

## Health Risks Associated with Processed Meat Consumption

### Key Messages

- ※ Processed meat generally refers to meat that has been processed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation. Examples of processed meat are ham, sausages, bacon, luncheon meat, corned beef, meat jerky, as well as canned meat and meat-based preparations.
- ※ Processed meat contains a number of harmful chemicals and other components, such as nitrate/nitrite/nitrosamine compounds, high salt and saturated fat contents, etc. Excessive consumption of processed meat may increase the risk of chronic non-communicable diseases, including hypertension, heart disease, stroke, certain cancers and type 2 diabetes. The higher intake of processed meat, the higher the risk of chronic diseases and mortality.
- ※ The Health Behaviour Survey 2018/19 of the Department of Health found that 9.9% of persons aged 15 or above ate processed meat and associated products on average at least once a day.
- ※ To attain good health, members of the public should reduce processed meat consumption, eat in accordance with the 'Healthy Eating Food Pyramid' guide and observe the basic principles of healthy eating. For more information about healthy eating, please visit the Centre for Health Protection website at [www.chp.gov.hk/en/resources/465/8800.html](http://www.chp.gov.hk/en/resources/465/8800.html).

## Health Risks Associated with Processed Meat Consumption

Excessive consumption of processed meat and associated products is one of the leading risk factors of chronic non-communicable diseases (NCDs). Processed meat generally refers to meat that has been processed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation. Most processed meats contain pork or beef, but they may also contain other red meats, poultry, offal, or meat by-products (such as blood).<sup>1</sup> Around the world, there is a huge variety of processed meat and associated products with different characteristics. Examples of processed meat are ham, sausages, bacon, luncheon meat, corned beef, meat jerky, as well as canned meat and meat-based preparations.<sup>1</sup> Since the 1990s, scientific evidence of potential associations between processed meat consumption and an increased risk of chronic NCDs and of premature mortality has been accumulating.<sup>2</sup> In 2015, the International Agency for Research on Cancer of the World Health Organization classified processed meat as a Group 1 carcinogen (i.e. cancer-causing to humans),<sup>3</sup> the same category as tobacco smoke, alcohol, asbestos and ionizing radiation. In 2019, the Global Burden of Disease Study estimated that a diet high in processed meat was responsible for

304 000 deaths and 8.56 million disability-adjusted life years (i.e. the number of years lost due to ill-health, disability or early death).<sup>4</sup>

### Plausible Mechanisms and Epidemiological Evidence of Processed Meat Consumption on Increased Risk of Chronic NCDs

Processed meat contains a number of harmful chemicals and other components that excessive consumption may increase the risk of chronic NCDs, including cardiovascular diseases (CVD), certain cancers and type 2 diabetes (Table 1).<sup>5</sup> In particular, nitrates or nitrites added to meat for preservation would react with stomach acid and other chemicals to form nitrosamine compounds which are known carcinogens and can have toxic effects on pancreatic cells that lead to impaired insulin secretion, thereby increasing the risk of developing cancer and type 2 diabetes.<sup>1, 2, 5</sup> Nitrates and their byproducts (such as peroxy nitrite) can also cause vascular tissue injury and promote atherosclerosis (hardening of the arteries), thus increasing the risk of CVD (such as hypertension, coronary heart disease, heart failure and stroke).<sup>5, 6</sup>

**Table 1: Examples of processed meat components/metabolites and increased risk of chronic NCDs**

Components/metabolites of processed meat	Cancer	CVD	Type 2 diabetes
Nitrate, nitrite, nitrosamine compounds	√	√	√
Haem iron	√	√	√
Salt/sodium	√ (stomach)	√	√
Saturated fat	√	√	
Polycyclic aromatic hydrocarbons	√		
Heterocyclic aromatic amines	√		
Advanced glycation end products	√		√

Source: Rohrmann et al 2016.

