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Health Tips

Studies have suggested possible associations between red meat consumption and increased chronic disease risks. However, red meat contains essential nutrients required for normal body functioning. If consumed in moderation, red meat can be part of a healthy balanced diet.

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Red Meat Consumption : the Good and the Bad

Red meat generally refers to pork, beef/veal and mutton/lamb, which have a relatively high content of myoglobin (an iron- and oxygen-binding protein) in the muscles that gives the meat its red colour. Red meat is one of the best sources of some essential nutrients, including protein (necessary for growth, maintenance and repair of body tissue, and regulation of enzymes and hormones), dietary iron (required for the production of haemoglobin in red blood cells), zinc (for growth and tissue repair and a healthy immune system), B vitamins such as B6 and B12 (necessary for proper cell growth and a healthy nervous system), and omega-3 fatty acids (which play a role in combating heart disease and contributing positively to brain function). However, red meat contains considerable quantities of saturated fat, but no dietary fibre.[1]

Red Meat Consumption and Health Risks

Red meat in the diet may be processed or unprocessed. Processed red meat includes red meat that has been preserved by methods other than freezing, such as salting, smoking, marinating or air-drying. Common examples are ham, bacon, sausages, salami, corned beef and tinned meat. Epidemiological studies have implicated possible associations between eating too much red meat (both processed and unprocessed) and weight gain, as well as increase in various chronic disease risks including cardiovascular diseases, type 2 diabetes and colorectal cancer.

Weight Gain

Fats are a rich source of energy. Each gram (g) of fat provides about 9 kilocalories (kcal) of energy. It was postulated that the saturated fatty acids from excessive red meat consumption can lead to weight gain, although the fat content of red meat varies depending on the type of red meat, the cut or the degree of trimming. A prospective study in the United States (US) found that unprocessed red meat and processed meat were two of the foods associated with the greatest weight gain, having assessed changes in multiple diet and lifestyle factors and weight gain every four years over 12 to 20 years of follow-up in three separate cohorts involving over 120 000 US men and women who were free of chronic diseases and not obese at baseline. After multivariable adjustment, one serving per day increase of unprocessed red meat and processed meat consumption would lead to an average 0.95 and 0.93 pounds weight gain respectively within each 4-year period.[2]

Cardiovascular Diseases (Coronary Heart Disease & Stroke)

Red meat has often been regarded as a contributor to cardiovascular diseases due to its relatively high content of saturated fats, despite it also contains some potentially cardio-protective nutrients, such as omega-3 fatty acids. Studies have shown that saturated fats may increase low-density-lipoprotein cholesterol concentrations and affect the selective uptake of cholesterol in the arterial wall, thereby increasing the risk of atherosclerosis (i.e. hardening of arteries) and cardiovascular disease events.[3] However, while the association between processed red meat consumption and increased cardiovascular disease risks has been more consistently shown, that between unprocessed red meat and cardio-vascular disease risks is less so. A systematic review and meta-analysis of 17 prospective cohorts and 3 case-control studies (published between 1992 and 2009) concluded that while processed red meat was associated with a higher incidence of coronary heart disease (CHD), a significant association between unprocessed red meat consumption and a higher risk for CHD or stroke could not be found.[4] It was postulated that processed versus unprocessed red meat may have some important nutritional differences, such as in contents of calories, specific fats, sodium, iron, or additives (e.g. nitrates), or differences in their preparation methods (e.g. high-temperature commercial cooking) that could produce differing effects on cardio-metabolic risk. After the systemic review and meta-analysis, several large studies have been published with conflicting results on the role of unprocessed red meat on CHD and stroke risks. A large prospective study of 26 years of follow-up, which involved over 84 000 women aged 30-55 years and free of chronic diseases at baseline, reported that women in the highest quintile of unprocessed red meat consumption would have a 13% elevated risk of CHD as compared with those in the lowest quintile, after controlling for various cardiovascular risk factors.[5]

As for the risk for stroke, a study published in 2011 that involved over 34 000 Swedish women with a mean follow-up of 10.4 years showed that while women in the highest quintile of processed meat consumption had a 24% increased risk of cerebral infarction (a type of stroke due to interruption of blood supply to the brain) as compared to their peers who were in the lowest quintile, unprocessed meat consumption was not associated with total stroke or with any stroke subtype.[6] In contrast, another large cohort study, which prospectively followed 43 150 men aged 40-75 years at baseline for 22 years and 84 010 women aged 30-55 years at baseline for 26 years, found that both processed and unprocessed red meat consumption were significantly associated with increased total stroke risk in both genders. For unprocessed red meat consumption, the study observed that men who ate slightly more than one serving a day had a 11% increased risk of stroke compared to men who ate about a tenth of a serving a day. Women who ate slightly more than one serving a day would have a 19% higher risk of stroke than women who ate about one third of a serving a day.[7]

