	1000 - 1100	16	14 - 19
Soybean drink		893	830 - 970	14	9 - 19
Fruit and vegetable juice		888	630 - 1300	6	6 - 7
Carbonated drink		11	4 - 29	3	ND

TDS Food Item	Number of composite samples	Potassium (mg/kg)		Selenium (µg/kg)	
		Mean	Range	Mean	Range
Tea, chrysanthemum		129	95 - 150	3	ND
Water, bottled, distilled		0.4	ND	0.5	ND
Water, drinking		2	2 - 2	0.8	ND - 1
Mixed dishes	**48**	**1103**	**70 - 2400**	**96**	**5 - 260**
Siu Mai		1750	1200 - 2300	208	190 - 250
Dumpling, steamed		913	770 - 1100	113	71 - 190
Dumpling, pan-fried		1475	1000 - 1900	141	94 - 190
Dumpling, including wonton		938	860 - 1000	133	110 - 150
Steamed barbecued pork bun		1050	1000 - 1200	88	65 - 110
Turnip cake		630	400 - 750	51	33 - 66
Steamed minced beef ball		2225	2100 - 2400	63	44 - 97
Glutinous rice dumpling		1043	830 - 1400	84	40 - 140
Steamed rice-rolls with filling		593	500 - 760	28	22 - 34
Steamed rice-rolls, plain		92	70 - 140	9	5 - 16
Chinese soup		510	370 - 700	19	9 - 27
Hamburger		2025	1800 - 2300	218	170 - 260
Snack foods	**4**	**9450**	**8900 - 10000**	**68**	**44 - 96**
Potato chips		9450	8900 - 10000	68	44 - 96
Sugars and confectionery	**8**	**2334**	**12 - 5900**	**86**	**ND - 280**
Chocolate		4650	3700 - 5900	169	95 - 280
Granulated white sugar		18	12 - 24	3	ND
Condiments, sauces and herbs	**20**	**1765**	**48 - 5700**	**23**	**ND - 130**
Table salt		84	68 - 100	3	ND
Soya sauce		2950	2100 - 3700	3	ND
Oyster sauce		608	420 - 810	92	70 - 130
Tomato paste/ ketchup		5125	4600 - 5700	13	11 - 16
Cornstarch		58	48 - 63	7	5 - 10

Table E: Sodium and Zinc Contents in TDS Foods of the 1st HKTDS

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Cereals and their products	**76**	**1690**	**ND - 6100**	**7764**	**1400 - 46000**
Rice, white		2	ND	5575	4300 - 6700
Rice, unpolished		6	ND - 17	8500	6100 - 11000
Corn		1098	390 - 1400	5100	4500 - 5500
Noodles, Chinese or Japanese style		745	570 - 870	2050	1400 - 2400
Pasta, Western style		25	4 - 56	5425	4300 - 6500
Instant noodles		638	530 - 720	2550	2200 - 3100
Noodles, rice		25	ND - 62	2250	1400 - 2900
Bread, plain		3500	2900 - 4200	9425	8000 - 11000
Bread, raisin		1645	280 - 2500	8800	8000 - 9500
"Pineapple" bun		1243	670 - 1700	8150	7700 - 8400
Sausage/ham/luncheon meat bun		4325	4100 - 4600	13000	12000 - 14000
Chinese steamed bread		630	420 - 870	4300	3900 - 5200
Biscuits		4750	3700 - 6100	9050	5600 - 13000
Cakes		2325	2100 - 2800	6950	4500 - 8800
Pastries		2250	2100 - 2400	6725	5900 - 7500
Pastries, Chinese		353	200 - 470	9625	8900 - 10000
Oatmeal		6	5 - 7	3225	2900 - 3900
Breakfast cereals		4525	3000 - 5800	28000	12000 - 46000
Deep-fried dough		4025	2500 - 4700	8825	7900 - 9800
Vegetables and their products	**140**	**999**	**ND - 33000**	**3446**	**390 - 13000**
Carrot/ Radish		418	310 - 550	1800	1400 - 2200
Potato		13	7 - 18	2750	2400 - 3400
Potato, fried		2850	2100 - 3800	5475	4900 - 5900
Broccoli		298	160 - 500	3800	2600 - 4600
Cabbage, Chinese		156	75 - 190	3050	2800 - 3400

