

Nutrition and weight management services

A toolkit for pharmacists

2021



FIP Development Goals



International
Pharmaceutical
Federation

Colophon

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Executive summary

A healthy lifestyle, including proper nutrition and adequate physical activity, is essential for optimal health and well-being. It is widely understood that poor or unbalanced diets and a lack of physical activity have a detrimental impact on health worldwide. Not only can these factors lead to the development and progression of several non-communicable diseases, but they can also influence outcomes for those with other medical conditions. In fact, poor diets are ultimately responsible for more deaths than any other behavioural risk factor, including tobacco smoking,¹ and up to five million deaths per year could be prevented if populations were more physically active.² These facts highlight the urgent need for the entire healthcare workforce to be involved in efforts focused on improving nutrition and physical activity, and pharmacists should be actively engaged in these efforts as key members of interprofessional teams.

Pharmacists, while primarily trained to promote health through pharmacologic means, are well-positioned to educate patients on strategies to improve their nutrition and physical activity. Given that patients often have difficulty sustaining lifestyle changes and many may also be unaware of how to appropriately make these changes, pharmacists have a unique opportunity to fill this gap in care. As one of the most accessible healthcare professionals worldwide, community pharmacists are often the healthcare provider that patients see most frequently. Because of this, they may have the most opportunities of any healthcare provider to promote healthy lifestyles and appropriate nutrition choices, through a variety of means, to their patients.

In order to fill this role, pharmacists must be aware that nutrition plays a role in both primary and secondary prevention of a range of non-communicable conditions that are likely present in the communities in which they practise, such as diabetes, cardiovascular conditions and several others.

Additionally, given that poor nutrition often leads to individuals becoming overweight or obese, pharmacists must also be aware of the benefits of regular physical activity as well as strategies to educate their patients and the public on safe, sustainable weight management strategies. While most pharmacists will not necessarily be experts in these areas, having a general understanding of these principles is a necessary first step.

The aim of this toolkit is to equip pharmacists with knowledge in general nutrition and general weight management strategies so they can play an increased role in the communities they serve and support other healthcare providers involved in their patients' care, including general and specialist physicians, nurses, dietitians, nutritionists, dentists etc., and to be proactive in facilitating discussions about nutrition and physical activity with their patients.

Pharmacists across the world are already taking steps to promote healthy lifestyles among their patients through a variety of innovative initiatives, ranging from educational campaigns to more direct patient counselling strategies and programmes. To increase the adoption and delivery of such services, this toolkit aims to provide support and guidance for pharmacists to begin having conversations with their patients regarding appropriate nutrition choices, weight management strategies and the importance of following a healthy lifestyle. Given the immense global health concern that poor nutrition, inadequate physical activity, and overweight and obesity present, pharmacists have an opportunity to make an even greater impact on the health of their communities by involving these considerations as a vital component of their approach to patient care.

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Foreword

By the president of the International Pharmaceutical Federation

In 2018, the World Health Organization (WHO) organised the Global Conference on Primary Health Care in Astana, Kazakhstan, where WHO member states, international agencies and civil society organisations — including FIP — signed the Declaration of Astana, reaffirming their commitment to primary health care as an essential stepping stone towards sustainable and resilient health systems, and universal health coverage.

By signing this declaration, FIP conveyed the commitment of our profession to work towards the provision of primary health care services that are high quality, safe, comprehensive, integrated, accessible, available and affordable for everyone and everywhere. We also committed to provide services that empower and engage individuals and communities in maintaining and enhancing their health and well-being.

As FIP president, I firmly believe that pharmacists — and community pharmacists in particular, considering their position at the heart of each community — are ideally placed to play an important role in disease prevention, health education, early disease screening and patient referral, disease state management and secondary disease prevention, i.e., preventing the aggravation of established diseases.

It is widely known that nutrition and dietary choices are a fundamental pillar of good health.

A poor or unbalanced diet is a risk factor for several non-communicable diseases and other conditions. Also, a diet that is not suitable for a particular type of patient can lead to disease aggravation or complications, ultimately leading to loss of quality of life, fewer life years, additional pressure on health systems and higher health expenditure, both by individuals and health systems.

Pharmacists can play a role in advising on appropriate dietary choices for each type of person, and supporting them in adopting and sustaining lifestyle and dietary changes and informed self-care as part of an interprofessional approach to disease prevention and management in the community.

With this in mind, FIP has developed this new resource for pharmacists and their professional organisations, to support them in implementing and advocating for these roles in their countries around the world.

This toolkit provides an overview of evidence-based dietary options, treatment options and professional services for nutrition-related disease prevention and management, as well as weight-management services by pharmacists.

These services are closely aligned with FIP Development Goal 15 (People-centred care), which aims at developing collaborative interprofessional strategies and people-centred professional services to support the prevention, screening, clinical management and therapeutic optimisation of non-communicable diseases and long-term conditions, including cardiovascular diseases, chronic respiratory conditions (such as asthma and chronic obstructive pulmonary disease, COPD), diabetes, cancer, mental health conditions, dermatological conditions and others. It is also directly linked to several other FIP Development Goals.

I hope this toolkit will be of great value to pharmacists across the world and I encourage you to use it and share it with your colleagues.



Dominique Jordan
President
International Pharmaceutical Federation

1 Background

Pharmacists are highly trained to treat and manage medical conditions using medicines as interventions. However, given their unique position within the healthcare system and the trust placed in them by the public, pharmacists also have a unique opportunity to play a broader role in primary health care and public health, including a major role in prevention of disease. This can include addressing medical conditions by promoting appropriate approaches to nutrition, physical activity and weight management to their patients. It is well known that a poor or unbalanced diet are risk factors for the development and progression of several non-communicable diseases, including obesity and being overweight, and other medical conditions. Further, a diet that is not suitable for a particular patient or medical condition can lead to disease aggravation or complications, ultimately leading to decreased quality of life, loss of functional capacity, additional pressure on health systems, higher health expenditure both by individuals and health systems, and potentially injury or death. Pharmacists can play an important role in advising their patients on appropriate nutrition choices and supporting lifestyle and dietary changes as part of an interprofessional approach to disease prevention and management in the community.

A healthy diet and adequate physical activity can have numerous health benefits and decrease the risk of developing many diseases. However, patients often have difficulty sustaining these lifestyle changes and many may also be unaware of how to appropriately make these changes. Poor diets are ultimately responsible for more deaths than any other behavioural risk factor, including tobacco smoking,¹ which showcases the importance of ensuring patients make these lifestyle changes if needed. It is further estimated that, in 2017, 11 million deaths and 255 million disability-adjusted life years (DALYs) were attributable to dietary risk factors, including high sodium intake, and low intake of whole grains and fruits. By addressing these dietary risk factors, one in every five deaths globally could be prevented.¹ The World Health Organization (WHO) estimates that approximately 16 million DALYs and 1.7 million deaths worldwide can be attributed specifically to low fruit and vegetable consumption. This lack of fruit and vegetable consumption also leads to around 14% of gastrointestinal cancer deaths, 11% of ischaemic heart disease deaths and around 9% of stroke deaths globally.³ These facts highlight the urgent need for the entire healthcare workforce to focus their efforts on improving nutrition, and pharmacists should be actively participating in these efforts.

This toolkit provides suggestions and guidance for pharmacists on how to improve their patients' health through nutrition for a variety of medical conditions, including non-communicable diseases, communicable diseases and situations such as pregnancy. It also provides general guidance regarding weight management strategies. Throughout this toolkit, various dietary considerations will be presented. However, these considerations can have different interpretations and may need to be adapted for different population groups, including religious groups, or those with certain dietary restrictions, such as those with food intolerances or those who are vegetarian or vegan. It is not within the scope of this toolkit to provide specific guidance for all these groups, but general guidance will be presented that can be adapted to various situations as needed.

1.1 Pharmacists' role in healthy lifestyle promotion

Community pharmacists are one of the most accessible health professionals worldwide. They are well-positioned and optimally trained to promote healthy lifestyles among their patients, with a focus on nutrition and weight management. Community pharmacists have the benefit of being trusted by the communities they serve and are often members of those communities themselves. This trusting relationship, coupled with patients frequently visiting the pharmacy to obtain medicines, means that pharmacists have an opportunity to promote and educate their patients regarding proper nutrition, weight management, and physical activity and help them sustain these changes. With a global shortage of healthcare workers that is estimated to reach 15 million by 2030, it is more important than ever that pharmacists are working to their fullest potential to improve health and support the efforts of other members of the healthcare team.⁴

In order to facilitate discussions with patients regarding appropriate nutrition choices, pharmacists must have a general understanding of the nutritional requirements for various medical conditions and situations. Pharmacists should also consider how the needs of each individual patient, including their medical history, current lifestyle, food intolerances or allergies, and willingness to change their diet, may play a role in their diet. Based on this information, pharmacists can provide patients with general nutrition recommendations and direct them to reputable resources to learn more. For complex patients or patients who may require specialist care, pharmacists can introduce concepts on the importance of nutrition and then provide referrals to appropriate specialists, such as nutritionists or dieticians.

Additionally, given that poor nutrition often leads to individuals becoming overweight or obese, pharmacists can also educate their patients about the importance of regular physical activity and provide guidance on

steps to lose weight in a healthy, sustainable way. This can be done in collaboration with the patient's physician, nutritionist, dietician or other healthcare professionals, but a pharmacist is well qualified to support the nutrition and weight loss goals developed by these healthcare professionals and assist the patient in losing weight and maintaining a healthy lifestyle. Pharmacists can identify medicines that may be contributing to weight gain, or those that may be making it difficult to lose weight. They can also meet with patients during their regular visits to the pharmacy to provide motivational counselling to ensure they are continuing their efforts to improve their diet, increase their physical activity and achieve their weight loss goals.

Ultimately, poor or unbalanced diets and a lack of physical activity have an immense impact on health around the world, contribute to the development of diseases and cause many preventable deaths every year. These risk factors need to be targeted from all sides of the healthcare system and pharmacists must be a key part of these efforts. While these factors are most commonly associated with non-communicable diseases, pharmacists must also consider how they influence other diseases, including communicable diseases, and special populations, such as pregnant women and the elderly.

Finally, while pharmacists have an important role to play in promoting nutrition, physical activity, and weight management, it is important that these services do not take place in a silo. Pharmacists should endeavour to always collaborate with other healthcare providers and ensure a multidisciplinary approach to nutrition and weight management is taken, for the ultimate benefit of the patient.

1.2 World Health Organization's general nutrition guidance

When discussing healthy dietary choices with patients, pharmacists should consider that the WHO broadly recommends that a healthy diet for adults include the following:⁵

- Fruit, vegetables, legumes (e.g., lentils and beans), nuts and whole grains (e.g., unprocessed maize, millet, oats, wheat, and brown rice).
- At least 400g (i.e., five portions) of fruit and vegetables per day, excluding potatoes, sweet potatoes, cassava and other starchy roots.
- Less than 10% of total energy intake from free sugars, which is equivalent to 50g (or about 12 level teaspoons) for a person of healthy body weight consuming about 2,000 calories per day, but ideally is less than 5% of total energy intake for additional health benefits.
 - Free sugars are all sugars added to foods or drinks by the manufacturer, cook or consumer, as well as sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates.
- Less than 30% of total energy intake from fats.
 - Unsaturated fats (found in fish, avocado and nuts, and in sunflower, soybean, canola and olive oils) are preferable to saturated fats (found in fatty meat, butter, palm and coconut oils, cream, cheese, ghee and lard) and trans-fats of all kinds, including both industrially produced trans-fats (found in baked and fried foods, and pre-packaged snacks and foods, such as frozen pizza, pies, cookies, biscuits, wafers, and cooking oils and spreads) and ruminant trans-fats (found in meat and dairy foods from ruminant animals, such as cows, sheep, goats and camels).
 - It is suggested that the intake of saturated fats be reduced to less than 10% of total energy intake and trans-fats to less than 1% of total energy intake. In particular, industrially produced trans-fats are not part of a healthy diet and should be avoided.
- Less than 5g of salt per day. Salt should be iodised.
 - WHO member states have agreed to reduce the global population's salt intake by 30% by 2025.

Fruits and vegetables

- Eating at least 400g, or five portions, of fruit and vegetables per day reduces the risk of non-communicable diseases and helps ensure an adequate daily intake of dietary fibre.
- To improve intake:
 - Always include vegetables in meals;
 - Eat fresh fruit and raw vegetables as snacks;
 - Eat fresh fruit and vegetables that are in season; and
 - Eat a variety of fruit and vegetables.

Fats

- Reduce total fat intake to less than 30% of total energy intake to prevent unhealthy weight gain.
- The risk of developing non-communicable diseases is lessened by:
 - Reducing saturated fats to less than 10% of total energy intake;
 - Reducing trans-fats to less than 1% of total energy intake; and
 - Replacing both saturated fats and trans-fats with unsaturated fats — in particular, with polyunsaturated fats.
- To reduce fat intake:
 - Replace butter, lard and ghee with healthier fats like olive, soy, sunflower or corn oil when cooking;
 - Select low-fat or reduced-fat versions of milk and dairy products;
 - Choose white meats like poultry and fish which are generally lower in fats than red meat, trim meat of visible fat and limit the consumption of processed meats;⁶
 - Steam or boil instead of frying when cooking; and
 - Limit the consumption of baked and fried foods, and pre-packaged snacks and foods (e.g., doughnuts, cakes, pies, cookies, biscuits and wafers) that contain industrially produced trans-fats.

Salt, sodium, and potassium

- High sodium and low potassium intake can contribute to high blood pressure. Reducing salt intake to less than 5g per day (equivalent to 2g of sodium) could prevent 1.7 million deaths each year.
- To reduce salt intake:
 - Limit the amount of salt and high-sodium condiments (e.g. soy sauce, fish sauce and bouillon) when cooking and preparing foods;
 - Do not have salt or high-sodium sauces on the table;
 - Limit the consumption of salty snacks; and
 - Choose products with lower sodium content.
- To increase potassium intake:
 - Consume fresh fruit and vegetables.

Sugars

- In adults and children, the total intake of sugars should be less than 10% of total energy intake, with a reduction to less than 5% providing additional health benefits.
- To reduce intake:
 - Limit the consumption of foods and drinks containing high amounts of sugars, such as sugary snacks, candies and sugar-sweetened beverages (i.e., all types of beverages containing free sugars — these include carbonated and non-carbonated soft drinks, certain fruit or vegetable juices and drinks, liquid and powder concentrates, flavoured water, energy and sports drinks, ready-to-drink tea, ready-to-drink coffee and flavoured milk drinks); and
 - Eat fresh fruit and raw vegetables as snacks instead of sugary snacks.

1.3 World Health Organization’s general physical activity guidance

When discussing physical activity with patients, pharmacists should consider that the WHO recommends adults aged 18–64 years do the following:²

- At least 150–300 minutes of moderate-intensity aerobic physical activity per week, or at least 75–150 minutes of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity throughout the week.
- Muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on two or more days a week.
- Limit the amount of time spent being sedentary.

- Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.
- For additional benefits:
 - Increase moderate-intensity aerobic physical activity to more than 300 minutes;
 - Or do more than 150 minutes of vigorous-intensity aerobic physical activity;
 - Or an equivalent combination of moderate- and vigorous-intensity activity throughout the week.

To help reduce the detrimental effects of high levels of sedentary behaviour on health, all adults and older adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.

For adults aged 65 years and older, consider also recommending exercises that emphasise functional balance and strength training at moderate or greater intensity on three or more days of the week, in order to enhance functional capacity and prevent falls.²

2 Non-communicable diseases

Non-communicable diseases (NCDs) are the leading cause of deaths globally and broadly include four major disease states for which nutrition and dietary choices are a significant risk factor: cardiovascular diseases, diabetes, cancer and chronic respiratory diseases. According to the WHO, nearly 71% of annual global deaths, or 41 million, are due to NCDs. Among these deaths, 15 million occur in those between 30 and 69 years of age and over 85% of these premature deaths occur in low- and middle-income countries (LMICs).⁷ Poor diets are one of the biggest contributors to the high NCD burden globally, and they are the first or second biggest contributor to NCD disease burden in each of the six WHO regions.⁸

As the incidence of poor or unbalanced diets continues to rise, so will the global burden of NCDs. As this burden grows, it is necessary for the pharmacy profession to be prepared to prevent and manage these conditions not only through pharmacological means, but also through other approaches, including nutrition and weight management services. While there are many risk factors that lead to the development and progression of NCDs, a healthy diet and adequate physical activity can significantly mitigate the impact of these diseases. Community pharmacists have a unique opportunity to address this global health priority by educating themselves and their patients on the benefits of proper nutrition and physical activity for their specific condition. It is important to note that while the WHO presents general guidelines for a healthy diet, each NCD has additional, unique considerations that must come into play when considering what a healthy, appropriate diet would look like for an individual patient.

2.1 Cardiovascular diseases

2.1.1 Background

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels, and include:⁹

- Hypertension (high blood pressure);
- Coronary heart disease (and heart attack);
- Cerebrovascular disease (and stroke);
- Peripheral vascular disease;
- Heart failure;
- Rheumatic heart disease;
- Congenital heart disease; and
- Cardiomyopathies.

CVDs are the number one cause of deaths globally, resulting an estimated 17.9 million deaths every year and representing 31% of all deaths globally. Four out of five of these CVD deaths are due to heart attacks and strokes, and one third of these deaths occur prematurely in people younger than 70 years old. Heart attacks and strokes are most likely to occur in individuals with certain behavioural risk factors, including tobacco use, harmful use of alcohol, physical inactivity and unhealthy diet. These risk factors can then lead to individuals developing high blood pressure, high blood glucose or blood lipids, and becoming overweight or obese, which can, in turn, increase an individual's risk of having a severe health event, including a heart attack, stroke or other complication.¹⁰

Hypertension and high cholesterol are common conditions found throughout the world. Hypertension, specifically, affects an estimated 1.13 billion people throughout the world and less than one in five of these individuals have their blood pressure adequately controlled.¹¹ Further, hypertension and high cholesterol, as well as the above behavioural risk factors, have been shown to account for most of the risk of having a heart attack or stroke.^{12, 13} Therefore, efforts must be made to address these risk factors in order to reduce the global impact of CVDs.

Pharmacists have an opportunity to help address the growing burden of CVDs by working with their patients to help them improve their diets and increase their physical activity. Of the many types of CVDs, pharmacists can have the biggest impact on their patients' health by addressing disease states that occur as a result of behavioural risk factors: hypertension and high cholesterol. Dietary choices and physical activity can have a significant impact on these two conditions and pharmacists are well-positioned to promote lifestyle changes to their patients.

2.1.2 Dietary considerations

2.1.2.1 Mediterranean diet

The Mediterranean diet is a well-researched dietary approach that can be promoted to patients to improve their health and wellbeing. The Mediterranean diet originated in the olive-growing areas of the Mediterranean region and still has a strong cultural association with these areas. While definitions vary, the Mediterranean diet is generally characterised by a “high intake of plant-based foods (fruit, vegetables, nuts and cereals) and olive oil; a moderate intake of fish and poultry; a low intake of dairy products (principally yoghurt and cheese), red meat, processed meats and sweets (for which fresh fruit is often substituted); and a moderate wine intake, normally consumed with meals”.¹⁴

There are also social and cultural factors associated with the Mediterranean diet, including longer mealtimes, post-meal siestas, regular physical activity and shared eating practices. See Appendix 1 for the Mediterranean diet pyramid, which was developed and designed by the Mediterranean Diet Foundation, in collaboration with international organisations and experts from around the world. The pyramid not only includes recommendations regarding dietary choices, but also includes social and cultural elements to reflect the Mediterranean way of life.¹⁵ The foundation has also developed 10 recommendations to support the adoption of the Mediterranean diet (Table 1).

Table 1: Mediterranean Diet Foundation’s 10 basic recommendations¹⁶

Recommendation	Justification
Use olive oil as your main source of added fat	This is the most widely used oil in Mediterranean cuisine. It is rich in vitamin E, beta-carotenes and a type of vegetal fat (monounsaturated) that helps prevent cardiovascular diseases. It represents a treasure in the Mediterranean diet and has remained through centuries among regional gastronomical traditions, conferring on dishes unique tastes and aromas.
Eat plenty of fruits, vegetables, legumes and nuts	Fruits and vegetables are a main source of vitamins, minerals and fibre in our diets and they also provide us with a large amount of water. It is very important to consume five servings of fruits and vegetables daily. Thanks to their elevated content of antioxidants and fibre, they can contribute to prevent various cardiovascular diseases and certain cancers, among other conditions.
Bread and other grain products (pasta, rice, and whole grains) should be a part of your everyday diet	Daily consumption of pasta, rice and grain products in general is essential due to their high content in carbohydrates. They provide us with an important amount of energy needed for our daily activities. Keep in mind that whole grain products provide more fibre, vitamins and minerals.
Foods that have undergone minimal processing, that are fresh and locally produced are best	It is important to take advantage of in-season products since they are at their best in terms of nutrients, aroma and flavour.
Consume dairy products daily, mainly yoghurt and cheese	Dairy products are excellent sources of proteins, minerals (calcium, phosphorus, etc.) and vitamins. Fermented dairy products (yoghurt, bio, etc.) are associated with health benefits since they contain live microorganisms capable of improving the balance of our intestinal microflora.
Red meat should be consumed in moderation and, if possible, as part of stews and other recipes*	Processed meat should be consumed in small amounts and as a part of sandwiches or other dishes. Meat contains proteins, iron and animal fat in variable quantities. An excessive intake of animal fat is not healthy. Therefore, small amounts of meat are recommended, lean meat whenever possible and as a part of a dish with a cereal and vegetable base.
Consume fish abundantly and eggs in moderation	It is recommended to consume fatty (dark meat) fish at least once or twice a week since its fat — even though of animal origin — has properties quite similar to those of vegetable origin which are known to protect against heart disease. Eggs are rich in high quality proteins, fat and many vitamins and minerals that make them a very complete food item. Eating eggs three or four times a week is a good alternative to fish and meat.
Fresh fruit should be your everyday dessert, and sweets, cakes and dairy desserts should be consumed only on occasion	Fresh fruit should be our usual dessert, before sweets and pastries. Fruits are highly nutritious and bring colour and flavour to our diet as well as being a healthy snack alternative.

Recommendation	Justification
Water is the beverage par excellence in the Mediterranean diet	Water is fundamental to our diet. Wine should be taken in moderation and with meals. Wine is a traditional part of the Mediterranean diet that can provide health benefits, but it must be taken as a part of a balanced diet.
Be physically active every day, since it is just as important as eating well	Keeping physically fit and doing physical activity adapted to our needs every day is key in keeping healthy.

**The International Agency for Research on Cancer classifies processed meats as Group 1, carcinogenic to humans, and red meat as Group 2A, probably carcinogenic to humans. Therefore, it is recommended that individuals limit their consumption of these meats to small amounts.¹⁷*

The Mediterranean diet has numerous health benefits, but the most widely researched benefits surround the protective benefits of the diet against CVD, likely due to improvements in blood lipid profiles as well as reduction of blood pressure, insulin resistance, and serum markers of inflammation.¹⁸⁻²⁰ Of note is that this diet has also been shown to reduce the incidence of CVD in non-Mediterranean populations, with higher adherence to the diet showing greater cardiovascular benefits.²¹ Research also suggests that individuals at high cardiovascular risk may benefit from reduced incidence of cardiovascular events if they are following a Mediterranean diet supplemented with extra virgin olive oil or nuts compared with those on a reduced-fat diet.²²

Specifically, the Mediterranean diet has been inversely associated with stroke risk.²³ In all, a critical review of the Mediterranean diet concludes that available evidence for the diet is “large, strong, and consistent” and that better adherence to the diet is associated with better cardiovascular outcomes, including reductions in coronary heart disease, ischaemic stroke and total CVD.²⁴ For more information on how to adapt the Mediterranean diet to various regions of the world, you can refer to Online Table 1 in a 2015 report entitled “Food consumption and its impact on cardiovascular disease: Importance of solutions focused on the globalized food system: A report from the workshop convened by the World Heart Federation”, cited here.²⁵

2.1.2.2 DASH diet

Another commonly recommended dietary approach for individuals with cardiovascular disease, especially hypertension, is the DASH (Dietary Approaches to Stop Hypertension) diet. This diet was developed in 1997 and emphasises eight components: high consumption of fruits, vegetables, whole grains, low-fat dairy foods, legumes and nuts, and low intake of sodium, sweetened beverages, and red and processed meats.

Individuals who follow the DASH diet have lower blood pressure as well as decreased risk of stroke, especially those with high adherence to the diet.^{26, 27} Additional studies have found that even modest adherence to the DASH diet is associated with lower risk of mortality from CVD, cancers, stroke and all-causes with increased adherence strengthening this association.²⁸ Further, by coupling the DASH diet with reduced sodium intake, there are even greater effects on blood pressure.²⁹ Therefore, given the proven benefits of the DASH diet on hypertension and other CVDs, pharmacists have an opportunity to promote this dietary pattern to their patients. However, it is important to note that individuals with hypertension and/or diabetes may require more tailored nutritional advice before commencing the DASH diet as the recommended daily intake of fruits may be too high for some individuals with diabetes.

There are many existing tools available to help guide patients into adopting this dietary pattern; however, broadly, recommended daily intakes for the DASH diet can be seen in Table 2.

Table 2: DASH eating plan general guidance³⁰

Food group	Daily servings	Serving sizes (1 oz=28.3g; 1 cup=237ml; 1 tsp=4.93ml; 1 tbsp=14.70ml)
Grains	6-8	1 slice bread 1 oz dry cereal ½ cup cooked rice, pasta or cereal (Whole grains are recommended for most grain servings as a good source of fibre and nutrients)
Vegetables	4-5	1 cup raw leafy vegetable ½ cup cut-up raw or cooked vegetable ½ cup vegetable juice

Food group	Daily servings	Serving sizes (1 oz=28.3g; 1 cup=237ml; 1 tsp=4.93ml; 1 tbsp=14.70ml)
Fruits	4-5	1 medium fruit ¼ cup dried fruit ½ cup fresh, frozen, or canned fruit ½ cup fruit juice
Fat-free or low-fat milk and milk products	2-3	1 cup milk or yogurt 1 ½ oz cheese
Lean meats, poultry, and fish	6 or fewer	1 oz cooked meats, poultry, or fish 1 egg
Nuts, seeds, and legumes	4-5 per week	¼ cup or 1 ½ oz nuts 2 tbsp peanut butter 2 tbsp or ½ oz seeds ½ cup cooked legumes (dry beans and peas)
Fats and oils	2-3	1 tsp soft margarine 1 tsp vegetable oil 1 tbsp mayonnaise 2 tbsp salad dressing (Ensure fats and oils being consumed or recommended do not contain harmful trans fats.) ³¹
Sweets and added sugars	5 or fewer per week	1 tbsp sugar 1 tbsp jelly or jam ½ cup sorbet, gelatine 1 cup lemonade

Additional resources and information, including sample weekly meal plans, are cited here.^{30,32}

When promoting the DASH diet to patients, pharmacists should recommend that patients take small steps and change their diet gradually. Pharmacists can also remind patients that their daily diet may not always align directly with the recommended serving sizes, some days may be more, and others may be less; however, as long as the average of several days are close to the DASH diet recommendations, it will still benefit their health.

2.1.2.3 Sodium/potassium intake

High levels of sodium intake (>2g/day or 5g salt/day) and low levels of potassium intake (less than 3.5g/day) can contribute to increased blood pressure and a subsequent increased risk of other CVDs, including heart attacks and stroke.

Many people consume too much salt, with average levels of 9–12g per day. By reducing salt intake to less than 5g per day, around 2.5 million lives will be saved every year. Reduced salt intake has been shown as one of the most cost-effective interventions to improve public health. By 2025, WHO member states have pledged to reduce global consumption of salt by 30%.

Salt, the main dietary source of sodium, can be found in processed foods (pre-made meals, processed meats such as bacon, ham, and salami, salty snack foods, instant noodles, etc.) and can also be added to food during cooking (bouillon, stock cubes) or at the table (soy sauce, fish sauce, table salt). In fact, in many countries, about 80% of salt intake in a person's diet comes from processed foods. Because sodium is found so commonly in foods that are eaten every day, and these foods often do not taste salty, it is easy to see how many individuals are consuming sodium at levels that are higher than the recommended amount.³³ Pharmacists can promote decreased salt intake by recommending the following:^{34,35}

At home —

- Avoid, or use very small amounts, of salt during food preparation, instead, focus on using other spices;
- Remove saltshakers from the table where meals are eaten;
- Limit the consumption of salty snacks;
- Eat more fruits and vegetables;
- Drain and rinse canned beans and vegetables before cooking to reduce the amount of sodium; and
- If not able to immediately transition to no sodium, recommend halving salt intake or combined low sodium with regular versions of the same food (e.g., soups, pasta sauces, etc.).

