Chapter 9
Physical and Biochemical Measurements

The PHS invited a random subsample of persons aged between 15 and 84 who had been enumerated in the household survey and signed the survey consent form to undergo a follow-up health examination, including physical and biochemical measurements, to estimate prevalence of cardiovascular disease and assess their risk factors. Self-reported prevalences of chronic diseases have been reported in Chapter 3. However, self-reported prevalence estimates have been found to substantially underestimate the true prevalences as they do not include data on undiagnosed cases of the diseases. The PHS aims to collect information on both diagnosed and undiagnosed cases of diabetes, hypertension and other cardiovascular risk factors to provide more accurate prevalence estimates, by performing physical measurements and collecting biochemical samples, namely blood and urine, from survey participants. This chapter presents the results of health examination including anthropometric and blood pressure measurements as well as biochemical testing covering blood tests for fasting plasma glucose, HbA1c and lipid profile, and 24-hour urine tests for sodium and potassium excretion.

Snapshot of Population's Physical and Biochemical Measurements (for persons aged 15 to 84)

Indicator	Female	Male	Overall
Proportion of population who were overweight and obese			
• Overweight (body mass index# $\geq$ 23.0 kg/m^2 and < 25 kg/m^2)	19.3%	20.9%	20.1%
• Obese (body mass index# $\geq$ 25.0 kg/m^2)	24.4%	36.0%	29.9%
Proportion of population who had central obesity			
• Central obesity defined by waist circumference	37.2%	28.2%	32.9%
• Central obesity defined by waist-hip ratio	38.9%	41.5%	40.1%

Indicator	Female	Male	Overall
Prevalence of hypertension	25.5%	30.1%	27.7%
• No known history of hypertension	11.5%	14.9%	13.2%
• Previously diagnosed hypertension	14.0%	15.2%	14.6%
Prevalence of diabetes mellitus	6.4%	10.5%	8.4%
• No known history of diabetes mellitus	3.2%	6.0%	4.5%
• Previously diagnosed diabetes mellitus	3.2%	4.6%	3.8%
Prevalence of hypercholesterolaemia	48.8%	50.3%	49.5%
• No known history of hypercholesterolaemia	34.7%	34.8%	34.8%
• Previously diagnosed with raised blood cholesterol	7.9%	6.8%	7.4%
• Previously diagnosed with normal blood cholesterol	6.1%	8.7%	7.4%
Mean population intake of salt (g*) per day	7.9 g	9.8 g	8.8 g
Proportion of population with salt intake ≥ 5 g* per day	82.2%	90.8%	86.3%
Proportion of population with potassium intake < 3.5 g* per day	92.5%	90.5%	91.5%

Notes: * g stands for gram.
Body mass index (BMI) is defined as weight (kilogram) divided by the square of height (metre). Its unit of measurement is kilogram/metre^2 (kg/m^2).

9.1 Anthropometric Measurements and Blood Pressure

Anthropometric and blood pressure measurements were performed in designated health examination centres under standardised procedures with standardised equipment. Measurement of blood pressure was performed in participants of health examination using an electronic sphygmomanometer. The anthropometric measurements in this survey include measurements of individual participant's body weight, height, waist and hip circumferences. These measurements were used for computing body mass index (BMI), waist circumference (WC) and waist-hip ratio (WHR), as measures of central or abdominal obesity which is predisposing factor for cardiovascular disease [1].

9.1.1 Weight and Height

Body weight and height are measures of body size and can be used to calculate respondents' BMI. Based on the results of the health examination attended by respondents aged 15-84, it is estimated that the mean body weights of females and males aged 15-84 were 56.5 kg and 68.6 kg respectively, and the mean body heights were 157.1 cm and 169.5 cm respectively (Table 9.1.1a).

Table 9.1.1a: Mean weight and height among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total	Female	Male	Total
	Weight (kg)			Height (cm)		
15 - 24	53.6	63.7	58.8	159.7	172.3	166.1
25 - 34	55.2	70.6	62.5	159.8	172.9	166.0
35 - 44	57.1	71.3	63.5	158.3	171.4	164.2
45 - 54	58.5	72.6	65.0	157.4	169.9	163.2
55 - 64	57.1	67.3	62.2	154.7	166.4	160.5
65 - 84	56.6	65.0	60.7	153.0	164.7	158.7
15 - 84	56.5	68.6	62.3	157.1	169.5	163.0

Base: All respondents aged 15 - 84 who had participated in the health examination.

9.1.2 Body Mass Index

The BMI is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of her / his height in metres. Raised BMI is a major risk factor for non-communicable diseases such as cardiovascular diseases (mainly heart disease and stroke), diabetes, musculoskeletal disorders and some cancers. The risk for these non-communicable diseases increases with BMI [2]. Based on the body weight and height measurements collected from participants of health examination, the mean BMI for females and males aged 15-84 were 22.9 kg/m^2 and 23.9 kg/m^2 respectively (Table 9.1.2a).

Table 9.1.2a: Distribution of body mass index (BMI) categories among persons aged 15 to 84 by age group and gender

Age group/ BMI categories	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Underweight	90.4	23.0%	71.9	17.6%	162.3	20.2%
Normal	215.9	55.0%	230.5	56.3%	446.3	55.7%
Overweight	37.9	9.7%	51.9	12.7%	89.8	11.2%
Obese I	32.7	8.3%	47.5	11.6%	80.2	10.0%
Obese II	15.5	3.9%	7.5	1.8%	23.0	2.9%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Underweight	74.8	14.8%	25.3	5.6%	100.1	10.4%
Normal	297.7	58.8%	205.2	45.1%	502.9	52.3%
Overweight	53.3	10.5%	82.6	18.2%	136.0	14.1%
Obese I	64.9	12.8%	110.0	24.2%	174.9	18.2%
Obese II	15.6	3.1%	31.9	7.0%	47.5	4.9%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Underweight	46.8	8.3%	9.5	2.1%	56.3	5.5%
Normal	287.3	51.2%	171.0	37.2%	458.3	44.9%
Overweight	112.4	20.0%	105.8	23.0%	218.1	21.4%
Obese I	82.7	14.7%	149.0	32.4%	231.7	22.7%
Obese II	32.3	5.7%	24.5	5.3%	56.7	5.6%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%

(To be continued)

Table 9.1.2a: Distribution of body mass index (BMI) categories among persons aged 15 to 84 by age group and gender (continued)

Age group/ BMI categories	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
45 - 54						
Underweight	33.4	5.3%	6.0	1.1%	39.4	3.3%
Normal	266.6	42.0%	141.1	25.7%	407.7	34.5%
Overweight	160.1	25.2%	120.8	22.0%	280.9	23.7%
Obese I	132.5	20.9%	238.1	43.4%	370.5	31.3%
Obese II	42.1	6.6%	42.4	7.7%	84.5	7.1%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Underweight	21.3	4.0%	21.0	4.0%	42.3	4.0%
Normal	238.9	44.5%	171.5	32.5%	410.5	38.5%
Overweight	101.0	18.8%	131.9	25.0%	232.9	21.9%
Obese I	137.6	25.6%	178.7	33.8%	316.3	29.7%
Obese II	38.7	7.2%	24.9	4.7%	63.6	6.0%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Underweight	13.4	2.9%	24.9	5.6%	38.3	4.2%
Normal	161.5	34.5%	148.5	33.1%	310.0	33.8%
Overweight	132.7	28.4%	103.5	23.1%	236.2	25.8%
Obese I	135.9	29.0%	156.2	34.8%	292.1	31.9%
Obese II	24.7	5.3%	15.5	3.4%	40.1	4.4%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Underweight	280.0	9.0%	158.6	5.6%	438.7	7.4%
Normal	1 467.8	47.3%	1 067.9	37.5%	2 535.7	42.6%
Overweight	597.4	19.3%	596.5	20.9%	1 193.9	20.1%
Obese I	586.3	18.9%	879.5	30.9%	1 465.8	24.6%
Obese II	168.8	5.4%	146.6	5.1%	315.4	5.3%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

	Mean BMI (kg/m^2)		
Gender / Age group	**Female**	**Male**	**Total**
15 – 24	21.0	21.4	21.2
25 – 34	21.6	23.6	22.6
35 – 44	22.8	24.3	23.5
45 – 54	23.6	25.1	24.3
55 – 64	23.8	24.3	24.1
65 – 84	24.2	23.9	24.1
15 – 84	22.9	23.9	23.4

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: Underweight: BMI $< 18.5\ kg/m^2$
Normal: BMI ≥ 18.5 and $< 23.0\ kg/m^2$
Overweight: BMI ≥ 23.0 and $< 25.0\ kg/m^2$
Obese I: BMI ≥ 25.0 and $< 30.0\ kg/m^2$
Obese II: BMI $\geq 30.0\ kg/m^2$
Figures may not add up to the total due to rounding.

