

Eat More Fruit and Vegetables

Key Messages

- ※ Fruit and vegetables contain a myriad of health-promoting nutrients and constituents, including antioxidants, phytochemicals, vitamins, minerals, dietary fibre and plant proteins, etc. These natural bioactive compounds are likely to act synergistically to prevent or slow down the onset of chronic non-communicable diseases (NCDs) through various potential mechanisms.
- ※ Increasing consumption of fruit and (non-starchy) vegetables probably protects against cardiovascular diseases (including hypertension, coronary heart disease and stroke) and a number of aerodigestive cancers (such as oral cancer and colorectal cancer), as well as possibly reduces the risk of type 2 diabetes and adiposity.
- ※ To improve overall health and reduce the risk of chronic NCDs, the Department of Health recommends adults and adolescents aged 12–17 to consume at least 2 servings of fruit and 3 servings of vegetables a day, which is in line with the World Health Organization’s recommendation of at least 5 servings of fruit and vegetables a day.
- ※ The Health Behaviour Survey 2018/19 observed that persons aged 15 or above consumed an average of 1.2 servings of fruits and 1.5 servings of vegetables on the days when they ate fruit and vegetables. Overall, 95.6% persons aged 15 or above had inadequate fruit and vegetables consumption with an average of 2.4 servings of fruit and vegetables a day.
- ※ People in Hong Kong should include an array of seasoned and coloured fruit and vegetables in their daily diet in order to meet the daily goal of “2 Plus 3 Every Day”. For more information about “2 Plus 3 Every Day”, including healthy fruit and vegetables recipes, please visit the thematic webpage at www.chp.gov.hk/en/static/100011.html.

Eat More Fruit and Vegetables

When people think of healthy eating, the first food items that often come to mind are fruit and vegetables.¹ To improve overall health and reduce the risk of chronic non-communicable diseases (NCDs), the World Health Organization (WHO) recommends adults to consume at least 400 grams (g) of fruit and vegetables each day, excluding potatoes, sweet potatoes and other starchy roots, as part of a healthy diet. This equals 5 or more servings of fruit and vegetables and each serving weighs about 80 g.²

Due to certain constraining factors (such as low availability or affordability, lack of knowledge about the nutrition values of fruit and vegetables), many people around the world consume too few fruit and vegetables. In 2010, the estimated mean global fruit and vegetables consumption (including legumes) among adults was 81.3 g/day and 208.8 g/day respectively.³ As a result, the burden of disease attributed to inadequate fruit and vegetables consumption is substantial.¹ According to the Global Burden of Disease Study, diet low in fruit was responsible for 27.7 million of disability-adjusted life years (DALYs, i.e. years of life lost due to

illness, disability and premature deaths) and 1.05 million deaths in 2019.⁴ The number of DALYs and deaths due to diet low in vegetables was 13.0 million and 529 000 respectively.⁵

Mechanisms and Epidemiologic Evidence of Fruit and Vegetables on NCD Risk Reduction

Fruit and vegetables contain a myriad of health-promoting nutrients and constituents, including antioxidants, phytochemicals (such as carotenoids, flavonoids, anthocyanins and lycopene), vitamins (such as A, C and folate), minerals (such as potassium, magnesium and zinc), dietary fibre (including soluble and non-soluble) and plant proteins, etc. These natural bioactive compounds are likely to act synergistically to prevent or slow down the onset of NCDs through various potential mechanisms (Box 1).⁶⁻⁸

Box 1: Disease-preventive mechanisms of fruit and vegetables

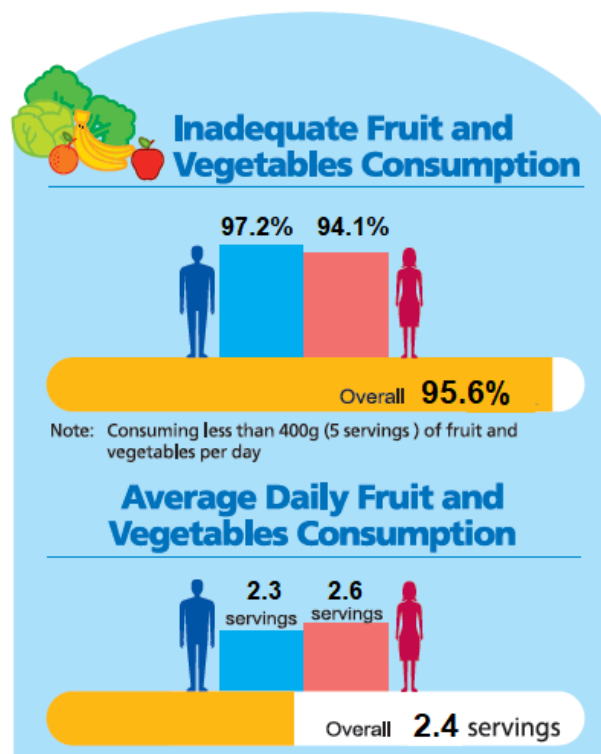
- Antioxidant effect to reduce oxidative damage to cells and DNA caused by free radicals
- Anti-inflammatory effect to lessen chronic inflammation
- Increased the activity of enzyme to detoxify toxins and potential carcinogens
- Decreased platelet aggregation and risk of thrombosis
- Blood pressure reduction
- Reduction in serum low-density-lipoprotein cholesterol and triglyceride concentrations
- Increased insulin sensitivity and improved regulation of blood glucose
- Modulation of hormone metabolism and concentrations
- Stimulation of the immune system
- Inhibitory effect on certain bacterial and fungal activities
- Improved gut microbiota composition and diversity
- Increased gut motility and decreased colonic transit time