When grocery shopping —

- Choose products with lower sodium content when available (“low” or “reduced” sodium or “no salt added”);
- Look closely at food labels and compare the amount of sodium in different products;
- Check the amount of sodium per serving, as well as the number of servings per container;
- Buy fresh, frozen or canned vegetables with no salt or sauce added; and
- When possible, purchase fresh poultry, fish, pork and lean meat instead of cured, salted, smoked or other processed meats.

Potassium is an essential nutrient that is needed to maintain total body fluid volume, acid and electrolyte balance, and normal cell function. Potassium can be found in unprocessed foods, especially fruits and vegetables. However, diets that are high in processed foods and low in fruits and vegetables can also be low in potassium. Low potassium can lead to increased blood pressure.

Studies have shown that the greatest impact on decreasing blood pressure and protecting against CVDs, including stroke, can be seen when potassium intake is approximately 90–120mmol/day. Ultimately, the WHO, recommends an intake level of at least 90mmol/day because there is limited evidence regarding the precise level of potassium that will result in maximum benefits. The WHO further recommends that potassium be consumed through food. Examples of these foods and their approximate potassium content can be seen in Table 3.

Table 3: WHO examples of potassium-containing foods³⁶

Food group	Approximate potassium content (mg/100g fresh weight)	Examples
Beans and peas	1,300	Cowpeas, pigeon peas, lima beans, African yam beans
Nuts	600	Hazelnuts, walnuts, cashew nuts, Brazil nuts
Green vegetables	550	Spinach, cabbage, parsley
Root vegetables	200	Carrots, onions, beetroot
Other vegetables	300	Tomatoes, cucumbers, pumpkins
Fruits	300	Bananas, papayas, dates

The information in this table is based on approximate calculations of the average potassium content from an example of foods within each food group from food composition databases from around the globe. The potassium content varies within the food groups. Thus, the information provided can be used only for approximate comparisons of various food groups and should not be used to estimate daily intake.

2.1.2.4 Dietary fats

Dietary fats are another important consideration for those with or at risk of cardiovascular disease, especially as they pertain to cholesterol. The WHO broadly recommends that total fat intake is restricted to less than 30% of total energy intake, with saturated fats being less than 10% and trans fats being less than 1%. The WHO also recommends replacing both saturated fats and trans fats with unsaturated fats, in particular, with polyunsaturated fats.⁵ There can be considerable confusion among patients regarding dietary fats and whether they should be included in their diet. There is also continued discussion regarding the role of specific types of fats to be included in the diet, and in what amounts, among experts in the scientific literature. However, despite this, fats are an important component of our daily dietary intake and this section will broadly outline the three main dietary sources of fats: saturated fats, unsaturated fats, and trans fats.

Saturated fats are primarily found in animal products, such as dairy, meat and poultry, and are typically solid fats that you can see in the foods you eat. Saturated fats are associated with increased low-density lipoprotein (LDL) cholesterol, which is a leading cause of atherosclerosis. There is significant evidence to support recommendations to limit saturated fats in the diet and to replace them with unsaturated, specifically polyunsaturated, fats as often as possible, as this can contribute to reducing the risk of coronary heart disease events and CVD mortality.³⁷ Replacing saturated fats with monounsaturated or polyunsaturated fats has also been shown to decrease LDL cholesterol and triglycerides and is associated with lower rates of CVD and all-cause mortality.

Overall, polyunsaturated fats from vegetable oils appear to reduce CVD somewhat more than monounsaturated fat when replacing saturated fat in the diet.³⁸ Further, a recent systematic review found that reducing saturated fat in the diet led to a 21% reduction in the risk of CVD, including heart disease and

stroke, but found no effect on the risk of dying. Greater decreases in saturated fat were associated with greater decreases in cholesterol. Of note, people who are healthy appeared to benefit from this reduction as much as those at increased risk for heart disease or stroke, including those with hypertension, high cholesterol or diabetes.³⁹

- Examples of foods high in saturated fat:
 - Fatty beef, lamb, pork, poultry with skin, beef fat (tallow), lard and cream, butter, cheese, and other dairy products made from whole or reduced fat (2%) milk;
 - Many baked goods and fried foods; and
 - Some plant-based oils, such as palm oil, palm kernel oil and coconut oil.⁴⁰

Unsaturated fats include both monounsaturated and polyunsaturated fats. These are typically found in plants and seafood and are usually liquid at room temperature as oils. Exceptions to this include certain tropical plant oils that are high in saturated fats (coconut, palm and palm kernel) and partially hydrogenated oils (a source of industrially produced trans fats). Diets where unsaturated fats, especially polyunsaturated fats, replace saturated fats are associated with reduced total cholesterol and LDL cholesterol, which also reduces the risk of developing CVD.

- Examples of foods high in monounsaturated fats:
 - Avocados, mayonnaise and oil-based salad dressings, nuts (such as almonds, hazelnuts, peanuts and pecans), olives, seeds (such as pumpkin and sesame seeds), soft margarine (liquid, spray and tub), vegetable oils (such as canola, olive, peanut, sesame and safflower oils).
- Examples of foods high in polyunsaturated fats:
 - Fish (such as herring, mackerel, salmon, trout and tuna), mayonnaise and oil-based salad dressings, nuts (such as pine nuts and walnuts), seeds (such as flax, pumpkin, sesame and sunflower seeds), soft margarine (liquid, spray, and tub), vegetable oils (such as corn, cottonseed, soybean and sunflower oils).⁴¹

There are two main sources of trans fats: natural sources (in the dairy products and meats of ruminants such as cows and sheep) and industrially produced sources (partially hydrogenated oils). These partially hydrogenated oils were originally introduced to replace butter and are primarily used for deep frying and as an ingredient in baked goods. While trans fats are easy to use, inexpensive and increase the shelf life of products, research has shown that they can be extremely detrimental to health. Currently, the WHO recommends that total daily trans fat intake is limited to less than 1% of total energy intake per day, but they have implemented an initiative to eliminate industrially produced trans fats from the global food supply. They estimate that every year, trans fat intake leads to more than 500,000 deaths due to cardiovascular disease. This is because trans fats increase LDL cholesterol, decrease high-density lipoprotein (HDL) cholesterol, and increase the risk of heart disease by 21% and deaths by 28%.⁴² Further, a 2% absolute increase in energy intake from trans fats has been associated with a 23% increase in cardiovascular risk. High intake of trans fats can also increase the incidence of cancer and diabetes, among other health conditions.⁴³ In all, patients should be highly encouraged to avoid intake of trans fats as much as possible and to review the nutrition labels of foods they purchase and consume to identify if trans fats are present.

- Examples of foods with trans fats:
 - Baked goods, such as cakes, cookies and pies, shortening, microwave popcorn, frozen pizza, refrigerated dough, such as biscuits and rolls, fried foods, including French fries, doughnuts and fried chicken, non-dairy coffee creamer and margarine.⁴⁴

2.2 Diabetes

2.2.1 Background

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin, or when the body cannot make good use of the insulin it produces. Insulin is a hormone that regulates blood glucose. Not being able to produce insulin, or use it effectively, leads to raised glucose levels in the blood (known as hyperglycaemia). Over the long-term, high glucose levels can lead to damage of the body and failure of various organs and tissues.

There are two main types of diabetes: type 1 and type 2. With type 1 diabetes, the body is unable to produce adequate amounts of insulin and, therefore, the individual must administer insulin on a daily basis. There is no known cause or cure for type 1 diabetes.⁴⁵ Type 2 diabetes occurs when the body is not able to effectively use or respond to insulin and is the most common type of diabetes, representing about 90% of all diabetes

cases. Type 2 diabetes is most commonly found in older adults but is increasingly being seen in children and adolescents as a result of rising levels of obesity, physical inactivity and poor diet worldwide.⁴⁶

According to the International Diabetes Federation, there are approximately 463 million adults, aged 20–79 years, living with diabetes globally and this number is expected to rise to 700 million by 2045. Of adults living with diabetes, 79% live in low- and middle-income countries and one in five are above 65 years old. Diabetes also causes approximately 4.2 million deaths annually. The growing number of cases and deaths due to diabetes is contributing to increased healthcare expenditures, with diabetes causing at least USD 760 billion in healthcare expenditures in 2019, which amounts to 10% of total global health spending on adults.⁴⁷ Given that diabetes is a leading cause of death and a major cause of blindness, kidney failure, heart attack, stroke and lower limb amputation, it is imperative to take steps to reduce rates of the disease, specifically type 2 diabetes.⁴⁵

Of further concern, it is estimated that one in two people with diabetes are undiagnosed and more than 374 million people are at increased risk of developing type 2 diabetes. People with type 2 diabetes almost always have prediabetes first, but this usually does not cause symptoms. Consequently, millions of people over the age of 20 years have prediabetes, but 90% are not aware of this. Prediabetes treatment can prevent more serious health problems, including type 2 diabetes and problems with the heart, blood vessels, eyes and kidneys.⁴⁷

Therefore, pharmacists have an opportunity to not only promote healthy lifestyles among their patients with prediabetes and diabetes, but also to screen patients for prediabetes and diabetes and, if elevated blood glucose levels are detected, refer them to a physician for treatment to prevent any subsequent health problems. The WHO considers a patient to have diabetes if they have:

- Fasting plasma glucose values of ≥ 7.0 mmol/l (126 mg/dl);
- Two-hour post-load plasma glucose ≥ 11.1 mmol/l (200 mg/dl);
- Haemoglobin A1c (glycated haemoglobin, or HbA1c) $\geq 6.5\%$ (48 mmol/mol); or
- A random blood glucose ≥ 11.1 mmol/l (200 mg/dl) in the presence of signs and symptoms.

If elevated levels of any of these tests are detected in a patient without symptoms, it is recommended that the same test is repeated as soon as possible on a future day to confirm the diagnosis. However, pharmacists may prefer to refer the patient to a physician for confirmatory testing and diagnosis if one test shows elevated values.⁴⁸

To manage and prevent type 2 diabetes, pharmacists should promote healthy lifestyles among their patients, including healthy diets, adequate physical activity and a healthy body weight. The International Diabetes Federation says that a majority of cases of type 2 diabetes could be delayed or prevented through healthy diet and regular physical activity.

The International Diabetes Federation further recommends that individuals do physical activity between three to five days a week, for a minimum of 30–45 minutes, as regular physical activity is essential to help keep blood glucose levels under control. Physical activity is most effective when it includes a combination of both aerobic (e.g., jogging, swimming, cycling) exercise and resistance training, as well as reduced amounts of time spent being inactive. As for diet, it is broadly recommended that all people with diabetes follow a healthy diet that includes reducing the intake of calories if the patient is overweight or obese, replacing saturated fats (e.g., cream, cheese, butter) with unsaturated fats (e.g., avocado, nuts, olive, and vegetable oils), eating dietary fibre (e.g., fruit, vegetables, whole grains), and avoiding tobacco use, excessive alcohol and added sugar.

The American Diabetes Association and the European Association for the Study of Diabetes also note in a consensus statement on the management of hyperglycaemia that there is no single ratio of carbohydrates, proteins and fats that is optimal for every person with type 2 diabetes. Instead, they recommend individualised dietary approaches that “emphasise foods of demonstrated health benefit, that minimise foods of demonstrated harm, and that accommodate patient preference and metabolic needs, with the goal of identifying healthy dietary habits that are feasible and sustainable”.⁴⁹

In all, pharmacists have an opportunity to promote non-pharmacological strategies to prevent and manage type 2 diabetes among their patients, including diet and nutrition, in addition to screening patients for elevated blood glucose levels and referring them to appropriate care, if needed.⁴⁶ Various studies have shown that patients with diabetes, specifically type 2 diabetes, require reinforcement of diabetes education, including dietary management, from a variety of healthcare stakeholders in order to facilitate their understanding of the disease and to improve outcomes. Therefore, pharmacists have an opportunity to reinforce the recommendations made by a patient’s other healthcare providers to appropriately manage their diabetes.⁵⁰ While no specific dietary approach will work for all patients with diabetes, this section will explore some of the most common dietary approaches for individuals with diabetes.

2.2.2 Dietary considerations

2.2.2.1 Diabetes prevention

The World Health Organization and the Food and Agriculture Organization recommend the following for the prevention of type 2 diabetes:⁵¹

- Limit saturated fatty acid intake to less than 10% of total energy intake. For high-risk groups, limit to less than 7%.
- Minimum daily intake of 20g of dietary fibre through regular consumption of wholegrain cereals, legumes, fruits and vegetables.
- Reduce the intake of free sugars to less than 10% of total energy intake. A further reduction to below 5% could have additional health benefits.⁵²
- Maintain an optimum body mass index (BMI) at the lower end of the normal range. For the adult population, this means maintaining a mean BMI in the range 21–23kg/m² and avoiding weight gain (>5kg) in adult life.
- Voluntary weight reduction in overweight or obese individuals with impaired glucose tolerance (although screening for such individuals may not be cost-effective in many countries).
- Practising an endurance activity at moderate or greater level of intensity (e.g., brisk walking) for one hour or more per day on most days per week.

The International Diabetes Federation also provides the following recommendations for the general population to prevent type 2 diabetes:⁵³

- Choosing water, coffee or tea instead of fruit juice, soda, or other sugar-sweetened beverages.
- Eating at least three servings of vegetables every day, including green leafy vegetables.
- Eating up to three servings of fresh fruit every day.
- Choosing nuts, a piece of fresh fruit, or unsweetened yoghurt for a snack.
- Limiting alcohol intake to a maximum of two standard drinks per day.
- Choosing lean cuts of white meat, poultry or seafood instead of red or processed meat.
- Choosing peanut butter instead of chocolate spread or jam.
- Choosing whole-grain bread, rice or pasta instead of white bread, rice or pasta.
- Choosing unsaturated fats (olive oil, canola oil, corn oil, or sunflower oil) instead of saturated fats (butter, ghee, animal fat, coconut oil or palm oil).

2.2.2.2 Mediterranean diet

The Mediterranean Diet (explained further in section 2.1.2.1) has been shown to benefit patients with type 2 diabetes and has been associated with improvements in glycaemic control, cardiovascular risk factors and body weight in multiple meta-analyses.^{54,55} Another network meta-analysis compared nine dietary approaches and found that the Mediterranean diet was the most effective in improving glycaemic control in patients with type 2 diabetes.⁵⁶

2.2.2.3 Glycaemic index

Glycaemic index (GI) is used to measure how carbohydrates affect blood glucose levels. All carbohydrates are digested and absorbed at different rates and the GI is a way to represent how quickly a carbohydrate-based food or drink will raise blood glucose levels after it is ingested. The GI runs from 0 to 100 and typically uses pure glucose, with a GI of around 100, as a reference. Carbohydrates that are slowly absorbed have a low GI of 55 or below.⁵⁷ High GI carbohydrates cause blood glucose levels to spike and crash, whereas low GI carbohydrates cause blood glucose to be slowly released into the bloodstream. GI values are determined through scientific methods and cannot be estimated based on the composition of the food or nutrition information on food packaging.⁵⁸ A low-GI diet has been shown to be beneficial for people with diabetes, especially type 2 diabetes, but focusing only on the GI of foods can lead to an unbalanced diet that is high in fat and calories. This is due to the fact that fat lowers the GI of foods; for example, chocolate has a low GI. Protein also lowers the GI of foods, with milk and other dairy products having low GI due to their high protein and fat content.⁵⁷ A few examples of foods and their GIs are listed here:⁵⁹

- High glycaemic index (>70) — white rice, white bread, potatoes, rice cakes.
- Moderate glycaemic index — brown rice, brown bread, sweet potatoes, bananas.
- Low glycaemic index (<55) — mushrooms, milk, apples, peanuts.

Research supports the effectiveness of a low-GI diet for individuals with diabetes. A systematic review and meta-analysis of 54 studies showed that low-GI diets effectively reduced HbA1c, fasting glucose, BMI, total cholesterol and LDL cholesterol in patients with prediabetes or diabetes, especially type 2 diabetes.⁶⁰ Another meta-analysis of 18 trials that compared low- and high-GI diets found that low-GI diets result in improved glycaemic control for patients with diabetes.⁶¹

Further, a high-GI diet has been shown to increase the risk of developing type 2 diabetes. One study showed that those who consumed the highest-GI diets had a 33% greater risk of developing type 2 diabetes than those who consumed the lowest-GI diets.⁶² This is further supported by a meta-analysis of prospective cohort studies which states that food and nutrition advice that favours low-GI diets has the potential to produce cost savings for healthcare systems.^{63, 64}

To support patients who wish to integrate more low-GI foods into their diet, there are many online tools and lists that include the GI of foods. Examples include the Glycaemic Index Search Tool developed by the University of Sydney, cited here⁶⁵, or the Glycaemic Index Food Guide developed by Diabetes Canada, cited here.⁶⁶

2.2.2.4 Ketogenic and low-carbohydrate diets

A ketogenic diet is one that encourages very low intake of carbohydrates. This diet is different from a typical low-carbohydrate diet as it encourages individuals to focus on eating fats and proteins while significantly reducing carbohydrates. The high intake of fat coupled with restrictions in carbohydrates puts the body in a metabolic state of ketosis, which is when the body burns fat for fuel instead of carbohydrates. This is hypothesised to benefit patients with type 2 diabetes because they will not be subject to the spikes and crashes of blood glucose levels associated with the breakdown of carbohydrates. Research on the effectiveness, safety and sustainability of the ketogenic diet has shown mixed results; therefore, this is a riskier option to recommend to patients compared with other dietary approaches, such as the Mediterranean diet.⁶⁷

Further, the ketogenic diet requires individuals to avoid eating high fibre, unrefined carbohydrates, such as whole grains, fruits, legumes, etc., which are some of the most health-promoting foods, especially for individuals with type 2 diabetes.⁶⁷ For example, a review of 45 prospective studies found that whole grains intake is associated with a dose-dependent reduction in the risk of coronary heart disease, cardiovascular disease, total cancer and all-cause mortality.⁶⁸ Specific to type 2 diabetes, prospective cohort studies have found that higher consumption of total whole grains and several whole grain foods, such as whole grain breakfast cereal, oatmeal, dark bread, brown rice, added bran, and wheat germ, is significantly associated with a lower risk of type 2 diabetes.⁶⁹ Finally, it has been seen that adherence to ketogenic diets appears to be poor and individuals will often revert to higher carbohydrate intake.⁷⁰ Therefore, if patients are interested in the ketogenic diet, it is best to refer them to their physician, dietician or nutritionist.

While a ketogenic, or very low-carb, diet can be a risky option for patients with type 2 diabetes, there is evidence to support a diet that is lower in carbohydrates. However, there are no clear, international guidelines that differentiate between a high-carb and low-carb diet or between low-carb and ketogenic diets. Thus, it can be difficult to accurately interpret some of the literature surrounding this topic or make recommendations to patients. One study defines low-carbohydrate diets as those that include 50–150g of carbohydrates per day and ketogenic diets as those that include only 20–50g of carbohydrates per day.⁷⁰ Another definition of the ketogenic diet includes 55–60% fat, 30–35% protein and 5–10% carbohydrates. For example, in a 2,000 calorie per day diet, carbohydrates would amount to 20–50g.⁷¹ However, again, definitions will vary, and these numbers should serve only as general guidance.

Studies have shown that low-carbohydrate diets can positively impact HbA1c, triglycerides and HDL cholesterol, but these diets do not have significant effects on long-term weight loss.⁷² A recent systematic review has also shown that a low-carbohydrate diet (<40% from carbohydrates) might be slightly more effective than a low-fat diet (<30% from fat).⁷³ In all, patients should be encouraged to evaluate both the quantity and quality (high-GI vs low-GI) of the foods and carbohydrates they consume and work with their healthcare team to develop a healthy diet that they will be able to adhere to and sustain for years to come.

2.2.2.5 Plant-based diets

Plant-based diets, such as vegetarian or vegan diets, are those that primarily include whole foods, such as legumes, whole grains, fruits, vegetables and nuts, and have limited or no intake of animal products. It has been shown that plant-based diets are beneficial for both preventing and treating type 2 diabetes, while also providing other health benefits such as improvements in cardiovascular disease and cancer prevention.⁷⁴

If a plant-based diet is recommended to patients, they should ensure they are including primarily healthy plant foods in their diet. Some individuals who follow vegetarian plant-based diets include less healthy plant foods,

such as sweetened food and beverages, which can be harmful to health. Data from three prospective cohort studies have shown that a diet that emphasises plant foods and is low in animal foods is associated with a 20% reduction of risk for developing diabetes. Specifically, those that followed a plant-based diet that emphasised healthy plant foods experienced a greater risk reduction, 34%, and those who followed a plant-based diet high in less healthy plant foods actually experienced a 16% increased risk of developing type 2 diabetes. Therefore, patients should aim to include primarily healthy plant-based foods in their diet. Broadly, this study considered healthy plant foods to include whole grains, fruits, vegetables, nuts, legumes, vegetable oils and tea/coffee. Less healthy plant foods include fruit juices, sugar-sweetened beverages, refined grains, potatoes and sweets/desserts.⁷⁵

Plant-based diets, in conjunction with educational interventions, are associated with significant improvements in psychological health, quality of life, HbA_{1c}, and weight for patients with type 2 diabetes. Plant-based diets could also potentially improve diabetic neuropathic pain and total cholesterol, LDL cholesterol and triglycerides.⁷⁶ Vegetarian diets specifically have shown similar results, with the diet causing significant reductions in HbA_{1c} and improvements in overall glycaemic control, LDL cholesterol, non-HDL cholesterol and body weight/adiposity in individuals with diabetes.^{77,78} Finally, for diabetic patients who have chronic kidney disease, a plant-based diet can have positive effects on their health by delaying progression of the disease. It can also help to manage and prevent some symptoms and metabolic complications of chronic kidney disease.^{74,79}

2.2.2.6 Calorie reduction

Dietary guidelines from the International Diabetes Federation recommend, for patients with type 2 diabetes, a low-calorie diet, with the goal of losing weight or reaching a healthy body weight. Overweight or obese patients with type 2 diabetes should generally reduce their daily caloric intake by about 500–600 calories; however, this will be dependent on current dietary intake and should also take into account the quality and type of food being consumed. People with type 2 diabetes should avoid sugar, sweets, sweetened beverages, and snacks whenever possible. They should also limit eating out at restaurants, cafes, etc. where the size and content of meals cannot be controlled. Overall, patients should select foods that are high in fibre and have a low glycaemic index, with a general goal of three to five daily portions of vegetables and/or fruits, fish, grains and monosaturated fats.⁴⁶

One simple strategy to help patients visualise their dietary intake and control portion sizes is the plate method. This method recommends the following:⁸⁰

- Fill half of the plate with non-starchy vegetables, such as salad, green beans, broccoli, cauliflower, cabbage, or carrots;
- Fill one quarter of the plate with a lean protein, such as chicken, turkey, beans, tofu, or eggs;
- Fill one quarter of the plate with carb foods, such as grains, starchy vegetables like potatoes or peas, rice, pasta, beans, fruits and yoghurt (a cup of milk counts as a carb food); and
- Choose water or a low-calorie, unsweetened drink to accompany your meal.

2.3 Cancer

2.3.1 Background

Cancer is the second leading cause of death globally, estimated to cause 9.6 million deaths, or one in six deaths, in 2018. The most common cancers in men are lung, prostate, colorectal, stomach and liver cancer, and in women the most common cancers are breast, colorectal, lung, cervical and thyroid. The global burden of cancer continues to grow, and many health systems are not prepared to manage this increasing patient population. To reduce the burden of cancer globally, early detection and management is an important strategy. Around 30–50% of cancer deaths could be prevented by modifying or avoiding certain risk factors, many of which relate to healthy lifestyles, including:

- Avoiding tobacco use, including cigarettes and smokeless tobacco;
- Maintaining a healthy weight;
- Eating a healthy diet with plenty of fruit and vegetables;
- Exercising regularly;
- Limiting alcohol consumption;
- Practising safer sex;
- Getting vaccinated against hepatitis B and human papilloma virus;

- Reducing exposure to ultraviolet radiation and ionising radiation (occupational or medical diagnostic imaging);
- Avoiding urban air pollution and indoor smoke from household use of solid fuels; and
- Getting regular medical care.

Some chronic infections are also risk factors for cancer. People in low- and middle-income countries are more likely to develop cancer through chronic infections.⁸¹ The strength of evidence surrounding the impact of lifestyle factors on the risk of developing cancer can be seen in Table 4.

Table 4: Summary of strength of evidence on lifestyle factors and the risk of developing cancer⁸²

Evidence	Decreased risk	Increased risk
Convincing	Physical activity (colon)	<ul style="list-style-type: none"> • Overweight and obesity (oesophagus, colorectum, breast in postmenopausal women, endometrium, kidney) • Alcohol (oral cavity, pharynx, larynx, oesophagus, liver, breast) • Aflatoxins (liver) • Chinese-style salted fish (nasopharynx)
Probable	Fruits and vegetables (oral cavity, oesophagus, stomach, colorectum*) Physical activity (breast)	<ul style="list-style-type: none"> • Preserved meat (colorectum) • Salt-preserved foods and salt (stomach) • Very hot (thermally) drinks and food (oral cavity, pharynx, oesophagus)
Possible/ Insufficient	Fibre Soya Fish n-3 Fatty acids Carotenoids Vitamins B2, B6, folate, B12, C, D, E Calcium, zinc and selenium Non-nutrient plant constituents (e.g. allium compounds, flavonoids, isoflavones, lignans)	<ul style="list-style-type: none"> • Animal fats • Heterocyclic amines • Polycyclic aromatic hydrocarbons • Nitrosamines

**For colorectal cancer, a protective effect of fruit and vegetable intake has been suggested by many case-control studies but this has not been supported by results of several large prospective studies, suggesting that if a benefit does exist it is likely to be modest.*

2.3.2 Dietary considerations

It is estimated that dietary factors account for 30% of cancers in industrialised countries and 20% in developing countries.⁸² The WHO recommends the following for reducing the risk of developing cancer:

- Consumption of alcoholic beverages is not recommended: if consumed, do not exceed two units per day.
- Chinese-style fermented salted fish should only be consumed in moderation, especially during childhood. Overall consumption of salt-preserved foods and salt should be moderate.
- Minimise exposure to aflatoxins in foods.
- Have a diet which includes at least 400g/day of fruits and vegetables.
- Moderate consumption of preserved meat (e.g., sausages, salami, bacon, ham).
- Do not consume foods or drinks when they are at a scalding hot temperature.
- Maintain weight (among adults) such that BMI is in the range of 18.5–24.9kg/m² and avoid weight gain (>5kg) during adult life.
- Maintain regular physical activity. The primary goal should be to perform physical activity on most days of the week; 60 minutes per day of moderate-intensity activity, such as walking, may be needed to maintain healthy body weight in otherwise sedentary people. More vigorous activity, such as fast walking, may give some additional benefits for cancer prevention.

The World Cancer Research Fund International provides additional recommendations for cancer prevention, resources with information relating to specific risk factors and cancer types, and information relating to suggested policy changes. These resources can be accessed on their website.⁸³ Its 10 recommendations for cancer prevention are outlined below.⁸⁴

1. Be a healthy weight
2. Limit sugary drinks
3. Be physically active
4. Limit alcohol
5. Eat wholegrains, vegetables, fruits and beans
6. Do not rely on supplements
7. Limit fast foods
8. Breastfeed your baby
9. Limit red and processed meats
10. After a cancer diagnosis, continue to follow these recommendations

2.4 Chronic obstructive pulmonary disease

2.4.1 Background

Chronic obstructive pulmonary disease (COPD) is a progressive, life threatening lung disease that can cause breathlessness and lead to dangerous exacerbations, serious illness and death. It is estimated that there are 251 million cases of COPD globally and that, in 2015, 3.17 million deaths were caused by the disease, with 90% of these deaths occurring in low- and middle-income countries. The number of cases of COPD is predicted to increase in the coming years due to increased smoking prevalence and ageing populations.