Based on the classification of BMI categories for Chinese adults adopted by the Department of Health [3], the ranges of BMI values for classification of underweight, normal, overweight and obese are:

BMI category	**Range of BMI values**
Underweight	< 18.5 kg/m^2
Normal	≥ 18.5 and < 23.0 kg/m^2
Overweight	≥ 23.0 and < 25.0 kg/m^2
Obese	≥ 25.0 kg/m^2
Obese I	≥ 25.0 and < 30.0 kg/m^2
Obese II	≥ 30.0 kg/m^2

Among persons aged 15-84 participating in health examination, 29.9% were classified as obese and 20.1% overweight, 42.6% within normal range and 7.4% underweight. Analysed by gender, 24.4% of females and 36.0% of males in this age group were classified as obese and 19.3% of females and 20.9% of males were overweight. Analysed by age group, the proportion of females classified as obese increased with age from 12.3% for those aged 15-24 to 34.3% for those aged 65-84. The proportion of males classified as obese increased from 13.4% among males aged 15-24 to 51.1% for males aged 45-54, then decreased to 38.3% for those aged 65-84 (Table 9.1.2a).

Analysed by household income, in general, the proportion of persons classified as overweight or obese decreased with increasing household income from 58.0% among those with a monthly household income between $5,000 and $9,999 to 46.3% among those with a monthly household income of $50,000 or more (Table 9.1.2b).

Table 9.1.2b: Distribution of BMI categories among persons aged 15 to 84 by monthly household income

	Less than $5,000		$5,000 – $9,999		$10,000 – $19,999		$20,000 – $29,999		$30,000 – $39,999		$40,000 – $49,999		$50,000 or more		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
BMI categories																
Underweight	29.5	8.6%	29.2	9.2%	65.7	6.7%	85.6	7.6%	73.8	7.1%	54.1	7.2%	100.7	7.3%	438.7	7.4%
Normal	133.0	38.7%	104.8	32.9%	402.3	41.0%	478.2	42.4%	443.6	42.5%	331.7	44.0%	637.3	46.4%	2 530.9	42.6%
Overweight	74.2	21.6%	95.1	29.8%	209.9	21.4%	235.1	20.9%	180.7	17.3%	148.1	19.7%	248.2	18.1%	1 191.2	20.1%
Obese I	93.0	27.1%	76.7	24.0%	240.9	24.6%	258.2	22.9%	297.0	28.5%	187.5	24.9%	310.4	22.6%	1 463.6	24.6%
Obese II	14.1	4.1%	13.3	4.2%	61.7	6.3%	69.4	6.2%	47.6	4.6%	32.0	4.2%	77.3	5.6%	315.4	5.3%
Total	343.8	100.0%	319.1	100.0%	980.5	100.0%	1 126.4	100.0%	1 042.7	100.0%	753.4	100.0%	1 373.9	100.0%	5 939.8	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination and provided information on monthly household income.

Notes: Underweight: BMI < 18.5 kg/m^2

Normal: BMI ≥ 18.5 and < 23.0 kg/m^2

Overweight: BMI ≥ 23.0 and < 25.0 kg/m^2

Obese I: BMI ≥ 25.0 and < 30.0 kg/m^2

Obese II: BMI ≥ 30.0 kg/m^2

Figures may not add up to the total due to rounding.

Weight perception is a correlate of weight control practices. Table 9.1.2c presents perception of own body weight of persons aged 15-84 by their BMI categories. 74.1% of those who were overweight and 40.7% of those classified as obese considered themselves very / a little bit thin or about the right weight. In contrast, 60.3% of those classified as underweight regarded themselves as about the right weight or a little bit fat.

Table 9.1.2c: Perception of body weight among persons aged 15 to 84 by BMI categories

Perception of body weight \ BMI category	Underweight		Normal		Overweight		Obese I		Obese II		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
Very thin/underweight	12.2	2.8%	4.8	0.2%	2.7	0.2%	-	-	-	-	19.6	0.3%
A little bit thin/a little bit light	162.1	37.0%	249.3	9.8%	23.2	1.9%	16.7	1.1%	2.7	0.9%	454.0	7.6%
About the right weight	261.3	59.6%	2 019.4	79.6%	859.2	72.0%	660.5	45.1%	45.7	14.5%	3 846.1	64.6%
A little bit fat/a little bit heavy	3.0	0.7%	258.9	10.2%	308.8	25.9%	754.4	51.5%	200.0	63.4%	1 525.0	25.6%
Very fat/overweight	-	-	3.4	0.1%	-	-	34.2	2.3%	67.0	21.2%	104.6	1.8%
Total	438.7	100.0%	2 535.7	100.0%	1 193.9	100.0%	1 465.8	100.0%	315.4	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.
Notes: Underweight: BMI < 18.5 kg/m^2
Normal: BMI ≥ 18.5 and < 23.0 kg/m^2
Overweight: BMI ≥ 23.0 and < 25.0 kg/m^2
Obese I: BMI ≥ 25.0 and < 30.0 kg/m^2
Obese II: BMI ≥ 30.0 kg/m^2
Figures may not add up to the total due to rounding.

9.1.3 Waist Circumference, Hip Circumference and Waist-hip Ratio

Waist circumference (WC) and waist-hip ratio (WHR) are indicators to measure central or abdominal obesity. The WHR is the WC divided by hip circumference (HC). Experts of the World Health Organization (WHO) suggested that the WC and WHR may be superior to BMI in predicting risk of cardiovascular disease and diabetes [1]. In addition, WC alone has been suggested to be a more practical correlate of abdominal fat distribution and associated ill health [4]. According to the International Diabetes Federation classification of the Asian standard, females with WC greater than 80 cm and males with WC greater than 90 cm are classified as centrally obese. According to the WHO, sex-specific cut-off points for WHR at 0.85 or above in females and 0.90 or above in males are used to signify substantially increased risk of metabolic complications associated with obesity[1].

Among persons aged 15-84, the mean values of WC were 77.7 cm for females and 84.4 cm for males; the mean values of HC were 93.6 cm for females and 95.8 cm for males; and the mean values of WHR were 0.83 for females and 0.88 for males (Table 9.1.3a).

Table 9.1.3a: Mean waist circumference (WC), hip circumference (HC) and waist-to-hip ratio (WHR) among persons aged 15 to 84 by age group and gender

	Female	Male	Total	Female	Male	Total	Female	Male	Total
Age group		**WC (cm)**			**HC (cm)**			**WHR**	
15 - 24	69.8	75.9	72.9	90.9	92.9	91.9	0.77	0.82	0.79
25 - 34	73.9	82.4	77.9	92.5	97.0	94.6	0.80	0.85	0.82
35 - 44	76.5	84.8	80.2	93.6	96.9	95.1	0.82	0.87	0.84
45 - 54	79.9	87.7	83.5	94.8	97.3	96.0	0.84	0.90	0.87
55 - 64	81.0	86.6	83.8	94.1	95.4	94.7	0.86	0.91	0.88
65 - 84	82.9	87.0	84.9	94.7	94.5	94.6	0.87	0.92	0.90
15 - 84	77.7	84.4	80.9	93.6	95.8	94.6	0.83	0.88	0.85

Base: All respondents aged 15 - 84 who had participated in the health examination with valid measurements of waist and hip circumferences.

According to the sex-specific cut-off points for WC mentioned above, it was estimated that almost one-third (32.9%) of persons aged 15-84 (37.2% for females and 28.2% for males) had central obesity defined by WC (Table 9.1.3b). According to classification of WHR, 40.1% of persons aged 15-84 (38.9% for females and 41.5% for males) had central obesity (Table 9.1.3c). Analysed by age group, the prevalences of central obesity based on both WC and WHR definitions generally increased with age from 10.5% for those aged 15-24 to 48.3% for 65-84 and from 8.3% for those aged 15-24 to 64.5% for 65-84 respectively (Table 9.1.3b and Table 9.1.3c).

Table 9.1.3b: Proportion of population who had central obesity as defined by WC among persons aged 15 to 84 by age group and gender

Gender / Age group	Whether had central obesity as defined by WC*					
	Yes		No		Total	
	No. of persons ('000)	Rate# (%)	No. of persons ('000)	Rate# (%)	No. of persons ('000)	Rate# (%)
Female						
15 - 24	49.4	12.7%	341.1	87.3%	390.5	100%
25 - 34	109.0	21.9%	388.6	78.1%	497.7	100%
35 - 44	172.8	31.1%	382.3	68.9%	555.1	100%
45 - 54	268.6	43.3%	352.3	56.7%	621.0	100%
55 - 64	268.9	50.8%	260.2	49.2%	529.1	100%
65 - 84	271.5	58.0%	196.6	42.0%	468.1	100%
Total	1 140.3	37.2%	1 921.1	62.8%	3 061.4	100%
Male						
15 - 24	34.2	8.5%	370.2	91.5%	404.3	100%
25 - 34	92.7	20.7%	355.8	79.3%	448.5	100%
35 - 44	117.3	25.9%	335.9	74.1%	453.2	100%
45 - 54	209.4	38.6%	333.0	61.4%	542.4	100%
55 - 64	167.7	32.5%	347.7	67.5%	515.4	100%
65 - 84	170.4	38.2%	275.5	61.8%	446.0	100%
Total	791.7	28.2%	2 018.0	71.8%	2 809.7	100%
Both gender						
15 - 24	83.6	10.5%	711.2	89.5%	794.8	100%
25 - 34	201.8	21.3%	744.4	78.7%	946.2	100%
35 - 44	290.1	28.8%	718.2	71.2%	1 008.3	100%
45 - 54	478.1	41.1%	685.3	58.9%	1 163.4	100%
55 - 64	436.6	41.8%	607.9	58.2%	1 044.5	100%
65 - 84	441.9	48.3%	472.2	51.7%	914.1	100%
Total	1 932.0	32.9%	3 939.1	67.1%	5 871.1	100%

Base: All respondents aged 15 - 84 who had participated in the health examination with valid measurement of waist circumference.