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Cabbage, Chinese flowering		553	170 - 1100	5500	3200 - 8300
Cabbage, European variety		233	170 - 310	1475	1200 - 1600
Cabbage, Petiole Chinese		630	250 - 1200	3750	3100 - 4100
Celery		763	520 - 960	1103	630 - 1600
Chinese kale		488	260 - 1100	4525	3600 - 5500
Chinese spinach		140	88 - 240	7500	5000 - 13000
Leaf mustard		163	93 - 210	4375	3500 - 6200
Lettuce, Chinese		133	93 - 180	3150	2700 - 4200
Lettuce, European		29	15 - 42	1230	920 - 1700
Mung bean sprout		49	41 - 59	2550	2400 - 2700
Spinach		858	460 - 1000	7475	5100 - 9100
Water spinach		273	250 - 280	3300	3000 - 3800
Watercress		363	220 - 760	5625	2300 - 9100
Bitter melon		17	14 - 24	1825	1500 - 2200
Cucumber		16	10 - 25	1425	1300 - 1500
Hairy gourd		4	ND - 9	1180	920 - 1500
Pumpkin		2	ND	1600	1000 - 2100
Sponge gourd		14	7 - 22	3725	3400 - 4300
Wax gourd		2	ND	428	390 - 480
Zucchini		2	ND	4025	3500 - 4700
Eggplant		21	8 - 42	1400	1300 - 1600
Sweet pepper		15	8 - 22	1650	1500 - 1900
Tomato		59	34 - 91	1160	940 - 1500
Garlic		198	180 - 220	7125	6600 - 7700
Onion		51	33 - 80	1900	1200 - 2500
Spring onion		26	11 - 50	3575	2800 - 4800
Preserved vegetables		24750	21000 - 33000	2700	2200 - 3300
Mushroom, dried shiitake		9	9 - 10	9450	8900 - 10000

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Mushrooms		1188	950 - 1400	6725	6300 - 7000
Ear fungus		178	120 - 230	2300	2100 - 2500
Legumes, nuts and seeds and their products	**24**	**5855**	**ND - 29000**	**15690**	**48 - 35000**
Green string beans, with pod		11	4 - 21	4575	4300 - 4900
Mung bean vermicelli		5	ND - 9	89	48 - 110
Beancurd		86	10 - 190	7725	7000 - 8900
Fermented bean products		27500	25000 - 29000	18250	12000 - 21000
Peanut		4200	3000 - 5000	33250	31000 - 35000
Peanut butter		3325	3000 - 4000	30250	26000 - 34000
Fruits	**68**	**23**	**ND - 270**	**1090**	**160 - 3500**
Apple		6	ND - 10	195	160 - 240
Banana		2	ND	2200	1900 - 2500
Dragon fruit		2	ND	3275	3000 - 3500
Grapes		15	6 - 32	423	370 - 460
Kiwi fruit		15	8 - 21	1050	1000 - 1100
Longan/ Lychee		3	ND - 5	2300	2100 - 2600
Mango		4	ND - 8	1040	840 - 1300
Melons		220	170 - 270	1073	660 - 1700
Orange		4	ND - 8	840	710 - 1100
Papaya		41	24 - 59	815	770 - 900
Peach		19	ND - 34	800	750 - 910
Pear		8	5 - 10	535	410 - 680
Persimmon		17	ND - 36	450	360 - 570
Pineapple		8	ND - 19	885	800 - 1000
Plum		4	ND - 9	738	600 - 860
Pummelo /Grapefruit		7	5 - 8	630	570 - 680
Watermelon		15	10 - 23	1275	1000 - 1600
Meat, poultry and game and their products	**48**	**5037**	**440 - 15000**	**35667**	**11000 - 140000**