COPD is primarily caused by tobacco smoke, with other risk factors including air pollution, both indoor and outdoor, occupational dusts and chemicals, and frequent lower respiratory infections during childhood. COPD is not curable, but the most cost-effective available treatment for people with COPD who still smoke is smoking cessation. While COPD is not curable and requires frequent monitoring and pharmacological treatment, there are important nutritional considerations pharmacists should be aware of that may improve outcomes for their patients with COPD.⁸⁵

Patients with COPD are often faced with unintentional weight loss, malnutrition, and a decline in exercise capacity due to skeletal muscle loss, which can ultimately lead to increased healthcare utilisation, increased costs and poorer health outcomes. However, research has shown that malnutrition can be treated in patients with stable COPD and can lead to increased functional capacity, respiratory muscle strength and quality of life.⁸⁶

2.4.2 Dietary considerations

2.4.2.1 Malnutrition

Malnutrition is a common concern among patients with COPD. Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/nutrients and can manifest, broadly, in three ways: undernutrition (including wasting, stunting and underweight), micronutrient-related malnutrition, and overweight, obesity, or diet-related non-communicable diseases.⁸⁷

To help you assess whether your patients may be at risk of malnutrition, there are many tools to choose from. Most of these tools include an assessment of recent weight loss, recent poor intake/appetite, and body weight measurements in order to determine a numerical score associated with a patient's risk of malnutrition.⁸⁸ Examples include the Malnutrition Screening Tool, the Malnutrition Universal Screening Tool, and the Subjective Global Assessment.⁸⁹⁻⁹¹

The Global Initiative for Chronic Obstructive Lung Disease, in its 2020 report entitled "Global strategy for the diagnosis, management, and prevention of COPD", recommends nutritional supplementation for patients with COPD as this has been shown to have a positive effect on body weight, fat mass, and fat-free mass when provided to patients. They further state that nutritional antioxidant supplementation (vitamins C and E, zinc and selenium) has been shown to improve antioxidant deficits, quadriceps strength and serum total protein. However, the guidelines do not recommend optimal amounts or durations of supplementation.⁹²

The COPD Foundation recommends that a patient with COPD should include the following components in their diet:

- Protein;
- Fluids, unless a patient's healthcare provider is encouraging them to follow a fluid-restricted diet;

- Calcium;
- Magnesium; and
- Potassium.

They also recommend limiting the intake of salt and sodium because large amounts can cause fluid retention, which can increase blood pressure and shortness of breath.⁹³

While it is commonly suggested that milk products should be avoided in patients with COPD because they can increase mucus production, there is insufficient evidence to support such a recommendation. There are recent studies, focusing primarily on patients with asthma, that show there is some evidence to support that a dairy-free diet reduces mucus production, but this has not yet been extensively studied in patients with COPD.⁹⁴

For additional information regarding strategies to address or educate COPD patients about malnutrition, refer to the Malnutrition Pathway website (www.malnutritionpathway.co.uk) which contains many resources developed by a multi-professional expert panel, including resources for use by pharmacists, informational leaflets and pamphlets for patients, and dietary recommendations for patients at various risk levels for malnutrition, among many others.⁹⁵

Specific to COPD, see Appendix 2 for leaflets developed by the Malnutrition Pathway that provide dietary advice, advice on eating and physical activity, and tips for coping with common symptoms of COPD. These three colour-coded leaflets can be given to patients and carers to provide advice to those at low, medium or high risk of malnutrition, with the high-risk leaflet also including advice on incorporating oral nutritional supplements into the diet. These materials are offered with the kind permission of the Malnutrition Pathway.

3 Communicable diseases

3.1 About communicable diseases

Communicable diseases (infectious diseases) are diseases that spread from one person or an animal to another, resulting from the infection, presence and growth of pathogenic agents, such as bacteria, fungi, viruses, protozoa, multicellular parasites, or prions.

3.1.1 Background

While the connection between nutrition and NCDs is well known, there is also a direct connection between an individual's diet and communicable diseases. This connection can clearly be seen when you consider the direct influence dietary choices have on the development of various gastrointestinal infections, food poisonings or intestinal diseases.⁹⁶ However, this connection goes even further. In fact, malnutrition has a clear link to the development of communicable diseases. Malnutrition can reduce the functioning of an individual's immune system, which can then lead to increased susceptibility to developing communicable diseases, and vice versa, with frequent infectious diseases leading to malnutrition through decreased appetite, malabsorption of essential nutrients or increased metabolic needs. Specifically, malnutrition can increase an individual's susceptibility to measles, acute respiratory infections/pneumonia, malaria, diarrhoeal diseases, tuberculosis and HIV/AIDS.⁹⁷ Obesity can also increase an individual's susceptibility to communicable diseases.^{98, 99}

3.1.2 Dietary considerations

A well-balanced, healthy diet can strengthen the immune system and allow for a substantial immune response against any pathogens, shorter infection times, and potentially less severe symptoms. Additionally, several vitamins, including A, B6, B12, C, D and E, folate, and trace elements, including zinc, iron, selenium, magnesium, and copper, can play an important role in supporting the immune system. The micronutrients with the strongest evidence to support their immune system benefits are vitamins C and D and zinc.¹⁰⁰

3.1.2.1 Vitamin C

Evidence surrounding vitamin C supplementation has mixed conclusions on its potential benefits and risks. Overall, evidence suggests that regular intake of vitamin C at doses of at least 200mg/day does not reduce the incidence of the common cold in the general population, but it might be helpful to those exposed to extreme physical exercise or cold environments as well as those with deficient vitamin C status, including chronic smokers and the elderly. Vitamin C supplementation may shorten the duration of a cold and improve symptom severity in the general population; however, taking vitamin C after cold symptoms have started does not appear to be beneficial.¹⁰¹

Additional studies have shown that supplementation with vitamin C, at levels of 100–200mg/day, may prevent certain infections.¹⁰² Further, a meta-analysis of nine randomised controlled trials showed that high doses of vitamin C (700–800mg/day) may reduce the duration of the common cold and relieve certain symptoms, including chest pain, fever and chills.¹⁰³ However, there is heterogeneity in results surrounding the benefits of vitamin C supplementation and there is minimal evidence to support the benefits of high doses of vitamin C in healthy individuals.¹⁰⁴

Vitamin C has low toxicity and therefore is not likely to cause serious adverse effects at high dosages. The most common side effects patients may experience are diarrhoea, nausea, abdominal cramps and other gastrointestinal symptoms. However, in individuals with haemochromatosis, chronic vitamin C consumption at higher doses can lead to increased iron absorption, thus exacerbating iron overload and causing tissue damage.¹⁰¹

3.1.2.2 Vitamin D

Studies exploring the role of vitamin D supplementation in preventing respiratory infections have shown mixed results. However, a large meta-analysis showed that daily or weekly vitamin D supplementation may reduce the risk of respiratory tract infections in both children and adults, with greatest benefits being seen in those who are deficient.¹⁰⁵ However, additional research is needed before conclusions can be drawn regarding vitamin D's role in protecting against respiratory infections.

Consuming too much vitamin D can be toxic. Vitamin D toxicity can cause marked hypercalcaemia, hypercalciuria, and high serum 25 hydroxyvitamin D, or 25(OH)D, levels. Hypercalcaemia can then lead to nausea, vomiting, muscle weakness, neuropsychiatric disturbances, pain, loss of appetite, dehydration, polyuria, excessive thirst and kidney stones. If severe, vitamin D toxicity can cause renal failure, calcification of soft tissues throughout the body, cardiac arrhythmias and death.¹⁰⁶

3.1.2.3 Zinc

Addressing zinc deficiencies has been shown to boost the immune system and reduce mortality from infectious diseases, including viral infections.¹⁰⁷ Giving zinc, at a dose of at least 75mg/day, within 24 hours of the onset of symptoms of the common cold may reduce the duration and severity of symptoms in healthy individuals. However, more research is needed to determine the optimal dosage, formulation and duration before general recommendations can be made. Further, there is insufficient evidence to recommend prophylactic zinc supplementation.¹⁰⁸ Of note is that intranasal zinc should not be recommended due to reports of anosmia resulting from its usage, with some cases resulting in long-lasting or permanent loss of smell.¹⁰⁹

Zinc toxicity can be acute or chronic. Symptoms of acute toxicity include nausea, vomiting, loss of appetite, abdominal cramps, diarrhoea and headaches. Symptoms of chronic toxicity can include low copper status and copper deficiency-associated anaemia, altered iron function, reduced immune function and reduced levels of high-density lipoproteins. In one study, patients who took zinc long-term (80mg/day for 6.3 years on average) showed a significant increase in hospitalisations for genitourinary problems.¹⁰⁹

4 Additional diseases

4.1 Coeliac disease

4.1.1 Background

Coeliac disease is an autoimmune disease triggered by dietary gluten in genetically susceptible individuals. This disease damages the small intestinal absorptive surface and those affected cannot tolerate gluten, a protein found in wheat, rye and barley. When gluten is ingested by those with coeliac disease, the body mounts an immune response against the lining of the small intestine.¹¹⁰ As this lining becomes damaged, the body becomes less able to absorb necessary nutrients. People living with coeliac disease are at an increased risk of developing other autoimmune disorders, including type 1 diabetes, dermatitis herpetiformis, multiple sclerosis and autoimmune thyroiditis, as well as other conditions, such as anaemia, osteoporosis, infertility and miscarriage, neurological conditions like epilepsy and migraines, heart disease and others.¹¹¹ Coeliac disease can present with gastrointestinal symptoms and/or extraintestinal symptoms. Due to the wide range of presenting symptoms, a diagnosis of coeliac disease is often delayed and patients often receive mistaken diagnoses of other conditions, such as irritable bowel syndrome.¹¹²

The prevalence of this disease has increased over the past two decades and it has become a major public health problem worldwide. Historically, coeliac disease was thought to primarily affect countries with predominantly Caucasian populations, but research now shows that it appears throughout the world. It is suggested that the prevalence based on serological tests is 1.4%, and 0.7% based on biopsy results. The prevalence varies with sex, age and geographical location. Coeliac disease was 1.5 times more commonly found in females, and twice as common in children than adults. The highest prevalence can be found in Europe and Oceania and the lowest prevalence in South America.¹¹³ Another recent study suggests that the incidence of coeliac disease has increased by 7.5% per year over the past several decades.¹¹⁴

Coeliac disease is found in approximately 6% of individuals with type 1 diabetes. These individuals typically have asymptomatic coeliac disease or have symptoms that are misattributed to their diabetes. Because of this, it is recommended that patients with type 1 diabetes are screened for coeliac disease. Likewise, those with coeliac disease should be screened for type 1 diabetes and counselled on its signs and symptoms, such as frequent urination, thirst, hunger, weight loss, dry mouth and fatigue.¹¹⁵ Individuals with coeliac disease are often overweight, with one study showing that 40% of patients were overweight at diagnosis and 13% were obese, which can put these patients at increased risk of type 2 diabetes. This is compounded by the fact that gluten-free diets are often low in fibre and that many processed gluten-free products have an increased glycaemic index with increased fat and lower protein compared with gluten-containing meals.¹¹⁶

4.1.2 Dietary considerations

Given that there are no currently available treatments, those with coeliac disease must follow a strict, gluten-free diet. It is also important to remind patients that not only should their foods be gluten-free, but they must be aware of whether or not gluten is present in other things they ingest, especially medicines. See Appendix 3 for guidelines produced by the World Gastroenterology Organisation Guidelines and Publications Committee (<http://www.worldgastroenterology.org/>) regarding grains, flours and starches that are and are not allowed in a gluten-free diet.¹¹⁷ Broadly, those with coeliac disease should include naturally gluten-free foods in their diets, including fruits, vegetables, meat and poultry, fish and seafood, dairy, beans, legumes and nuts.¹¹⁸ Finally, as a pharmacist, ensure that your patients with coeliac disease are taking medicines, vitamins, herbal supplements, etc., that do not include gluten. If you are unsure, contact the manufacturer for verification.

4.2 Irritable bowel syndrome

4.2.1 Background

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder associated with abdominal pain and changes in bowel movements, which can be diarrhoea, constipation or a combination of both. Other symptoms include bloating, feeling as if you have not finished a bowel movement, or whitish mucus in the stool. IBS causes these symptoms without any visible signs of damage or disease in the digestive tract and does not lead to other health problems. IBS is a chronic condition with no cure, but symptoms can come and go, and they can be managed through a variety of interventions, including lifestyle changes, medicines, probiotics and mental health therapy. Lifestyle changes include making dietary changes, increasing physical activity, reducing stressful life situations as much as possible and getting adequate sleep.¹¹⁹ IBS is a common condition, with the International Foundation for Functional Gastrointestinal Disorders (IFFGD) estimating that IBS affects 10–15% of adults worldwide. And, even though IBS is not fatal, it is associated with significant burden on the health system and is the second most common cause of absenteeism from work after the

common cold.¹²⁰ Therefore, it is important to be aware of strategies to reduce symptoms and improve quality of life for individuals affected by this condition.

4.2.2 Dietary considerations

Broadly, the following dietary recommendations can be considered for patients with IBS: increasing fibre intake, avoiding gluten and following a low FODMAP diet (see below). However, every patient will respond differently to dietary interventions and an individualised approach is necessary to ensure a patient's symptoms are reduced while also ensuring they are not on an unnecessarily restrictive diet.¹²² Therefore, some healthcare providers will recommend that patients keep a diary of their dietary intake for a couple weeks and monitor their intake, symptoms and other associated factors, such as stressors, sleep, medicines, etc.¹²²

Increasing dietary fibre intake is commonly recommended by physicians who treat patients with IBS. Increased fibre intake is especially helpful for IBS patients prone to constipation as it can make stools softer and easier to pass. There are two types of dietary fibres: soluble, which are found in beans, fruit and oat products, and insoluble, which are found in whole-grain products and vegetables.¹¹⁹ Typically, it is recommended that patients increase their dietary fibre intake to 20–35g/day. This increase should be done slowly, with intake increased by no more than 5g/day each week. Increasing fibre intake too quickly can cause abdominal bloating, discomfort or changes in bowel habits as the body adjusts.¹²³ Further, soluble fibres, such as psyllium, tend to be better tolerated by patients than insoluble fibres, such as bran, but this can vary.¹²⁴ Gluten can cause some individuals with IBS to have increased symptoms. Therefore, it may be recommended that patients trial a gluten-free diet to see if their symptoms improve.¹¹⁹

Finally, restricting intake of foods with highly fermentable oligosaccharides, disaccharides, monosaccharides, and polyol (FODMAPs) can help to reduce symptoms associated with IBS. FODMAPs are short-chain carbohydrates that are poorly absorbed and rapidly fermented by gut bacteria. The gas production from this fermentation may then cause IBS symptoms.¹²⁵ Foods that contain FODMAPs include:¹¹⁹

- Fruits such as apples, apricots, blackberries, cherries, mangoes, nectarines, pears, plums and watermelons, or the juice of any of these fruits;
- Canned fruit in natural fruit juice, or large amounts of fruit juice or dried fruit;
- Vegetables such as artichokes, asparagus, beans, cabbage, cauliflower, garlic and garlic salts, lentils, mushrooms, onions, and sugar snap peas or mangetout (snow peas);
- Dairy items such as milk, milk products, soft cheeses, yoghurt, custard and ice cream;
- Wheat and rye products;
- Honey and foods with high-fructose corn syrup; and
- Products, including candies and gums, with sweeteners ending in “-ol,” such as sorbitol, mannitol, xylitol and maltitol.

Meta-analyses have shown that low FODMAP diets can have a positive impact on IBS symptoms, especially on abdominal pain, bloating and diarrhoea.^{125, 126} One study showed that 86% of patients who followed a low-FODMAP diet reported improvements in gastrointestinal symptoms, including bloating, abdominal pain and flatulence, compared with 49% of patients following standard dietary advice.¹²⁷ A low-FODMAP diet can be complex and require careful monitoring; therefore, it is recommended that pharmacists refer patients to dietitians or nutritionists for specialised guidance on how to safely follow this diet. Most studies that have evaluated the impact of a low-FODMAP diet have involved dietitians or nurses to educate patients on the diet.¹²⁴

Additional general tips for reducing symptoms associated with IBS from the IFFGD include:¹²²

- Eating smaller meals more frequently throughout the day — instead of eating three meals per day, try five or six regularly scheduled smaller meals;
- Eating meals more slowly and not rushing to finish a meal;
- Avoiding meals that over-stimulate the gut, including large meals or high-fat foods;
- Eating breakfast if you are constipated as this is the meal most likely to stimulate the colon and cause a bowel movement; and
- Cutting out foods from your diet if you suspect they may be contributing to symptoms — if after 12 weeks there are no changes in symptoms, you can reintroduce it to your diet.

4.3 Gout

4.3.1 Background

Gout is a common type of inflammatory arthritis that is caused by sustained high levels of uric acid in the body, also known as hyperuricaemia. Uric acid is made when the body breaks down purines, which can be found in the body and in foods. With too much uric acid in the body, uric acid crystals (monosodium urate) can begin to deposit and build up in the body's joints, fluids and tissues. This can cause pain, swelling, redness or heat in the affected joint — also called an acute gout attack or flare. It is important to note that hyperuricaemia does not always cause gout and asymptomatic hyperuricaemia does not require treatment.

Given that gout is a chronic condition, efforts must be made by patients to reduce the risks of future attacks. Beyond the typical pharmacological treatment, pharmacists can also encourage their patients to make changes to their diet and lifestyle. This is especially important because common risk factors for gout include obesity, drinking alcohol, ingesting food and drinks that are high in fructose, having certain non-communicable diseases (including hypertension and diabetes), and having a diet high in purines.¹²⁸

With rising rates of obesity and comorbidities worldwide, it is easy to see why the prevalence and incidence of gout seems to be growing, with rates being highest in men and postmenopausal women in high-income countries. Despite this increasing global burden of gout, many with gout are not being optimally managed. In fact, only one-third to one-half of patients are treated with urate-lowering therapies and less than half of patients are adherent to their treatment.^{129, 130} Therefore, pharmacists must be involved in efforts to prevent gout and reduce the risk of flares, both through pharmacological means and lifestyle modifications. In addition to the dietary considerations discussed below, pharmacists should also recommend that patients with gout who are overweight or obese make lifestyle changes to lose weight, including reducing their calorie intake and gradually increasing their physical activity, as weight loss has been associated with lower serum uric acid levels and fewer gout attacks.^{131, 132}

4.3.2 Dietary considerations

To decrease gout flares and help medicines be more effective, specific diet modifications can be recommended to patients.¹³³ However, beyond these specific considerations, it is also broadly recommended that patients follow a balanced diet, such as the Mediterranean diet (see section 2.1.2.1) or the DASH diet (see section 2.1.2.2), as they both limit red meat, sugars and processed foods, and focus on whole, healthy foods.¹³²

Guidelines from the European League Against Rheumatism and the American College of Rheumatology highlight the importance of providing patients with advice regarding lifestyle strategies to improve the management of their condition, including information regarding diet. While all patients should receive this information and be aware of the potential effects of their diet on their condition, these guidelines both note that the overall impact of these dietary considerations on serum urate levels is small. However, these dietary factors may serve as flares for gout attacks and patients may ask for advice regarding their diet. Therefore, it is important for pharmacists to be aware of the potential impacts of diet on gout management.^{134, 135}

4.3.2.1 High purine foods

Foods that are high in purines should generally be avoided in patients with gout, especially red meat, organ meat and seafood. Purine intake, especially purines from animal products, can increase the risk of gout attacks by almost five-fold¹³⁶ and can increase serum uric acid levels.^{137, 138} Conversely, moderate intake of vegetables that are high in purines (peas, beans, lentils, spinach, mushrooms, oats and cauliflower), do not increase the risk of gout or gout flares.¹³⁹

4.3.2.2 Alcohol

Alcohol is associated with increased serum uric acid levels and gout flares. Beer, including non-alcoholic beer, has the largest effect on serum uric acid levels due to its high content of the purine guanosine and liquor also has a significant association with gout. Wine may be safe for patients with gout in moderation (<1 serving per day).^{135, 140}

4.3.2.3 Fructose

Fructose can raise serum uric acid levels. Therefore, foods and beverages with high levels of fructose, especially sugary sodas, fruit juices, and foods with high fructose corn syrup should be avoided if possible. It is hypothesised that the increased intake in sugar-sweetened drinks and fructose consumption in the past few decades is a reason behind the increased prevalence of gout.¹⁴¹

4.3.2.4 Coffee

Long-term coffee consumption at greater than four cups per day is associated with lower serum uric acid levels and a lower risk of developing gout. Research has not shown an association between coffee intake and gout flares.¹⁴⁰

4.3.2.5 Dairy products

The incidence of gout has been seen to decrease with increased intake of low-fat dairy products, including milk and yoghurt. Casein and lactalbumin, the proteins found in milk, are thought to benefit patients with gout by promoting the excretion of uric acid in the urine.¹³⁷

4.4 Osteoporosis

4.4.1 Background

Osteoporosis is a common bone disease characterised by low bone mineral density and microarchitectural deterioration of bone tissue. As a result of this, those with osteoporosis are more susceptible to bone fractures. Osteoporosis can be caused by certain medicines and medical conditions but can also be a result of the normal ageing process.¹⁴²

Osteoporosis affects a significant number of individuals worldwide, with rates being highest in Caucasians, women and the elderly. As the global population continues to age, the incidence of osteoporosis will continue to increase. It is currently estimated that one in three women and one in five men over the age of 50 worldwide are affected by osteoporosis. This presents an enormous public health concern, especially as fractures due to osteoporosis cause substantial pain, disability, loss of independence, morbidity and mortality.¹⁴³ In Europe, for example, osteoporotic fractures cause greater disability than most cancers and the same or greater disability than many non-communicable diseases.¹⁴⁴ In order to reduce the risk of developing osteoporosis and promote bone health, pharmacists may recommend the inclusion of certain vitamins and nutrients in their patients' diets.

4.4.2 Dietary considerations

4.4.2.1 Calcium

Calcium plays an important role in building and maintaining strong bones, with 99% of the body's calcium being stored in bones. The amount of calcium that an individual needs for optimal bone health changes throughout their life. Requirements are highest in adolescents, when bones are still growing and developing, and in the elderly, when the body is no longer able to absorb calcium effectively.

Recommendations for calcium intake vary by country.¹⁴⁵ However, the Food and Agriculture Organization of the United Nations and the WHO generally recommend 800–1,000mg of calcium per day for men and women aged over 50 years.¹⁴⁶ For more specific recommendations, many countries follow or have similar recommendations to those developed by the Institute of Medicine of the U.S. National Academy of Sciences, which can be seen in Table 5.

Table 5: Recommended calcium intake¹⁴⁷

Recommended calcium intake for women	
19–50 years old	1,000mg/day
51+ years old	1,200mg/day
Pregnancy/lactation (14–18 years old)	1,300mg/day
Pregnancy/lactation (19–50 years old)	1,000mg/day
Recommended calcium intake for men	
19–70 years old	1,000mg/day
70+ years old	1,200mg/day
Recommended calcium intake for children & adolescents	
1–3 years old	700mg/day
4–8 years old	1,000mg/day
9–18 years old	1300mg/day

It is preferred that individuals obtain most of their calcium from dietary sources. The International Osteoporosis Foundation lists the calcium content of a variety of foods on its website,¹⁴⁸ with dairy being the main dietary source of calcium. Examples of calcium-rich foods include milk, yoghurt, cheese, tofu, almonds and green vegetables (e.g., broccoli, kale). There are multiple calculators available online that pharmacists can provide to patients who are unsure of how much calcium they are getting through their current diet. One example is the Calcium Calculator¹⁴⁹ developed by the International Osteoporosis Foundation, which is available in multiple languages.

For those who are not able to get sufficient calcium from their diet, calcium supplementation may be recommended. There are two primary forms of calcium found in supplements, calcium carbonate and calcium citrate. A comparison of these two types of calcium can be seen in Table 7. Doses of calcium should be limited to 500–600mg/day and should be taken in combination with vitamin D; calcium supplementation alone is not typically recommended. In combination with vitamin D, calcium supplementation can lead to a modest reduction in fractures. The evidence for this reduction is most evident in those who are at greatest risk for calcium or vitamin D deficiencies.

Table 6: Primary forms of calcium found in supplements¹⁵⁰

Type of calcium	% Elemental calcium	Administration instructions	Additional information
Calcium carbonate	40%	Take with food (acid-dependent absorption)	Typically less expensive, requires fewer tablets due to higher elemental calcium, may cause gastrointestinal (GI) side effects
Calcium citrate	21%	Take with or without food (acid-independent absorption)	Typically more expensive, requires more tablets to reach desired dose, much less likely to cause GI side effects

4.4.2.2 Vitamin D

Vitamin D is important to bone health as it helps to promote and assist with calcium absorption. Vitamin D has two major forms: vitamin D₂ (ergocalciferol), which is the primary dietary source of vitamin D and comes from plant-based sources, and vitamin D₃ (cholecalciferol), which is synthesised in the skin after exposure to sunlight. There are very few foods with high levels of vitamin D; therefore, exposure to sunlight is how we obtain 70–80% of the vitamin D we need.¹⁵¹ However, exposure to sunlight is not always a reliable method of obtaining vitamin D as it is dependent on seasons, geographical latitudes, city smog, skin pigmentation, age and many other factors.

The International Osteoporosis Foundation recommends higher doses of vitamin D for those over the age of 60 as this has been associated with greater muscle strength and improved bone health. Seniors are particularly susceptible to vitamin D deficiencies as they often spend less time in sunlight and their skin produces less vitamin D when exposed to sun compared with those who are younger.¹⁵¹ When considering vitamin D supplementation for patients, which vitamin D to choose must be considered. Research has shown that vitamin D₃ (cholecalciferol) appears to be more efficacious than vitamin D₂ (ergocalciferol) in raising total 25(OH)D levels, and is therefore a preferred choice for supplementation.^{152, 153} Recommended amounts of vitamin D intake are set out in Table 8.

Table 8: Recommendations for vitamin D intake

Age/parameter	Institute of Medicine ¹⁴⁷	International Osteoporosis Foundation ¹⁵⁴
1–59 years	600IU/day	Not assessed
60–70 years	600IU/day	800–1,000IU/day
71+ years	800IU/day	800–1,000IU/day
Target 25(OH)D Levels*	50nmol/l for bone health at all ages	75nmol/l for fall and fracture prevention

* 25-Hydroxyvitamin D is used to determine the amount of vitamin D in the body.

4.4.2.3 Protein

Adequate protein intake can both promote bone mass gain during youth and preserve bone and muscle mass during ageing. In children and adolescents, inadequate intake of protein can lead to impaired bone development, which may increase their risk of osteoporosis when they are older. In those who are older,

inadequate protein intake can result in muscle weakness, sarcopenia and frailty. This is most dangerous for those who already have osteoporosis, or those who are at high risk, as it may increase their susceptibility to falling and suffering a fracture.^{155, 156} A systematic review of clinical practice guidelines recommends the use of protein supplements, with a recommended intake of 1.2g/kg daily, for patients with hip fractures as it can minimise bone loss, decrease the risk of infection, decrease the length of hospital stays and increase functional recovery.¹⁵⁷

4.4.2.4 Other considerations

High levels of alcohol intake can increase the risk of developing osteoporosis and significantly increase the risk of fractures by decreasing calcium absorption.¹⁵⁸ A systematic review of clinical practice guidelines recommends limiting the consumption of alcohol to no more than two units per day.¹⁵⁷ Caffeine from tea and coffee can modestly increase calcium excretion and reduce absorption. A systematic review of clinical practice guidelines recommends limiting coffee consumption to no more than four cups per day.¹⁵⁷

4.5 Anaemia

4.5.1 Background

Anaemia is a blood disorder that occurs when the number of red blood cells or amount of haemoglobin in the blood is insufficient. Haemoglobin is an iron-rich protein found inside red blood cells that carries oxygen from the lungs to the body's tissues. Therefore, when there is not enough of this protein, the body's tissues do not receive enough oxygen. As a result of this, individuals with anaemia may experience fatigue, weakness, shortness of breath, dizziness and headaches. Anaemia is most commonly found in pregnant women and children, with at least 40% of pregnant women and 42% of children under five years old being anaemic. It is further estimated that one-third of all women of reproductive age are anaemic.¹⁵⁹ The most common causes of anaemia are nutritional deficiencies, primarily iron deficiencies, but also deficiencies in folate, vitamin B12, vitamin A and copper. Consequently, interventions to increase intake of these nutrients, when deficient, can have a positive effect on those with anaemia.