Notes: * Normal: WC Male ≤ 90 cm, Female ≤ 80 cm

Central obesity: WC Male > 90 cm, Female > 80 cm

The rates are expressed as the percentage of its respective age/gender subgroup.

Figures may not add up to the total due to rounding.

Table 9.1.3c: Proportion of population who had central obesity as defined by WHR among persons aged 15 to 84 by age group and gender

Gender / Age group	Whether had central obesity as defined by WHR*					
	Yes		No		Total	
	No. of persons ('000)	Rate# (%)	No. of persons ('000)	Rate# (%)	No. of persons ('000)	Rate# (%)
Female						
15 - 24	26.9	6.9%	363.6	93.1%	390.5	100%
25 - 34	100.3	20.2%	397.4	79.8%	497.7	100%
35 - 44	162.9	29.3%	392.2	70.7%	555.1	100%
45 - 54	284.6	45.8%	336.3	54.2%	621.0	100%
55 - 64	307.5	58.1%	221.6	41.9%	529.1	100%
65 - 84	309.8	66.2%	158.3	33.8%	468.1	100%
Total	1 192.1	38.9%	1 869.3	61.1%	3 061.4	100%
Male						
15 - 24	38.9	9.6%	365.4	90.4%	404.3	100%
25 - 34	78.9	17.6%	369.6	82.4%	448.5	100%
35 - 44	156.3	34.5%	296.9	65.5%	453.2	100%
45 - 54	296.6	54.7%	245.8	45.3%	542.4	100%
55 - 64	314.1	60.9%	201.3	39.1%	515.4	100%
65 - 84	280.2	62.8%	165.8	37.2%	446.0	100%
Total	1 165.0	41.5%	1 644.8	58.5%	2 809.7	100%
Both Gender						
15 - 24	65.8	8.3%	729.0	91.7%	794.8	100%
25 - 34	179.2	18.9%	766.9	81.1%	946.2	100%
35 - 44	319.2	31.7%	689.1	68.3%	1 008.3	100%
45 - 54	581.2	50.0%	582.2	50.0%	1 163.4	100%
55 - 64	621.6	59.5%	422.8	40.5%	1 044.5	100%
65 - 84	590.0	64.5%	324.1	35.5%	914.1	100%
Total	2 357.1	40.1%	3 514.0	59.9%	5 871.1	100%

Base: All respondents aged 15 - 84 who had participated in the health examination with valid measurements of WHR.

Notes: * Normal: WHR Male < 0.90, Female < 0.85

Central obesity: WHR Male ≥ 0.90, Female ≥ 0.85

The rates are expressed as the percentage of its respective age/gender subgroup.

Figures may not add up to the total due to rounding.

9.1.4 Blood Pressure

Blood pressure is measured in millimetres of mercury (mmHg) and is recorded as two numbers. The first or upper number, known as the systolic blood pressure (SBP), represents the pressure on the blood vessels when the heart contracts to pump blood, whereas the second or bottom number, known as the diastolic blood pressure (DBP), represents the pressure when the heart relaxes between beats. Blood pressure changes from minute to minute throughout the day with posture, physical activities, emotions, sleep, etc [5].

According to the protocol for blood pressure monitoring recommended by the WHO, three blood pressure measurements with at least three minute rest between each of the measurements were taken and the mean of the second and third readings of both SBP and DBP were reported. The mean SBP for females and males aged 15-84 were 117.0 mmHg and 123.2 mmHg respectively, while the mean DBP for females and males were 75.9 mmHg and 79.8 mmHg respectively (Table 9.1.4a).

Table 9.1.4a: Distribution of blood pressure* among persons aged 15 to 84 by gender

	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
Systolic blood pressure (mmHg)						
Below 80.0	5.8	0.2%	-	-	5.8	0.1%
80.0 - 99.9	587.1	18.9%	110.1	3.9%	697.2	11.7%
100.0 - 119.9	1 437.2	46.4%	1 289.6	45.3%	2 726.8	45.8%
120.0 - 139.9	586.8	18.9%	984.4	34.6%	1 571.2	26.4%
140.0 - 159.9	329.0	10.6%	333.6	11.7%	662.6	11.1%
160.0 - 179.9	127.2	4.1%	114.7	4.0%	241.8	4.1%
180.0 or above	27.3	0.9%	16.7	0.6%	44.0	0.7%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%
Mean	117.0		123.2		120.0	
Diastolic blood pressure (mmHg)						
Below 60.0	123.5	4.0%	50.1	1.8%	173.7	2.9%
60.0 - 69.9	761.1	24.5%	394.5	13.8%	1 155.6	19.4%
70.0 - 79.9	1 233.0	39.8%	1 028.8	36.1%	2 261.8	38.0%
80.0 - 89.9	631.1	20.4%	901.2	31.6%	1 532.3	25.8%
90.0 - 99.9	271.1	8.7%	366.5	12.9%	637.6	10.7%
100.0 - 109.9	63.6	2.1%	92.2	3.2%	155.8	2.6%
110.0 or above	16.9	0.5%	15.8	0.6%	32.7	0.5%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%
Mean	75.9		79.8		77.8	

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Blood pressure was calculated as the mean of the second and third readings with at least three minutes rest between each measurement.
Figures may not add up to the total due to rounding.

Both the mean SBP and mean DBP increased generally with age. The mean SBP increased from 107.7 mmHg for the 15-24 age group to 138.6 mmHg for the 65-84 age group. For DBP, its mean increased from 71.8 mmHg for those aged 15-24 to 82.2 mmHg for those in the 55-64 age group and decreased to 78.8 mmHg for those aged 65-84 (Table 9.1.4b).

Table 9.1.4b: Distribution of blood pressure* among persons aged 15 to 84 by age group

	15-24		25-34		35-44		45-54		55-64		65-84		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
Systolic blood pressure (mmHg)														
Below 80.0	3.8	0.5%	2.0	0.2%	-	-	-	-	-	-	-	-	5.8	0.1%
80.0 - 99.9	189.3	23.6%	220.1	22.9%	181.0	17.7%	63.8	5.4%	27.8	2.6%	15.2	1.7%	697.2	11.7%
100.0 - 119.9	492.2	61.4%	585.3	60.9%	591.9	58.0%	585.2	49.5%	337.7	31.7%	134.5	14.7%	2 726.8	45.8%
120.0 - 139.9	104.7	13.1%	147.4	15.3%	195.4	19.1%	365.5	30.9%	398.6	37.4%	359.5	39.2%	1 571.2	26.4%
140.0 - 159.9	11.7	1.5%	6.5	0.7%	48.3	4.7%	134.0	11.3%	206.1	19.3%	255.9	27.9%	662.6	11.1%
160.0 - 179.9	-	-	-	-	4.5	0.4%	28.6	2.4%	78.0	7.3%	130.7	14.3%	241.8	4.1%
180.0 or above	-	-	-	-	-	-	5.9	0.5%	17.2	1.6%	20.9	2.3%	44.0	0.7%
Total	801.6	100.0%	961.4	100.0%	1 021.2	100.0%	1 183.0	100.0%	1 065.5	100.0%	916.7	100.0%	5 949.4	100.0%
Mean	107.7		108.5		111.9		121.4		129.6		138.6		120.0	
Diastolic blood pressure (mmHg)														
Below 60.0	58.6	7.3%	35.5	3.7%	29.1	2.9%	18.9	1.6%	11.1	1.0%	20.5	2.2%	173.7	2.9%
60.0 - 69.9	262.1	32.7%	262.5	27.3%	213.7	20.9%	148.8	12.6%	131.0	12.3%	137.4	15.0%	1 155.6	19.4%
70.0 - 79.9	341.9	42.7%	462.9	48.2%	417.7	40.9%	395.6	33.4%	298.6	28.0%	345.0	37.6%	2 261.8	38.0%
80.0 - 89.9	116.2	14.5%	148.6	15.5%	235.1	23.0%	390.1	33.0%	357.1	33.5%	285.2	31.1%	1 532.3	25.8%
90.0 - 99.9	22.8	2.8%	43.0	4.5%	102.5	10.0%	167.6	14.2%	202.5	19.0%	99.1	10.8%	637.6	10.7%
100.0 - 109.9	-	-	6.8	0.7%	20.9	2.0%	42.2	3.6%	56.4	5.3%	29.4	3.2%	155.8	2.6%
110.0 or above	-	-	2.0	0.2%	2.1	0.2%	19.8	1.7%	8.8	0.8%	-	-	32.7	0.5%
Total	801.6	100.0%	961.4	100.0%	1 021.2	100.0%	1 183.0	100.0%	1 065.5	100.0%	916.7	100.0%	5 949.4	100.0%
Mean	71.8		73.9		76.9		81.1		82.2		78.8		77.8	

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Blood pressure were calculated as the mean of the second and third readings with at least three minutes rest between each measurement.
Figures may not add up to the total due to rounding.

9.1.5 Hypertension

Hypertension, also known as high or raised blood pressure, is a chronic disease in which the blood pressure in the arteries is persistently elevated. It is also a risk factor of other serious health problems, including stroke, coronary heart disease, heart failure, and premature mortality and disability. Hypertension rarely causes symptoms in the early stages and many people go undiagnosed [6].