Haem iron can catalyse the formation of nitrosamine compounds.<sup>1</sup> It may also increase cellular oxidative stress and inflammation, insulin resistance and atherosclerotic plaque formation.<sup>2, 7</sup> Processed meats are often high in salt/sodium and saturated fat that would raise blood pressure and promote build-up of fatty plaques inside the arterial walls, thereby increasing the risk of hypertension, coronary heart disease and stroke. Consumption of too much salt and saturated fat may impair insulin sensitivity and increase diabetic risk.<sup>2, 5</sup> Animal models have also shown that excessive salt consumption can alter the viscosity of the mucus protecting the stomach, enhance the formation of nitrosamine compounds, as well stimulate the colonisation of *Helicobacter pylori* (a type of bacteria that can cause ulcers and inflammation of the stomach lining), so that it can increase the risk of stomach cancer development.<sup>8</sup>

Epidemiological studies indicated that each additional daily 50 grams (g) of processed meat consumption was associated with 37% increased risk of developing type 2 diabetes;<sup>9</sup> 12–27% increased risk of developing hypertension, heart failure, stroke and coronary heart disease;<sup>10, 11</sup> 17–72% increased risk of developing specific cancers;<sup>12-15</sup> and an overall 23% increased risk of death.<sup>16</sup> The higher the intake of processed meat, the higher the risk of chronic diseases and mortality.

Examples of processed meat, each weighs about 50 grams

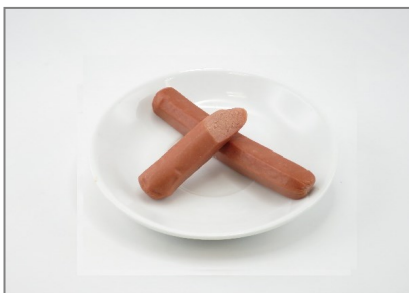
**Ham**



**Luncheon Meat**



**Sausages**



**Bacon**



## Consumption Pattern of Processed Meat

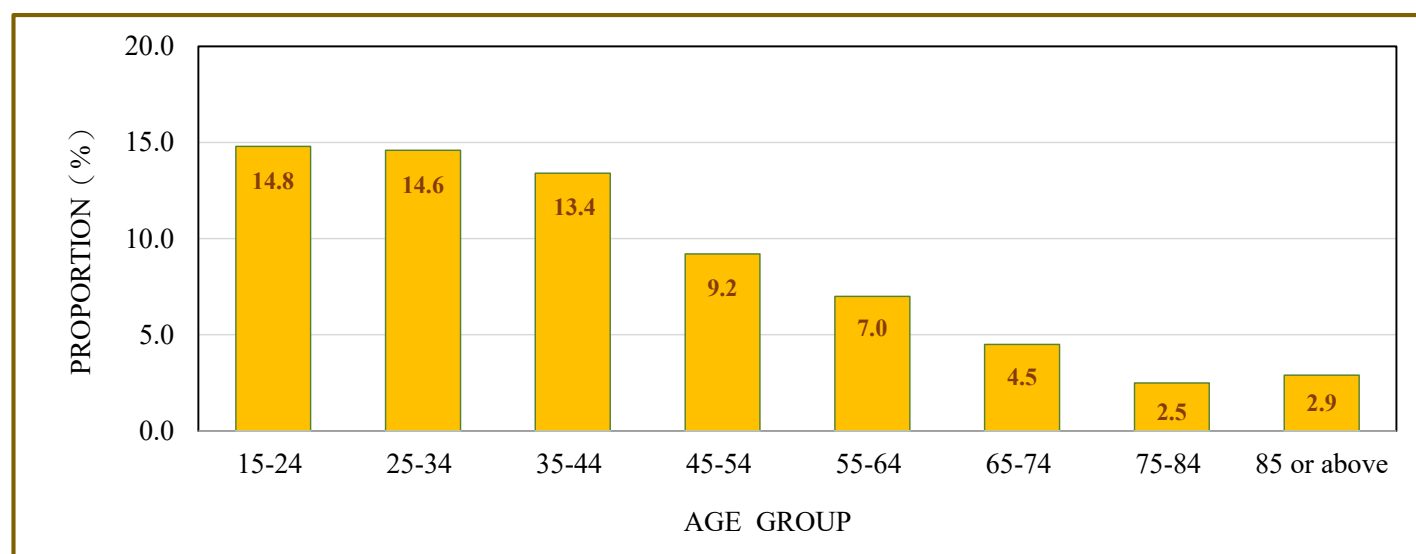
A systematic analysis aimed to quantify global intakes of key foods (including processed meat) related to NCDs reported that mean global intake of processed meat among adult population was 13.7 g per day in 2010. As calculated, 2.72 billion people (representing 61.5% of the global adult population) had intake of more than 1 (50 g) serving of processed meat per week, while 1.7 billion people (representing 38.5% of the global adult population) had intake of one or less than serving of processed meat per week.<sup>17</sup>