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Beef		578	510 - 600	64250	58000 - 68000
Mutton		655	440 - 810	47000	43000 - 49000
Pork		618	590 - 660	28250	21000 - 37000
Ham		14000	13000 - 15000	26000	24000 - 30000
Luncheon meat		8775	7500 - 11000	19250	15000 - 23000
Barbecued pork		7825	6200 - 8900	40750	40000 - 42000
Roasted pork		9000	7000 - 11000	30500	25000 - 34000
Pig liver		618	600 - 630	108000	72000 - 140000
Chicken meat		623	530 - 700	14000	13000 - 15000
Chicken, soy sauce		4300	3700 - 5300	12250	11000 - 13000
Roasted duck/goose		4675	3500 - 7200	22750	21000 - 24000
Meat sausage		8775	8100 - 10000	15000	14000 - 16000
Egg and their products	**12**	**7042**	**1500 - 17000**	**19667**	**15000 - 24000**
Egg, chicken		1625	1500 - 1800	21250	19000 - 24000
Egg, lime preserved		6525	6000 - 7500	15750	15000 - 16000
Egg, salted		12975	8900 - 17000	22000	18000 - 24000
Fish and seafood and their products	**76**	**2142**	**260 - 7800**	**29966**	**3700 - 400000**
Fish, Big head		498	400 - 630	9350	8100 - 11000
Fish, Mandarin fish		493	380 - 710	8825	6400 - 12000
Fish, Grass carp		358	260 - 550	6625	6100 - 7100
Fish, Golden thread		940	660 - 1200	5900	5600 - 6300
Fish, Grouper		853	700 - 1100	10175	8700 - 12000
Fish, Horse head		873	710 - 1000	5975	5600 - 6600
Fish, Pomfret		1018	590 - 1600	7250	6800 - 8000
Fish, Sole		3850	2600 - 5500	4725	4200 - 5100
Fish, Tuna		2275	1700 - 2700	7250	6700 - 7900
Fish, Grey mullet		618	530 - 680	8625	7800 - 9100
Fish, Salmon		418	340 - 480	3900	3700 - 4000

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Fish, Yellow croaker		1070	980 - 1100	9875	8200 - 12000
Fish, Dace, minced		7250	6100 - 7700	11075	9300 - 14000
Fish ball/fish cake		6900	5800 - 7800	4050	3700 - 4400
Shrimp/ Prawn		2925	1700 - 4200	16750	15000 - 19000
Crab		3675	3000 - 4900	60500	50000 - 76000
Oyster		1145	830 - 1800	315000	170000 - 400000
Scallop		2275	1300 - 4800	53750	16000 - 150000
Squid		3275	2400 - 4700	19750	17000 - 23000
Dairy products	**20**	**2070**	**320 - 11000**	**11150**	**3200 - 44000**
Milk, whole		428	400 - 450	4450	4100 - 4900
Milk, skim		395	370 - 420	4475	4300 - 4600
Cheese		8475	7400 - 11000	37000	31000 - 44000
Yoghurt		583	510 - 640	5425	4800 - 6000
Ice-cream		468	320 - 620	4400	3200 - 6200
Fats and oils	**8**	**1614**	**ND - 5400**	**426**	**94 - 1000**
Butter		3225	1600 - 5400	698	450 - 1000
Oil, vegetable		2	ND	154	94 - 180
Beverages, alcoholic	**8**	**33**	**21 - 59**	**395**	**ND - 960**
Beer		34	21 - 59	8	ND - 12
Red wine		33	27 - 39	783	610 - 960
Beverages, non-alcoholic	**40**	**121**	**ND - 560**	**1200**	**ND - 7300**
Tea, Chinese		2	ND - 2	165	140 - 200
Tea, Milk tea		253	230 - 290	1445	480 - 2000
Coffee		193	120 - 230	520	180 - 920
Malt drink		530	500 - 560	6900	6600 - 7300
Soybean drink		121	45 - 170	2450	2100 - 2600
Fruit and vegetable juice		28	10 - 61	360	260 - 550
Carbonated drink		53	48 - 55	24	ND - 56