4.5.2 Dietary considerations

4.5.2.1 Iron

As part of the haemoglobin molecule, iron is an essential nutrient for the production of red blood cells. Insufficient amounts of iron, either due to low intake or loss of iron, causes iron-deficiency anaemia, which is the most common type of anaemia worldwide, contributing to an estimated 50% of anaemia cases among women. Iron requirements increase when an individual has a condition that requires an increase in red blood cells, such as pregnancy. Iron deficiency anaemia is also common in infants and young children, especially those younger than two years old, as their rapid growth and development requires high amounts of iron. There is some evidence that has shown associations between iron deficiencies and poor cognitive and motor development outcomes in children; however, a causal link has not been clearly established. To increase iron intake and absorption, the following may be considered:

- Meat, fish, and poultry are rich sources of dietary iron with plant-based sources typically being more difficult to absorb. However, the absorption of plant-based sources may be increased by also consuming citric, malic or ascorbic (e.g., vitamin C) acids.
- To increase the overall bioavailability and absorption of iron, consider adding haem-iron from animal-source foods (especially from beef, but also lamb, pork, liver and chicken) to foods containing non-haem iron.
- Avoid combining known inhibitors of non-haem iron, including tea and coffee, with meals to increase absorption.
- Soaking, fermenting, germinating, and thermal or mechanical processing can also improve the bioavailability and absorption of iron.¹⁶⁰

4.5.2.2 Folate and vitamin B12

Both folate and vitamin B12 contribute to the development of macrocytic anaemia due to their effects on DNA synthesis, cell division and erythropoiesis (red blood cell production). Vitamin B12 deficiencies result from low intake of the nutrient in the diet, especially if the diet is low in animal-source food. However, it can also be a result of low nutrient absorption, most commonly seen in the elderly. Folate deficiencies are most common in populations whose diets include unfortified wheat or rice and include low amounts of legumes and green leafy vegetables. Additionally, pregnant women, preterm infants and those in malaria-endemic regions are

also at increased risk of folate deficiencies. To increase intake of vitamin B12 and folate, the following should be considered:

- Vitamin B12 is only found in animal-source foods, including shellfish, beef liver, other meats, fish, and poultry and dairy products.
- Folate can be found in legumes, green leafy vegetables, whole grains, fruits and fruit juices.¹⁶⁰

4.5.2.3 Vitamin A

Inadequate intake of Vitamin A and associated deficiency is suggested to play a role in the development of anaemia through several different methods including by decreasing the mobilisation of iron from stores in the liver and spleen. Because of this, anaemias due to vitamin A show an increase in iron stores and increased serum ferritin levels. This type of anaemia is common in low- and middle-income countries, especially in young children, pregnant women and women of reproductive age. To increase intake of vitamin A, the following should be considered:

- The carotenoids alpha-carotene and beta-carotene are called pro-vitamin A carotenoids because they can be converted to active vitamin A. They are found in plant-source foods, including green leafy vegetables and orange/yellow fruits and vegetables in the form of pro-carotenoids.
- Consuming fat improves the absorption of carotenoids from the diet.
- Dairy products, eggs, fish oil and liver are rich sources of vitamin A.
- Short cooking times and steaming rather than boiling may reduce oxidation and loss of carotenoids in foods.¹⁶⁰

4.5.2.4 General recommendations

The WHO recommends dietary diversification as a key strategy to prevent anaemias since inadequate dietary intake is the primary pathway by which nutritional anaemias develop. Beyond anaemias, dietary diversification also supports improved growth in children and reduced intake of less nutritious foods that contribute to the development of non-communicable diseases and weight gain.¹⁶⁰ Below is a list of specific recommendations to promote dietary diversification.

WHO key actions and recommendations: dietary diversification and enhancing the bioavailability of micronutrients¹⁶⁰

1. Increase the production and consumption of foods that are rich in vitamin A/carotenoid, such as green leafy vegetables, orange-fleshed fruits and vegetables (e.g. orange-fleshed sweet potatoes), dairy products, eggs, liver and fish oils.
2. Increase the production and consumption of iron-rich foods, primarily animal-source foods such as meat (especially red meat), poultry and fish, but also iron-rich plant sources such as legumes.
3. Add fruits and vegetables that are rich in citric or ascorbic acid (e.g. citrus fruits) to the diet, to increase the absorption of non-haem iron. Vitamin C degrades with cooking, so consumption of uncooked (or lightly cooked) fruits and vegetables with high vitamin C content should be encouraged (assuming considerations of food hygiene and food safety are addressed).
4. Identify and promote culturally appropriate and feasible methods of food processing and preparation, to improve bioavailability and absorption.
 - a. Iron: germination, fermentation and soaking may improve absorption.
 - b. Vitamin A: short cooking times and steaming rather than boiling will maintain pro-vitamin A activity.
5. Avoid combining known inhibitors of iron absorption with meals that are high in iron content. For example:
 - a. Separate tea and coffee drinking from mealtimes; consumption 1–2 hours later will not inhibit iron absorption;
 - b. Consume dairy products (milk, cheese and other foods made from milk) as a between meal snack, not at a mealtime.

5 Special populations

5.1 Pregnant women

A healthy diet is key to ensuring the health of mothers and their children both during and after pregnancy. Broadly, the WHO recommends that pregnant women follow a healthy diet that includes “adequate energy, protein, vitamins and minerals, obtained through the consumption of a variety of foods, including green and orange vegetables, meat, fish, beans, nuts, pasteurised dairy products and fruit”.¹⁶¹ However, this diet is not always followed, and many pregnant women are undernourished, overweight or obese, which is associated with poor pregnancy outcomes. In response to this, the WHO recommends several nutritional interventions for a positive pregnancy experience (see Table 8).

Table 8: WHO recommendations on antenatal care for a positive pregnancy experience¹⁶²

	Recommendation	Level of recommendation
Dietary interventions	Counselling about healthy eating and keeping physically active during pregnancy is recommended for pregnant women to stay healthy and to prevent excessive weight gain during pregnancy. ^a	Recommended
	In undernourished populations, nutrition education on increasing daily energy and protein intake is recommended for pregnant women to reduce the risk of low-birth-weight neonates.	Context-specific recommendation
	In undernourished populations, balanced energy and protein dietary supplementation is recommended for pregnant women to reduce the risk of stillbirths and small-for-gestational-age neonates.	Context-specific recommendation
	In undernourished populations, high-protein supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes.	Not recommended
Iron and folic acid supplements	Daily oral iron and folic acid supplementation with 30–60mg of elemental iron ^b and 400µg (0.4mg) of folic acid ^c is recommended for pregnant women to prevent maternal anaemia, puerperal sepsis, low birth weight and preterm birth. ^d	Recommended
	Intermittent oral iron and folic acid supplementation with 120mg of elemental iron ^e and 2,800µg (2.8mg) of folic acid once weekly is recommended for pregnant women to improve maternal and neonatal outcomes if daily iron is not acceptable due to side effects, and in populations with an anaemia prevalence among pregnant women of less than 20%. ^f	Context-specific recommendation
Calcium supplements	In populations with low dietary calcium intake, daily calcium supplementation (1.5–2.0g oral elemental calcium) is recommended for pregnant women to reduce the risk of pre-eclampsia. ^g	Context-specific recommendation
Vitamin A supplements	Vitamin A supplementation is only recommended for pregnant women in areas where vitamin A deficiency is a severe public health problem, ^h to prevent night blindness. ⁱ	Context-specific recommendation
Zinc supplements	Zinc supplementation for pregnant women is only recommended in the context of rigorous research.	Context-specific recommendation (research)
Multiple micronutrient supplements	Multiple micronutrient supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes.	Not recommended
Vitamin B6 (pyridoxine) supplements	Vitamin B6 (pyridoxine) supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes.	Not recommended
Vitamin E and C supplements	Vitamin E and C supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes.	Not recommended

	Recommendation	Level of recommendation
Vitamin D supplements	Vitamin D supplementation is not recommended for pregnant women to improve maternal and perinatal outcomes. ^j	Not recommended
Restricting caffeine intake	For pregnant women with high daily caffeine intake (more than 300mg per day), ^k lowering daily caffeine intake during pregnancy is recommended to reduce the risk of pregnancy loss and low-birth-weight neonates.	Context-specific recommendation

- a) A healthy diet contains adequate energy, protein, vitamins and minerals, obtained through the consumption of a variety of foods, including green and orange vegetables, meat, fish, beans, nuts, whole grains and fruit.
- b) The equivalent of 60mg of elemental iron is 300mg of ferrous sulphate heptahydrate, 180mg of ferrous fumarate or 500mg of ferrous gluconate.
- c) Folic acid should be commenced as early as possible (ideally before conception) to prevent neural tube defects.
- d) This recommendation supersedes the previous recommendation found in the WHO publication guideline: daily iron and folic acid supplementation in pregnant women (2012).
- e) The equivalent of 120mg of elemental iron equals 600mg of ferrous sulphate heptahydrate, 360mg of ferrous fumarate or 1,00 mg of ferrous gluconate.
- f) This recommendation supersedes the previous recommendation in the WHO publication guideline: intermittent iron and folic acid supplementation in non-anaemic pregnant women (2012).
- g) This recommendation is consistent with the WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia (2011) and supersedes the previous recommendation found in the WHO publication guideline: calcium supplementation in pregnant women (2013).
- h) Vitamin A deficiency is a severe public health problem if >5% of women in a population have a history of night blindness in their most recent pregnancy in the previous 3–5 years that ended in a live birth, or if >20% of pregnant women have a serum retinol level <0.70µmol/l. Determination of vitamin A deficiency as a public health problem involves estimating the prevalence of deficiency in a population by using specific biochemical and clinical indicators of vitamin A status.
- i) This recommendation supersedes the previous recommendation found in the WHO publication Guideline: vitamin A supplementation in pregnant women (2011).

Further, to assess the nutritional status of pregnant patients, the International Federation of Gynaecology and Obstetrics (FIGO) developed a Nutrition Checklist¹⁶³, a validated clinical practice tool that consists of four sections with questions focusing on dietary requirements, body mass index, diet quality and micronutrients. FIGO recommends that this checklist be used to collect baseline information on weight and nutritional status in order to inform conversations with patients surrounding their health and identify potential nutritional issues that may need to be analysed further or addressed. This information should be shared with a patient's other healthcare providers, especially their physician.¹⁶⁴

Below is a list of discussion points from the FIGO Nutrition Checklist that can serve as a general guide for conversation with patients planning to get pregnant or those who are already pregnant. Pharmacists can provide general education and promote awareness of these topics and should encourage patients to speak to their physician about these more in depth.

International Federation of Gynaecology and Obstetrics recommended discussion points¹⁶³

Pre-pregnancy/when planning a pregnancy

- Importance of a healthy diet and exercise
- Problems associated with sedentary behaviour, such as screen-time
- Risky behaviours and exposures, including tobacco, alcohol, recreational drugs and environmental toxins
- Chronic disease screening and management
- Supplementation with folic acid (400µg/day) and other nutrients (iron, iodine, vitamin B12)

During pregnancy

- Dietary counselling, safe levels of exercise, sedentary time, weight management and gestational weight gain
- Risky behaviours and exposures, including tobacco, alcohol, recreational drugs, and sources of food-borne infections
- Screening and management for pregnancy complications (gestational diabetes and blood pressure)

- Supplementation with folic acid (400µg/day), iron (30–60mg/day) and other nutrients as needed (iodine, vitamin B12, vitamin D)

5.2 Older adults

The number of people aged 60 years and older is rapidly increasing, with numbers projected to rise from one billion in 2019 to 2.1 billion in 2050. As a result, it is likely the world will see a corresponding rise in various health conditions, including non-communicable diseases, hearing loss, sight loss, osteoporosis, depression and dementia. It is therefore important that these patients are not only receiving optimal pharmacological treatment, but also supplementing this care by maintaining a healthy lifestyle.¹⁶⁵

As people age, they experience various physiological changes that put them more at risk of being undernourished or malnourished, due in part to sensory impairment and changes in body composition which are not always reflected in changes in weight. According to the WHO, it is recommended that oral supplemental nutrition with dietary advice be recommended for older people affected by undernutrition.

To support this recommendation, it is further recommended that nutritional assessments be conducted with patients that include nutritional history, records of food intake, physical examinations and specific laboratory tests if applicable.¹⁶⁶ Examples include the Malnutrition Screening Tool, the Malnutrition Universal Screening Tool, and the Subjective Global Assessment.⁸⁹⁻⁹¹

An important dietary consideration for the ageing population is protein. As people age, protein absorption decreases, and low protein intake is associated with loss of lean body mass, sarcopenia, osteoporosis and impaired immune response. To combat this, many studies focused on protein supplementation aimed to provide protein with non-protein energy sources such as carbohydrates and fats. Typically, most trials aimed to provide, per serving, 300–400kcal, 10–20g of protein, and additional vitamins and minerals.¹⁶⁶ Additionally, vitamin and mineral deficiencies in the ageing population have been shown to increase the risk of developing non-communicable diseases, chronic fatigue, and cognitive and neuromuscular disorders. Therefore, it is important to promote nutrient-rich diets and adequate nutrition intake for older adults.¹⁶⁷

For additional information regarding specific dietary recommendations for the elderly, oral nutritional supplements, and considerations for those in care homes, refer to the Malnutrition Pathway website¹⁶⁸, which contains resources developed by a multi-professional expert panel, some in partnership with the National Nurses Nutrition Group, including malnutrition care plans¹⁶⁹, resources for those working in care and residential homes¹⁷⁰, a pathway for using oral nutritional supplements¹⁷¹, and protein guidance.¹⁷²

6 Micronutrient supplementation

Vitamins and minerals, also known as micronutrients, are an essential component of a healthy diet. Most micronutrients, except vitamin D, are not produced in the body and must be obtained through the diet. It is only necessary to obtain small amounts of these micronutrients from food, but it is important to ensure adequate intake because deficiencies can have severe health impacts.¹⁷³ Deficiencies in iron, vitamin A and iodine are the most common around the world, especially in children and pregnant women.¹⁷⁴ It is always preferred that individuals obtain necessary micronutrients through their diet, but when an individual is deficient or high-risk, they may require supplementation. Common micronutrients are listed below along with general recommendations. Before recommending any of these, or others, to patients, ensure you are familiar with the appropriate indications for use, potential side effects or toxicities, and interactions with other medicines.

6.1 Common micronutrients

6.1.1 Calcium

Calcium plays an important role in building and maintaining strong bones, with 99% of our body's calcium being stored in our bones. Calcium can also reduce the risk of hypertensive disorders, such as pre-eclampsia and eclampsia, during pregnancy.

- In populations with low dietary calcium intake, daily calcium supplementation (1.5–2g oral elemental calcium) is recommended for pregnant women to reduce the risk of pre-eclampsia.¹⁷⁵
- For those who are at high risk of calcium and vitamin D insufficiency and those who are receiving treatment for osteoporosis, calcium supplementation may be recommended. Doses should be limited to 500–600mg/day and should be taken in combination with vitamin D.¹⁴⁵

6.1.2 Folate (vitamin B9)

Folate is essential early in pregnancy to ensure healthy development of the fetus's brain and spine. Having sufficient levels of folate prior to pregnancy can reduce neural tube defects, including spina bifida and anencephaly.¹⁷³

- All women should take a folic acid supplement (400µg daily) from the moment they begin trying to conceive until 12 weeks of gestation.
- Women who have had a fetus diagnosed as affected by a neural tube defect or who have given birth to a baby with a neural tube defect should: (1) receive information on the risk of recurrence; (2) be advised on the protective effect of periconceptional folic acid supplementation; (3) be offered high-dose supplementation (5mg of folic acid daily); and (4) be advised to increase their dietary intake of folate.¹⁷⁶

6.1.3 Iodine

Severe deficiencies in iodine can lead to brain damage. During pregnancy, it can result in stillbirths, spontaneous abortion, and congenital anomalies as it is essential for healthy brain development, and women's iodine requirements increase substantially during pregnancy. Less severe deficiencies can result in mental impairment that reduces intellectual capacity. To reduce iodine deficiencies, the preferred method is universal salt iodisation. This requires that all food-grade salt used in households and food processing be fortified with iodine.¹⁷⁴

- Iodine supplementation is recommended for pregnant and lactating women in countries where less than 20% of households have access to iodised salt.¹⁷⁷

6.1.4 Iron

Iron is essential for motor and cognitive development. Deficiencies are most common in children and pregnant women. Iron deficiency is also the leading cause of anaemia. During pregnancy, iron deficiency anaemia can have negative health impacts on both the mother and the fetus.

- Daily oral iron supplementation with 30–60mg of elemental iron is recommended for pregnant women to prevent maternal anaemia, puerperal sepsis, low birth weight and preterm birth.
 - 60mg of elemental iron = 300mg ferrous sulphate heptahydrate = 180mg ferrous fumarate = 500mg ferrous gluconate.¹⁷⁸
- Oral iron supplementation, either alone or with folic acid, may be provided to postpartum women for 6–12 weeks following delivery to reduce the risk of gestational anaemia in areas where this is a public health concern.
 - 20% or higher population prevalence of gestational anaemia is considered a moderate public health problem.¹⁷⁹
- Daily iron supplementation is recommended in menstruating adult women and adolescent girls¹⁸⁰, infants and young children aged 6–23 months¹⁸¹, preschool-age children aged 24–59 months¹⁸², and school-age children aged 60 months and older¹⁸³ living in settings where the prevalence of anaemia is 40% or higher in these age groups.¹⁸⁰

6.1.5 Vitamin A

Vitamin A deficiencies are the leading cause of preventable blindness in children. It can also increase the risk of disease and death from severe infections, including diarrhoeal disease and measles. Breastfeeding is the best way to protect babies from vitamin A deficiencies.¹⁷⁴

- In settings where vitamin A deficiency is a public health problem, high-dose vitamin A supplementation is recommended in infants and children aged 6–59 months.
 - Vitamin A deficiency is considered a public health problem when the prevalence of night blindness is 1% or higher in children aged 24–59 months or where the prevalence of vitamin A deficiency (serum retinol 0.70µmol/l or lower) is 20% or higher in infants and children aged 6–59 months.¹⁸⁴
- Given that deficiencies can also occur in women during the final trimester of pregnancy, supplementation for pregnant women is only recommended in areas where vitamin A deficiency is a severe public health problem.¹⁸⁵
 - Vitamin A deficiency is a severe public health problem if ≥5% of women in a population have a history of night blindness in their most recent pregnancy in the previous 3–5 years that ended in a live birth, or if ≥20% of pregnant women have a serum retinol level <0.70µmol/l.¹⁸⁴

When considering vitamin A supplementation, it is important to note that, according to the WHO, a single dose of vitamin A greater than 25,000IU is not recommended as its safety is uncertain. If this dose is consumed between 15 and 60 days from conception, it could be teratogenic.¹⁸⁶ Further, one study found that of women who took more than 10,000IU of preformed vitamin A per day in the form of supplements, around one in 57 infants had a malformation that could be attributed to the supplement.¹⁸⁷ Therefore, caution is warranted if recommending vitamin A supplementation to pregnant women.

6.1.6 Vitamin C

Vitamin C deficiency has historically been associated with scurvy, with symptoms appearing within one month of little to no vitamin C intake. In the present day, vitamin C deficiencies are rare in developed countries, with symptoms only occurring if vitamin C intake falls below around 10mg/day for multiple weeks. Vitamin C inadequacy, which is intake below the recommended daily amount but above deficiency, can be seen in smokers, infants fed evaporated or boiled milk, individuals with limited food variety, and people with malabsorption and certain chronic diseases.

Evidence surrounding the role of vitamin C supplementation in treating or preventing the common cold is mixed, but generally suggests:

- Regular intake of vitamin C at doses of at least 200mg/day does not reduce the incidence of the common cold in the general population, but it might be helpful to those exposed to extreme physical exercise or cold environments as well as those with deficient vitamin C status, including chronic smokers and the elderly.
- Taking vitamin C after cold symptoms have started does not appear to be beneficial.

It is also suggested that vitamin C may play a role in cancer prevention and treatment, cardiovascular disease and age-related macular degeneration and cataracts.¹⁰¹

- Cancer prevention: There is inconsistent evidence on whether dietary vitamin C intake affects cancer risk. Vitamin C supplementation, alone and with other nutrients, offers no benefits for cancer prevention.
- Cancer treatment: Some researchers support using high-dose IV vitamin C as a drug to treat cancer, but evidence is not yet sufficient to show its benefit.
- Cardiovascular disease: Most studies do not provide convincing evidence that vitamin C supplementation protects against cardiovascular disease or reduces its morbidity or mortality.
- Age-related macular degeneration (AMD) and cataracts: Evidence does not support that vitamin C, either alone or with other antioxidants, affects the risk of developing AMD. However, some evidence suggests that the AREDS formulations (500mg vitamin C, 400IU vitamin E, 15mg beta-carotene, 80mg zinc, and 2mg copper) might slow its progression in people at high risk of developing advanced AMD.

6.1.7 Vitamin D

Vitamin D deficiencies can cause bone diseases, including rickets in children and osteomalacia in adults. Vitamin D also helps the immune system prevent bacterial and viral infections and helps the body absorb calcium to support bone health. Further, it is required for muscle and nerve function.¹⁷³ Vitamin D is produced by the body during exposure to sunlight and can also be found in oily fish, eggs and fortified food products.

- In pregnant women, vitamin D supplementation is not recommended to improve maternal and perinatal outcomes.¹⁸⁸
- Some studies have suggested that vitamin D supplementation can decrease the frequency and severity of respiratory infections among children, but additional research is needed before specific recommendations can be made.¹⁸⁹
- Current evidence suggests that vitamin D supplements may be effective in preventing rickets, particularly for infants and children who may be at higher risk due to limited sun exposure or those with darker skin pigmentation; however further research is needed before specific recommendations can be made.¹⁹⁰
- For those who are at high risk for calcium and vitamin D insufficiency and those who are receiving treatment for osteoporosis, calcium supplementation (at doses limited to 500–600mg per day), in combination with vitamin D, may be recommended.¹⁴⁵

In all, while vitamin D has been extensively studied for a variety of conditions, a recent study concludes that firm universal conclusions about its benefits cannot be drawn. The study suggests a probable association between vitamin D concentrations and birth weight, dental caries in children, maternal vitamin D concentrations at term, and parathyroid hormone concentrations in patients with chronic kidney disease requiring dialysis, but additional studies are needed to provide recommendations.¹⁹¹

Studies exploring the role of vitamin D supplementation in preventing respiratory infections have shown mixed results. However, a large meta-analysis showed that daily or weekly vitamin D supplementation may reduce the risk of respiratory tract infections in both children and adults, with greatest benefits being seen in those who are deficient.¹⁰⁵ However, additional research is needed before conclusions can be drawn regarding vitamin D's role in protecting against respiratory infections.

When considering vitamin D supplementation, the type of vitamin D chosen must be considered. Research has shown that vitamin D₃ (cholecalciferol) appears to be more efficacious than vitamin D₂ (ergocalciferol) in raising total 25(OH)D levels, and is therefore a preferred choice for supplementation.^{152, 153}

6.1.8 Zinc

Zinc is an important micronutrient for cellular growth, cellular differentiation and metabolism. In children, zinc deficiencies can limit childhood growth and reduce resistance to infections. In pregnant women, a zinc deficiency can negatively impact pregnancy outcomes for both the mother and the infant. Severe zinc deficiencies are rare in humans, but mild to moderate deficiencies are common. One area where zinc supplementation is recommended is in the management of diarrhoea in children. Zinc supplementation has been shown to reduce the duration and severity of diarrhoea and prevent future episodes; however, the mechanism through which this occurs is not fully understood.

- The WHO requires further research before specific recommendations can be made for zinc supplementation in pregnant women or children.^{192, 193}
- It is recommended that children with diarrhoea are provided with 20mg of zinc per day for 10–14 days (10mg/day for infants under the age of six months).¹⁹⁴

Addressing zinc deficiencies has been shown to boost the immune system and reduce mortality from infectious diseases, including viral infections.¹⁰⁷ Giving zinc, at a dose of at least 75mg/day, within 24 hours of the onset of symptoms of the common cold may reduce the duration and severity of symptoms in healthy individuals. However, more research is needed to determine the optimal dosage, formulation and duration before general recommendations can be made. Further, there is insufficient evidence to recommend prophylactic zinc supplementation.¹⁰⁸ Of note is that patients who take excess amounts of zinc or continue taking zinc supplementation for long periods may be at risk for developing zinc-induced copper deficiency anaemia, which requires immediate medical attention.¹⁹⁵

7 Weight management

7.1 Background

Maintaining a healthy weight is an important contributor to living a healthy life. However, rates of obesity and overweight continue to grow, with obesity nearly tripling since 1975. In 2016, more than 1.9 billion adults, or 39% of the global population, were overweight and, of these, over 650 million, or 13%, were obese. This trend is also seen in children, with 38 million children under the age of five years being overweight in 2019. Further, over 340 million children and adolescents aged 5–19 were overweight or obese in 2016. These growing rates of overweight and obesity are of particular concern given that higher weights are a major risk factor for NCDs, including cardiovascular diseases, diabetes, musculoskeletal disorders, some cancers and other conditions. In children, specifically, obesity is linked to higher chances of obesity and premature death and disability in adulthood. They may also experience breathing difficulties, increased risks of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and psychological effects.¹⁹⁶ Therefore, given the increasing global rates of overweight and obesity in both adults and children, it is imperative that steps are taken to assist individuals in achieving and sustaining a healthy weight.

Generally, overweight and obesity are classified based on an individual's body mass index (BMI). BMI is defined as a person's weight in kilograms divided by the square of their height in metres (kg/m²). For adults, the WHO defines overweight as a BMI greater than or equal to 25kg/m² and obesity as a BMI greater than or equal to 30kg/m² (Table 9). BMI is the most commonly used population-level measurement as it is the same for all genders and all ages of adults. However, BMI is not a perfect measurement as it does not take into account individual patient factors, including muscle mass, lifestyle, overall body composition, ethnicity or age, and it does not always directly correlate with a patient's health. However, despite this, BMI is still a commonly used indicator due to the simplicity of measuring and calculating it in a variety of healthcare settings.¹⁹⁶

Table 9: Body Mass Index¹⁹⁷

BMI	Weight status
Below 18.5kg/m ²	Underweight
18.5–24.9kg/m ²	Normal weight
25.0–29.9kg/m ²	Overweight
30.0kg/m ² and above	Obese

To supplement BMI, other measures can be used, including waist circumference, waist-to-hip ratio or waist-to-height ratio. These measures of abdominal obesity may be better predictors of cardiovascular disease risk, the leading cause of obesity-related deaths, as increased visceral adipose tissue is associated with many risk factors for cardiovascular diseases. However, given that these measurements do not have universally agreed reference values, it may be best to utilise BMI in conjunction with the measure(s) best suited to your practice. Waist circumference is the most commonly used of these measurements given the simplicity of only needing one measurement.¹⁹⁸

To accurately measure waist circumference, have the patient stand and place a measuring tape around their mid-section, just above the hipbone. Ensure the measuring tape is horizontal around the waist and parallel to the floor. Keep the tape snug around the waist, but do not compress the skin. Take the measurement just after they breathe out normally.¹⁹⁹

There is no universally agreed upon definition for a healthy waist circumference; however, the International Diabetes Federation has compiled guidelines and cut-off values for defining central (abdominal) obesity (Table 10) that are gender and ethnic-group specific, not country of residence specific. These data are taken from different sources and more data are needed to link these reference points to certain risks; however, they provide a helpful framework through which a patient's general risk can be determined.

Table 10: International Diabetes Federation ethnic-specific values for waist circumference to define central (abdominal) obesity²⁰⁰

Country/ethnic group	Waist circumference
Europeans*	Male ≥94cm Female ≥80cm <i>In the USA, the ATP III** values (10 cm male; 88cm female) are likely to continue to be used for clinical purposes</i>
South Asians	Male ≥90cm Female ≥80cm

Country/ethnic group	Waist circumference
Chinese	Male ≥90cm Female ≥80cm
Japanese***	Male ≥90cm Female ≥80cm
Ethnic South and Central American	Use South Asian recommendations until more specific data are available
Sub-Saharan Africans	Use European data until more specific data are available
Eastern Mediterranean and Middle East (Arab) populations	Use European data until more specific data are available

* In future epidemiological studies of populations of Europid origin, prevalence should be given using both European and North American cut-points to allow better comparisons.