In Hong Kong, the Department of Health (DH) conducted the Health Behaviour Survey between 2018 and 2019 which successfully interviewed over 5 900 residents aged 15 or above about their health-related behaviours and lifestyle practices, including usual consumption of processed meat and associated products. Results showed that 9.9% of persons aged 15 or above (13.3% for males; 6.8% for females)

ate processed meat and associated products on average at least once a day.<sup>18</sup> The proportion was higher than 5.5% (6.8% for males; 4.4% for females) found in the Population Health Survey 2014/15.<sup>19</sup> Analysed by age group, persons aged 15–24 (14.8%) and 25–34 (14.6%) were more likely than those in older age groups to report that they ate processed meat and associated products on average at least once a day (Figure 1).<sup>18</sup>

In the survey, one serving of processed meat and associated products was defined as equivalent to the size of a mahjong tile or ping-pong ball (i.e. about 1 tael or 37.5 g of meat). Overall, 26.8% of persons aged 15 or above (32.4% for males; 21.8% for females) reported that they ate two or more servings of processed meat and associated products per day on the days they ate processed meat and associated products.<sup>18</sup>

**Figure 1: Proportion of persons aged 15 or above reported eating processed meat and associated products on average at least once a day by age group**



Source: Health Behaviour Survey 2018/19, Department of Health.

## Eat Well for Health

To attain good health, members of the public should reduce the consumption of processed meat, eat in accordance with the 'Healthy Eating Food Pyramid' guide and observe the basic principles of healthy eating that include consuming at least 5 daily servings of fruit and vegetables with appropriate amounts of wholegrain products, fish, poultry or lean meat, as well as limiting the consumption of fat, salt and sugar. Studies show that certain components in fruit and vegetables (such as phenolic compounds, vitamin C and E) can inhibit the formation of nitrosamine compounds and reduce their carcinogenic effects.<sup>20, 21</sup> When buying or making deli meat sandwiches, hot dogs or other dishes with processed meats at home, it may be healthier to add some fresh vegetables (such as lettuce, tomato, cucumber and onion) and fruits (such as pineapple, avocado and banana slices). However, it is best to reduce the consumption of processed meat. Besides, diet with more vegetables and less meat would also contribute to cutting greenhouse gas emissions and bringing multiple co-benefits to the environment and public health.<sup>22</sup> For more information about healthy eating, please visit the Centre for Health Protection website at [www.chp.gov.hk/en/resources/465/8800.html](http://www.chp.gov.hk/en/resources/465/8800.html).

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## Data Brief

- Epidemiological studies indicated each additional daily 50 g of processed meat consumption would increase the risk of developing multiple chronic diseases and death significantly.
- The higher the intake of processed meat, the higher the risk of chronic diseases and mortality.

### Estimated increased risk of chronic diseases and death for each additional daily 50 g of processed meat consumption

	Estimated increased risk
<b>Type 2 diabetes<sup>1</sup></b>	37%
<b>Cardiovascular diseases</b>	
Hypertension <sup>2</sup>	12%
Heart failure <sup>3</sup>	12%
Stroke <sup>3</sup>	17%
Coronary heart disease <sup>3</sup>	27%
<b>Cancer</b>	
Colorectal cancer <sup>4</sup>	17%
Breast cancer <sup>5</sup>	18%
Pancreatic cancer <sup>6</sup>	19%
Gastric cancer <sup>7</sup>	72%
<b>All-cause mortality<sup>8</sup></b>	23%

1. Schwingshackl L, Hoffmann G, Lampousi AM, et al. Food groups and risk of type 2 diabetes mellitus: a systematic review and meta-analysis of prospective studies. *European Journal of Epidemiology* 2017;32(5):363-375.
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