TDS Food Item	Number of composite samples	Sodium (mg/kg)		Zinc (µg/kg)	
		Mean	Range	Mean	Range
Tea, chrysanthemum		24	8 - 33	130	110 - 150
Water, bottled, distilled		0.4	ND	1	ND
Water, drinking		7	4 - 9	9	3 - 23
Mixed dishes	**48**	**3510**	**66 - 6300**	**7404**	**300 - 19000**
Siu Mai		5875	5200 - 6300	10300	9200 - 11000
Dumpling, steamed		3925	3600 - 4300	4800	4500 - 5400
Dumpling, pan-fried		3525	2400 - 4200	6350	6100 - 6700
Dumpling, including wonton		3375	2000 - 4000	6150	5200 - 7000
Steamed barbecued pork bun		2700	2300 - 3100	7275	6100 - 8900
Turnip cake		4450	3300 - 5100	3750	2900 - 4500
Steamed minced beef ball		5225	4700 - 5700	17250	15000 - 19000
Glutinous rice dumpling		3600	2600 - 4700	12200	8800 - 19000
Steamed rice-rolls with filling		2050	1800 - 2300	6050	4800 - 7100
Steamed rice-rolls, plain		374	66 - 650	2050	1200 - 3000
Chinese soup		2075	1900 - 2400	620	300 - 1300
Hamburger		4950	3700 - 5900	12050	9200 - 15000
Snack foods	**4**	**5575**	**4800 - 6500**	**8050**	**6300 - 9200**
Potato chips		5575	4800 - 6500	8050	6300 - 9200
Sugars and confectionery	**8**	**365**	**ND - 1100**	**8135**	**11 - 21000**
Chocolate		728	400 - 1100	16250	10000 - 21000
Granulated white sugar		2	ND	20	11 - 40
Condiments, sauces and herbs	**20**	**97353**	**33 - 380000**	**2030**	**ND - 6700**
Table salt		380000	380000 - 380000	20	ND - 40
Soya sauce		57000	35000 - 66000	4500	2700 - 6700
Oyster sauce		42750	40000 - 49000	2325	1100 - 3800
Tomato paste/ ketchup		6975	6600 - 7200	3000	2700 - 3200
Cornstarch		42	33 - 57	305	260 - 340