The PHS collected data of both diagnosed and undiagnosed cases of hypertension through self-reporting of existing diagnosis and measurement of blood pressure respectively. In this survey, respondents were classified as having self-reported doctor-diagnosed hypertension if they answered affirmatively to the question "Have you ever been diagnosed by a doctor that you had hypertension?" Otherwise, they would be classified as having "previously undiagnosed but measured" hypertension if their systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥ 90 mmHg according to the WHO criteria[6].

Overall, self-reported doctor-diagnosed hypertension was reported by 14.6% of persons aged 15-84. However, measurement of blood pressure revealed another 13.2% of persons in this age group who have hypertension by the WHO criteria, giving an overall prevalence of hypertension of 27.7% (25.5% for females and 30.1% for males). Both the prevalences of self-reported doctor-diagnosed and "previously undiagnosed but measured" hypertension increased steadily with age, with the combined prevalence increasing from 4.5% for people aged 15-24 to 64.8% for people aged 65-84 (Table 9.1.5).

Table 9.1.5: Prevalence of hypertension among persons aged 15 to 84 by age group and gender (including self-reported doctor-diagnosed and previously undiagnosed but measured hypertension)

Age group / Whether had hypertension	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Yes	7.7	2.0%	28.1	6.9%	35.7	4.5%
Self-reported doctor-diagnosed hypertension	*5.9*	*1.5%*	*2.2*	*0.5%*	*8.1*	*1.0%*
*Previously undiagnosed but measured**	*1.8*	*0.5%*	*25.8*	*6.3%*	*27.6*	*3.4%*
No	384.6	98.0%	381.2	93.1%	765.9	95.5%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Yes	13.2	2.6%	40.7	8.9%	53.9	5.6%
Self-reported doctor-diagnosed hypertension	-	-	*4.2*	*0.9%*	*4.2*	*0.4%*
*Previously undiagnosed but measured**	*13.2*	*2.6%*	*36.5*	*8.0%*	*49.6*	*5.2%*
No	493.2	97.4%	414.3	91.1%	907.5	94.4%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Yes	68.3	12.2%	86.5	18.8%	154.9	15.2%
Self-reported doctor-diagnosed hypertension	*19.4*	*3.5%*	*20.3*	*4.4%*	*39.8*	*3.9%*
*Previously undiagnosed but measured**	*48.9*	*8.7%*	*66.2*	*14.4%*	*115.1*	*11.3%*
No	493.1	87.8%	373.3	81.2%	866.3	84.8%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Yes	148.5	23.4%	167.4	30.5%	315.9	26.7%
Self-reported doctor-diagnosed hypertension	*56.1*	*8.8%*	*68.0*	*12.4%*	*124.1*	*10.5%*
*Previously undiagnosed but measured**	*92.4*	*14.6%*	*99.4*	*18.1%*	*191.8*	*16.2%*
No	486.1	76.6%	381.0	69.5%	867.1	73.3%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Yes	237.5	44.2%	257.2	48.7%	494.7	46.4%
Self-reported doctor-diagnosed hypertension	*144.1*	*26.8%*	*143.8*	*27.2%*	*288.0*	*27.0%*
*Previously undiagnosed but measured**	*93.4*	*17.4%*	*113.4*	*21.5%*	*206.8*	*19.4%*
No	300.0	55.8%	270.8	51.3%	570.8	53.6%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Yes	314.9	67.3%	278.7	62.1%	593.6	64.8%
Self-reported doctor-diagnosed hypertension	*207.5*	*44.3%*	*194.2*	*43.3%*	*401.7*	*43.8%*
*Previously undiagnosed but measured**	*107.5*	*23.0%*	*84.4*	*18.8%*	*191.9*	*20.9%*
No	153.2	32.7%	169.9	37.9%	323.1	35.2%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Yes	790.1	25.5%	858.6	30.1%	1 648.7	27.7%
Self-reported doctor-diagnosed hypertension	*433.0*	*14.0%*	*432.8*	*15.2%*	*865.8*	*14.6%*
*Previously undiagnosed but measured**	*357.2*	*11.5%*	*425.7*	*14.9%*	*782.9*	*13.2%*
No	2 310.2	74.5%	1 990.5	69.9%	4 300.7	72.3%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Previously undiagnosed hypertension but measured systolic blood pressure $\geq$ 140 mmHg and/or diastolic blood pressure $\geq$ 90 mmHg.
Figures may not add up to the total due to rounding.

9.2 Biochemical Testing for Diabetes Mellitus

The PHS collected biochemical information through testing of fasting blood sample for markers of major chronic diseases, including fasting plasma glucose (FPG) and glycated haemoglobin (HbA1c) for diabetes mellitus (DM), in persons aged 15-84. Fasting blood specimen was analysed by spectrophotometry for plasma glucose, while ethylenediaminetetraacetic acid (EDTA) whole blood was analysed by ion exchange high performance liquid chromatography for HbA1c. The prevalence of DM was estimated based on blood concentration of FPG and HbA1c level, and responses collected from the questionnaire survey. The unit of blood concentration of FPG was mmol/L, while the HbA1c level was denoted in percentage.

9.2.1 Fasting Plasma Glucose

The PHS classified a respondent as having DM if her/his level of fasting plasma glucose is 7.0 mmol/L or above. The normal range for fasting plasma glucose is defined as below 6.1 mmol/L. A fasting plasma glucose reading that is below 7.0 mmol/L but greater than or equal to 6.1 mmol/L indicates impaired fasting glucose.

The mean values of FPG for females and males aged 15-84 were 4.9 mmol/L and 5.1 mmol/L respectively. Analysed by age group, the mean values of FPG increased with age from 4.5 mmol/L for females age 15-24 to 5.3 mmol/L for those aged 65-84 and from 4.6 mmol/L for males aged 15-24 to 5.6 mmol/L for those aged 65-84. (Table 9.2.1).

Table 9.2.1: Mean fasting plasma glucose (mmol/L) among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total
15 - 24	4.5	4.6	4.5
25 - 34	4.6	4.7	4.6
35 - 44	4.8	5.0	4.9
45 - 54	5.0	5.3	5.1
55 - 64	5.1	5.5	5.3
65 - 84	5.3	5.6	5.4
Total	4.9	5.1	5.0

Base: All respondents aged 15 - 84 who had participated in the health examination.

9.2.2 Glycated Haemoglobin (HbA1c)

HbA1c level represents the percentage of circulating haemoglobin to which glucose is bound. It provides an indication of the average blood glucose concentration over the three months before the blood test and is not influenced by daily fluctuations in blood glucose concentration. HbA1c is used as an indicator of diabetes management, with higher HbA1c values indicating poorer diabetes control. The American Diabetes Association (ADA) and the WHO have recommended that HbA1c can also be used as a diagnostic test for diabetes and a value of HbA1c $\geq$ 6.5% indicates diabetes [7, 8]. A value of less than 6.5% does not exclude diabetes diagnosed using FPG [8].

The mean values of HbA1c for females and males aged 15-84 were 5.6% and 5.7% respectively. Analysed by age group, the mean values of HbA1c increased with age in both genders from 5.2% for females and males age 15-24 to 6.1% for those aged 65-84. (Table 9.2.2).

Table 9.2.2: Mean HbA1c among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total
15 - 24	5.2%	5.2%	5.2%
25 - 34	5.4%	5.4%	5.4%
35 - 44	5.5%	5.6%	5.5%
45 - 54	5.7%	5.8%	5.8%
55 - 64	5.9%	6.0%	5.9%
65 - 84	6.1%	6.1%	6.1%
Total	5.6%	5.7%	5.7%

Base: All respondents aged 15 - 84 who had participated in the health examination with valid HbA1c results.

9.2.3 Diabetes Mellitus

Diabetes mellitus (DM) is a disease characterized by an elevated blood glucose level. It is due to insulin deficiency, insulin resistance or both. DM is the tenth leading cause of deaths in Hong Kong in 2015. In this survey, a respondent was classified as having "previously diagnosed DM" based on self-reported history of doctor-diagnosed DM or having DM with "no known history of DM" if she/he did not report history of doctor-diagnosed DM and had result of FPG being at least 7.0 mmol/L or HbA1c at least 6.5%. The latter case is also classified as having "undiagnosed DM". The overall prevalence of DM among persons aged 15-84 was estimated as the proportion of those having "previously diagnosed DM" or having DM but with "no known history of DM".

Among the persons aged 15-84, 8.4% had DM either because they had previously diagnosed DM or had DM but without known history of the disease. More people were unaware of their DM (4.5%) than those who had previously diagnosed DM (3.8%). In addition, another 1.0% of persons aged 15-84 had impaired fasting glucose (IFG) with FPG between 6.1 and 6.9 mmol/L. Analysed by gender, higher proportion of males (10.5%) than females (6.4%) had DM. The proportions of undiagnosed DM were 3.2% and 6.0% for females and males respectively, while the proportions of previously diagnosed DM were 3.2% and 4.6% for females and males respectively. The corresponding proportions of IFG were 0.8% and 1.3% respectively (Table 9.2.3a).