Epidemiological studies showed that high versus low fruit, vegetables, and fruit and vegetables consumption was associated with 13%, 13% and 18% reduced risk of mortality respectively.⁶ There is sufficient evidence that increasing consumption of fruit and vegetables reduces the risk of cardiovascular diseases.^{8, 9} Compared to people with the lowest category of fruit consumption, those with the highest fruit consumption category would have 17%, 11%, and 7% reduced risk of developing stroke, coronary heart disease, and hypertension respectively.^{10, 11} Comparing the highest to the lowest categories of vegetables consumption was associated with 13% reduced risk of stroke and 8% reduced risk of coronary disease.¹⁰ Regarding cancer, greater consumption of fruit and non-starchy vegetables probably protects against a number of aerodigestive cancers (such as cancers of the mouth, pharynx and larynx, nasopharynx, oesophagus, lung, stomach and colorectum) and possibly some other cancers (such as bladder cancer).¹² For some people, consuming more fruit and non-starchy vegetables could possibly lower the risk of adiposity.^{1, 13} While dietary fibre have beneficial effects in improving insulin sensitivity, fruit and vegetables consumption may also indirectly protect against type 2 diabetes in adults by lowering the obesity risk.^{9, 14} Studies found that the risk of type 2 diabetes reduced by 10% with increasing fruit consumption up to 200–300 g/day and 9% with increasing vegetables consumption up to 300 g/day.¹⁵ Moreover, eating more fruit and vegetables may enhance eye health with reduced risk of certain eye diseases (such as age-related macular degeneration, cataract and glaucoma); mental health with lower risk of depression, anxiety and dementia; as well as pulmonary health with possible preventive effects against asthma and chronic obstructive pulmonary disorder development.^{8, 9} In the wake of coronavirus disease 2019 (COVID-19), adequate fruit and vegetables consumption can boost the immune system, defending the body from infections or reducing the severity of respiratory infections.^{1, 16}

Pattern of Fruit and Vegetables Consumption among People in Hong Kong

The Department of Health recommends adults and adolescents aged 12–17 to consume at least 2 servings of fruit and 3 servings of vegetables a day, which is in line with the WHO's recommendation of at least 5 servings of fruit and vegetables a day. However, local people consumed far less fruit and vegetables than the recommended level. The Health Behaviour Survey 2018/19 interviewed over 5 900 persons aged 15 or above about their lifestyle practices, including consumption of fruit and vegetables. Results showed that 67.7% of respondents ate fruit at least once a day, with an average of 1.2 servings on the days when they ate fruit. For vegetables, 89.6% of respondents ate vegetables at least once a day, with an average of 1.5 servings on the days when they ate vegetables. Overall, 95.6% persons aged 15 or above had inadequate fruit and vegetables consumption (i.e. less than 5 servings a day) with an average of 2.4 servings of fruit and vegetables a day (Figure 1).¹⁷

Figure 1: Consumption of fruit and vegetables among persons aged 15 and above



Go for a Variety of Colourful Fruit and Vegetables

People in Hong Kong should eat more fruit and vegetables in order to meet the daily goal of “2 Plus 3 Every Day” (Box 2). Fruit and vegetables come in different colours (red, orange, yellow, green, purple, blue, white, brown, etc.), each of which carries its own set of nutrients and indicates an abundance of specific phytochemicals (Table 1). To obtain the maximum health benefits from fruit and vegetables, variety is as important as quantity.^{1, 18} In Hong Kong, various kinds of fresh fruit and vegetables are in year round availability. Members of the public are encouraged to include an array of seasoned and coloured fruit and vegetables in their daily diet. Below are some general tips for eating more fruit and vegetables —

- ◇ Keep fruit and vegetables around and in eye-catching areas;
- ◇ Serve fruit and vegetables as snacks, such as apple, banana, grapes, cherry tomatoes or baby carrots;
- ◇ Have fruit for appetiser or dessert, such as mixed fruit salad or chopped fresh fruit (or dried fruit without added sugar) topped with low-fat yoghurt;
- ◇ Add vegetables to the majority of dishes, rice or noodles, soups or stews;
- ◇ Add vegetables to sandwiches, such as lettuce, sliced cucumbers or tomato.