** National Cholesterol Education Program — Third Adult Treatment Panel

*** Originally different values were proposed for Japanese people but new data support the use of the values shown above.

Once it has been determined that a patient is overweight or obese, the next step is to determine the actions that can be taken to reduce a patient's weight, assuming they are interested in losing weight. Given that obesity is a complex, multifaceted chronic condition, the support of a variety of healthcare providers is needed to ensure patients can successfully and safely lose weight and maintain their weight loss. Members of this multidisciplinary team may include physicians, nurses, dietitians, nutritionists, behavioural/mental health professionals and pharmacists.²⁰¹ Even though pharmacological treatment is not necessary for most patients interested in weight loss, pharmacists can still play an important role in this multidisciplinary team. Pharmacists can provide general education on weight loss strategies, refer patients to other healthcare professionals for more specialised care, and provide information to both patients and other healthcare providers regarding weight loss medicines or other weight loss products found in pharmacies.

7.2 Non-pharmacological treatment

The preferred approach to addressing overweight and obesity is a non-pharmacological approach that encourages patients to make changes to their lifestyles, including following healthier diets and increasing their physical activity. While there are numerous “fad” diets patients can follow, including low-carb, intermittent fasting, juice cleanses, etc., the best and safest way to ensure healthy lifestyle changes are sustained is through incremental changes that ultimately result in a healthy, balanced diet, calorie intake reduction and consistent physical activity. In fact, the reason that any popular, fad diet results in weight loss is due to calorie reduction, which can be achieved without following a specific diet.²⁰² Further, some of these popular diets restrict intake of certain important nutrients which can lead to dehydration, weakness or fatigue, nausea and headaches, constipation, and inadequate vitamin and mineral intake.²⁰³ Therefore, pharmacists should refer to section 1.2 and section 1.3 of this toolkit for general guidance from the WHO on recommendations for a healthy, balanced diet and adequate physical activity. Pharmacists should also consider the recommendations throughout this toolkit regarding dietary considerations for specific disease states.

In order to promote healthy lifestyle changes, pharmacists can follow the recommendations and strategies found in section 8 of this toolkit. However, it should be noted that pharmacists should not be providing counselling or therapy to patients looking to lose weight. They should instead refer patients to a behavioural or mental health professional or a physician so they can receive more specialised, focused care. These professionals can comprehensively assess patients before they begin their weight loss journey, provide cognitive behavioural counselling and education to ensure weight loss goals are met, and manage any other mental health concerns a patient may have, whether or not they are related to weight or eating.

Additionally, while pharmacists can provide guidance and education regarding nutrition, they should also consider referring patients to nutritionists, dietitians or physicians so they can receive more specific guidance and support in making appropriate changes to their diets in order to lose weight.²⁰¹ Given that pharmacists likely interact with patients more often than other healthcare providers, they have an opportunity to not only promote and educate their patients about non-pharmacological approaches to weight loss but can also refer their patients to appropriate care so they have the support they need to safely reach their goals. Meal replacements and self-monitoring are two non-pharmacological approaches to weight loss that patients may request advice about from their pharmacist.

7.2.1 Meal replacements

While it is typically preferred in clinical guidelines that patients obtain their nutrients through healthy, whole foods, patients do have the option of also utilising meal replacement products, which are defined by Astbury et al. as “discrete foods, food products, or drinks that are used to replace foods usually consumed at one or more meals with the intent to reduce daily energy intake for the purposes of achieving weight loss or weight

maintenance following weight loss”.²⁰⁴ These can be in the forms of “soups, shakes and bars” but also include “portion-controlled ready meals as well as discreet portions of readily available conventional foods such as breakfast cereal or rice”. Given that these products are often sold at pharmacies, pharmacists should be aware of the evidence surrounding their effectiveness. A systematic review and meta-analysis²⁰⁴ analysed the effectiveness of meal replacements for weight loss and found that interventions that included meal replacement products showed weight loss at one year that was significantly greater than in interventions that did not use these products. Specifically, they found that those who followed a meal replacement diet, compared with a normal diet approach, lost an additional 1.44kg at one year and this difference appears to be sustained for up to four years. Thus, the authors conclude that meal replacements can be an effective approach to achieve weight loss in those who are overweight or obese.

It is important to note that this study evaluated meal replacements, which are designed to replace one or more usual meals, but not all meals. Instructions for these products typically suggest eating a food-based meal at least once a day to ensure adequate intake of nutrients and vitamins. Total diet replacement, on the other hand, involves liquid or formula food products that replace all meals and snacks and are formulated to be the only source of nutrition. Patients who wish to pursue total diet replacement should do so under the supervision of a healthcare professional, such as a dietician.²⁰⁴

7.2.2 Self-monitoring

To help patients understand their current calorie intake and physical activity, self-monitoring can be an effective tool that allows them to identify areas of improvement in order to reach their weight loss goals. Self-monitoring includes recording food intake, calculating daily calorie and nutrient intake, recording physical activity, and/or recording weight. A systematic review of 22 studies showed the benefits of self-monitoring, with more frequent self-monitoring significantly associated with weight loss compared with less frequent self-monitoring.²⁰⁵ The method by which a patient monitors their dietary intake and physical activity can vary. It can be in the form of a notebook/diary or through an electronic app or website, of which there are many currently available. It is best to work with the patient to identify which strategies would encourage them to be consistent in self-monitoring. Pharmacists should encourage patients to share their self-monitoring data with other members of their healthcare team, such as physicians, dietitians or nutritionists, as they can identify strategies to improve the patient’s lifestyle and help them make adjustments to reach their weight loss goals.

7.3 Pharmacological treatment

This section is based on an article by Dr Aurora Simón, director of the Medicines Information Centre of the Portuguese Pharmaceutical Society, and adapted to an international context. FIP and the authors acknowledge the contribution of Dr Simón and her kind permission to use the text.

When a patient is unable to achieve desirable weight loss through lifestyle modifications, pharmacological treatment may be considered. There are multiple products that can be recommended, but their availability and approval will vary by country. Generally, pharmacological treatment is considered when lifestyle modifications to lose weight have not been successful and if a patient has a BMI greater than 30kg/m² or has a BMI greater than 27kg/m² in addition to weight-related health problems, such as high blood pressure or type 2 diabetes.²⁰⁶

For most patients, a 5–10% decrease in body weight can help to improve health and reduce complications associated with obesity and overweight, including reductions in blood pressure, blood glucose and triglycerides. It may also contribute to improvements in joint pain and sleep apnoea.²⁰⁶ The medicines listed in this section have demonstrated efficacy in promoting weight loss, but their efficacy is typically limited to a 5–10% reduction in body weight in one year, but this will vary depending on the lifestyle changes a patient makes in conjunction with their treatment.²⁰⁷ Some weight loss medicines are only approved for short-term use, up to 12 weeks, and others are approved for longer-term use, but this approval will likely vary by country and pharmacists should verify the conditions surrounding appropriate doses and durations of these medicines specific to their country. Finally, it is important to note that pregnant women and women who are planning to get pregnant should also avoid the medicines listed in this section because they may cause harm to the fetus.²⁰⁶

This section describes common weight loss medicines, which are best used in conjunction with a healthy diet and physical activity.

7.3.1 Orlistat

Orlistat is a reversible inhibitor of gastric and pancreatic lipases that reduces the absorption of dietary fats by around 30%, causing a caloric deficit and, subsequently, weight loss. This medicine is taken three times daily, either during meals or up to one hour after meals, and is typically recommended for those who are obese or overweight with other risk factors, in conjunction with a low-calorie diet.²⁰⁷ Orlistat is the only weight loss medicine that does not involve mechanisms surrounding appetite. It is also one of the safest weight loss medicines as it has very limited systemic absorption.²⁰⁸

In the “Xenical in the prevention of diabetes in obese subjects (XENDOS)” study, orlistat (Xenical) resulted in significantly greater weight loss at one year compared with the placebo (10.6kg vs 6.2kg) and this significant change was sustained through the end of the four-year study (5.8kg vs 3.0kg). Further, 72.8% of patients taking orlistat achieved weight loss greater than or equal to 5% after one year, compared with 45.1% of placebo patients. Beyond weight loss, those taking orlistat in conjunction with lifestyle changes showed improvements in cardiovascular risk factors that were sustained throughout the study. These factors included blood pressure, waist circumference and lipids. Specifically, total and LDL cholesterol were significantly reduced in those taking orlistat compared with placebo.²⁰⁹ Further, a meta-analysis of 16 orlistat studies showed that orlistat reduced the incidence of diabetes and improved total cholesterol, LDL cholesterol, blood pressure and glycaemic control in patients with diabetes. However, it also showed slightly reduced levels of HDL cholesterol and higher rates of gastrointestinal side effects. Finally, this analysis showed that 21% more patients achieved 5% weight loss and 12% more achieved 10% weight loss when taking orlistat compared with placebo.²¹⁰

Side effects from orlistat are typically gastrointestinal and commonly include fatty/oily stools, faecal urgency and oily spotting, which occurred at a frequency of about 15–20% in the 16 studies included in the meta-analysis.²¹⁰ Other side effects include flatulence, cramps and faecal incontinence. Side effects due to orlistat are typically the main reason treatment is discontinued by the patient as they can be unpleasant. To avoid side effects, it can be recommended that patients limit their daily fat intake to less than 30% of their total calories.²⁰⁷ Patients may also need to take a multivitamin while on orlistat because the medicine may reduce the absorption of fat-soluble vitamins A, D, E and K.²⁰⁸⁻²¹⁰

Rarely, orlistat has been associated with cholelithiasis and pancreatitis. Further, because it increases absorption of oxalic acid, it can cause kidney stones or acute kidney injury. Therefore, renal function should be monitored periodically. Orlistat is contraindicated in those with chronic malabsorption syndrome and cholestasis.²¹¹ Finally, orlistat may decrease absorption of cyclosporine, amiodarone, some antiepileptics, levothyroxine, and antiretrovirals for HIV treatment. It can also decrease vitamin K absorption, requiring warfarin doses to be decreased.^{208, 211, 212}

7.3.2 Liraglutide

Liraglutide is a glucagon-like peptide-1 (GLP-1) receptor agonist that is most commonly used in the treatment of type 2 diabetes. More recently, liraglutide has been approved for weight loss, in conjunction with a reduced calorie diet and increased physical activity, for adults with a BMI $\geq 30\text{kg/m}^2$ or $27\text{--}30\text{kg/m}^2$ with at least one weight-related comorbidity, including hypertension, type 2 diabetes, dyslipidaemia, or obstructive sleep apnoea. Liraglutide results in weight loss by acting on the GLP-1 receptor in several areas of the brain associated with appetite regulation and causes increased satiety. It also slows gastric emptying, stimulates insulin secretion, and reduces glucagon secretion in a glucose-dependent manner.^{207, 213}

The “Satiety and clinical adiposity-liraglutide” (SCALE) studies provide evidence for the efficacy and safety of liraglutide for weight loss. These four trials (“SCALE-Obesity and prediabetes”, “SCALE-Diabetes”, “SCALE-Maintenance”, and the three-year assessment of the “SCALE-Obesity and prediabetes” trial) compared the use of liraglutide and placebo in individuals with and without comorbidities, in combination with reduced calorie diets and increased physical activity. All trials showed significantly greater reductions in weight in the liraglutide treatment groups compared with placebo. In addition to weight loss, the trials showed that liraglutide resulted in improvements in glycaemic control, blood pressure, lipid levels and health-related quality of life in overweight or obese trial participants.^{207, 208}

The most common side effects associated with liraglutide are gastrointestinal effects, including nausea, diarrhoea, vomiting, constipation and dyspepsia. However, these are typically mild to moderate and can be lessened with gradual dose increases. Other potential side effects include hypoglycaemia, headache, increased heart rate and dizziness. Liraglutide has also been associated with gallstones and, rarely, acute pancreatitis. Liraglutide is contraindicated in those with a personal or family history of medullary thyroid carcinoma and in patients with Multiple Endocrine Neoplasia syndrome type 2 (MEN 2). It should also not be used in those with severe renal or hepatic impairment.^{207, 208, 213}

7.3.3 Naltrexone/bupropion

Naltrexone is an opioid receptor antagonist used primarily in the treatment of alcohol and opioid dependence. Bupropion is a selective dopamine and noradrenaline (norepinephrine) reuptake inhibitor that is primarily used for depression and smoking cessation. The mechanism through which the combination product of naltrexone/bupropion contributes to weight loss is not fully understood, but is believed that, together, these drugs have a synergistic effect on appetite suppression and exert their effects in the hypothalamus.^{207, 208}

This medicine has shown dose-dependent effectiveness in weight reduction in several clinical studies, most notably, the “Contrave obesity research” (COR) trials: “COR-I”, “COR-II”, “COR-Behaviour modification” and “COR-Diabetes”. Both the COR-I and COR-II trials showed that treatment with naltrexone/bupropion resulted in significant reductions in weight compared with placebo.^{214, 215} The COR-Behaviour modification trial specifically looked at the efficacy of the medicine as an adjunct to intensive behaviour modification. These behaviour modifications included following an energy-reduced diet, participating in group behavioural modification sessions, and increasing physical activity. In all, those who took naltrexone/bupropion in addition to making behavioural modifications efforts lost an average of 9.3% of initial weight compared with 5.1% for those who only followed the behavioural modifications. In addition, 66.4% of those in the treatment group lost 5% of their body weight compared with only 42.5% of those who did not receive naltrexone/bupropion.²¹⁶ Finally, the COR-Diabetes trial saw similar significant reductions in weight in patients with type 2 diabetes who received naltrexone/bupropion compared with those who received a placebo and this weight loss was accompanied by significant reductions in HbA1c.²¹⁷ In all, the COR trials showed that naltrexone/bupropion is an effective medicine to reduce weight and is also associated with improvements in cardiometabolic indicators, including glycaemic control, insulin resistance and lipid profiles.²⁰⁸

The main side effect associated with naltrexone/bupropion is nausea, which, in some patients, is severe enough for them to discontinue the medicine. It can also cause headaches, dizziness, vomiting, dry mouth and constipation. Rarely, this medicine can cause seizures. To avoid side effects, it is best to slowly increase the dose over time. Typically, the dose is started at one tablet per day (each tablet contains 8mg naltrexone and 90mg bupropion) and is increased by one tablet per week over four weeks to a maximum dose of two tablets in the morning and two tablets in the afternoon. However, most side effects will tend to decrease after several weeks of treatment. Further, naltrexone/bupropion can cause insomnia; therefore, it is recommended that patients take this medicine in the morning, at least when they are beginning treatment. This medicine has also been associated with cases of increased heart rate and blood pressure; therefore, it is recommended that blood pressure is monitored before and during treatment.^{207, 208}

Naltrexone/bupropion is contraindicated with uncontrolled hypertension, seizure disorder, anorexia nervosa or bulimia, chronic opioid use, during or within 14 days of taking a monoamine oxidase inhibitor (MAOI), and in those undergoing abrupt discontinuation of alcohol, benzodiazepines, barbiturates or antiepileptic medicines. Because this medicine contains bupropion, patients with major depressive disorder may experience worsening depression symptoms or the emergence of suicidal thoughts in the early phases of treatment; therefore, these patients should be monitored closely. Finally, there is limited evidence on the long-term effects of naltrexone/bupropion on cardiovascular morbidity and mortality, which may limit its use in patients with increased cardiovascular risk.^{207, 218}

7.3.4 Phentermine/topiramate

Phentermine is a sympathomimetic amine anorectic and topiramate is typically used as an anticonvulsant. A combination product containing both these drugs is available in some countries. Phentermine suppresses appetite, and causes weight loss, primarily by mediating the release of catecholamines in the hypothalamus, but other metabolic effects may also be involved. The exact mechanism by which topiramate causes weight loss is not fully understood, but it may be due to its effects on reducing appetite and increasing satiety.²¹⁹

The efficacy of this medicine can be seen in the “Controlled-release phentermine plus topiramate combination in overweight and obese adults” (CONQUER) study. This study showed 8.1kg and 10.2kg weight loss in the two different treatment groups, 7.5mg phentermine/46mg topiramate controlled release (CR) and 15mg phentermine/92mg topiramate CR, respectively, compared with 1.4kg in the placebo group. It also showed that a higher proportion of patients achieved 5% weight loss in the treatment groups compared with the placebo group, namely, 62% and 70% compared with 21% in the placebo group.²²⁰ Another randomised controlled trial, “EQUIP”, showed similar results, with patients who received either a low dose (3.75mg phentermine/23mg topiramate CR) or a high dose (15mg phentermine/92mg topiramate CR) experiencing significantly greater weight loss compared with the placebo group, namely, 5.1%, 10.9% and 1.6%, respectively.²²¹ In both trials, phentermine/topiramate showed significant improvements in cardiometabolic risk factors, including waist circumference, glycaemic control and lipid profiles.²⁰⁸

This medicine is best taken in the morning as it can cause insomnia if taken later in the day. The dose of phentermine/topiramate should also be slowly increased, typically with at least two weeks between dose

increases, beginning with 3.75mg phentermine/23mg topiramate CR. If a patient has been on the highest dose of phentermine/topiramate CR, 15mg/92mg, for 12 weeks and has not achieved 5% weight loss, the medicine should be slowly discontinued. To prevent possible seizures, it should be gradually tapered by taking one dose of the medicine every other day for at least a week.²²²

The most common side effects of this medicine are paraesthesia, dizziness, dysgeusia (altered sense of taste), insomnia, constipation and dry mouth. There are also many warnings and precautions that should be considered before starting a patient on this medicine.²¹⁹

Phentermine/topiramate is teratogenic and should not be taken by those who are pregnant or may become pregnant. Exposure to topiramate in the first trimester of pregnancy can increase the risk of cleft lip with or without cleft palate. Because of this risk, pregnancy testing is recommended before beginning therapy and monthly during treatment. Additional contraindications for this medicine include those who have glaucoma or hyperthyroidism and those who are taking or have taken an MAOI in the past 14 days due to the risk of hypertensive crisis. Finally, it should be noted that the effect of this medicine on cardiovascular morbidity and mortality has not yet been established.²¹⁹

Phentermine/topiramate is associated with several other serious side effects that require close monitoring of patients who are taking this medicine. First, it can increase resting heart rates in patients up to 20 beats per minute; therefore, regular measurements of resting heart rates should be taken while on this medicine. The clinical significance of this increase is unclear, but any patients with a history of cardiovascular or cerebrovascular disease should use this medicine with caution. For all patients, if this increased heart rate is sustained, consider reducing the dose or discontinuing the medicine. Topiramate can increase the risk of suicidal behaviour or ideation; therefore, patients should be monitored for changes in mood, worsening depression, or suicidal thoughts or behaviours and the medicine should be discontinued if these thoughts or behaviours occur. Acute myopia-associated secondary angle closure glaucoma can occur while taking this medicine so intraocular pressure should be monitored. Symptoms will typically occur within one month of initiating treatment with topiramate but could occur at any time during treatment. Phentermine/topiramate can also cause mood disorders, including depression, anxiety and insomnia, as well as cognitive impairment, including lack of concentration, difficulty with memory, and speech or language problems. Given its ability to impair cognitive function, patients should be cautioned about driving or operating hazardous machinery until they know how this medicine affects them. Finally, phentermine/topiramate can cause metabolic acidosis, elevated creatine, hypoglycaemia, hypokalaemia, kidney stones and oligohidrosis (decreased sweating).^{219, 222}

7.3.5 Treatment selection

When determining the most appropriate weight loss medicine for a patient, consider the goals of the patient, their comorbidities, other medicines, as well as the side effects and mechanism of action of the medicine. For example, liraglutide can be used in those with and without diabetes but is preferred in people with type 2 diabetes and those with cardiovascular disease. Further, because of liraglutide's low potential for drug interactions, its safety profile, and its effects on weight and glycaemic control, it is considered by some to be a first-line medicine for weight loss. However, gastrointestinal side effects, the need for daily injections, and the cost of therapy may limit its widespread use.

Orlistat, on the other hand, is often available over the counter without a prescription, which may be attractive to some patients. Further, it is a well-established medicine with an acceptable safety profile. It improves several cardiovascular risk factors and, long-term, decreases the incidence of diabetes. However, its unpleasant gastrointestinal side effects may limit its use. Orlistat may be a good option for patients without bowel problems who wish to choose a medicine that has limited systemic absorption.

Naltrexone with bupropion may be useful in some cases, but the uncertainty surrounding its cardiovascular effects has caused experts to prefer other medicines as these concerns limit its use in those with increased cardiovascular risk.²⁰⁷

Phentermine/topiramate has been shown to be effective, but its side effect profile and associated warnings may limit its use and should be carefully considered if a patient is started on this treatment. The potential health concerns associated with this medicine have limited its approval globally; therefore, this medicine may not be available in your country. For example, the European Medicines Agency rejected the medicine's application for approval in 2013.²²³ In all, individual patient factors, comorbidities, side effects and patient preferences should be considered when deciding on an appropriate pharmacological approach to weight management.

7.4 Weight loss supplements

In addition to the medicines mentioned in section 7.3, pharmacists should also be aware of the many natural and dietary supplements for weight loss that exist in the market. These products can take many forms, including capsules, tablets, liquids, powders, etc. and are often promoted as a quick way to lose weight. The manner in which these products are regulated and sold will vary by country and regulatory agency; however, given that many of these products are sold at pharmacies, pharmacists should be aware of the most common ingredients in these products as well as the potential risks associated with their use.²²⁴

Generally, the evidence supporting the usefulness of dietary or natural supplements to promote weight loss is limited and unconvincing. Reviews of the literature surrounding the most common ingredients in weight loss supplements have found that these products do not contribute to meaningful weight loss and that some can even cause harm to the patient, while also being costly. This harm can be due to the ingredients themselves, their interactions with a patient's other medicines, or through the presence of non-labelled substances in the product.²²⁵⁻²²⁸

As the demand for weight loss supplements continues to grow globally, so do concerns regarding the quality and safety of products on the market. This increased demand may be due to patients being worried about the side effects or stigma associated with the medicines listed in the previous section and an interest in trying supplements that are marketed as natural or herbal approaches to weight loss. Others may be looking for a "quick fix" that does not require significant changes to their lifestyle. Regardless of patients' motivations, these products are growing increasingly popular and, despite being labelled as natural, herbal, etc., they can be unsafe and ineffective.²²⁹

Regulations surrounding supplements for weight loss are typically less strict than those for medicines.²²⁴ In fact, in the European Union and the United States, regulatory agencies legally consider dietary supplements as foods.²²⁹ The relative leniency associated with supplements creates opportunities for unsafe products to enter the market and potentially cause harm to patients.

A systematic review of the European Rapid Alert System for Food and Feed (RASFF) analysed reports of supplements reported to have quality problems. Of the reports for products marketed for weight loss, 63.3% contained unapproved, synthetic drug ingredients, most commonly DNP (2,4-dinitrophenol) and sibutramine. DNP is a compound that is associated with severe adverse effects that can be fatal. Sibutramine has been associated with increased blood pressure and pulse rate and an increased risk of non-fatal myocardial infarction and stroke in patients with pre-existing cardiovascular disease and was withdrawn from the European market in 2010. In all, this review concluded that many weight loss products contain undeclared synthetic compounds in order to increase their efficacy. These undeclared compounds can then cause serious adverse effects and unpredictably interact with a patient's other medicines. This is more concerning given that the number of adulterated products reported to RASFF has increased substantially since 2016, with reports of DNP contamination reappearing in 2017 for the first time since 2003.²³⁰

Another review²²⁹ focused on the adulteration of plant food supplements (PFS), which are dietary supplements that have plants or botanicals as ingredients. Many PFS products market themselves as "natural" or "healthy" products for weight loss given that they include plants or plant extracts and, because of this, patients often assume these products are safe and without risk. However, this review highlights that, in order to increase their profits, manufacturers may add illicit, synthetic, often unsafe, substances to their products that result in quick weight loss. These substances commonly include:

- Anorexics — sibutramine, orlistat, diethylpropion (amfepramone), rimonabant, fenproporex, phentermine, mazindol, etc.
- Stimulants — ephedrine, norephedrine and synephrine
- Anxiolytics — benzodiazepines
- Antidepressants — fluoxetine, sertraline
- Diuretics — furosemide, hydrochlorothiazide
- Laxatives — phenolphthalein

Of note is that many of these substances are considered controlled substances or prescription medicines and some have been withdrawn from the market due to their dangerous adverse effects. The most common of these substances is sibutramine, an anorexic that is structurally related to amphetamines. According to the U.S. Food and Drug Administration (FDA), from 2010 to 2015, 87% of cases of adulterated weight loss products included sibutramine. In response to growing concerns surrounding these products, the FDA provides the following general advice to consumers if they are considering using a product marketed as a supplement for weight loss:²³¹

- Ask yourself if it sounds too good to be true.
- Be cautious if the claims for the product seem exaggerated or unrealistic.
- Watch out for extreme claims such as “quick and effective” or “totally safe”.
- Be sceptical about anecdotal information from personal “testimonials” about incredible benefits or results from using a product.
- Look for potential warning signs that a product may be unsafe, such as:
 - Promises of a quick fix, for example, “lose 10 pounds in one week”;
 - Use of the words “guaranteed” or “scientific breakthrough”;
 - Products marketed in a foreign language;
 - Products marketed through mass e-mails; and
 - Products marketed as herbal alternatives to or as having effects similar to prescription medicines.

For evidence-based information regarding common weight loss supplements present in pharmacies that can be passed on to patients, refer to Appendix 4. It contains information on the safety and efficacy of the most common ingredients in weight loss dietary supplements compiled by the U.S. National Institutes of Health Office of Dietary Supplements.²²⁸ However, it should be noted that some products patients may be considering may also include substances not labelled or declared and, therefore, there is no way to know how the product may affect the patient or how it may interact with their medicines. Additionally, products may contain multiple ingredients that have not been tested in combination with each other, creating the potential for adverse effects. Specific information regarding medicines interactions for the products listed in Appendix 4 can be found in a recent article by Barrea *et al.* entitled “Nutritionist and obesity: brief overview on efficacy, safety, and drug interactions of the main weight-loss dietary supplements”, cited here.²³²

7.5 Pharmacy programmes

Given that being obese or overweight can lead to the development or exacerbation of many disease states, pharmacists have an opportunity to improve the health of those they serve through the initiation of weight loss management programmes. Various studies from the United States, Scotland, Australia, Pakistan, and Malaysia have shown that patients are open to receiving these services in pharmacies. Primary barriers to the successful uptake of pharmacy-based weight management services were lack of training of pharmacy staff, lack of privacy, payment and waiting times.²³³⁻²³⁷

A scoping review of nine studies examining community pharmacist-led weight management programmes found that programmes were able to successfully achieve modest weight loss for their patients.²³⁸ Another study in Spain supported these results and demonstrated a statistically significant reduction in weight, BMI, and waist circumference, and decreased total cholesterol and LDL cholesterol after two months.²³⁹ A study in Australia supported these results and showed participants reported overall positive experiences with the service.²⁴⁰ Despite many studies showing the benefits of these services, efforts are still needed to identify best practices and to examine how best to implement these services in different countries. This presents an immense opportunity for pharmacists to conduct further research and pilot programmes to determine best practices for implementing these services in practice while also ensuring optimal benefits for patients.

As you begin to think about the weight management initiatives you might want to implement, see Table 11 which provides examples of pharmacies that have already taken the step to implement programmes to promote weight management.