Appendix II

Table A: Dietary Intake of Boron by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	1.2	2.4
Female aged 20 – 29	1.2	2.5
Male aged 30-39	1.4	3.0
Female aged 30 – 39	1.4	2.6
Male aged 40-49	1.5	2.9
Female aged 40 – 49	1.6	2.8
Male aged 50-59	1.7	3.1
Female aged 50 – 59	1.6	3.0
Male aged 60-69	1.7	3.2
Female aged 60 – 69	1.5	2.8
Male aged 70-84	1.5	2.8
Female aged 70 – 84	1.3	2.5
Male aged 20-84	1.5	3.0
Female aged 20 – 84	1.4	2.7
Adult aged 20 – 84	**1.5**	**2.8**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table B: Dietary Intake of Calcium by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	410	860
Female aged 20 – 29	400	820
Male aged 30-39	430	850
Female aged 30 – 39	430	840
Male aged 40-49	440	810
Female aged 40 – 49	460	840
Male aged 50-59	430	800
Female aged 50 – 59	450	860
Male aged 60-69	440	880
Female aged 60 – 69	430	850
Male aged 70-84	390	830
Female aged 70 – 84	410	870
Male aged 20-84	430	840
Female aged 20 – 84	430	840
Adult aged 20 – 84	**430**	**840**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table C: Dietary Intake of Cobalt by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake # (µg/day)	
	Average	High Consumers @
Male aged 20 – 29	8.5	14
Female aged 20 – 29	7.6	14
Male aged 30-39	9.6	17
Female aged 30 – 39	8.8	16
Male aged 40-49	11	20
Female aged 40 – 49	9.5	17
Male aged 50-59	11	20
Female aged 50 – 59	9.1	16
Male aged 60-69	11	20
Female aged 60 – 69	8.8	16
Male aged 70-84	9.6	17
Female aged 70 – 84	8.1	16
Male aged 20-84	10	18
Female aged 20 – 84	8.7	16
Adult aged 20 – 84	**9.4**	**17**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table D: Dietary Intake of Copper by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (µg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	970	1900
Female aged 20 – 29	790	1400
Male aged 30-39	1100	2500
Female aged 30 – 39	920	1900
Male aged 40-49	1100	1800
Female aged 40 – 49	910	1600
Male aged 50-59	1000	1600
Female aged 50 – 59	830	1300
Male aged 60-69	960	1600
Female aged 60 – 69	740	1200
Male aged 70-84	820	1400
Female aged 70 – 84	670	1100
Male aged 20-84	1000	1900
Female aged 20 – 84	840	1500
Adult aged 20 – 84	**920**	**1700**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table E: Dietary Intake of Iron by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	8.8	18
Female aged 20 – 29	7.3	15
Male aged 30-39	9.7	19
Female aged 30 – 39	8.4	18
Male aged 40-49	9.2	18
Female aged 40 – 49	7.9	17
Male aged 50-59	8.7	17
Female aged 50 – 59	7.1	13
Male aged 60-69	7.6	15
Female aged 60 – 69	6.4	13
Male aged 70-84	6.7	16
Female aged 70 – 84	5.7	12
Male aged 20-84	8.7	17
Female aged 20 – 84	7.4	15
Adult aged 20 – 84	**8.0**	**17**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table F: Dietary Intake of Magnesium by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	200	330
Female aged 20 – 29	180	300
Male aged 30-39	220	370
Female aged 30 – 39	200	320
Male aged 40-49	230	400
Female aged 40 – 49	210	340
Male aged 50-59	240	410
Female aged 50 – 59	210	350
Male aged 60-69	230	410
Female aged 60 – 69	190	340
Male aged 70-84	200	330
Female aged 70 – 84	180	330
Male aged 20-84	220	380
Female aged 20 – 84	200	330
Adult aged 20 – 84	**210**	**360**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table G: Dietary Intake of Manganese by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	4.1	7.3
Female aged 20 – 29	3.2	5.7
Male aged 30-39	4.7	8.2
Female aged 30 – 39	3.8	7.1
Male aged 40-49	5.3	9.3
Female aged 40 – 49	4.2	7.7
Male aged 50-59	5.5	10
Female aged 50 – 59	4.0	7.2
Male aged 60-69	5.5	10
Female aged 60 – 69	4.1	8.1
Male aged 70-84	5.1	10
Female aged 70 – 84	3.7	7.4
Male aged 20-84	5.0	9.3
Female aged 20 – 84	3.8	7.2
Adult aged 20 – 84	**4.3**	**8.5**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table H: Dietary Intake of Molybdenum by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake # (µg/day)	
	Average	High Consumers @
Male aged 20 – 29	110	200
Female aged 20 – 29	90	160
Male aged 30-39	120	220
Female aged 30 – 39	99	190
Male aged 40-49	130	210
Female aged 40 – 49	100	180
Male aged 50-59	120	200
Female aged 50 – 59	98	170
Male aged 60-69	120	220
Female aged 60 – 69	94	160
Male aged 70-84	110	190
Female aged 70 – 84	89	150
Male aged 20-84	120	210
Female aged 20 – 84	96	170
Adult aged 20 – 84	**110**	**190**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table I: Dietary Intake of Phosphorus by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	1100	1900
Female aged 20 – 29	880	1400
Male aged 30-39	1200	1900
Female aged 30 – 39	960	1600
Male aged 40-49	1200	1900
Female aged 40 – 49	950	1600
Male aged 50-59	1100	1800
Female aged 50 – 59	940	1500
Male aged 60-69	1000	1800
Female aged 60 – 69	850	1400
Male aged 70-84	910	1500
Female aged 70 – 84	800	1400
Male aged 20-84	1100	1900
Female aged 20 – 84	920	1500
Adult aged 20 – 84	**1000**	**1700**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table J: Dietary Intake of Potassium by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake # (g/day)	
	Average	High Consumers @
Male aged 20 – 29	1.8	3.1
Female aged 20 – 29	1.6	2.7
Male aged 30-39	2.0	3.2
Female aged 30 – 39	1.8	3.1
Male aged 40-49	2.1	3.4
Female aged 40 – 49	1.9	3.2
Male aged 50-59	2.2	3.6
Female aged 50 – 59	2.0	3.3
Male aged 60-69	2.1	3.6
Female aged 60 – 69	1.9	3.1
Male aged 70-84	1.9	3.2
Female aged 70 – 84	1.7	3.0
Male aged 20-84	2.0	3.4
Female aged 20 – 84	1.8	3.1
Adult aged 20 – 84	**1.9**	**3.2**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table K: Dietary Intake of Selenium by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake # (µg/day)	
	Average	High Consumers @
Male aged 20 – 29	150	260
Female aged 20 – 29	120	210
Male aged 30-39	170	300
Female aged 30 – 39	140	250
Male aged 40-49	170	290
Female aged 40 – 49	130	250
Male aged 50-59	170	310
Female aged 50 – 59	130	250
Male aged 60-69	150	310
Female aged 60 – 69	120	230
Male aged 70-84	130	280
Female aged 70 – 84	120	250
Male aged 20-84	160	290
Female aged 20 – 84	130	240
Adult aged 20 – 84	**140**	**280**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table L: Dietary Intake of Sodium by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake # (g/day)	
	Average	High Consumers @
Male aged 20 – 29	2.7	5.0
Female aged 20 – 29	2.2	4.3
Male aged 30-39	2.8	5.2
Female aged 30 – 39	2.6	5.2
Male aged 40-49	2.9	5.0
Female aged 40 – 49	2.6	4.7
Male aged 50-59	2.9	5.5
Female aged 50 – 59	2.4	4.4
Male aged 60-69	2.6	5.3
Female aged 60 – 69	2.3	4.9
Male aged 70-84	2.3	4.8
Female aged 70 – 84	2.1	4.3
Male aged 20-84	2.8	5.2
Female aged 20 – 84	2.4	4.6
Adult aged 20 – 84	**2.6**	**4.9**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Table M: Dietary Intake of Zinc by Age-gender Groups (Average and High Consumers of the Population)