Box 2: Examples of one serving of fruit or vegetables



Source: Department of Health.

Table1: Key phytochemicals and health effects as well as examples of fruit and vegetables by 5 basic colour groups

Colour Group	Key phytochemicals and health effects	Examples
Red	Lycopene and anthocyanins that can lower the risk of cancer and improve heart health	<ul style="list-style-type: none"> water melon, cherry, strawberry, red apple, red grape, pink guava tomato, red capsicum
Orange or Yellow	Carotenoids, lutein and zeaxanthin that help keep eyes healthy	<ul style="list-style-type: none"> orange, mango, lemon, papaya, pineapple, cantaloupe melon, apricot carrot, yellow sweetcorn, orange/yellow capsicum, pumpkin
Green	Chlorophyll with anti-cancer properties	<ul style="list-style-type: none"> kiwifruit, green apple, green grape, avocado, lime green leafy vegetables, broccoli, celery, cucumber, asparagus, green capsicum,
Purple or Blue	Anthocyanins that can reduce the risk of cancer, stroke and heart disease	<ul style="list-style-type: none"> blueberry, purple grape, plum, prune, purple fig eggplant, purple onion, purple cabbage
White or Brown	Anthoxanthins and allicin with antiviral and anti-bacterial properties as well as rich in potassium	<ul style="list-style-type: none"> banana, pear, pomelo, white peach cauliflower, cabbage, mushroom and fungi, onion, garlic

As many nutrients from fruit and vegetables (such as vitamins and minerals) can be lost during handling, preparing or cooking, below are some general tips for preserving or reducing the loss of nutrients fruit and vegetables —

- ◇ Rinse fresh fruit and vegetables (including those with skins and rinds) with running water to remove any bacteria, insects or pesticides on the fruit surface before eating, cutting or cooking. Avoid soaking fresh fruit and vegetables for long duration to minimise the loss of water-soluble vitamins (such as B and C);
- ◇ Limit peeling, where appropriate, as the edible skins of many fruit and vegetables tend to be loaded with dietary fibre and anti-oxidants like carotenoids and flavonoids;
- ◇ Go for whole fruit and vegetables rather than juices. Once juiced, most dietary fibre from the fruit and vegetables as well as some vitamins (particularly vitamin C which is easily destroyed by light and air) would be lost;
- ◇ Serve cut-up fruit and vegetables promptly. The longer they stand, the more nutrients would be lost. If indicated, store and refrigerate the cut or peeled produce properly and consume them as soon as possible to reduce the risk of food-borne illness;
- ◇ Cook fruit and vegetables whole if possible, or cut them into large pieces to reduce the loss of nutrients by limiting the surface area exposed to air and water. Avoid overcooking fruit and vegetables. Choose steaming, microwaving or stir-frying. If boiling is preferred, use as small amount of water as possible, or use the water to make stocks or gravies to recapture some of the leached nutrients;
- ◇ Be aware that some antioxidants are more available to the body when the fruit and vegetables are raw (such as carotene found in carrots), and others are more available when the fruit and vegetables are cooked (e.g. lycopene found in tomatoes).

Of note, some patients with certain diseases should avoid or limit consumption of certain kinds of fruit. For example, patients with kidney diseases should avoid star fruit as their weakened kidneys

would not be able to process and pass out the ‘toxic substances’ (such as oxalate and caramboxin) present in star fruit.¹⁹ While there is no need for diabetics to avoid certain kinds of fruit (such as banana) because of their sweeter taste, they should control the amount. If indicated, consult a doctor or dietitian. For more information about “2 Plus 3 Every Day”, including healthy fruit and vegetables recipes, please visit the thematic webpage at www.chp.gov.hk/en/static/100011.html.