Type 2 Diabetes

Saturated fatty acids can impair insulin sensitivity, affect glucose uptake in tissue and increase diabetic risk.[3] As with the risk for CHD and stroke, earlier cohort studies have observed a higher risk of type 2 diabetes among 'high' red meat consumers, as compared to 'low' red meat consumers.[1] However, a systematic review and meta-analysis published in 2010 of 5 cohort studies did not find a significant association between unprocessed red meat intake and type 2 diabetes.[4] Yet, in 2011, an updated meta-analysis of 3 prospective cohort studies of US adults with 4 033 322 person-years of

follow-up was published, and it showed that one serving per day increase of unprocessed red meat, processed red meat and total red meat was associated with a respective 12%, 32%, and 14% elevated risk of type 2 diabetes, after adjusting for a number of demographic factors (such as age and ethnicity), lifestyle practices (such as physical activity level, dietary habits, smoking and alcohol consumption) and health status (such as body mass index, family history of diabetes, history of hypertension or high blood cholesterol).[8]

Colorectal Cancer

Some epidemiological studies have also linked high intake of red meat (both processed and unprocessed) to increased cancer risk, particularly colorectal cancer risk, because of its association with several known mutagens, including *N*-nitroso compounds and heterocyclic amines formed during high-temperature cooking. These compounds, along with other substances present in red meat, such as haem iron, saturated fats, salt or estradiol, have been theorised to increase DNA synthesis and cell proliferation, affect hormone metabolism or promote free radical damage, all of which may promote the development of cancer.[9,10] An expert panel of the World Cancer Research Fund and the American Institute for Cancer Research (WCRF/AICR) stated in 2007 that "red meat is a convincing cause of colorectal cancer".[10] An update of evidence in a dose-response meta-analysis in 2011 found that increase of every 100 g of fresh red meat consumption per day would increase a person's risk of colorectal cancer by 17%.[11] However, the evidence suggesting that red meat consumption increases the risk for cancer at other sites is limited, including that for oesophagus, breast, lung, pancreas, endometrium in women or prostate in men.[10, 12]

Patterns of Red Meat Consumption

Health concerns linked to red meat consumption, changing lifestyles and incomes as well as market situations are among the factors that have shaped the consumption patterns of red meat, both globally and locally.

Global Overview

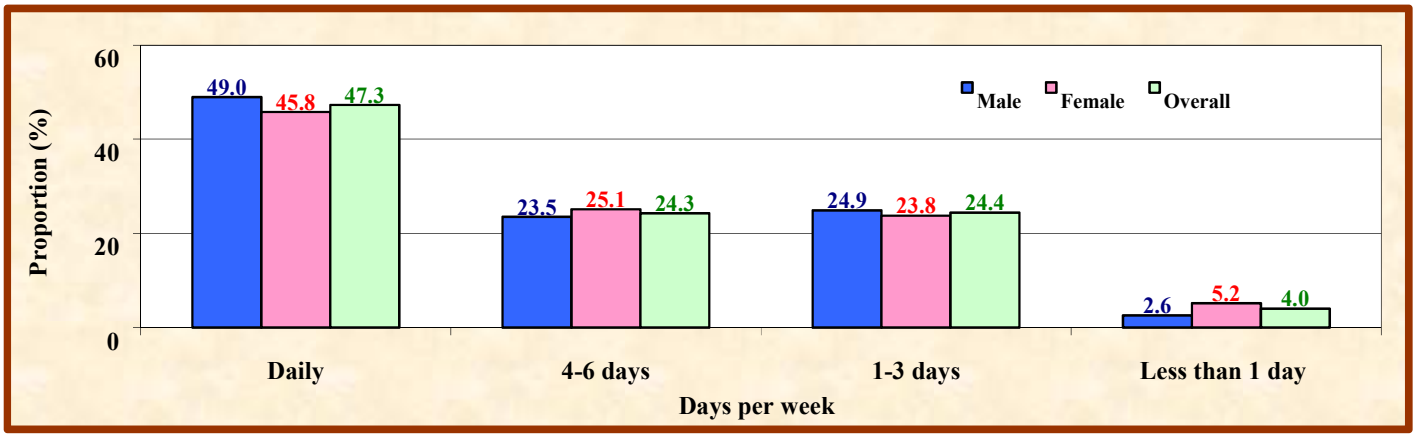
The amount and type of red meat consumed varies widely throughout the world with socio-economic factors, political influences, religious beliefs or geographical differences. In Europe, a prospective study based on 24-hour dietary recalls of about 36 000 subjects aged 35-74 years at recruitment from 27 centres across 10 countries (including France, Italy, Spain, Greece, the Netherlands, the UK, Germany, Denmark and Sweden between 1995 and 1998; and Norway between 1999 and 2000) reported that mean red meat intake varied from 40 g to 121 g per day in men and from 24 g to 57 g per day in women. While most pork was consumed in the German, Swedish, Danish and Dutch centres, intake of beef/veal and mutton was highest in the centres of Northern Spain, Italy and France.[13] In the US, per capita red meat consumption has dropped from 105 g per day in 1970 to 85 g per day in 2007. However, the National Health and Nutrition Examination Survey (2003-2004) data from a single 24-hour dietary recall among people aged 2 and above indicated that red meat still represented the largest proportion of meat consumed (58%), with a mean daily intake of 69.8 g - 87.6 g for males and 52.8 g for females. Peak red meat consumption occurred in adults aged 20-49, with a mean intake of 80.3 g per day.[14] Conversely, analyses of animal products consumption trends in China showed that per capita annual consumption of red meat increased from below 10 kilograms (kg) during the 1970s to 18.2 kg in 2002.