Table 11: Examples of pharmacy-led weight management initiatives

Country	Activity
Argentina	Campaign on Obesity: Aimed to raise awareness on the importance of obesity prevention and maintaining a healthy weight. Posters and brochures related to BMI were created and distributed to patients so they could estimate their own BMI. ²⁴¹
Australia	A pharmacy-based weight management service called “A healthier life program” (AHLP), for overweight and obese individuals, was implemented in community pharmacies. Pharmacists were trained to provide the programme, which consisted of six individual visits with the patient over three months. The programme focused on three areas: diet, physical activity, and behavioural change. Overall, patients were satisfied with the service and it resulted in modest reductions in weight and waist circumference, improvements in dietary behaviour and increases in physical activity. ²⁴⁰

Country	Activity
England	<p>A community pharmacy weight management clinic was implemented to assist obese patients in reducing their weight. Pharmacists were trained to take patient measurements, motivate patients to change their behaviour, and provide advice and support.</p> <p>Results showed that patients achieved a reduction in weight and waist circumference after three months in the programme. These results were also seen after six months, in addition to a reduction in blood pressure.²⁴²</p>
Scotland	<p>The Counterweight weight management programme was introduced into community pharmacies in Scotland for patients with a BMI $\geq 30\text{kg/m}^2$ or a BMI $\geq 28\text{kg/m}^2$ with a co-morbidity. Pharmacy staff, primarily pharmacy assistants, were trained by specialist dieticians in programme delivery. Over 12 months, pharmacy staff provided education to patients on weight management and communicated information on behaviour change strategies. Patients had six initial appointments (10–30 minutes each) and follow-up visits at 6, 9, and 12 months.</p> <p>In all, results showed similar effectiveness to other primary care-based weight management programmes.²⁴³</p>
Spain	<p>A pharmacist-led intervention in the management of obesity and overweight was implemented in community pharmacies. Pharmacists provided education, counselling and advice to patients regarding medication management in addition to education on healthy lifestyle promotion (including diet and physical activity).</p> <p>Results showed that the programme had a positive impact on weight, BMI, waist circumference, total cholesterol, LDL cholesterol and triglycerides. It also reduced the number of patients who had drug-related problems from 56% at the first visit to 9.4% at the two-month visit.²³⁹</p>
Thailand	<p>Pharmacists met with patients individually for one hour and provided individualised advice regarding healthy diet and exercise in addition to a weight loss handbook for self-study.</p> <p>Results showed that individual counselling from a pharmacist can be effective. While no significant changes in weight, BMI or waist circumference were observed (potentially due to the short study duration of 16 weeks), intention to perform healthy dieting behaviour and knowledge about overweight and obesity, among other indicators, were significantly increased.²⁴⁴</p>
USA	<p>A 12-week pharmacist-led walking programme was able to induce significant changes in HDL cholesterol, cholesterol, fasting blood glucose and blood pressure. To encourage participation, patients were required to complete weekly pedometer checks and, if they met their goals, were able to enter a raffle. This programme may present a simple way to engage with patients and encourage healthy physical activity habits.²⁴⁵</p>

8 Pharmacist interventions

There are many strategies by which the information in this toolkit can be shared with patients, ranging from indirect educational campaigns to more direct conversations and educational counselling. It is best to consider what may work best at your specific pharmacy, what strategies you are most comfortable with, and what you have time to implement. Finally, pharmacists should remember that these approaches are best done in collaboration with other healthcare providers in order to ensure optimal outcomes for patients.

8.1 Educational campaigns

One method by which nutrition and weight management advice can be shared with patients is through public health educational campaigns, which can be focused on general nutrition and wellness guidance or focused on a specific disease state. Advice for creating a successful public health campaign can be found in the WHO's "Effective Communications Participant Handbook". Broadly, the WHO recommends the following approach:²⁴⁶

1. Framing your communications

- Identify the SOCO (single overarching communications outcome) by asking yourself:
 1. What is your issue?
 2. Why do you want to focus on this issue and why do you want to focus on it now?
 3. Who needs to change their behaviour (audience)?
 4. What is the change that you want to see in your audience as a result of your communication (this is the SOCO)?
- Identify the audience.
 - Remember that audiences are often distracted, overloaded, and sometimes confused about your issue.
 - Ensure your messaging begins with the point and then supports it with evidence.

2. Developing communication materials and products

- Develop the storyline and talking points.
 - People generally follow these steps of the decision ladder:
 - Awareness → Comprehension → Conviction → Action
 - The goal of your efforts should be to take your audience to the top step: action.
 - Generally, humans are not set up to understand logic; they are set up to understand stories.
- Ensure your communications are effective by following the checklist described in Table 12.

Table 12: 7 Cs of public health communications

Communication step	Description
Command attention	Have you focused on the point quickly? Does it have compelling arguments, facts and images?
Clarify message	Is your message clear (meaning of numbers, pictures, risk groups, actions needed by particular audience and consequences of them not doing them)? Is it clear what should be done?
Communicate a benefit	Have you made the benefit explicit to the target audience(s)?
Consistency counts	Are the numbers, facts and calls to action consistent?
Cater to the heart and head	Do you have your facts right? Are they backed up by evidence or agreement? Have you paid equal attention to the emotional needs of your audiences?
Create trust	Is your message trustworthy? Is it transparent and credible? Does it express empathy?
Call to action	Is there a call to action? Is there a verb?

As you begin to think about the educational campaigns you might want to implement, see Table 13 which provides examples of pharmacies that have already taken the step to implement campaigns to promote healthy lifestyles.

Table 13: Example of pharmacy-led health promotion initiatives

Country	Activity
Argentina	<p>The FARCAVI (“<i>Farmacéuticos por la calidad de vida</i>”, or Pharmacists For Quality of Life) Health Promotion Programme: Aimed to help pharmacists have a stronger role in health promotion and disease prevention in the community, by identifying and tackling risk factors and promoting healthy lifestyles for a better quality of life.</p> <ul style="list-style-type: none"> In 2008, the theme was “healthy diet” and a poster and patient leaflet were developed that encouraged patients to speak to their pharmacist for nutritional advice. <ul style="list-style-type: none"> A survey was run to evaluate food habits of patients. Pharmacists gave lectures to the community on healthy food habits (schools, nursing homes, etc.) A healthy diet campaign was shared through the radio.²⁴⁷
Austria	<p>“Healthy Appetite” Healthy Diet Campaign: Aimed to promote healthy eating habits for different age groups in order to fight obesity.</p> <ul style="list-style-type: none"> This initiative developed a nutrition brochure that was free of charge in all pharmacies in Vienna. The concise booklet combines information on the different nutritional needs of various age groups (children, adolescents, adults, and the elderly) and has special tips from the pharmacy.²⁴⁸
Italy	<p>Childhood Obesity Prevention Campaign: Aimed to educate parents and children on healthy food habits.</p> <ul style="list-style-type: none"> In this campaign, posters and leaflets were developed and shared in 300 community pharmacies. Children were offered a brochure where they could report their achievement every day on the main messages of the campaign. Children could also partake in a drawing contest and win a prize from their pharmacy.²⁴⁹
Spain	<p>The General Pharmaceutical Council of Spain launched multiple campaigns focusing on nutrition recommendations for a variety of populations. Some of the topics that have been covered through the Plenufar programme include:</p> <ul style="list-style-type: none"> Improving children’s food habits (Plenufar II) — Pharmacists, in collaboration with schools, gave lectures to children and/or parents. This programme aimed to target children aged 10–12 years and educate them about healthy eating through presentations and activities.²⁵⁰ Improving the elderly’s food habits (Plenufar III) — Pharmacists provided advice to senior patients at community pharmacies, nursing homes and other appropriate locations. Pharmacists were provided with materials to support their activities, including patient leaflets and a guidance document entitled “Caring for the elderly”. This programme also assessed nutritional status through administering a mini nutritional assessment.²⁵¹ Promoting exercise and proper nutrition for physically active people (Plenufar VI) — Pharmacists were provided with an opportunity to be trained on topics related to the theme. It also supported the dissemination of posters to advertise the campaign at pharmacies and to conduct surveys of their patients to investigate their food and lifestyle habits and determine whether pharmacists can intervene to help promote a healthy diet.²⁵² <p>Additional campaigns can be found on the organisation’s website.²⁵³</p>
Switzerland	<p><i>Ça marche dans ma pharmacie!</i>: Aimed to educate patients on healthy lifestyles.</p> <ul style="list-style-type: none"> Pharmacy staff conducted interactive workshops in their community pharmacies focusing on the importance of drinking water, fat content of food, slimming products and associated weight gain, importance of five vegetables/fruits per day, and physical activity. Participants were provided with educational materials after the workshop.²⁵⁴

8.2 Motivational counselling/health coaching

A more direct approach to improving patients’ lifestyles is through motivational counselling and health coaching. These have multiple definitions but are primarily focused on working with patients to help them identify their own motivations for change and empowering them to make and sustain positive changes. Historically the process has been associated with working with individuals with substance abuse disorders, but has wide applicability to many different situations, including those surrounding healthy lifestyles.

There are five primary principles of motivational interviewing outlined by Miller and Rollnick, the pioneers of motivational interviewing and change talk:²⁵⁵

- Principle 1: Express empathy through reflective listening.
- Principle 2: Develop discrepancy between clients' goals or values and their current behaviour.
- Principle 3: Avoid argument and direct confrontation.
- Principle 4: Adjust to client resistance rather than opposing it directly.
- Principle 5: Support self-efficacy and optimism.

To guide conversations with patients regarding their lifestyles, the Agency for Healthcare Research and Quality (AHRQ) presented the six A's for health behaviour change counselling, outlined in Table 14.

Table 14: 6 A's for health behaviour change counselling²⁵⁶

"A"	Description	Example
Ask	Clinician asks the patient about weight, nutrition and exercise.	"Do you exercise?" "What do you typically eat for breakfast?"
Advise	Clinician provides the patient with clear, strong advice.	"You need to get 30 minutes of exercise a day, five days a week." "I think you need to lose about 20 pounds." "Because of your diabetes and hypertension, it is really important that you exercise."
Assess	Clinician verbally assesses patient's readiness to change.	"Is attaining a healthier weight something you might want to do in the near future?" "Do you see yourself getting more exercise in the coming months?"
Assist	Clinician assists by providing brief counselling or self-help materials.	"What might get in the way of your plans to exercise three times a week?" "How are you feeling about being able to make this change?" "Is your family supportive of your attempts to eat better?"
Arrange	Clinician arranges for follow-up with health care professional or community-based resource.	"I will make a referral to [XXX]. They have an excellent programme to help you attain a healthier weight."
Applaud	It is important for clinicians to recognise even small changes in patient behaviour and to applaud these changes.	

There are also four core skills of motivational interviewing that should be integrated into the above conversation guide:

1. **Open-ended questions** Open-ended questions require a response that is more than "yes" or "no" and guide the conversation to be more focused on change.

Examples of closed and open-ended questions:

- Closed — "You need to achieve a healthier weight. Are you ready to start a diet and increase exercise?"
- Open — "You need to achieve a healthier weight. What are you already doing to be healthy?"
- Open — "What is working for you around diet and exercise? Why might you want to make a change in diet and exercise?"

Additional examples of open-ended questions to help patients further explore their motivations to change:

- Questions requiring answers that are disadvantages to maintaining the status quo:
 - What concerns you about your weight?
 - What makes you think you need to do something about your weight?
 - What hassles have you experienced in relation to your weight?
 - How has your weight stopped you from doing what you want to do in life?
 - What do you think will happen if you do not change anything about your weight?
- Questions that require answers that focus on the advantages of change:
 - How would you like things to be different?
 - What would be good things about attaining a healthier weight?
 - What would you like your life to be like five years from now?

- What are the main reasons you see for making a change?
- Questions that can be used to measure confidence and optimism about making a change:
 - If you decided to make a change in diet and exercise, what would you do to be successful?
 - What do you think would work for you if you decided to change your diet or exercise more?
 - When else in your life have you made a significant change like this? How did you do it?
 - What personal strengths do you have that will help you achieve a healthy weight?
- Questions to gauge a patient's intention to change:
 - What are you thinking about your eating and exercise habits at this point?
 - What do you think you might do?
 - What would you be willing to try?
 - What do you want to have happen?

2. **Affirmations** Affirmations can help to build trust between you and your patient through the change process as it confirms you want the patient to succeed.

Examples include:

- Commenting positively on a patient attribute — “You have demonstrated a strong commitment to others.”
- Making a statement of appreciation — “I appreciate your being honest with me about how your spouse is going to make this change difficult for you.”
- Catching your patient demonstrating a positive behaviour — “You've been very consistent with your approach to eating breakfast every day.”
- An expression of hope, caring, or support — “With both our efforts we will get your weight to a healthy level.”

3. **Reflections** Reflective statements let your patients know that you are listening and hearing what they are saying. These statements convey empathy, meaning that you understand what your patient is saying without necessarily agreeing. These statements should restate what the patient says and selectively reinforce their talk about change.

Example:

- “So, you say your children won't eat vegetables, and they are expensive, but you feel you can prepare them for yourself.”

4. **Summaries** End visits by first making a summary statement that consists of information you learned from the patient during the visit, then move into an action step, and then to your goal setting action.

Examples include:

- Summary — “You've expressed concern about your weight, hypertension and family health habits.”
- Action step — “Let me summarise and see if I missed anything.”
- Goal setting action — “We've talked about a lot of things today; if you had to pick one to work on, what would it be?”

These skills and tools can be adapted for use by community pharmacists and can serve as a guide to promote behaviour change. Research has shown that there is great opportunity for pharmacist-led motivational interviewing and health coaching to improve health outcomes.^{257, 258} In fact, one study in the United States showed that pharmacist health coaching visits, which consisted of education, goal setting and monitoring through evaluation of treatment goals and physical assessment, led to significant improvements in cardiovascular risk factors and 90% of patients were satisfied with the service and care they received.²⁵⁹

9 Conclusion

Pharmacists play an important role in improving the health of their communities and the patients they serve. While pharmacists do not typically receive extensive training regarding nutrition or weight management, they are well-positioned to promote awareness of these topics and provide education to patients. As one of the most accessible healthcare providers, pharmacists have a unique opportunity to step into this new role and promote healthy lifestyles among their patients and work with them to ensure they are appropriate for their medical conditions and easily sustainable.

While many barriers exist to widespread adoption of pharmacist-led nutrition and weight management services, this toolkit aims to provide an introduction into nutritional considerations specific to common disease states pharmacists may encounter and general guidance regarding weight management strategies.

As pharmacists begin to take steps into promoting nutrition and weight management to their patients, it should always be remembered that interprofessional approaches to care are necessary to ensure optimal health outcomes, and patients should be referred to specialists whenever possible. However, pharmacies present an opportunity to meet patients where they are, get them thinking about nutrition and weight management and its influence on their life and health, and refer them to additional care if needed.

10 References

1. Afshin A, Sur PJ, Fay KA et al. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. 2019;393(10184):1958–72. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30954305>.
2. World Health Organization. Physical activity. 2020. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>.
3. World Health Organization. Promoting fruit and vegetable consumption around the world. [accessed: 19 March 2021]. Available at: <https://www.who.int/dietphysicalactivity/fruit/en/>.
4. Liu JX, Goryakin Y, Maeda A et al. Global Health Workforce Labor Market Projections for 2030. *Human Resources for Health*. 2017;15(1):11. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/28159017/>.
5. World Health Organization. Healthy diet. 2020. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>.
6. World Health Organization. HealthyAtHome: Healthy Diet. [accessed: 12 April 2021]. Available at: <https://www.who.int/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome/healthyathome---healthy-diet>.
7. World Health Organization. Non communicable diseases. 2021. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>.
8. Branca F, Lartey A, Oenema S et al. Transforming the food system to fight non-communicable diseases. *BMJ*. 2019;364:l296. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30692128>.
9. World Health Organization. About cardiovascular diseases. [accessed: 19 March 2021]. Available at: https://www.who.int/cardiovascular_diseases/about_cvd/en/.
10. World Health Organization. Cardiovascular diseases (CVDs). 2017. [accessed: 19 March 2021]. Available at: [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)).
11. World Health Organization. Hypertension. 2019. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/hypertension>.
12. Yusuf S, Hawken S, Ôunpuu S et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *The Lancet*. 2004;364(9438):937–52. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/15364185/>.
13. O'Donnell MJ, Xavier D, Liu L et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *The Lancet*. 2010;376(9735):112–23. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/20561675/>.
14. Renzella J, Townsend N, Jewell J et al. What national and subnational interventions and policies based on Mediterranean and Nordic diets are recommended or implemented in the WHO European Region, and is there evidence of effectiveness in reducing noncommunicable diseases? *Health Evidence Network Synthesis Report 58*. 2018. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK519076/>.
15. Fundación Dieta Mediterránea. Mediterranean Diet Pyramid: A Lifestyle for Today. 2010. [accessed: 19 March 2021]. Available at: https://dietamediterranea.com/piramidedm/piramide_INGLES.pdf.
16. Fundación Dieta Mediterránea. What's The Mediterranean Diet? 10 Basics. [accessed: 19 March 2021]. Available at: <https://dietamediterranea.com/en/nutrition/>.
17. World Health Organization. Cancer: Carcinogenicity of the consumption of red meat and processed meat. 2015. [accessed: 12 April 2021]. Available at: <https://www.who.int/news-room/q-a-detail/cancer-carcinogenicity-of-the-consumption-of-red-meat-and-processed-meat>.

18. Grosso G, Mistretta A, Frigiola A et al. Mediterranean diet and cardiovascular risk factors: a systematic review. *Crit Rev Food Sci Nutr.* 2014;54(5):593-610. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24261534>.
19. Martínez-González MA, Salas-Salvadó J, Estruch R et al. Benefits of the Mediterranean Diet: Insights From the PREDIMED Study. *Progress in Cardiovascular Diseases.* 2015;58(1):50-60. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/25940230/>.
20. Ahmad S, Moorthy MV, Demler OV et al. Assessment of Risk Factors and Biomarkers Associated With Risk of Cardiovascular Disease Among Women Consuming a Mediterranean Diet. *JAMA Netw Open.* 2018;1(8):e185708. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30646282>.
21. Tong TYN, Wareham NJ, Khaw K-T et al. Prospective association of the Mediterranean diet with cardiovascular disease incidence and mortality and its population impact in a non-Mediterranean population: the EPIC-Norfolk study. *BMC Med.* 2016;14. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5041408/>.
22. Estruch R, Ros E, Salas-Salvadó J et al. Primary Prevention of Cardiovascular Disease with a Mediterranean Diet Supplemented with Extra-Virgin Olive Oil or Nuts. *New England Journal of Medicine.* 2018;378(25):e34. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/29897866/>.
23. Saulle R, Lia L, De Giusti M et al. A systematic overview of the scientific literature on the association between Mediterranean Diet and the Stroke prevention. *Clin Ter.* 2019;170(5):e396-e408. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/31612199>.
24. Martínez-González Miguel A, Gea A, Ruiz-Canela M. The Mediterranean Diet and Cardiovascular Health. *Circulation Research.* 2019;124(5):779-98. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/30817261/>.
25. Anand SS, Hawkes C, de Souza RJ et al. Food Consumption and its Impact on Cardiovascular Disease: Importance of Solutions Focused on the Globalized Food System: A Report From the Workshop Convened by the World Heart Federation. *Journal of the American College of Cardiology.* 2015;66(14):1590-614. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/26429085/>.
26. Saneei P, Salehi-Abargouei A, Esmailzadeh A et al. Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: a systematic review and meta-analysis on randomized controlled trials. *Nutr Metab Cardiovasc Dis.* 2014;24(12):1253-61. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25149893>.
27. Feng Q, Fan S, Wu Y et al. Adherence to the dietary approaches to stop hypertension diet and risk of stroke. *Medicine (Baltimore).* 2018;97(38). [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6160167/>.
28. Soltani S, Arablou T, Jayedi A et al. Adherence to the dietary approaches to stop hypertension (DASH) diet in relation to all-cause and cause-specific mortality: a systematic review and dose-response meta-analysis of prospective cohort studies. *Nutr J.* 2020;19(1):37. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/32321528>.
29. Sacks FM, Svetkey LP, Vollmer WM et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med.* 2001;344(1):3-10. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/11136953>.
30. National Heart Lung and Blood Institute. Your Guide to Lowering Your Blood Pressure with DASH. 2006. [accessed: 19 March 2021]. Available at: https://www.nhlbi.nih.gov/files/docs/public/heart/new_dash.pdf.
31. World Health Organization. Nutrition: Trans fat. 2018. [accessed: 12 April 2021]. Available at: <https://www.who.int/news-room/q-a-detail/nutrition-trans-fat>.
32. National Heart Lung and Blood Institute. DASH Eating Plan. [accessed: 19 March 2021]. Available at: <https://www.nhlbi.nih.gov/health-topics/dash-eating-plan>.

33. World Health Organization. Salt reduction. 2020. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/salt-reduction>.
34. Centers for Disease Control and Prevention. How to Reduce Sodium. 2020. [accessed: 19 March 2021]. Available at: https://www.cdc.gov/salt/reduce_sodium_tips.htm.
35. American Heart Association. How to Reduce Sodium. 2018. [accessed: 19 March 2021]. Available at: <https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/sodium/how-to-reduce-sodium>.
36. World Health Organization. Guideline: potassium intake for adults and children. 2012. [accessed: 19 March 2021]. Available at: <https://www.who.int/publications-detail-redirect/9789241504829>.
37. Kris-Etherton PM, Krauss RM. Public health guidelines should recommend reducing saturated fat consumption as much as possible: YES. *The American Journal of Clinical Nutrition*. 2020;112(1):13-8. [accessed: 28 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/32491173/>.
38. Sacks Frank M, Lichtenstein Alice H, Wu Jason HY et al. Dietary Fats and Cardiovascular Disease: A Presidential Advisory From the American Heart Association. *Circulation*. 2017;136(3):e1-e23. [accessed: 28 April 2021]. Available at: <https://www.ahajournals.org/doi/10.1161/CIR.0000000000000510>.
39. Hooper L, Martin N, Jimoh OF et al. Reduction in saturated fat intake for cardiovascular disease. *Cochrane Database of Systematic Reviews*. 2020(5). [accessed: 28 April 2021]. Available at: <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD011737.pub2/full>.
40. American Heart Association. Saturated Fat. [accessed: 28 April 2021]. Available at: <https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats>.
41. U.S. Food and Drug Administration. Monounsaturated and Polyunsaturated Fats. 2020. [accessed: 27 April 2021]. Available at: https://www.accessdata.fda.gov/scripts/interactivenutritionfactslabel/assets/InteractiveNFL_MUFA&PUFA_March2020.pdf.
42. World Health Organization. WHO plan to eliminate industrially-produced trans-fatty acids from global food supply. 2018. [accessed: 28 April 2021]. Available at: <https://www.who.int/news/item/14-05-2018-who-plan-to-eliminate-industrially-produced-trans-fatty-acids-from-global-food-supply>.
43. Islam MA, Amin MN, Siddiqui SA et al. Trans fatty acids and lipid profile: A serious risk factor to cardiovascular disease, cancer and diabetes. *Diabetes Metab Syndr*. 2019;13(2):1643-7. [accessed: 28 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/31336535>.
44. Mayo Clinic. Trans fat: Double trouble for your heart. 2020. [accessed: 28 April 2021]. Available at: <https://www.mayoclinic.org/diseases-conditions/high-blood-cholesterol/in-depth/trans-fat/art-20046114>.
45. World Health Organization. Diabetes. 2021. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/diabetes>.
46. International Diabetes Federation. Type 2 diabetes. 2020. [accessed: 19 March 2021]. Available at: <https://www.idf.org/aboutdiabetes/type-2-diabetes.html>.
47. International Diabetes Federation. IDF Diabetes Atlas, 9th edn. 2019. [accessed: 26 April 2021]. Available at: <https://www.diabetesatlas.org>.
48. World Health Organization. Classification of diabetes mellitus. 2019. [accessed: 26 April 2021]. Available at: <https://apps.who.int/iris/handle/10665/325182>.
49. Davies MJ, D'Alessio DA, Fradkin J et al. Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*. 2018;41(12):2669-701. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30291106>.
50. Sami W, Ansari T, Butt NS et al. Effect of diet on type 2 diabetes mellitus: A review. *Int J Health Sci (Qassim)*. 2017;11(2):65-71. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5426415/>.

51. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of the joint WHO/FAO expert consultation. 5.3 - Recommendations for preventing diabetes. 2003. [accessed: 19 March 2021]. Available at: https://www.who.int/dietphysicalactivity/publications/trs916/en/gsfao_diabetes.pdf?ua=1.
52. World Health Organization. Global report on diabetes. 2016. [accessed: 19 March 2021]. Available at: <https://www.who.int/publications-detail-redirect/9789241565257>.
53. International Diabetes Federation. Diabetes Prevention. 2019. [accessed: 12 April 2021]. Available at: <https://www.idf.org/aboutdiabetes/prevention.html>.
54. Esposito K, Maiorino MI, Bellastella G et al. A journey into a Mediterranean diet and type 2 diabetes: a systematic review with meta-analyses. *BMJ Open*. 2015;5(8):e008222. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/26260349>.
55. Huo R, Du T, Xu Y et al. Effects of Mediterranean-style diet on glycemic control, weight loss and cardiovascular risk factors among type 2 diabetes individuals: a meta-analysis. *Eur J Clin Nutr*. 2015;69(11):1200-8. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25369829>.
56. Schwingshackl L, Chaimani A, Hoffmann G et al. A network meta-analysis on the comparative efficacy of different dietary approaches on glycaemic control in patients with type 2 diabetes mellitus. *Eur J Epidemiol*. 2018;33(2):157-70. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5871653/>.
57. Diabetes UK. Glycaemic index and diabetes. [accessed: 27 April 2021]. Available at: <https://www.diabetes.org.uk/guide-to-diabetes/enjoy-food/carbohydrates-and-diabetes/glycaemic-index-and-diabetes>.
58. Glycaemic Index Foundation. Low Gi Explained. [accessed: 27 April 2021]. Available at: <https://www.gisymbol.com/low-gi-explained/>.
59. World Health Organization Regional Office for the Western Pacific. Healthy Eating Habits for Patients with Diabetes. 2017. [accessed: 27 April 2021]. Available at: <https://iris.wpro.who.int/bitstream/handle/10665.1/13561/9789290618072-diab-mod4-eng.pdf>.
60. Zafar MI, Mills KE, Zheng J et al. Low-glycemic index diets as an intervention for diabetes: a systematic review and meta-analysis. *The American Journal of Clinical Nutrition*. 2019;110(4):891-902. [accessed: 27 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/31374573/>.
61. Wang Q, Xia W, Zhao Z et al. Effects comparison between low glycemic index diets and high glycemic index diets on HbA_{1c} and fructosamine for patients with diabetes: A systematic review and meta-analysis. *Prim Care Diabetes*. 2015;9(5):362-9. [accessed: 26 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25524422>.
62. Bhupathiraju SN, Tobias DK, Malik VS et al. Glycemic index, glycemic load, and risk of type 2 diabetes: results from 3 large US cohorts and an updated meta-analysis¹²³. *The American Journal of Clinical Nutrition*. 2014;100(1):218-32. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4144100/>.
63. Livesey G, Taylor R, Livesey HF et al. Dietary Glycemic Index and Load and the Risk of Type 2 Diabetes: Assessment of Causal Relations. *Nutrients*. 2019;11(6). [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6628270/>.
64. Livesey G, Taylor R, Livesey HF et al. Dietary Glycemic Index and Load and the Risk of Type 2 Diabetes: A Systematic Review and Updated Meta-Analyses of Prospective Cohort Studies. *Nutrients*. 2019;11(6). [accessed: 26 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/31195724>.
65. The University of Sydney. GI Database Search. [accessed: 27 April 2021]. Available at: <https://www.glycemicindex.com/foodSearch.php>.
66. Diabetes Canada. Glycemic Index Food Guide. [accessed: 27 April 2021]. Available at: <https://guidelines.diabetes.ca/docs/patient-resources/glycemic-index-food-guide.pdf>.