Table 9.2.3a: Prevalence of diabetes mellitus (including those with no known history of DM and previously diagnosed DM) among persons aged 15 to 84 by gender

	Female		Male		Total	
Whether had DM	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
DM	197.3	6.4%	299.8	10.5%	497.1	8.4%
*No known history of DM**	*99.2*	*3.2%*	*169.7*	*6.0%*	*268.9*	*4.5%*
Previously diagnosed DM	*98.1*	*3.2%*	*130.2*	*4.6%*	*228.3*	*3.8%*
Non-DM	2 903.0	93.6%	2 549.3	89.5%	5 452.3	91.6%
IFG §	*25.3*	*0.8%*	*35.8*	*1.3%*	*61.1*	*1.0%*
Non IFG	*2 877.7*	*92.8%*	*2 513.4*	*88.2%*	*5 391.1*	*90.6%*
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * No previous history and newly diagnosed DM (fasting glucose ≥ 7.0 mmol/L or HbA1c ≥ 6.5%)

§ Impaired fasting glucose (IFG): fasting glucose 6.1-6.9 mmol/L

Figures may not add up to the total due to rounding.

The prevalence of DM increased with age from 0.2% for persons aged 15-24 to 25.4% for those aged 65-84. Among persons aged between 25 and 64 who had DM, more people were not aware of their DM than those with known history of diagnosed DM. However, the opposite were observed in persons aged 15-24 and 65-84 (Table 9.2.3b).

Table 9.2.3b: Prevalence of diabetes mellitus (including those with no known history of DM and previously diagnosed DM) among persons aged 15 to 84 by age group

	15-24		25-34		35-44		45-54		55-64		65-84		Total	
Whether had DM	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
DM	1.8	0.2%	4.4	0.5%	39.5	3.9%	86.9	7.3%	131.4	12.3%	233.2	25.4%	497.1	8.4%
*No known history of DM**	*-*	*-*	*4.4*	*0.5%*	*29.7*	*2.9%*	*57.6*	*4.9%*	*72.2*	*6.8%*	*104.9*	*11.4%*	*268.9*	*4.5%*
Previously diagnosed DM	*1.8*	*0.2%*	*-*	*-*	*9.8*	*1.0%*	*29.2*	*2.5%*	*59.1*	*5.5%*	*128.4*	*14.0%*	*228.3*	*3.8%*
Non-DM	799.8	99.8%	957.0	99.5%	981.7	96.1%	1 096.1	92.7%	934.1	87.7%	683.5	74.6%	5 452.3	91.6%
IFG §	*-*	*-*	*-*	*-*	*5.5*	*0.5%*	*14.6*	*1.2%*	*22.9*	*2.2%*	*18.1*	*2.0%*	*61.1*	*1.0%*
Non IFG	*799.8*	*99.8%*	*957.0*	*99.5%*	*976.2*	*95.6%*	*1 081.6*	*91.4%*	*911.2*	*85.5%*	*665.4*	*72.6%*	*5 391.1*	*90.6%*
Total	801.6	100.0%	961.4	100.0%	1 021.2	100.0%	1 183.0	100.0%	1 065.5	100.0%	916.7	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * No known history and newly diagnosed DM (fasting glucose ≥ 7.0 mmol/L or HbA1c ≥ 6.5%)

§ Impaired fasting glucose (IFG): fasting glucose 6.1–6.9 mmol/L

Figures may not add up to the total due to rounding.

9.3 Biochemical Testing for Hypercholesterolaemia

Besides DM, the PHS collected biochemical information on lipid profile, including blood concentrations of total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL) and triglyceride. The blood specimens were analysed by spectrophotometry for total cholesterol, HDL and triglyceride. LDL was calculated by using the Friedewald Formula [9]:

$$\text{LDL} = \text{Total cholesterol} - \text{HDL} - (\text{Triglyceride} \div 2.2)$$

where all concentrations are given in mmol/L. Since the Friedewald Formula is not applicable when plasma triglyceride concentration exceeds 4.52 mmol/L, LDL results were not calculable for subjects with this level of triglyceride concentration. The prevalence of hypercholesterolaemia was estimated based on the results of measured blood concentration of total cholesterol and responses collected from the questionnaire survey.

9.3.1 Lipids and Lipoproteins

Cholesterol is a type of fat which is a major component of cell membrane, bile and various hormones. Since cholesterol is insoluble in blood, it is combined and wrapped around with lipoprotein before it can be transported in the blood vessels to all parts of the body. Excess cholesterol in blood will deposit on the inner walls of the blood vessels leading to partial or complete blockage of the lumen. A person may have coronary heart disease when the coronary artery that supplies blood to the heart muscles is blocked.

Among the persons aged 15-84, the mean concentrations of total cholesterol were 5.1 mmol/L and 5.0 mmol/L for females and males respectively. The mean HDL concentrations were higher in females (1.5 mmol/L) than in males (1.3 mmol/L), while the opposite was observed for the mean triglyceride concentrations (1.1 mmol/L for females and 1.4 mmol/L for males). The mean LDL concentrations were similar between the genders (3.1 mmol/L for females and 3.2 mmol/L for males). Generally, the mean concentrations of total cholesterol, LDL and triglyceride increased with age, while the mean concentrations of HDL were stable across the age groups (Table 9.3.1a).

Table 9.3.1a: Mean lipid and lipoproteins concentrations among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
	Total cholesterol* (mmol/L)			HDL* (mmol/L)			LDL§,# (mmol/L)			Triglyceride† (mmol/L)		
15 - 24	4.5	4.2	4.4	1.4	1.3	1.4	2.7	2.5	2.6	0.8	0.8	0.8
25 - 34	4.7	4.9	4.8	1.5	1.3	1.4	2.8	3.1	2.9	0.8	1.2	1.0
35 - 44	4.9	5.1	5.0	1.4	1.2	1.3	3.0	3.3	3.1	1.0	1.4	1.2
45 - 54	5.3	5.5	5.4	1.5	1.3	1.4	3.3	3.5	3.4	1.1	1.6	1.4
55 - 64	5.6	5.4	5.5	1.5	1.3	1.4	3.6	3.4	3.5	1.3	1.5	1.4
65 - 84	5.3	4.9	5.1	1.4	1.2	1.3	3.2	3.0	3.1	1.4	1.3	1.3
Total	5.1	5.0	5.1	1.5	1.3	1.4	3.1	3.2	3.1	1.1	1.4	1.2

Bases: * All respondents aged 15 - 84 who had participated in the health examination.
§ All respondents aged 15 - 84 who had participated in the health examination with valid LDL results.
†All respondents aged 15 - 84 who had participated in the health examination with valid triglyceride results.

Note: # LDL was calculated by applying the Friedewald Formula.

Total Cholesterol

Among the persons aged 15-84, 42.2% had total cholesterol at a borderline high or above level (total cholesterol ≥ 5.2 mmol/L). The proportions were similar for both genders. In general, the proportion who had total cholesterol at borderline high or above level increased with age from 15.5% for those aged 15-24 to 60.5% for those aged 55-64 and decreased to 44.0% for those aged 65-84 (Table 9.3.1b).

Table 9.3.1b: Level of total cholesterol among persons aged 15 to 84 by age group and gender

Age group / Total cholesterol level	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Borderline high or above *	79.2	20.2%	44.7	10.9%	123.9	15.5%
Normal †	313.1	79.8%	364.6	89.1%	677.7	84.5%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Borderline high or above *	110.3	21.8%	147.4	32.4%	257.7	26.8%
Normal †	396.1	78.2%	307.6	67.6%	703.7	73.2%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Borderline high or above *	187.8	33.5%	211.7	46.0%	399.5	39.1%
Normal †	373.6	66.5%	248.1	54.0%	621.7	60.9%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Borderline high or above *	348.7	55.0%	330.6	60.3%	679.3	57.4%
Normal †	285.9	45.0%	217.8	39.7%	503.7	42.6%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Borderline high or above *	352.1	65.5%	292.8	55.5%	645.0	60.5%
Normal †	185.4	34.5%	235.2	44.5%	420.5	39.5%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Borderline high or above *	244.8	52.3%	158.8	35.4%	403.6	44.0%
Normal †	223.3	47.7%	289.8	64.6%	513.1	56.0%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Borderline high or above *	1 323.0	42.7%	1 186.0	41.6%	2 509.0	42.2%
Normal †	1 777.3	57.3%	1 663.1	58.4%	3 440.4	57.8%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Borderline high or above : Total cholesterol in S.I. unit ≥ 5.2 mmol/L

† Normal : Total cholesterol in S.I. unit < 5.2 mmol/L

Figures may not add up to the total due to rounding.

High density lipoprotein (HDL)

Among the persons aged 15-84, 23.7% had low HDL concentration (i.e. HDL < 1.3 mmol/L for females and HDL < 1.0 mmol/L for males), while 30.2% reached the desirable level of HDL (i.e. HDL > 1.5 mmol/L for both genders). Analysed by gender, while more females (30.9%) in this age group had low HDL concentration than males (15.9%), desirable HDL level was also more common in females (42.6%) than in males (16.8%) (Table 9.3.1c).