Pork was the dominant red meat consumed in both urban and rural areas, accounting for 37% and 52% of animal products consumption in 2002 respectively.[15] In 2012, per capita consumption of pork, beef/veal and mutton in China was estimated to be about 30.1 kg, 2.8 kg and 2.7 kg respectively. Driven by rising affluence, income growth and urbanisation, the corresponding figures are expected to grow further to about 33.8 kg, 3.3 kg and 2.8 kg by 2021.[16] Globally, pork remains the most widely consumed red meat in both developed and developing countries. In the least developed countries, however, beef/veal is the preferred red meat. As the Organization for Economic Cooperation and Development (OECD) and Food and Agriculture Organization (FAO) of the United Nations (http://www.agri-outlook.org/) forecast, there will be a marginal increase in consumption of pork, beef/veal and mutton worldwide from about 12.3 kg, 6.5 kg and 1.7 kg per capita in 2012 to about 12.7 kg, 6.9 kg and 1.8 kg per capita in 2021 respectively. The increase in demand for red meat will mostly stem from large economies in Asia, Latin America and oil exporting countries.[16]

Local Situation

Pork and beef (including fresh, chilled and frozen) are the usual diet of Hong Kong people. A review of pork and beef consumption in Hong Kong reported that the per capita annual total pork and beef consumption increased from 42.2 kg in 1982 to 46.9 kg in 2002. Meanwhile, the ratio of per capita total pork consumption to per capita total beef consumption rose from 3.3:1 to 4.5:1.[17] The Population-based Food Consumption Survey 2005-2007 of the Food and Environmental Hygiene Department investigated the food consumption of Hong Kong adults aged 20-84 years, including red meat. Using two non-consecutive days of 24-hour dietary intake (24-hour recall) questionnaires to obtain food consumption estimates, the survey reported that pork, beef and sheep were consumed in the amount of 53.81 g per day, 15.06 g per day and 0.71 g per day respectively.[18] In 2009, another telephone-survey conducted by the Department of Health (DH) on over 2 100 community-dwelling people aged 18-64 found that close to half (47.3%) of respondents had consumed red meat every day during the thirty days prior to the survey (Figure 1). On average, respondents consumed 2.64 taels of red meat per day – 3.06 taels for males and 2.28 taels for females. Results also showed that the younger the respondents, the higher the daily average intake of red meat (Table 1).[19]

Figure 1: Red meat consumption per week among community-dwelling people aged 18-64 during the 30 days prior to the survey by sex and days per week



Note : All respondents excluding those with unknown / missing data.
Source: Behavioural Risk Factor Survey, April 2009.

Table 1: Average daily intake of red meat in taels* among community-dwelling people aged 18-64 during the 30 days prior to the survey by sex and age group

Age group	Male	Female	Overall
18-24	4.37	2.80	3.57
25-34	4.18	2.82	3.40
35-44	2.66	2.18	2.39
45-54	2.71	1.87	2.27
55-64	1.87	1.87	1.87
Overall	3.06	2.28	2.64

Notes: All respondents excluding those with unknown / missing data.

* One tael is approximately equal to 38 g.

Source: Behavioural Risk Factor Survey, April 2009.