67. Joshi S, Ostfeld RJ, McMacken M. The Ketogenic Diet for Obesity and Diabetes-Enthusiasm Outpaces Evidence. *JAMA Intern Med.* 2019. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/31305866>.
68. Aune D, Keum N, Giovannucci E et al. Whole grain consumption and risk of cardiovascular disease, cancer, and all cause and cause specific mortality: systematic review and dose-response meta-analysis of prospective studies. *BMJ.* 2016;353:i2716. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/27301975>.
69. Hu Y, Ding M, Sampson L et al. Intake of whole grain foods and risk of type 2 diabetes: results from three prospective cohort studies. *BMJ.* 2020;370:m2206. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/32641435>.
70. Brouns F. Overweight and diabetes prevention: is a low-carbohydrate-high-fat diet recommendable? *Eur J Nutr.* 2018;57(4):1301-12. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5959976/>.
71. Masood W, Annamaraju P, Uppaluri KR. Ketogenic Diet. *StatPearls.* 2021. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK499830/>.
72. Meng Y, Bai H, Wang S et al. Efficacy of low carbohydrate diet for type 2 diabetes mellitus management: A systematic review and meta-analysis of randomized controlled trials. *Diabetes Research and Clinical Practice.* 2017;131:124-31. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/28750216>.
73. van Zuuren EJ, Fedorowicz Z, Kuijpers T et al. Effects of low-carbohydrate- compared with low-fat-diet interventions on metabolic control in people with type 2 diabetes: a systematic review including GRADE assessments. *The American Journal of Clinical Nutrition.* 2018;108(2):300-31. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30007275>.
74. McMacken M, Shah S. A plant-based diet for the prevention and treatment of type 2 diabetes. *J Geriatr Cardiol.* 2017;14(5):342-54. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5466941/>.
75. Satija A, Bhupathiraju SN, Rimm EB et al. Plant-Based Dietary Patterns and Incidence of Type 2 Diabetes in US Men and Women: Results from Three Prospective Cohort Studies. *PLOS Medicine.* 2016;13(6):e1002039. [accessed: 27 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/27299701/>.
76. Toumpanakis A, Turnbull T, Alba-Barba I. Effectiveness of plant-based diets in promoting well-being in the management of type 2 diabetes: a systematic review. *BMJ Open Diabetes Research and Care.* 2018;6(1):e000534. [accessed: 27 April 2021]. Available at: <https://drc.bmj.com/content/6/1/e000534>.
77. Yokoyama Y, Barnard ND, Levin SM et al. Vegetarian diets and glycemic control in diabetes: a systematic review and meta-analysis. *Cardiovasc Diagn Ther.* 2014;4(5):373-82. [accessed: 27 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4221319/>.
78. Vigiuliouk E, Kendall CW, Kahleová H et al. Effect of vegetarian dietary patterns on cardiometabolic risk factors in diabetes: A systematic review and meta-analysis of randomized controlled trials. *Clin Nutr.* 2019;38(3):1133-45. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/29960809>.
79. Carrero JJ, González-Ortiz A, Avesani CM et al. Plant-based diets to manage the risks and complications of chronic kidney disease. *Nat Rev Nephrol.* 2020;16(9):525-42. [accessed: 27 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/32528189>.
80. Centers for Disease Control and Prevention. Diabetes Meal Planning. 2021. [accessed: 27 April 2021]. Available at: <https://www.cdc.gov/diabetes/managing/eat-well/meal-plan-method.html>.
81. World Health Organization. Cancer. [accessed: 19 March 2021]. Available at: https://www.who.int/health-topics/cancer#tab=tab_2.
82. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of the joint WHO/FAO expert consultation. 5.5 - Recommendations for preventing cancer. 2003. [accessed: 19 March 2021]. Available at: https://www.who.int/dietphysicalactivity/publications/trs916/en/gsfao_cancer.pdf?ua=1.

83. World Cancer Research Fund, American Institute for Cancer Research. Resources and toolkits. 2018. [accessed: 19 March 2021]. Available at: <https://www.wcrf.org/dietandcancer/resources-and-toolkit>.
84. World Cancer Research Fund, American Institute for Cancer Research. Continuous Update Project Expert Report 2018. Recommendations and public health and policy implications. 2018. [accessed: 19 March 2021]. Available at: <https://www.wcrf.org/wp-content/uploads/2021/01/Recommendations.pdf>.
85. World Health Organization. Chronic obstructive pulmonary disease (COPD). 2017. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-copd>.
86. Collins PF, Yang IA, Chang Y-C et al. Nutritional support in chronic obstructive pulmonary disease (COPD): an evidence update. *J Thorac Dis.* 2019;11(Suppl 17):S2230-S7. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6831917/>.
87. World Health Organization. Malnutrition. 2020. [accessed: 12 April 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/malnutrition>.
88. Evidence based practice guidelines for the nutritional management of malnutrition in adult patients across the continuum of care. *Nutrition & Dietetics.* 2009;66(3):S1-S34. [accessed: 19 March 2021]. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1747-0080.2009.01383.x>.
89. Alliance to Advance Patient Nutrition. Malnutrition Screening Tool (MST). 2014. [accessed: 19 March 2021]. Available at: http://static.abbottnutrition.com/cms-prod/malnutrition.com/img/Alliance_Malnutrition_Screening_Tool_2014_v1.pdf.
90. Canadian Malnutrition Task Force. Subjective global assessment (SGA) - Diagnosing Malnutrition. 2017. [accessed: 19 March 2021]. Available at: <https://nutritioncareincanada.ca/resources-and-tools/hospital-care-inpac/assessment-sga>.
91. British Association for Parenteral and Enteral Nutrition. The 'MUST' Toolkit. 2020. [accessed: 19 March 2021]. Available at: <https://www.bapen.org.uk/screening-and-must/must/must-toolkit>.
92. Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. 2020 Report. 2020. [accessed: 19 March 2021]. Available at: https://goldcopd.org/wp-content/uploads/2019/12/GOLD-2020-FINAL-ver1.2-03Dec19_WMV.pdf.
93. COPD Foundation. Nutrition for Someone with COPD. 2021. [accessed: 19 March 2021]. Available at: <https://www.copdfoundation.org/Learn-More/I-am-a-Person-with-COPD/Nutrition-for-Someone-with-COPD.aspx>.
94. Frosh A, Cruz C, Wellsted D et al. Effect of a dairy diet on nasopharyngeal mucus secretion. *The Laryngoscope.* 2019;129(1):13-7. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/30178886/>.
95. Malnutrition Pathway. Managing Malnutrition: Healthcare Professional Resources. [accessed: 27 April 2021]. Available at: <https://www.malnutritionpathway.co.uk/health-resources>.
96. Farhadi S, Ovchinnikov RS. The relationship between nutrition and infectious diseases: A review. 2018;2(3):168-72. [accessed: 19 March 2021]. Available at: <https://www.bmbtrj.org/text.asp?2018/2/3/168/240706>.
97. World Health Organization. Communicable Diseases and Severe Food Shortage: WHO Technical Note. 2010. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK304206/>.
98. Milner JJ, Beck MA. Micronutrients, immunology and inflammation The impact of obesity on the immune response to infection. *Proc Nutr Soc.* 2012;71(2):298-306. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4791086/>.
99. Yang J, Ma Z, Lei Y. A meta-analysis of the association between obesity and COVID-19. *Epidemiol Infect.* 2020;149:e11. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/33349290>.

100. Gombart AF, Pierre A, Maggini S. A Review of Micronutrients and the Immune System—Working in Harmony to Reduce the Risk of Infection. *Nutrients*. 2020;12(1). [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7019735/>.
101. National Institutes of Health - Office of Dietary Supplements. Vitamin C. 2021. [accessed: 19 March 2021]. Available at: <https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/>.
102. Carr AC, Maggini S. Vitamin C and Immune Function. *Nutrients*. 2017;9(11). [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5707683/>.
103. Ran L, Zhao W, Wang J et al. Extra Dose of Vitamin C Based on a Daily Supplementation Shortens the Common Cold: A Meta-Analysis of 9 Randomized Controlled Trials. *Biomed Res Int*. 2018;2018:1837634. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30069463>.
104. Cerullo G, Negro M, Parimbelli M et al. The Long History of Vitamin C: From Prevention of the Common Cold to Potential Aid in the Treatment of COVID-19. *Front Immunol*. 2020;11. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7655735/>.
105. Martineau AR, Jolliffe DA, Hooper RL et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. *BMJ*. 2017;356:i6583. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/28202713>.
106. National Institutes of Health - Office of Dietary Supplements. Vitamin D. 2021. [accessed: 19 March 2021]. Available at: <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>.
107. Chaari A, Bendriss G, Zakaria D et al. Importance of Dietary Changes During the Coronavirus Pandemic: How to Upgrade Your Immune Response. *Front Public Health*. 2020;8. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7481450/>.
108. Singh M, Das RR. Zinc for the common cold. *Cochrane Database of Systematic Reviews*. 2013(6). [accessed: 19 March 2021]. Available at: <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001364.pub4/full>.
109. National Institutes of Health - Office of Dietary Supplements. Zinc. 2021. [accessed: 19 March 2021]. Available at: <https://ods.od.nih.gov/factsheets/Zinc-HealthProfessional/>.
110. International Foundation for Gastrointestinal Disorders. Celiac Disease. [accessed: 19 March 2021]. Available at: <https://www.iffgd.org/other-disorders/celiac-disease.html>.
111. Celiac Disease Foundation. What is Celiac Disease? [accessed: 19 March 2021]. Available at: <https://celiac.org/about-celiac-disease/what-is-celiac-disease/>.
112. Green PHR, Jabri B. Coeliac disease. *The Lancet*. 2003;362(9381):383-91. [accessed: 12 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/12907013/>.
113. Singh P, Arora A, Strand TA et al. Global Prevalence of Celiac Disease: Systematic Review and Meta-analysis. *Clinical Gastroenterology and Hepatology*. 2018;16(6):823-36.e2. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/29551598/>.
114. King JA, Jeong J, Underwood FE et al. Incidence of Celiac Disease Is Increasing Over Time: A Systematic Review and Meta-analysis. *Official journal of the American College of Gastroenterology | ACG*. 2020;115(4):507-25. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/32022718/>.
115. Celiac Disease Foundation. Diabetes and Celiac Disease. [accessed: 26 April 2021]. Available at: <https://celiac.org/about-celiac-disease/related-conditions/diabetes-and-celiac-disease/>.
116. Al-Toma A, Volta U, Auricchio R et al. European Society for the Study of Coeliac Disease (ESsCD) guideline for coeliac disease and other gluten-related disorders. *United European Gastroenterol J*. 2019;7(5):583-613. [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6545713/>.
117. World Gastroenterology Organisation Guidelines Publications Committee. WGO Global Guidelines: Celiac Disease. 2016. [accessed: 19 March 2021]. Available at: <https://www.worldgastroenterology.org/UserFiles/file/guidelines/celiac-disease-english-2016.pdf>.

118. Celiac Disease Foundation. Gluten-Free Foods. [accessed: 19 March 2021]. Available at: <https://celiac.org/gluten-free-living/gluten-free-foods/>.
119. National Institute of Diabetes and Digestive and Kidney Diseases. Irritable Bowel Syndrome (IBS). 2017. [accessed: 26 April 2021]. Available at: <https://www.niddk.nih.gov/health-information/digestive-diseases/irritable-bowel-syndrome>.
120. International Foundation for Gastrointestinal Disorders. Introduction to IBS. [accessed: 26 April 2021]. Available at: <https://aboutibs.org/what-is-ibs/intro-to-ibs/>.
121. International Foundation for Gastrointestinal Disorders. Diet and IBS. [accessed: 25 April 2021]. Available at: <https://aboutibs.org/what-is-ibs/diet-and-ibs/>.
122. International Foundation for Gastrointestinal Disorders. IBS Diet: What to Do and What to Avoid. [accessed: 26 April 2021]. Available at: <https://aboutibs.org/treatment/ibs-diet/ibs-diet-what-to-do-and-what-to-avoid/>.
123. El-Salhy M, Ystad SO, Mazzawi T et al. Dietary fiber in irritable bowel syndrome (Review). *Int J Mol Med*. 2017;40(3):607-13. [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5548066/>.
124. Nanayakkara WS, Skidmore PML, O'Brien L et al. Efficacy of the low FODMAP diet for treating irritable bowel syndrome: the evidence to date. *Clin Exp Gastroenterol*. 2016;9:131-42. [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4918736/>.
125. Altobelli E, Del Negro V, Angeletti PM et al. Low-FODMAP Diet Improves Irritable Bowel Syndrome Symptoms: A Meta-Analysis. *Nutrients*. 2017;9(9). [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5622700/>.
126. Varjú P, Farkas N, Hegyi P et al. Low fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP) diet improves symptoms in adults suffering from irritable bowel syndrome (IBS) compared to standard IBS diet: A meta-analysis of clinical studies. *PLOS ONE*. 2017;12(8). [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5555627/>.
127. Staudacher HM, Whelan K, Irving PM et al. Comparison of symptom response following advice for a diet low in fermentable carbohydrates (FODMAPs) versus standard dietary advice in patients with irritable bowel syndrome. *J Hum Nutr Diet*. 2011;24(5):487-95. [accessed: 26 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21615553>.
128. Centers for Disease Control and Prevention. Arthritis: Gout. 2020. [accessed: 19 March 2021]. Available at: <https://www.cdc.gov/arthritis/basics/gout.html>.
129. Kuo C-F, Grainge MJ, Zhang W et al. Global epidemiology of gout: prevalence, incidence and risk factors. *Nature Reviews Rheumatology*. 2015;11(11):649-62. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/26150127/>.
130. Dehlin M, Jacobsson L, Roddy E. Global epidemiology of gout: prevalence, incidence, treatment patterns and risk factors. *Nature Reviews Rheumatology*. 2020;16(7):380-90. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/32541923/>.
131. Nielsen SM, Bartels EM, Henriksen M et al. Weight loss for overweight and obese individuals with gout: a systematic review of longitudinal studies. *Ann Rheum Dis*. 2017;76(11):1870-82. [accessed: 26 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5705854/>.
132. Arthritis Foundation. How Fat Affects Gout. [accessed: 26 April 2021]. Available at: <https://www.arthritis.org/health-wellness/about-arthritis/related-conditions/other-diseases/how-fat-affects-gout>.
133. Beyl RN, Hughes L, Morgan S. Update on Importance of Diet in Gout. *Am J Med*. 2016;129(11):1153-8. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/27452679/>.
134. Nuki G, Doherty M, Richette P. Current management of gout: practical messages from 2016 EULAR guidelines. *Pol Arch Intern Med*. 2017;127(4):267-77. [accessed: 26 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/28430170>.

135. FitzGerald JD, Dalbeth N, Mikuls T et al. 2020 American College of Rheumatology Guideline for the Management of Gout. *Arthritis Care & Research*. 2020;72(6):744-60. [accessed: 26 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/32391934/>.
136. Zhang Y, Chen C, Choi H et al. Purine-rich foods intake and recurrent gout attacks. *Ann Rheum Dis*. 2012;71(9):1448-53. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22648933>.
137. Choi HK, Atkinson K, Karlson EW et al. Purine-Rich Foods, Dairy and Protein Intake, and the Risk of Gout in Men. *New England Journal of Medicine*. 2004;350(11):1093-103. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/15014182/>.
138. Choi HK, Liu S, Curhan G. Intake of purine-rich foods, protein, and dairy products and relationship to serum levels of uric acid: The Third National Health and Nutrition Examination Survey. *Arthritis & Rheumatism*. 2005;52(1):283-9. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/15641075/>.
139. Li R, Yu K, Li C. Dietary factors and risk of gout and hyperuricemia: a meta-analysis and systematic review. *Asia Pac J Clin Nutr*. 2018;27(6):1344-56. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30485934>.
140. Towiwat P, Li Z-G. The association of vitamin C, alcohol, coffee, tea, milk and yogurt with uric acid and gout. *International Journal of Rheumatic Diseases*. 2015;18(5):495-501. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/26082349/>.
141. Rho YH, Zhu Y, Choi HK. The Epidemiology of Uric Acid and Fructose. *Semin Nephrol*. 2011;31(5):410-9. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3197219/>.
142. International Osteoporosis Foundation. About. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/health-professionals/about-osteoporosis>.
143. International Osteoporosis Foundation. Epidemiology. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/health-professionals/about-osteoporosis/epidemiology>.
144. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int*. 2006;17(12):1726-33. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/16983459>.
145. International Osteoporosis Foundation. Calcium. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/health-professionals/prevention/nutrition/calcium>.
146. Food and Agriculture Organization of the United Nations, World Health Organization. Human Vitamin and Mineral Requirements. Report of a joint FAO/WHO expert consultation. 2001. [accessed: 19 March 2021]. Available at: <http://www.fao.org/3/y2809e/y2809e.pdf>.
147. Institute of Medicine Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. Dietary Reference Intakes for Calcium and Vitamin D. 2011. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21796828>.
148. International Osteoporosis Foundation. Calcium content of common foods. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/patients/prevention/calcium-content-of-common-foods>.
149. International Osteoporosis Foundation. Calcium Calculator. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/educational-hub/topic/calcium-calculator>.
150. Sözen T, Özişik L, Başaran NÇ. An overview and management of osteoporosis. *Eur J Rheumatol*. 2017;4(1):46-56. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5335887/>.
151. International Osteoporosis Foundation. Vitamin D (Prevention). [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/patients/prevention/vitamin-d>.
152. Tripkovic L, Lambert H, Hart K et al. Comparison of vitamin D2 and vitamin D3 supplementation in raising serum 25-hydroxyvitamin D status: a systematic review and meta-analysis. *The American*

- Journal of Clinical Nutrition. 2012;95(6):1357-64. [accessed: 12 April 2021]. Available at: <https://academic.oup.com/ajcn/article/95/6/1357/4568382>.
153. Martineau AR, Thummel KE, Wang Z et al. Differential Effects of Oral Boluses of Vitamin D₂ vs Vitamin D₃ on Vitamin D Metabolism: A Randomized Controlled Trial. *The Journal of Clinical Endocrinology & Metabolism*. 2019;104(12):5831-9. [accessed: 12 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/31199458/>.
 154. International Osteoporosis Foundation. Vitamin D Recommendations. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/health-professionals/prevention/nutrition/vitamin-d>.
 155. Rizzoli R, Biver E, Bonjour JP et al. Benefits and safety of dietary protein for bone health—an expert consensus paper endorsed by the European Society for Clinical and Economical Aspects of Osteoporosis, Osteoarthritis, and Musculoskeletal Diseases and by the International Osteoporosis Foundation. *Osteoporos Int*. 2018;29(9):1933-48. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/29740667/>.
 156. International Osteoporosis Foundation. Protein and other nutrients. [accessed: 19 March 2021]. Available at: <https://www.osteoporosis.foundation/health-professionals/prevention/nutrition/protein-and-other-nutrients>.
 157. Coronado-Zarco R, Olascoaga-Gómez de León A, García-Lara A et al. Nonpharmacological interventions for osteoporosis treatment: Systematic review of clinical practice guidelines. *Osteoporos Sarcopenia*. 2019;5(3):69-77. [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6838743/>.
 158. Kanis JA, Johansson H, Johnell O et al. Alcohol intake as a risk factor for fracture. *Osteoporos Int*. 2005;16(7):737-42. [accessed: 19 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/15455194/>.
 159. World Health Organization. Anaemia. [accessed: 19 March 2021]. Available at: https://www.who.int/health-topics/anaemia#tab=tab_2.
 160. World Health Organization. Nutritional anaemias: tools for effective prevention and control. 2017. [accessed: 12 April 2021]. Available at: <https://www.who.int/publications-detail-redirect/9789241513067>.
 161. World Health Organization. Nutrition counselling during pregnancy. 2019. [accessed: 19 March 2021]. Available at: http://www.who.int/elena/titles/nutrition_counselling_pregnancy/en/.
 162. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. 2017. [accessed: 13 April 2021]. Available at: <https://www.who.int/publications/i/item/9789241549912>.
 163. International Federation of Gynecology and Obstetrics. FIGO nutrition checklist for pre-pregnant/early pregnant women. [accessed: 19 March 2021]. Available at: <https://bit.ly/2RjtBm2>.
 164. International Federation of Gynecology and Obstetrics. The FIGO Nutrition Checklist. [accessed: 19 March 2021]. Available at: <https://www.figo.org/news/figo-nutrition-checklist>.
 165. World Health Organization. Ageing and health. 2018. [accessed: 19 March 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>.
 166. World Health Organization. Integrated care for older people: guidelines on community-level interventions to manage declines in intrinsic capacity. 2017. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK488250/>.
 167. Bruins MJ, Van Dael P, Eggersdorfer M. The Role of Nutrients in Reducing the Risk for Noncommunicable Diseases during Aging. *Nutrients*. 2019;11(1). [accessed: 19 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6356205/>.
 168. Malnutrition Pathway. Managing Adult Malnutrition in the Community. [accessed: 19 March 2021]. Available at: <https://www.malnutritionpathway.co.uk/mal-overview>.
 169. Malnutrition Pathway. Managing Malnutrition: Care Plans. [accessed: 19 March 2021]. Available at: <https://www.malnutritionpathway.co.uk/careplans>.

170. Malnutrition Pathway. Managing Malnutrition: Care Homes. [accessed: 19 March 2021]. Available at: <https://www.malnutritionpathway.co.uk/carehomes>.
171. Malnutrition Pathway. Pathway for using Oral Nutritional Supplements (ONS) in the Management of Malnutrition. [accessed: 19 March 2021]. Available at: https://www.malnutritionpathway.co.uk/library/ons_pathway.pdf.
172. Malnutrition Pathway. Managing Malnutrition: Resources for Patients and Carers. [accessed: 19 March 2021]. Available at: <https://www.malnutritionpathway.co.uk/leaflets-patients-and-carers>.
173. Centers for Disease Control and Prevention. Micronutrient Facts. 2020. [accessed: 20 March 2021]. Available at: <https://www.cdc.gov/nutrition/micronutrient-malnutrition/micronutrients/index.html>.
174. World Health Organization. Micronutrients. [accessed: 20 March 2021]. Available at: https://www.who.int/health-topics/micronutrients#tab=tab_1.
175. World Health Organization. Calcium supplementation during pregnancy to reduce the risk of pre-eclampsia. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/calcium_pregnancy/en/.
176. World Health Organization. Periconceptional folic acid supplementation to prevent neural tube defects. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/folate_periconceptional/en/.
177. World Health Organization. Iodine supplementation in pregnant and lactating women. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/iodine_pregnancy/en/.
178. World Health Organization. Daily iron and folic acid supplementation during pregnancy. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/daily_iron_pregnancy/en/.
179. World Health Organization. Iron supplementation with or without folic acid to reduce the risk of postpartum anaemia. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/iron_postpartum/en/.
180. World Health Organization. Daily iron supplementation in adult women and adolescent girls. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/daily_iron_women/en/.
181. World Health Organization. Daily iron supplementation in children 6-23 months of age. 2019. [accessed: 20 March 2021]. Available at: <http://www.who.int/elena/titles/iron-children-6to23/en/>.
182. World Health Organization. Daily iron supplementation in children 24-59 months of age. 2019. [accessed: 20 March 2021]. Available at: <http://www.who.int/elena/titles/iron-children-24to59/en/>.
183. World Health Organization. Daily iron supplementation in children and adolescents 5-12 years of age. 2019. [accessed: 20 March 2021]. Available at: <http://www.who.int/elena/titles/iron-children-5to12/en/>.
184. World Health Organization. Vitamin A supplementation. [accessed: 12 April 2021]. Available at: http://www.who.int/elena/titles/full_recommendations/vitamina_supp/en/.
185. World Health Organization. Vitamin A supplementation during pregnancy. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/vitamina_pregnancy/en/.
186. World Health Organization. Vitamin A supplementation during pregnancy. [accessed: 12 April 2021]. Available at: http://www.who.int/elena/titles/guidance_summaries/vitamina_pregnancy/en/.
187. Rothman KJ, Moore LL, Singer MR et al. Teratogenicity of High Vitamin A Intake. *New England Journal of Medicine*. 1995;333(21):1369-73. [accessed: 12 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/7477116/>.
188. World Health Organization. Vitamin D supplementation during pregnancy. 2020. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/vitamin_d_supp_pregnancy/en/.

189. World Health Organization. Vitamin D supplementation and respiratory infections in children. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/vitamind_pneumonia_children/en/.
190. World Health Organization. Vitamin D supplementation in infants. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/vitamind_infants/en/.
191. Theodoratou E, Tzoulaki I, Zgaga L et al. Vitamin D and multiple health outcomes: umbrella review of systematic reviews and meta-analyses of observational studies and randomised trials. *BMJ*. 2014;348:g2035. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24690624>.
192. World Health Organization. Zinc supplementation and growth in children. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/zinc_stunting/en/.
193. World Health Organization. Zinc supplementation during pregnancy. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/zinc_pregnancy/en/.
194. World Health Organization. Zinc supplementation in the management of diarrhoea. 2019. [accessed: 20 March 2021]. Available at: http://www.who.int/elena/titles/zinc_diarrhoea/en/.
195. Myint ZW, Oo TH, Thein KZ et al. Copper deficiency anemia: review article. *Ann Hematol*. 2018;97(9):1527-34. [accessed: 12 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/29959467/>.
196. World Health Organization. Obesity and overweight. 2020. [accessed: 13 April 2021]. Available at: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
197. World Health Organization. Body mass index - BMI. [accessed: 25 April 2021]. Available at: <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>.
198. World Health Organization. Waist circumference and waist-hip ratio: report of a WHO expert consultation. 2011. [accessed: 13 April 2021]. Available at: <https://www.who.int/publications/i/item/9789241501491>.
199. Centers for Disease Control and Prevention. Assessing Your Weight. 2020. [accessed: 13 April 2021]. Available at: <https://www.cdc.gov/healthyweight/assessing/index.html>.
200. International Diabetes Federation. IDF Consensus Worldwide Definition of the Metabolic Syndrome. 2006. [accessed: 13 April 2021]. Available at: <https://www.idf.org/e-library/consensus-statements/60-idfconsensus-worldwide-definition-of-the-metabolic-syndrome.html>.
201. O'Neil PM, Rieder S. The Multidisciplinary Team in the Management of Obesity. 2005. [accessed: 25 April 2021]. Available at: <https://link.springer.com/chapter/10.1385/1-59259-865-X:355>.
202. Obert J, Pearlman M, Obert L et al. Popular Weight Loss Strategies: a Review of Four Weight Loss Techniques. *Curr Gastroenterol Rep*. 2017;19(12):61. [accessed: 25 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/29124370>.
203. Department of Health: State Government of Victoria. Weight loss and fad diets. 2011. [accessed: 26 April 2021]. Available at: <http://www.betterhealth.vic.gov.au/health/healthyliving/weight-loss-and-fad-diets>.
204. Astbury NM, Piernas C, Hartmann-Boyce J et al. A systematic review and meta-analysis of the effectiveness of meal replacements for weight loss. *Obes Rev*. 2019;20(4):569-87. [accessed: 13 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6849863/>.
205. Burke LE, Wang J, Sevick MA. Self-Monitoring in Weight Loss: A Systematic Review of the Literature. *Journal of the American Dietetic Association*. 2011;111(1):92-102. [accessed: 13 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/21185970/>.
206. National Institute of Diabetes and Digestive and Kidney Diseases. Prescription Medications to Treat Overweight and Obesity. 2016. [accessed: 25 April 2021]. Available at: <https://www.niddk.nih.gov/health-information/weight-management/prescription-medications-treat-overweight-obesity>.