Table 9.3.1c: Level of HDL among persons aged 15 to 84 by age group and gender

Age group / HDL level	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Low*	112.0	28.5%	34.0	8.3%	145.9	18.2%
Normal †	132.3	33.7%	286.7	70.0%	419.0	52.3%
Desirable ^	148.0	37.7%	88.7	21.7%	236.7	29.5%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Low*	137.2	27.1%	70.4	15.5%	207.6	21.6%
Normal †	128.9	25.5%	311.7	68.5%	440.6	45.8%
Desirable ^	240.3	47.4%	72.9	16.0%	313.2	32.6%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Low*	209.2	37.3%	73.9	16.1%	283.2	27.7%
Normal †	128.7	22.9%	332.1	72.2%	460.8	45.1%
Desirable ^	223.5	39.8%	53.7	11.7%	277.2	27.1%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Low*	172.1	27.1%	95.6	17.4%	267.7	22.6%
Normal †	160.4	25.3%	364.5	66.5%	524.9	44.4%
Desirable ^	302.1	47.6%	88.3	16.1%	390.4	33.0%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Low*	147.9	27.5%	102.0	19.3%	249.9	23.5%
Normal †	161.1	30.0%	322.3	61.0%	483.4	45.4%
Desirable ^	228.5	42.5%	103.8	19.7%	332.2	31.2%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Low*	179.5	38.4%	77.6	17.3%	257.1	28.0%
Normal †	110.7	23.7%	299.8	66.8%	410.5	44.8%
Desirable ^	177.9	38.0%	71.2	15.9%	249.1	27.2%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Low*	958.0	30.9%	453.5	15.9%	1 411.4	23.7%
Normal †	822.1	26.5%	1 917.1	67.3%	2 739.2	46.0%
Desirable ^	1 320.3	42.6%	478.5	16.8%	1 798.8	30.2%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Low: HDL in S.I. unit < 1.0 mmol/L (male) or < 1.3 mmol/L (female).

† Normal : HDL in S.I. unit ≥ 1.0 mmol/L and ≤ 1.5 mmol/L (male) or ≥ 1.3 mmol/L and ≤ 1.5 mmol/L (female).

^ Desirable : HDL in S.I. unit > 1.5 mmol/L.

Figures may not add up to the total due to rounding.

Low density lipoprotein (LDL)

Among the persons aged 15-84, 35.0% of persons aged 15-84 had LDL at borderline high or above level (i.e. LDL ≥ 3.4 mmol/L). Analysed by gender, 32.5% of females and 37.6% of males were at borderline high or above level of LDL. Analysed by age group, the proportion of LDL at borderline high or above level generally increased with age from 12.7% for those aged 15-24 to 51.5% for those aged 55-64 and then decreased to 36.1% for those aged 65-84 (Table 9.3.1d).

Table 9.3.1d: Level of LDL among persons aged 15 to 84 by age group and gender

Age group / LDL # level	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Borderline high or above *	54.3	13.9%	47.5	11.6%	101.8	12.7%
Normal †	338.0	86.1%	361.8	88.4%	699.8	87.3%
Not calculable ^	-	-	-	-	-	-
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Borderline high or above *	77.0	15.2%	132.0	29.0%	209.1	21.7%
Normal †	429.4	84.8%	314.1	69.0%	743.4	77.3%
Not calculable ^	-	-	8.9	2.0%	8.9	0.9%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Borderline high or above *	133.4	23.8%	193.6	42.1%	327.0	32.0%
Normal †	428.0	76.2%	263.8	57.4%	691.8	67.7%
Not calculable ^	-	-	2.3	0.5%	2.3	0.2%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Borderline high or above *	271.8	42.8%	291.4	53.1%	563.2	47.6%
Normal †	362.8	57.2%	239.1	43.6%	601.9	50.9%
Not calculable ^	-	-	17.9	3.3%	17.9	1.5%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Borderline high or above *	287.0	53.4%	261.6	49.5%	548.6	51.5%
Normal †	247.7	46.1%	253.4	48.0%	501.1	47.0%
Not calculable ^	2.8	0.5%	13.0	2.5%	15.8	1.5%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Borderline high or above *	185.4	39.6%	145.2	32.4%	330.6	36.1%
Normal †	282.7	60.4%	303.4	67.6%	586.1	63.9%
Not calculable ^	-	-	-	-	-	-
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Borderline high or above *	1 009.0	32.5%	1 071.3	37.6%	2 080.3	35.0%
Normal †	2 088.5	67.4%	1 735.7	60.9%	3 824.2	64.3%
Not calculable ^	2.8	0.1%	42.1	1.5%	44.9	0.8%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: # LDL was calculated by applying the Friedewald Formula.

* Borderline high or above: Calculated LDL in S.I. unit ≥ 3.4 mmol/L.

† Normal : Calculated LDL in S.I. unit < 3.4 mmol/L.

^ Not calculable : The Friedewald Formula cannot be applied to subjects with plasma triglyceride over 4.52 mmol/L.

Figures may not add up to the total due to rounding.

Triglyceride

Among the persons aged 15-84, 16.8% had triglyceride concentration at borderline high or above level (i.e. triglyceride ≥ 1.7 mmol/L). Analysed by gender, more males (21.7%) had their triglyceride at borderline high or above level than females (12.4%). Analysed by age group, in general, the proportion of triglyceride at borderline high or above level increased with age from 3.1% for those aged 15-24 to 24.4% for those aged 55-64 and then decreased to 20.7% for those aged 65-84 (Table 9.3.1e).

Table 9.3.1e: Level of triglyceride among persons aged 15 to 84 by age group and gender

Age group / Triglyceride level	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Borderline high or above *	11.5	2.9%	13.4	3.3%	24.8	3.1%
Normal †	380.8	97.1%	395.9	96.7%	776.8	96.9%
Unknown / missing	-	-	-	-	-	-
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Borderline high or above *	20.9	4.1%	79.3	17.4%	100.2	10.4%
Normal †	485.5	95.9%	375.7	82.6%	861.2	89.6%
Unknown / missing	-	-	-	-	-	-
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Borderline high or above *	49.4	8.8%	119.7	26.0%	169.1	16.6%
Normal †	512.0	91.2%	340.1	74.0%	852.1	83.4%
Unknown / missing	-	-	-	-	-	-
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Borderline high or above *	79.3	12.5%	179.0	32.6%	258.3	21.8%
Normal †	555.3	87.5%	369.4	67.4%	924.7	78.2%
Unknown / missing	-	-	-	-	-	-
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Borderline high or above *	116.3	21.6%	144.1	27.3%	260.4	24.4%
Normal †	421.2	78.4%	380.7	72.1%	801.9	75.3%
Unknown / missing	-	-	3.2	0.6%	3.2	0.3%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Borderline high or above *	105.6	22.6%	83.9	18.7%	189.4	20.7%
Normal †	362.5	77.4%	364.7	81.3%	727.3	79.3%
Unknown / missing	-	-	-	-	-	-
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Borderline high or above *	382.9	12.4%	619.4	21.7%	1 002.3	16.8%
Normal †	2 717.4	87.6%	2 226.5	78.1%	4 943.9	83.1%
Unknown / missing	-	-	3.2	0.1%	3.2	0.1%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: * Borderline high or above : Triglyceride in S.I. unit ≥ 1.7 mmol/L.

† Normal : Triglyceride in S.I. unit < 1.7 mmol/L

Figures may not add up to the total due to rounding.

9.3.2 Hypercholesterolaemia

Hypercholesterolaemia refers to the condition in which the level of cholesterol in blood is higher than normal range. Respondents were classified as having previously known history of hypercholesterolaemia if they answered affirmatively to the question "Have you ever been diagnosed by a doctor that your blood cholesterol level was high?" Respondents with known history of raised blood cholesterol were also asked whether they were currently taking prescribed medications to lower their blood cholesterol level. In addition, those without history of hypercholesterolaemia could be classified as having no known history with raised total cholesterol if their total cholesterol $\geq$ 5.2 mmol/L.

Among persons aged 15-84, 49.5% had ever been diagnosed with hypercholesterolaemia. However, 70.2% of those with the condition, i.e. 34.8% of persons aged 15-84, were unaware of their condition. The prevalence of hypercholesterolaemia was higher in males (50.3%) than in females (48.8%) among persons aged 15-84. The proportions of persons who had the condition but being unaware of it were similar between the genders. Analysed by age group, the prevalence of hypercholesterolaemia generally increased with age with the highest prevalence observed in the age group 55-64 in both genders (75.0% in females and 68.9% in males) (Table 9.3.2).