Red Meat in the Diet

While studies have suggested possible associations between red meat consumption and increased chronic disease risks, red meat contains essential nutrients required for normal body functioning. If consumed in moderation, red meat can be part of a healthy balanced diet. Here are some diet tips for red meat lovers -

When choosing red meat

- Choose leaner selections or cuts with the least amount of visible fat (marbling), or ask the butcher or grocer for the leanest selections or cuts of meat, such as lean ground beef, eye of round or top sirloin (which generally contain less than 10 g of total fat, 4.5 g or less of saturated fat, and less than 95 mg of cholesterol per 100 g of meat).[20]
- Beware of 'prime' cuts, which are usually fattier.[20]
- Avoid processed meat.

When preparing and cooking red meat

- Cut off any visible fat from meat.
- Use low-fat and low-sodium marinades, such as garlic, ginger, herbs or lemon juice in place of heavy gravies or sauces.
- Choose low-fat cooking methods, such as baking, grilling, roasting, steaming, boiling or stewing, instead of frying or deep-frying. Avoid adding extra oil. Drain the fat after cooking.
- Do not burn the meat because burnt meat contains polycyclic aromatic hydrocarbons, another group of compounds that have been linked to cancer development. Cut the burnt bits off before serving.

When eating red meat

- Keep serving size moderate, and avoid processed meat if possible.
- Add plenty fresh or cooked non-starchy vegetables or legumes whenever possible.

For more information about 'Healthy Diet', please visit the DH's Change for Health website at http://www.change4health.gov.hk, or call the 24-hour Health Education Hotline at 2833 0111.

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News Bites

A study from the United States (US) showed that both unprocessed and processed red meat consumption were associated with an increased risk of deaths. Substituting red meat with alternative healthier protein sources might lower the risk.

The study analysed data from two large prospective cohort studies of US doctors and nurses, involving over 37 600 men (with up to 22 years of follow-up) and 83 600 women (with up to 28 years of follow-up) who filled out questionnaires repeatedly over the course of the study about their health and various lifestyle patterns, including eating habits. After adjusting for a number of major health- and lifestyle-related factors, results showed that the increase in the risk of total mortality for one serving increase per day was 13% for unprocessed red meat (85 g) and 20% for processed red meat (such as 2 slices of bacon of about 13 g or 1 hot dog of about 45 g). On the other hand, substituting one daily serving of unprocessed red meat with one serving of fish, poultry, legumes, low-fat dairy products, whole grains or nuts per day was associated with a 5-18% lowered risk of total mortality. The corresponding estimates for processed red meat replacement by the above mentioned foods were 10-22% reduction in risk.

For optimal health, red meat lovers are urged to consume red meat in moderation, and choose more alternative healthful protein sources in place of red meat.

[Source: Pan A, Sun Q, Bernstein AM, et al. Red meat consumption and mortality. Arch Intern Med 2012; 172(7):555-63. doi:10.100/archinternmed.2011.2287.]

Data Brief

Colorectal cancer is a malignant neoplasm affecting the lower gastrointestinal tract. In Hong Kong, it ranked as the second most common cancer with 4 335 new cases in 2009 and was the second leading cancer killer responsible for 1 864 registered deaths in 2010. Both incidence and death rates were higher among males and increased with age.

Like many other cancers, most risk factors of colorectal cancer are diet- and lifestyle-related, and therefore modifiable and avoidable. Studies suggest that people may reduce their cancer risk by eating a balanced diet (with sufficient amounts of fruit and vegetables but limited consumption of red and processed meats), increasing physical activity, maintaining an optimal weight, not smoking and avoiding drinking alcohol (or limiting consumption if drinking at all).

Number (rate*) of cancer new cases and registered deaths due to colorectal cancer by sex and age group

Age group	Number (rate*) of new cases in 2009			Number (rate*) of registered deaths in 2010		
	Male	Female	Total	Male	Female	Total
44 and below	92 (5.0)	86 (4.0)	178 (4.5)	17 (0.9)	24 (1.1)	41 (1.0)
45-64	779 (76.2)	591 (55.4)	1 370 (65.6)	273 (26.1)	152 (13.7)	425 (19.7)
65 and above	1 534 (367.2)	1 253 (260.6)	2 787 (310.1)	746 (174.4)	652 (132.8)	1 398 (152.2)
Total	2 405 (73.2)	1 930 (52.3)	4 335 (62.2)	1 036 (31.4)	828 (22.2)	1 864 (26.5)

Note: * Rate per 100 000 population of respective sex and age group.

Sources: Hong Kong Cancer Registry, Department of Health and Census and Statistics Department.

Non-Communicable Diseases (NCD) WATCH is dedicated to promote public's awareness of and disseminate health information about non-communicable diseases and related issues, and the importance of their prevention and control. It is also an indication of our commitments in responsive risk communication and to address the growing non-communicable disease threats to the health of our community.

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