Age-gender groups	Dietary Intake[#] (mg/day)	
	Average	High Consumers[@]
Male aged 20 – 29	11	19
Female aged 20 – 29	7.7	14
Male aged 30-39	12	21
Female aged 30 – 39	8.5	15
Male aged 40-49	11	18
Female aged 40 – 49	8.3	15
Male aged 50-59	10	17
Female aged 50 – 59	7.9	12
Male aged 60-69	9.4	16
Female aged 60 – 69	7.1	11
Male aged 70-84	8.4	15
Female aged 70 – 84	6.4	11
Male aged 20-84	11	19
Female aged 20 – 84	7.9	14
Adult aged 20 – 84	**9.2**	**16**

Half of LOD is used for all results less than LOD in calculating the exposure estimates.

@ Exposures of high consumers refer to the exposures at 95th percentile.

Appendix III

Table A: Summary of Estimated Dietary Intakes of Minerals of the Hong Kong Adult Population

Minerals	Estimated Dietary Intakes	
	Average Consumers	High Consumers (95th percentile)
Boron	**1.5 mg/day**	**2.8 mg/day**
Calcium	**430 mg/day**	**840 mg/day**
Cobalt	**9.4 µg/day**	**17 µg/day**
Copper	**920 µg/day**	**1700 µg/day**
Iron	**8.0 mg/day**	**17 mg/day**
Magnesium	**210 mg/day**	**360 mg/day**
Manganese	**4.3 mg/day**	**8.5 mg/day**
Molybdenum	**110 µg/day**	**190 µg/day**
Phosphorus	**1000 mg/day**	**1700 mg/day**
Potassium	**1.9 g/day**	**3.2 g/day**
Selenium	**140 µg/day**	**280 µg/day**
Sodium	**2.6 g/day**	**4.9 g/day**
Zinc	**9.2 mg/day**	**16 mg/day**