Table 9.3.2: Prevalence of hypercholesterolaemia among persons aged 15 to 84 by age group and gender

Age Group / Whether had hypercholesterolaemia	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
15 - 24						
Ever had hypercholesterolaemia	81.3	20.7%	44.7	10.9%	125.9	15.7%
*No known history with raised total cholesterol **	*79.2*	*20.2%*	*42.4*	*10.4%*	*121.7*	*15.2%*
Previously known history without current drug treatment †	-	-	*2.2*	*0.5%*	*2.2*	*0.3%*
Previously known history with current drug treatment ^	-	-	-	-	-	-
Previously known history with normal cholesterol #	*2.0*	*0.5%*	-	-	*2.0*	*0.3%*
Never had hypercholesterolaemia	311.0	79.3%	364.6	89.1%	675.7	84.3%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 – 34						
Ever had hypercholesterolaemia	116.9	23.1%	147.4	32.4%	264.3	27.5%
*No known history with raised total cholesterol **	*106.3*	*21.0%*	*135.4*	*29.7%*	*241.6*	*25.1%*
Previously known history without current drug treatment †	*2.0*	*0.4%*	*12.1*	*2.6%*	*14.1*	*1.5%*
Previously known history with current drug treatment ^	*2.0*	*0.4%*	-	-	*2.0*	*0.2%*
Previously known history with normal cholesterol #	*6.5*	*1.3%*	-	-	*6.5*	*0.7%*
Never had hypercholesterolaemia	389.5	76.9%	307.6	67.6%	697.1	72.5%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 – 44						
Ever had hypercholesterolaemia	199.8	35.6%	224.4	48.8%	424.2	41.5%
*No known history with raised total cholesterol **	*166.1*	*29.6%*	*170.2*	*37.0%*	*336.4*	*32.9%*
Previously known history without current drug treatment †	*21.7*	*3.9%*	*39.3*	*8.5%*	*61.0*	*6.0%*
Previously known history with current drug treatment ^	-	-	*2.1*	*0.5%*	*2.1*	*0.2%*
Previously known history with normal cholesterol #	*12.0*	*2.1%*	*12.8*	*2.8%*	*24.8*	*2.4%*
Never had hypercholesterolaemia	361.6	64.4%	235.4	51.2%	597.0	58.5%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 – 54						
Ever had hypercholesterolaemia	364.8	57.5%	370.6	67.6%	735.4	62.2%
*No known history with raised total cholesterol **	*299.4*	*47.2%*	*278.3*	*50.7%*	*577.7*	*48.8%*
Previously known history without current drug treatment †	*44.1*	*6.9%*	*40.3*	*7.4%*	*84.4*	*7.1%*
Previously known history with current drug treatment ^	*5.2*	*0.8%*	*12.0*	*2.2%*	*17.2*	*1.5%*
Previously known history with normal cholesterol #	*16.1*	*2.5%*	*40.0*	*7.3%*	*56.1*	*4.7%*
Never had hypercholesterolaemia	269.8	42.5%	177.8	32.4%	447.6	37.8%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 – 64						
Ever had hypercholesterolaemia	403.0	75.0%	364.1	68.9%	767.0	72.0%
*No known history with raised total cholesterol **	*249.7*	*46.5%*	*240.5*	*45.6%*	*490.2*	*46.0%*
Previously known history without current drug treatment †	*76.4*	*14.2%*	*36.9*	*7.0%*	*113.3*	*10.6%*
Previously known history with current drug treatment ^	*26.0*	*4.8%*	*15.4*	*2.9%*	*41.4*	*3.9%*
Previously known history with normal cholesterol #	*50.9*	*9.5%*	*71.2*	*13.5%*	*122.1*	*11.5%*
Never had hypercholesterolaemia	134.5	25.0%	163.9	31.1%	298.5	28.0%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%

(To be continued)

Table 9.3.2: Prevalence of hypercholesterolaemia among persons aged 15 to 84 by age group and gender (continued)

Prevalence of hypercholesterolaemia	Female		Male		Total	
	No. of persons ('000)	%	No. of persons ('000)	%	No. of persons ('000)	%
65 - 84						
Ever had hypercholesterolaemia	347.4	74.2%	282.1	62.9%	629.5	68.7%
*No known history with raised total cholesterol **	*176.4*	*37.7%*	*124.6*	*27.8%*	*301.0*	*32.8%*
Previously known history without current drug treatment †	*30.3*	*6.5%*	*24.3*	*5.4%*	*54.7*	*6.0%*
Previously known history with current drug treatment ^	*38.1*	*8.1%*	*9.8*	*2.2%*	*47.9*	*5.2%*
Previously known history with normal cholesterol #	*102.6*	*21.9%*	*123.3*	*27.5%*	*225.8*	*24.6%*
Never had hypercholesterolaemia	120.7	25.8%	166.5	37.1%	287.2	31.3%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 – 84						
Ever had hypercholesterolaemia	1 513.1	48.8%	1 433.2	50.3%	2 946.3	49.5%
*No known history with raised total cholesterol **	*1 077.1*	*34.7%*	*991.4*	*34.8%*	*2 068.6*	*34.8%*
Previously known history without current drug treatment †	*174.5*	*5.6%*	*155.2*	*5.4%*	*329.7*	*5.5%*
Previously known history with current drug treatment ^	*71.4*	*2.3%*	*39.3*	*1.4%*	*110.7*	*1.9%*
Previously known history with normal cholesterol #	*190.1*	*6.1%*	*247.3*	*8.7%*	*437.3*	*7.4%*
Never had hypercholesterolaemia	1 587.2	51.2%	1 415.9	49.7%	3 003.1	50.5%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination.

Notes: *No history of doctor-diagnosed hypercholesterolaemia and total cholesterol ≥ 5.2 mmol/L.

† Doctor-diagnosed hypercholesterolaemia, total cholesterol ≥ 5.2 mmol/L and without current doctor-prescribed drug treatment.

^ Doctor-diagnosed hypercholesterolaemia, total cholesterol ≥ 5.2 mmol/L and with current doctor-prescribed drug treatment.

Doctor-diagnosed hypercholesterolaemia and total cholesterol < 5.2 mmol/L.

Figures may not add up to the total due to rounding.

9.4 Biochemical Testing for Sodium and Potassium Intake

Sodium and potassium intakes have been associated with high blood pressure and cardiovascular disease. They exist naturally in a variety of foods. Sodium is found naturally in milk, cream and eggs, while potassium-rich foods include beans and peas, nuts, vegetables such as spinach, cabbage and parsley, and fruits such as bananas, papayas and dates [10]. In addition, sodium is part of dietary salt which is commonly added when cooking and at the table, and is also found in processed foods, such as bread, processed meats like bacon, snack foods such as popcorn, as well as in condiments such as soy sauce and stock cube. Processing reduces the amount of potassium in many food products.

9.4.1 Sodium Intake

The WHO recommended a reduction in sodium intake to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease in adults. The recommended level in adults is below 2 grams (g) of sodium or below 5 g of salt (also known as sodium chloride) per day [11].

In healthy individuals, nearly 100% of ingested sodium is absorbed during digestion, and urinary excretion is the primary mechanism for maintaining sodium balance. Even in hot, humid climates, there are only minimal loses through faeces and sweat [11]. The most reliable method of estimating dietary salt intake is to measure sodium excretion from 24-hour urine collection, a method endorsed by the WHO [12, 13] and adopted in this survey.

Among the persons aged 15-84, the mean 24-hour urinary sodium excretion was 135.6 mmol and 167.1 mmol for females and males respectively. Analysed by age group, the mean 24-hour sodium excretion was the highest at 147.4 mmol for females in the age group 45-54 and at 181.8 mmol for males in the age group 35-44 (Table 9.4.1a).

Table 9.4.1a: Mean 24-hour urinary sodium excretion (mmol) among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total
15 - 24	134.3	157.7	146.3
25 - 34	136.8	169.1	152.0
35 - 44	145.1	181.8	161.7
45 - 54	147.4	177.1	161.2
55 - 64	128.8	165.2	146.7
65 - 84	115.6	148.1	131.5
Total	135.6	167.1	150.6

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urinary sodium results.
Note: One mmol of sodium (Na) is equivalent to 0.0585 grams of salt (NaCl).

In this survey, the amount of 24-hour urinary sodium excretion in mmol was converted into salt intake in gram by multiplying a factor 0.0585 because one mmol of sodium is equivalent to 0.0585 g of salt in sodium content. That is, approximately 17.1 mmol of sodium is equivalent to 1.0 g of salt in sodium content.

Among the persons aged 15-84, the mean values of dietary salt intake were estimated at 7.9 g per day and 9.8 g per day for females and males respectively. For females, the highest mean daily salt intake was in age group 45-54 (8.6 g per day), while the lowest mean daily salt intake was in age group 65-84 (6.8 g per day). For males, the highest mean daily salt intake was in age group 35-44 (10.6 g per day), while the lowest mean daily salt intake was in age group 65-84 (8.7 g per day) (Table 9.4.1b).

Table 9.4.1b: Mean daily salt intake (gram) among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total
15 - 24	7.9	9.2	8.6
25 - 34	8.0	9.9	8.9
35 - 44	8.5	10.6	9.5
45 - 54	8.6	10.4	9.4
55 - 64	7.5	9.7	8.6
65 - 84	6.8	8.7	7.7
Total	7.9	9.8	8.8

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urinary sodium results.

Among the persons aged 15-84, 86.3% had dietary salt intake above the WHO recommended daily limit of less than 5 g per day. Analysed by gender, 82.2% of females and 90.8% of males aged 15-84 had dietary salt intake at 5 g or more per day. Analysed by age group, the proportion of persons who had dietary salt intake at 5 g or more per day was the lowest at 79.2% for age group 65-84 age group and the highest at 90.7% for age group 45-54. (Table 9.4.1c)

Table 9.4.1c: Level of salt intake among persons aged 15 to 84 by age group and gender

	Female		Male		Total	
Age group / Salt intake level	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
15 - 24						
Salt intake ≥ 5g per day	323.6	82.5%	362.3	88.5%	685.9	85.6%
Salt intake < 5g per day	68.7	17.5%	47.0	11.5%	115.7	14.4%
Unknown / missing	-	-	-	-	-	-
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Salt intake ≥ 5g per day	428.9	84.7%	399.5	87.8%	828.3	86.2%
Salt intake < 5g per day	77.5	15.3%	50.4	11.1%	127.9	13.3%
Unknown / missing	-	-	5.1	1.1%	5.1	0.5%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Salt intake ≥ 5g per day	470.0	83.7%	432.8	94.1%	902.8	88.4%
Salt intake < 5g per day	87.5	15.6%	27.0	5.9%	114.5	11.2%
Unknown / missing	3.9	0.7%	-	-	3.9	0.4%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Salt intake ≥ 5g per day	557.3	87.8%	515.2	93.9%	1 072.5	90.7%
Salt intake < 5g per day	77.3	12.2%	33.2	6.1%	110.5	9.3%
Unknown / missing	-	-	-	-	-	-
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Salt intake ≥ 5g per day	431.9	80.4%	488.4	92.5%	920.3	86.4%
Salt intake < 5g per day	105.6	19.6%	28.6	5.4%	134.2	12.6%
Unknown / missing	-	-	11.0	2.1%	11.0	1.0%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Salt intake ≥ 5g per day	336.4	71.9%	389.3	86.8%	725.8	79.2%
Salt intake < 5g per day	125.8	26.9%	53.5	11.9%	179.2	19.6%
Unknown / missing	5.9	1.3%	5.8	1.3%	11.7	1.3%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Salt intake ≥ 5g per day	2 548.2	82.2%	2 587.5	90.8%	5 135.7	86.3%
Salt intake < 5g per day	542.3	17.5%	239.6	8.4%	782.0	13.1%
Unknown / missing	9.8	0.3%	21.9	0.8%	31.7	0.5%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urinary sodium results.