References

1. Fruit and Vegetables - Your Dietary Essentials. International Year of Fruits and Vegetables 2021. Background Paper. Food and Agriculture Organization of the United Nations, 2020.
2. Healthy Diet. World Health Organization, 29 April 2020. Available at www.who.int/news-room/fact-sheets/detail/healthy-diet.
3. Micha R, Khatibzadeh S, Shi P, et al. Global, regional and national consumption of major food groups in 1990 and 2010: A systematic analysis including 266 country-specific nutrition surveys worldwide. *BMJ Open* 2015;5(9):e008705.
4. GBD cause and risk summaries: Diet low in fruit-level 3 risk. *Lancet* 2020;396(October 17):S270-S271. Available at www.thelancet.com/pb-assets/Lancet/gbd/summaries/risks/diet-fruits.pdf.
5. GBD cause and risk summaries: Diet low in vegetables-Level 3 risk. *Lancet* 2020;396(October 17):S272-S273. Available at www.thelancet.com/pb-assets/Lancet/gbd/summaries/risks/diet-vegetables.pdf.
6. Aune D, Giovannucci E, Boffetta P, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality: a systematic review and dose-response meta-analysis of prospective studies. *International Journal of Epidemiology* 2017;46(3):1029-1056.
7. Lampe JW. Health effects of vegetables and fruit: Assessing mechanisms of action in human experimental studies. *American Journal of Clinical Nutrition* 1999;70(suppl):475S-490S.
8. Wallace TC, Bailey RL, Blumberg JB, et al. Fruits, vegetables, and health: A comprehensive narrative, umbrella review of the science and recommendations for enhanced public policy to improve intake. *Critical Reviews in Food Science and Nutrition* 2020;60(13):2174-2211.
9. Boeing H, Bechthold A, Bub A, et al. Critical review: vegetables and fruit in the prevention of chronic diseases. *European Journal of Nutrition* 2012;51(6):637-663.
10. Bechthold A, Boeing H, Schwedhelm C, et al. Food groups and risk of coronary heart disease, stroke and heart failure: A systematic review and dose-response meta-analysis of prospective studies. *Critical Reviews in Food Science and Nutrition* 2019;59(7):1071-1090.
11. Schwingshackl L, Schwedhelm C, Hoffmann G, et al. Food groups and risk of hypertension: A systematic review and dose-response meta-analysis of prospective studies. *Advances in Nutrition* 2017;8(6):793-803.
12. World Cancer Research Fund / American Institute for Cancer Research. Diet, Nutrition, Physical Activity and Cancer: a Global Perspective. Continuous Update Project Expert Report, 2018. Available at www.wcrf.org/dietandcancer.
13. Schwingshackl L, Hoffmann G, Kalle-Uhlmann T, et al. Fruit and vegetable consumption and changes in anthropometric variables in adult populations: A systematic review and meta-analysis of prospective cohort studies. *PloS One* 2015;10(10):e0140846.
14. Yao B, Fang H, Xu W, et al. Dietary fiber intake and risk of type 2 diabetes: A dose-response analysis of prospective studies. *European Journal of Epidemiology* 2014;29(2):79-88.
15. 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.
16. Chowdhury MA, Hossain N, Kashem MA, et al. Immune response in COVID-19: A review. *Journal of Infection and Public Health* 2020;13(11):1619-1629.
17. Health Behaviour Survey 2018/19. Hong Kong SAR: Department of Health, June 2020.
18. Garden-Robinson J. What Color is Your Food? North Dakota State University, August 2016.
19. Yasawardene P, Jayarajah U, De Zoysa I, et al. Mechanisms of star fruit (*Averrhoa carambola*) toxicity: A mini-review. *Toxicon* 2020;187:198-202.

Joyful Fruit Month 2021

The Department of Health had held the annual “Joyful Fruit Day” event since 2006/07 school year to encourage an adequate daily intake of fruit among students, and subsequently upgraded the event to the “Joyful Fruit Month” in the 2012/13 school year. Since then, April has been designated as the “Joyful Fruit Month” every year.

The “Joyful Fruit Month” aims to create a favourable environment that encourages students to develop the habit of eating adequate fruit every day. All schools are encouraged to systematically organise year-round fruit promotion activities to boost students’ and teacher’s interest in eating fruit, and to lift the atmosphere of eating fruit to a climax throughout the “Joyful Fruit Month” in April. For 2021, the slogan-cum-theme for the “Joyful Fruit Month” is “Healthy Fruit for Everyone at Any Time”.

For more details about the “Joyful Fruit Month” and relevant activities, please visit school.eatsmart.gov.hk/fruit.



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. The Editorial Board welcomes your views and comments. Please send all comments and/or questions to so_dp3@dh.gov.hk.

Editor-in-Chief

Dr Rita HO

Members

Dr Patrick CHONG	Dr Ruby LEE
Dr Thomas CHUNG	Dr YC LO
Dr Cecilia FAN	Dr Eddy NG
Dr Raymond HO	Dr Lilian WAN
Mr Kenneth LAM	