Table B: Summary of Estimated proportion of the population with dietary intakes of minerals below the Recommended Dietary Intakes

Minerals	Gender	Age Group	Recommended Dietary Intakes (Source)	Estimated proportion of the population with dietary intakes of minerals below the Recommended Dietary Intakes
Boron	All	20-84	-	-
Calcium	Male	20-59	RNI (WHO): 1000mg/day	97.9%
		60-84	RNI (WHO): 1300mg/day	99.7%
	Female	20-59	RNI (WHO): 1000mg/day	97.7%
		60-84	RNI (WHO): 1300mg/day	99.3%
Cobalt	All	20-84	-	-
Copper	All	20-84	Normative Requirement (WHO): 770µg/day for a 61.3-kg adult	44.6%
Iron	Male	20-84	RNI (CNS): 12mg/day	83.4%
	Female	20-49	RNI (CNS): 20mg/day	97.4%
		50-84	RNI (CNS): 12mg/day	93.8%
Magnesium	Male	20-69	RNI (WHO): 260mg/day	72.2%
		70-84	RNI (WHO): 224mg/day	71.7%
	Female	20-69	RNI (WHO): 220mg/day	67.9%
		70-84	RNI (WHO): 190mg/day	63.7%
Manganese	All	20-84	AI (CNS): 4.5mg/day	61.0%
Molybdenum	All	20-84	RNI (CNS): 100µg /day	50.4%
Phosphorus	All	20-69	RNI (CNS): 720mg/day	21.1%
		70-84	RNI (CNS): 700mg/day	36.3%
Potassium	All	20-84	AI (CNS): 2g/day	59.6%

Minerals	Gender	Age Group	Recommended Dietary Intakes (Source)	Estimated proportion of the population with dietary intakes of minerals below the Recommended Dietary Intakes
Selenium	Male	20-69	RNI (WHO): 34µg /day	0.4%
		70-84	RNI (WHO): 33µg /day	2.6%
	Female	20-69	RNI (WHO): 26µg /day	0.4%
		70-84	RNI (WHO): 25µg /day	1.1%
Sodium	All	20-84	-	-
Zinc	Male	20-84	Normative Requirement (WHO): 4.9mg/day for a 67.5-kg adult male	3.6%
	Female	20-84	Normative Requirement (WHO): 3.3mg/day for a 55.7-kg adult female	2.1%

Table C: Summary of Estimated proportion of the population with dietary intakes of minerals above the UL / Recommendations

Minerals	Gender	Age Group	UL / Recommendations (Source)	Estimated proportion of the population with dietary intakes of minerals above the UL / Recommendations
Boron	All	20-84	Acceptable safe range (WHO): 13mg/day	0%
Calcium	All	20-84	UL (WHO): 3000mg/day	<0.1%
Cobalt	All	20-84	Guidance level (Expert Group on Vitamins and Minerals, UK): 1410µg/day for a 61.3-kg adult	0%
Copper	Male	20-84	UL (WHO): 12mg/day	0%
	Female	20-84	UL (WHO): 10mg/day	0%
Iron	All	20-84	UL (CNS): 42mg/day	<0.1%
Magnesium	All	20-84	UL (WHO): 350mg/day	5.7%
Manganese	All	20-84	UL (CNS): 11mg/day	1.3%
Molybdenum	All	20-84	UL (CNS): 900µg/day	0%
Phosphorus	All	20-59	UL (CNS): 3500mg/day	0%
		60-84	UL (CNS): 3000mg/day	<0.1%
Potassium	All	20-84	-	-
Selenium	All	20-84	UL (WHO): 400µg/day	0.8%
Sodium	All	20-84	Recommendation (WHO): 2g/day	64.0%
Zinc	All	20-84	UL (WHO): 45mg/day	<0.1%