Note: Figures may not add up to the total due to rounding.

Analysed by frequency of eating-out for breakfast, lunch or dinner among persons aged 15-84, the proportion of high salt intake (5 g or more per day) increased with increasing frequency of eating-out from 80.7% for persons eating out less than once per week with mean salt intake of 8.0 g per day to 89.6% for persons eating out six times or more per week with mean salt intake of 9.3 g per day (Table 9.4.1d).

Table 9.4.1d: Level of salt intake among persons aged 15 to 84 by frequency of eating-out

	Eating-out less than once per week		Eating-out 1-3 times per week		Eating-out 4-5 times per week		Eating-out 6 times or more per week		Total	
Salt intake level	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
Salt intake ≥ 5g per day	726.9	80.7%	882.8	82.2%	799.6	88.9%	2 726.4	89.6%	5 135.7	86.8%
Salt intake < 5g per day	173.4	19.3%	191.5	17.8%	99.7	11.1%	317.4	10.4%	782.0	13.2%
Total	900.3	100.0%	1 074.3	100.0%	899.3	100.0%	3 043.8	100.0%	5 917.7	100.0%
Mean (g per day)	8.0		8.2		8.6		9.3		8.8	

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urinary sodium results.
Note: Figures may not add up to the total due to rounding.

Analysed by frequency of consuming preserved vegetables, the percentage of persons with high salt intake (5 g or more per day) were relatively higher for persons eating preserved vegetables at least 5 times per week than for persons eating preserved vegetables less than 5 times per week (Table 9.4.1e).

Table 9.4.1e: Level of salt intake among persons aged 15 to 84 by frequency of consuming preserved vegetables

	Less than once per week		1-4 times per week		5-6 times per week		7 times or more per week		Don't know		Total	
Salt intake level	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
Salt intake ≥ 5g per day	4 129.1	86.6%	939.4	87.4%	31.6	100.0%	24.8	89.7%	10.7	67.0%	5 135.7	86.8%
Salt intake < 5g per day	638.4	13.4%	135.4	12.6%	-	-	2.8	10.3%	5.3	33.0%	782.0	13.2%
Total	4 767.6	100.0%	1 074.8	100.0%	31.6	100.0%	27.6	100.0%	16.0	100.0%	5 917.7	100.0%
Mean (g per day)	8.8		8.9		10.7		8.3		5.4		8.8	

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urinary sodium results.
Note: Figures may not add up to the total due to rounding.

9.4.2 Potassium Intake

The WHO recommended an increase in potassium intake from food to reduce blood pressure and risk of cardiovascular disease, stroke and coronary heart disease in adults. The WHO suggested a potassium intake of at least 90 mmol/day (3.5 g/day) for adults [14].

Normally, most ingested potassium is excreted via the urine. Under conditions of extreme heat and intense physical activity that result in a high sweat production, potassium losses in sweat are increased and appreciable. WHO estimated that urinary potassium excretion was approximately 77% of intake, and therefore a factor of 1.30 was used to convert urinary potassium excretion to potassium intake [14, 15].

In this survey, the average daily intake of potassium was estimated through measurement of 24-hour urinary potassium excretion using the conversion factor of 1.3 (one mmol of potassium = 0.039 g of potassium and daily potassium intake = 24-hour urinary potassium excretion × 1.3).

Among the persons aged 15-84, the estimated mean daily potassium intake were 2.2 g and 2.3 g for females and males respectively. When compared to other persons in this age group, persons aged 35-64 had relatively higher mean daily potassium intake of 2.4 g (Table 9.4.2a).

Table 9.4.2a: Mean daily potassium intake (gram) among persons aged 15 to 84 by age group and gender

Age group	Female	Male	Total
15 - 24	1.9	1.9	1.9
25 - 34	2.1	2.3	2.2
35 - 44	2.4	2.4	2.4
45 - 54	2.4	2.4	2.4
55 - 64	2.4	2.5	2.4
65 - 84	2.1	2.4	2.2
Total	2.2	2.3	2.3

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urine test.

An overwhelming majority of the population aged 15-84 had average potassium intake below the recommended amount of 3.5 g per day. Among persons in this age group, 91.5% had potassium intake less than 3.5 g per day. Analysed by gender, 92.5% of females and 90.5% of males had potassium intake less than 3.5 g per day. Analysed by age group, the proportion of inadequate potassium intake (i.e. less than 3.5 g per day) was the highest among persons aged 15-24 (97.6%) (Table 9.4.2b).

Table 9.4.2b: Level of potassium intake among persons aged 15 to 84 by age group and gender

	Female		Male		Total	
Age group/Potassium intake level	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
15 - 24						
Potassium intake < 3.5g per day	382.0	97.4%	400.3	97.8%	782.3	97.6%
Potassium intake ≥ 3.5g per day	10.3	2.6%	9.0	2.2%	19.3	2.4%
Sub-total	392.3	100.0%	409.3	100.0%	801.6	100.0%
25 - 34						
Potassium intake < 3.5g per day	471.8	93.2%	397.0	87.2%	868.8	90.4%
Potassium intake ≥ 3.5g per day	34.6	6.8%	58.0	12.8%	92.6	9.6%
Sub-total	506.4	100.0%	455.0	100.0%	961.4	100.0%
35 - 44						
Potassium intake < 3.5g per day	505.6	90.1%	410.9	89.4%	916.6	89.8%
Potassium intake ≥ 3.5g per day	55.8	9.9%	48.9	10.6%	104.6	10.2%
Sub-total	561.4	100.0%	459.8	100.0%	1 021.2	100.0%
45 - 54						
Potassium intake < 3.5g per day	562.4	88.6%	499.3	91.1%	1 061.7	89.7%
Potassium intake ≥ 3.5g per day	72.2	11.4%	49.1	8.9%	121.3	10.3%
Sub-total	634.6	100.0%	548.4	100.0%	1 183.0	100.0%
55 - 64						
Potassium intake < 3.5g per day	496.6	92.4%	471.4	89.3%	968.0	90.8%
Potassium intake ≥ 3.5g per day	40.9	7.6%	56.6	10.7%	97.5	9.2%
Sub-total	537.5	100.0%	528.0	100.0%	1 065.5	100.0%
65 - 84						
Potassium intake < 3.5g per day	449.7	96.1%	398.9	88.9%	848.6	92.6%
Potassium intake ≥ 3.5g per day	18.4	3.9%	49.7	11.1%	68.1	7.4%
Sub-total	468.1	100.0%	448.6	100.0%	916.7	100.0%
15 - 84						
Potassium intake < 3.5g per day	2 868.0	92.5%	2 577.9	90.5%	5 445.9	91.5%
Potassium intake ≥ 3.5g per day	232.3	7.5%	271.2	9.5%	503.5	8.5%
Total	3 100.3	100.0%	2 849.1	100.0%	5 949.4	100.0%

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urine test.
Note: Figures may not add up to the total due to rounding.

Analysed by level of average daily fruit and vegetables intake, 91.8% of persons eating less than five servings of fruit and vegetables on average per day had potassium intake of less than 3.5 g per day. In contrast, 86.9% of those consuming at least five servings of fruit and vegetables on average per day had inadequate potassium intake as recommended by the WHO. The corresponding mean values of daily potassium intake were 2.3 g and 2.4 g for those consuming less than and at least five servings of fruit and vegetables on average per day respectively (Table 9.4.2c).

Table 9.4.2c: Level of potassium intake among persons aged 15 to 84 by level of fruit and vegetables intake

	Less than 5 servings a day		5 servings or more a day		Don't know		Total	
Potassium intake level	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**	**No. of persons ('000)**	**%**
Potassium intake < 3.5g per day	5 121.6	91.8%	321.6	86.9%	2.7	100.0%	5 445.9	91.5%
Potassium intake ≥ 3.5g per day	455.2	8.2%	48.3	13.1%	-	-	503.5	8.5%
Total	5 576.8	100.0%	369.9	100.0%	2.7	100.0%	5 949.4	100.0%
Mean (g per day)	2.3		2.4		0.9		2.3	

Base: All respondents aged 15 - 84 who had participated in the health examination with valid urine test.
Note: Figures may not add up to the total due to rounding.

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