207. Simón A. TERAPÊUTICA FARMACOLÓGICA DA OBESIDADE EM ADULTOS. 2020. [accessed: 13 April 2021]. Available at: https://www.ordemfarmaceuticos.pt/fotos/publicacoes/boletimcim_out_dez_2020_1710574369601a87c83aa6f.pdf.
208. Son JW, Kim S. Comprehensive Review of Current and Upcoming Anti-Obesity Drugs. *Diabetes Metab J.* 2020;44(6):802-18. [accessed: 13 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7801751/>.
209. Torgerson JS, Hauptman J, Boldrin MN et al. XENical in the Prevention of Diabetes in Obese Subjects (XENDOS) Study: A randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients. *Diabetes Care.* 2004;27(1):155-61. [accessed: 13 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/14693982>.
210. Rucker D, Padwal R, Li SK et al. Long term pharmacotherapy for obesity and overweight: updated meta-analysis. *BMJ.* 2007;335(7631):1194-9. [accessed: 13 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2128668/>.
211. Genentech. Xenical (orlistat) Capsules. 2010. [accessed: 13 April 2021]. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2010/020766s028lbl.pdf.
212. Bansal AB, Al Khalili Y. Orlistat. *StatPearls.* 2020. [accessed: 13 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK542202/>.
213. Novo Nordisk. Saxenda (liraglutide injection) Package Insert. 2020. [accessed: 22 April 2021]. Available at: <https://www.novo-pi.com/saxenda.pdf>.
214. Apovian CM, Aronne L, Rubino D et al. A randomized, phase 3 trial of naltrexone SR/bupropion SR on weight and obesity-related risk factors (COR-II). *Obesity (Silver Spring).* 2013;21(5):935-43. [accessed: 21 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23408728>.
215. Greenway FL, Fujioka K, Plodkowski RA et al. Effect of naltrexone plus bupropion on weight loss in overweight and obese adults (COR-I): a multicentre, randomised, double-blind, placebo-controlled, phase 3 trial. *Lancet.* 2010;376(9741):595-605. [accessed: 21 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/20673995>.
216. Wadden TA, Foreyt JP, Foster GD et al. Weight Loss With Naltrexone SR/Bupropion SR Combination Therapy as an adjunct to Behavior Modification: The COR-BMOD Trial. *Obesity (Silver Spring).* 2011;19(1):110-20. [accessed: 22 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4459776/>.
217. Hollander P, Gupta AK, Plodkowski R et al. Effects of naltrexone sustained-release/bupropion sustained-release combination therapy on body weight and glycemic parameters in overweight and obese patients with type 2 diabetes. *Diabetes Care.* 2013;36(12):4022-9. [accessed: 21 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24144653>.
218. Contrave (naltrexone HCl/bupropion HCl). [accessed: 13 April 2021]. Available at: <https://contrave.com>.
219. Vivus Inc. Qsymia (Phentermine and Topiramate extended-release) Capsules Prescribing Information. 2020. [accessed: 23 April 2021]. Available at: <https://qsymia.com/patient/include/media/pdf/prescribing-information.pdf>.
220. Gadde KM, Allison DB, Ryan DH et al. Effects of low-dose, controlled-release, phentermine plus topiramate combination on weight and associated comorbidities in overweight and obese adults (CONQUER): a randomised, placebo-controlled, phase 3 trial. *Lancet.* 2011;377(9774):1341-52. [accessed: 22 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21481449>.
221. Allison DB, Gadde KM, Garvey WT et al. Controlled-release phentermine/topiramate in severely obese adults: a randomized controlled trial (EQUIP). *Obesity (Silver Spring).* 2012;20(2):330-42. [accessed: 22 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22051941>.
222. Johnson DB, Quick J. Topiramate And Phentermine. *StatPearls.* 2021. [accessed: 23 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK482165/>.

223. European Medicines Agency. Qsiva (phentermine/topiramate). 2013. [accessed: 25 April 2021]. Available at: <https://www.ema.europa.eu/en/medicines/human/EPAR/qsiva>.
224. Dwyer JT, Coates PM, Smith MJ. Dietary Supplements: Regulatory Challenges and Research Resources. *Nutrients*. 2018;10(1). [accessed: 25 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5793269/>.
225. Pittler MH, Ernst E. Dietary supplements for body-weight reduction: a systematic review. *The American Journal of Clinical Nutrition*. 2004;79(4):529-36. [accessed: 25 April 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/15051593/>.
226. Wharton S, Bonder R, Jeffery A et al. The safety and effectiveness of commonly-marketed natural supplements for weight loss in populations with obesity: A critical review of the literature from 2006 to 2016. *Crit Rev Food Sci Nutr*. 2020;60(10):1614-30. [accessed: 24 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30896252>.
227. Maunder A, Bessell E, Lauche R et al. Effectiveness of herbal medicines for weight loss: A systematic review and meta-analysis of randomized controlled trials. *Diabetes Obes Metab*. 2020;22(6):891-903. [accessed: 25 April 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/31984610>.
228. National Institutes of Health - Office of Dietary Supplements. Dietary Supplements for Weight Loss. 2021. [accessed: 25 April 2021]. Available at: <https://ods.od.nih.gov/factsheets/WeightLoss-HealthProfessional/>.
229. Rocha T, Amaral JS, Oliveira MBPP. Adulteration of Dietary Supplements by the Illegal Addition of Synthetic Drugs: A Review. *Comprehensive Reviews in Food Science and Food Safety*. 2016;15(1):43-62. [accessed: 25 April 2021]. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12173>.
230. Koncz D, Tóth B, Roza O et al. A Systematic Review of the European Rapid Alert System for Food and Feed: Tendencies in Illegal Food Supplements for Weight Loss. *Front Pharmacol*. 2021;11. [accessed: 25 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7870490/>.
231. U.S. Food and Drug Administration. Beware of Products Promising Miracle Weight Loss. 2015. [accessed: 25 April 2021]. Available at: <https://www.fda.gov/consumers/consumer-updates/beware-products-promising-miracle-weight-loss>.
232. Barrea L, Altieri B, Polese B et al. Nutritionist and obesity: brief overview on efficacy, safety, and drug interactions of the main weight-loss dietary supplements. *Int J Obes Suppl*. 2019;9(1):32-49. [accessed: 25 April 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6683127/>.
233. Weidmann AE, Cunningham S, Gray G et al. Views of the Scottish general public on community pharmacy weight management services: international implications. *Int J Clin Pharm*. 2012;34(2):389-97. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22382887>.
234. Um IS, Armour C, Krass I et al. Weight management in community pharmacy: what do the experts think? *Int J Clin Pharm*. 2013;35(3):447-54. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23456174>.
235. O'Neal KS, Crosby KM. Patients' perceptions of a pharmacist-managed weight management clinic in a community setting. *Res Social Adm Pharm*. 2013;9(1):129-36. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22695218>.
236. Verma RK, Paraidathathu T, Taha NA et al. Perceptions of the Malaysian general public on community pharmacy-based weight management services. *J Pharm Policy Pract*. 2018;11:17. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/30094032>.
237. Atif M, Hasan S, Mushtaq I et al. A qualitative study to explore the role of pharmacists in healthy weight management in adults in Pakistan: current scenario and future perspectives. *BMC Health Services Research*. 2020;20(1):541. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/32539709>.
238. Rosenthal M, Ward LM, Teng J et al. Weight management counselling among community pharmacists: a scoping review. *International Journal of Pharmacy Practice*. 2018;26(6):475-84. [accessed: 20 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/29732639/>.

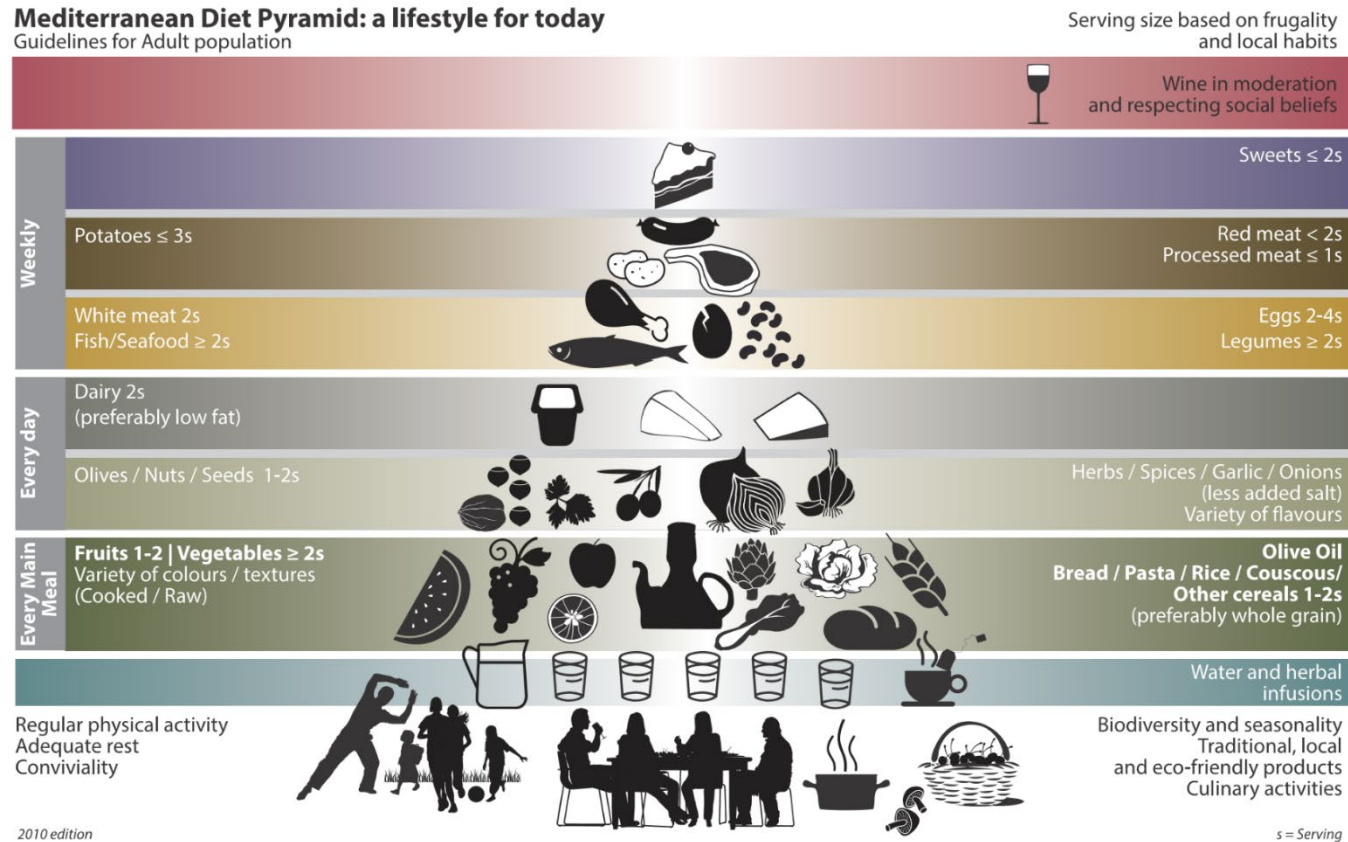
239. Gómez-Martínez J, López-Pintor E, Lumbreras B. Effectiveness of a Patient-Centered Weight Management Model in a Community Pharmacy: An Interventional Study. *Patient Prefer Adherence*. 2020;14:1501-11. [accessed: 20 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7457851/>.
240. Um IS, Krass I, Armour C et al. Developing and testing evidence-based weight management in Australian pharmacies: A Healthier Life Program. *Int J Clin Pharm*. 2015;37(5):822-33. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25920908>.
241. Confederación Farmacéutica Argentina. Las cifras de la Salud en la Región de las Américas Informe de la OPS. 2012. [accessed: 20 March 2021]. Available at: <http://servicios.cofa.org.ar/CorreoFarmaceutico/Correo129.pdf>.
242. Boardman HF, Avery AJ. Effectiveness of a community pharmacy weight management programme. *Int J Clin Pharm*. 2014;36(4):800-6. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/25027254>.
243. Morrison D, McLoone P, Brosnahan N et al. A community pharmacy weight management programme: an evaluation of effectiveness. *BMC Public Health*. 2013;13(1):282. [accessed: 20 March 2021]. Available at: <https://bmcpublihealth.biomedcentral.com/articles/10.1186/1471-2458-13-282>.
244. Phimarn W, Pianchana P, Limpikanchakovit P et al. Thai community pharmacist involvement in weight management in primary care to improve patient's outcomes. *Int J Clin Pharm*. 2013;35(6):1208-17. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24057434>.
245. Fanous AM, Kier KL, Rush MJ et al. Impact of a 12-week, pharmacist-directed walking program in an established employee preventive care clinic. *Am J Health Syst Pharm*. 2014;71(14):1219-25. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24973382>.
246. World Health Organization. WHO Effective Communications Participant Handbook. 2015. [accessed: 20 March 2021]. Available at: <https://www.who.int/communicating-for-health/resources/participant-handbook-english.pdf?ua=1>.
247. Farcavi. Programa FARCAVI: "Una iniciativa para mejorar la Calidad de Vida". 2008. [accessed: 19 March 2021]. Available at: <http://farcavi.blogspot.com/2008/08/una-iniciativa-para-mejorar-la-calidad.html>.
248. Österreichische Apothekerkammer. Wehsely und die Apothekerkammer Wien starten Kampagne "Gesunden Appetit!". 2010. [accessed: 20 March 2021]. Available at: https://www.ots.at/presseaussendung/OTS_20100414_OT50066/wehsely-und-die-apothekerkammer-wien-starten-kampagne-gesunden-appetit.
249. Federfarma Genova. Campagna prevenzione obesità infantile. 2010. [accessed: 20 March 2021]. Available at: <http://www.federfarmagenova.it/website/notizie/listNews.asp?idn=411#>.
250. Consejo General de Colegios Oficiales de Farmacéuticos. Campaña educativa sobre hábitos alimentarios en las escuelas. 2017. [accessed: 20 March 2021]. Available at: <https://www.portalfarma.com/Profesionales/campanaspf/categorias/Paginas/Alimentacion/plenufar2.aspx>.
251. Consejo General de Colegios Oficiales de Farmacéuticos. Plenufar III. 2017. [accessed: 20 March 2021]. Available at: <https://www.portalfarma.com/Profesionales/campanaspf/categorias/Paginas/Alimentacion/plenufar3.aspx>.
252. Consejo General de Colegios Oficiales de Farmacéuticos. Plenufar 6: Educación Nutricional en la actividad física. 2018. [accessed: 20 March 2021]. Available at: <https://www.portalfarma.com/Profesionales/campanaspf/categorias/Paginas/Plenufar-6.aspx>.
253. Consejo General de Colegios Oficiales de Farmacéuticos. Alimentación. [accessed: 20 March 2021]. Available at: <https://www.portalfarma.com/Profesionales/campanaspf/categorias/Paginas/Alimentacion/alimentacion.aspx>.

254. Société Vaudoise de Pharmacie. Ça marche dans ma pharmacie! 2012. [accessed: 20 March 2021]. Available at: <https://mangerbouger.promotionsantevaud.ch/projet/ca-marche-dans-ma-pharmacie-campagne-2012/>.
255. Center for Substance Abuse Treatment. Enhancing Motivation for Change in Substance Abuse Treatment. Chapter 3—Motivational Interviewing as a Counseling Style. 1999. [accessed: 20 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK64964/>.
256. Agency for Healthcare Research and Quality. Integrating Primary Care Practices and Community-based Resources to Manage Obesity. Chapter 3: Getting Patients Excited About Crossing the Bridge. 2014. [accessed: 20 April 2021]. Available at: <http://www.ahrq.gov/ncepcr/tools/obesity/obpcp3.html>.
257. Lonie JM, Austin Z, Nguyen R et al. Pharmacist-based health coaching: A new model of pharmacist-patient care. *Res Social Adm Pharm*. 2017;13(3):644-52. [accessed: 19 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/27497786>.
258. White N. Lifestyle Medicine and Health and Wellness Coaching in Pharmacy Practice. *Am J Lifestyle Med*. 2018;12(6):459-61. [accessed: 20 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6367873/>.
259. DiDonato KL, May JR, Lindsey CC. Impact of wellness coaching and monitoring services provided in a community pharmacy. *Journal of the American Pharmacists Association*. 2013;53(1):14-21. [accessed: 20 March 2021]. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23636151>.

11 Appendices

11.1 Appendix 1. Mediterranean Diet Pyramid

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The use and promotion of this pyramid is recommended without any restriction



11.2 Appendix 2. COPD malnutrition leaflets

Reproduced here with the kind permission of the Malnutrition Pathway (www.malnutritionpathway.co.uk)

Eating Well for Your Lungs

You have been given this leaflet to help you eat well and keep as healthy as possible.

- Your diet, nutritional and fluid intake are very important when you have COPD
- COPD can have an effect on your whole body. It is therefore important to eat a balanced and varied diet to help maintain your strength and fitness, as well as help your body fight infections
- When you are feeling well and strong, healthy eating can keep you feeling this way
- It is important to think about your weight. If you are very overweight your heart and lungs have to work harder to supply oxygen to your body. Likewise if you are too thin, you are more at risk from infections
- Ask your nurse what your Body Mass Index (BMI) is. If it is between 20 and 30, it is a healthy weight for someone with COPD
- If you start struggling to eat enough, find that you are losing weight and/or are finding it difficult to do everyday activities such as shopping and socialising, speak to your doctor or nurse

Protein Foods

For healthy strong muscles (including those that help with breathing)

- Try to eat protein foods at least twice a day, e.g. lunch, dinner and snacks
- Foods that provide us with protein include: meat, fish, eggs, dairy products (cheese, yogurt, milk), tofu, beans, lentils and nuts

Carbohydrate Foods

For energy

- Starchy foods include: potatoes, bread, pasta, rice, cereals - always include a starchy food at each meal
- Sugary foods include: cakes, biscuits, sweets, fizzy drinks - try to take in the diet occasionally as a treat

Fruit and Vegetables

For essential vitamins and minerals to boost your immune system

- We should include plenty of fruit and vegetables in our diets - aim for 5 portions a day
- Your fruit and vegetables can be fresh, frozen, canned - they all count

Dairy Foods

For strong bones

- People with COPD can have weaker bones. This can be a result of your medication or because you are less active
- Dairy foods include: cheese, milk, yogurt, fromage frais - include a portion of dairy food in your diet 3 times per day
- Non-dairy foods providing the same important nutrients (e.g. calcium) include leafy green vegetables, beans (e.g. kidney beans), chickpeas (e.g. hummus), nuts (e.g. almonds), seeds (e.g. sesame), fruit (e.g. oranges, dried figs) and seafood (e.g. canned salmon, sardines)

High Energy Foods

- High energy foods are the ones to think about avoiding if you are trying to reduce your weight
- They tend to contain a lot of calories but don't provide many of the important nutrients for your body - try to cut back on these foods
- High energy foods are those that are high in fat (e.g. chips, fried foods, meat pies), high in sugar (e.g. fizzy drinks, sweets), or high in both sugar and fat (e.g. chocolate, cream cakes)

Diet and Breathing

- If you become breathless when eating you may find it easier to eat 3 smaller meals and have snacks in between meals, however it is important not to reduce your overall food intake

Tips for Coping With a Dry Mouth

Dry mouth can be caused by using oxygen, nebulisers or inhalers. It can make it difficult to chew and swallow foods, and sometimes it can lead to taste changes

- Choose softer or moist foods, e.g. minced beef in shepherd's pie rather than pieces of meat
- Suck fruit sweets, ice lollies made with fruit juice or squash, or chew sugar-free gum
- Your doctor or nurse may prescribe some pastilles or saliva sprays if the problem continues
- If you are finding it difficult to swallow, are frequently coughing during meals or your voice becomes gargly ask your doctor or nurse to refer you to a speech and language therapist who will be able to advise you

Tips for Coping With Taste Changes

If your taste changes you may lose your appetite and may not feel like eating your usual foods

- After using a steroid inhaler rinse your mouth and gargle with water to prevent oral thrush
- Look after your mouth: regularly clean your teeth/dentures, use water and floss
- Focus on the foods you enjoy but don't be afraid to try new foods
- Try sharp or spicy foods, as they have a stronger taste
- Experiment with different seasonings and sauces
- If you go off a particular food, try it again regularly as your tastes may continue to change

Eating and Smoking

- Giving up smoking is a fantastic step to increasing your health and fitness but you may find your weight increases slightly. Don't be too concerned about this however - the most important thing is to continue on your 'stop smoking journey'. Stopping smoking will in time also improve your taste and sense of smell making food more pleasurable

Eating and Physical Activity

- If you are living with COPD it is very important to keep as active as possible, this helps your lungs and also the rest of your body to stay strong
- Try to gently increase the amount of activity you are doing, and ask about local activity programmes. Activity does not have to be strenuous – try gentle exercises such as walking or cycling
- Ask your doctor or nurse for advice

Improving Your Nutrition in COPD

You have been given this leaflet because, although you are quite well, you have lost some weight or muscle strength.

- Your diet, nutritional and fluid intake are very important when you have COPD
- COPD can have an effect on your whole body. It is important to eat a balanced and varied diet to help maintain your strength and fitness, as well as help your body fight infections
- If you are struggling to eat enough, you are losing weight, or you are losing strength in your muscles, then you need to think differently about the foods you are eating. Following the advice in this leaflet may help you regain some of the strength and weight you have lost

Monitor Your Weight Monthly

- Keep an eye on your weight each month as it is an indicator of what is happening in your body
- If you are unable to weigh yourself, be aware of visual signs of your weight decreasing, for example jewellery and clothes becoming looser. Sometimes you won't be able to gain back all of the weight you have lost, but the tips below can help you avoid losing more weight
- If you continue to lose weight over the next 3 months seek advice from your doctor or nurse or Dietitian
- Even if you are overweight, it is still important that your weight is monitored by a doctor or nurse and it is important to mention if you have lost weight without meaning to
- The free leaflet 'Your Guide to Making the Most of Your Food' contains more tips and ideas to help you get the most nutrition from your food (www.malnutritionpathway.co.uk/leaflets-patients-and-carers)

Protein Foods

For healthy strong muscles (including those that help with breathing)

- Try to eat protein foods 3 or 4 times a day, e.g. lunch, dinner and snacks
- Foods that provide protein include: meat, fish, eggs, dairy products (cheese, yogurt, milk), tofu, beans, lentils

Carbohydrate Foods

For energy – always include a starchy food at each meal

- Examples of these foods include: potatoes, bread, pasta, cereals, cakes, puddings

Fruit and Vegetables

For essential vitamins and minerals to boost your immune system

- We should include plenty of fruit and vegetables in our diets - aim for 5 portions a day
- Your fruit and vegetables can be fresh, frozen, canned, in pies, crumbles or trifles - they all count

Dairy Foods

For strong bones

- People with COPD can have weaker bones. This can be a result of medication or because you are less active
- Dairy foods include: cheese, milk, yogurt, cream, fromage frais - include a portion of dairy in your diet 3 times per day - don't choose low fat options
- Non-dairy foods providing the same important nutrients (e.g. calcium) include: leafy green vegetables, beans (e.g. kidney beans), chickpeas (e.g. hummus), nuts (e.g. almonds), seeds (e.g. sesame), fruit (e.g. oranges, dried figs) and seafood (e.g. salmon, sardines)

Tips for Eating When You Are Short of Breath

If you find you are eating less because you are short of breath

- Aim to eat something 6 times per day, try to eat 3 smaller meals and have snacks in between meals or nutritious drinks e.g. milky drink or fruit smoothie

Tips for Coping With a Dry Mouth

Dry mouth can be caused by using oxygen, nebulisers or inhalers. It can make it difficult to chew and swallow foods, and sometimes it can lead to taste changes

- Choose softer or moist foods, e.g. minced beef in shepherd's pie rather than pieces of meat
- Suck fruit sweets, ice lollies made with fruit juice or squash, or chew sugar-free gum
- Your doctor or nurse may prescribe some pastilles or saliva sprays if the problem continues
- If you are finding it difficult to swallow, are frequently coughing during meals or your voice becomes gargly ask your doctor or nurse to refer you to a speech and language therapist who will be able to advise you
- Always make sure you keep your mouth clean and moist to avoid infections. Ask your dentist for advice if needed

Tips for Coping With Taste Changes

If your taste changes you may lose your appetite and may not feel like eating your usual foods

- After using a steroid inhaler rinse your mouth and gargle with water to prevent oral thrush
- Look after your mouth: regularly clean your teeth/dentures, use water and floss
- Try sharp, spicy or sugary foods, as they have a stronger taste. Experiment with different seasonings and sauces
- If you go off a particular food, try it again regularly as your tastes may continue to change

Tips for Making the Most of Your Food and Drinks to Avoid Further Weight Loss

- Choose full fat foods (e.g. whole milk) or high energy foods - those high in fat (e.g. chips, fried foods), sugar (e.g. fizzy drinks, sweets) or fat and sugar (e.g. chocolate, cream cakes). Avoid low fat or 'diet' varieties
- Whilst these foods are usually recommended in moderation they can help you gain weight, or avoid losing more weight. Include them in your diet as often as possible as part of meals or snacks
- Add cream, grated cheese or cream cheese or ground almonds to food e.g. soups, sauces, curries, scrambled eggs
- Use mayonnaise, salad cream or dressing in sandwiches and on salads
- Add extra butter, margarine or ghee to vegetables, potatoes, scrambled eggs and bread
- Fortify your usual milk: whisk 2-4 tablespoons of milk powder into one pint of milk
- Add honey, syrup and jams to porridge, milky puddings, on bread, toast or tea cakes
- Take nourishing drinks e.g. smoothies, soups, fruit juice, milkshakes or hot chocolate
- Use convenience foods from the cupboard or freezer e.g. biscuits, baked beans, soup, tinned puddings, custard
- Powdered supplements (ask your pharmacist for further information) are available from most supermarkets and pharmacies and can be used in between meals
- Don't fill up on drinks before or during your meal
- Eat more of the foods that you enjoy at the times of day when you feel more like eating
- The free leaflet 'Your Guide to Making the Most of your Food' contains lots of additional tips and ideas (www.malnutritionpathway.co.uk/leaflets-patients-and-carers)

If you feel too tired to shop for, prepare or cook meals:

- Ask family, friends or your carer for help with cooking, shopping or ordering food for home delivery
- Ask to be assessed for a package of care (contact your local social services department)
- Use meals on wheels services or home delivery services offering pre-prepared meals
- Arrange to eat regularly with a friend or family member or attend a local lunch club

Eating and Physical Activity in COPD

It is important to keep as active as possible to help your lungs and the rest of your body to stay strong. Ask your doctor or nurse for advice

- Activity does not have to be strenuous - try gentle exercises such as walking or cycling
- Try to gently increase the amount of activity you are doing yourself - ask about local activity programmes
- Make sure you have a high energy snack after you have exercised to avoid losing further weight

Nutrition Support in COPD

You have been given this leaflet because you are having difficulty eating, may be losing weight, or becoming weaker.

- Your diet, nutritional and fluid intake are very important when you have COPD
- If you have lost weight don't worry if you can't gain it all back, but try to follow some of the nutrition support tips in this leaflet to help maintain your weight

Monitor Your Weight

Weigh yourself monthly if you can, or ask your doctor or nurse to weigh you at your appointments, as your weight is a good indicator of what is happening in your body

- If you are unable to weigh yourself, be aware of visual signs of your weight decreasing, for example jewellery and clothes becoming looser
- If you continue to lose weight or you struggle to eat enough during periods of illness, even if you are overweight, seek advice from your doctor or nurse

Tips for Eating When Short of Breath

You may find it more difficult to swallow and eat enough if you are very short of breath

- It may be easier to eat softer, moist foods at these times, e.g. casseroles, curries, sauces, gravy, milky puddings, fruit smoothies, ice creams
- Aim to eat something 6 times per day, even if it is smaller meals and nutritious drinks or snacks between meals (see tips below)

Tips for Making the Most of Your Food and Drinks

- Choose full fat or high energy options, e.g. whole milk, in place of 'low fat' or 'diet' versions
- Whilst fat and sugar are usually recommended in moderation they can help you gain weight, or avoid losing more weight when appetite is poor. Include them in your diet as often as possible as part of meals or snacks
- Examples of high energy snacks include a piece of cheese, a small handful of nuts, a slice of cake/teacake, a slice of toast with jam/peanut butter, a bar of chocolate, a pot of whole milk yogurt/fromage frais/mousse
- Add grated or cream cheese to mashed potato, soups, sauces, scrambled eggs, baked beans
- Add cream to sauces, scrambled eggs, soups, curries, mashed potatoes, desserts and porridge
- Use mayonnaise, salad cream or dressing in sandwiches and on salads
- Add extra butter, margarine or ghee to vegetables, potatoes, scrambled eggs and bread
- Fortify your usual milk: whisk 2-4 tablespoons of milk powder into one pint of milk, use for drinks, on cereals etc
- Add honey, syrup and jams to porridge, milky puddings, on bread, toast or tea cakes
- Take nourishing drinks e.g. smoothies, soups, fruit juice, milkshakes or hot chocolate
- Use convenience foods from the cupboard or freezer, e.g. long life milk, savoury snacks, biscuits, rice puddings, corned beef, baked beans, soups, tinned puddings and custard
- Powdered supplements (ask your pharmacist for further information) are available from most supermarkets and pharmacies and can be used in between meals
- Don't fill up on drinks before or during your meal
- Eat more of the foods that you enjoy at the times of day when you feel more like eating
- The free leaflet 'Your Guide to Making the Most of your Food' contains lots of additional tips and ideas (available from www.malnutritionpathway.co.uk/leaflets-patients-and-carers)

If you feel too tired to shop for, prepare or cook meals:

- Ask family, friends or your carer for help with cooking, shopping or ordering food for home delivery
- Ask to be assessed for a package of care (contact your local social services department)
- Use meals on wheels services or home delivery services offering pre-prepared meals
- Arrange to eat regularly with a friend or family member or attend a local lunch club



Tips for Coping With a Dry Mouth

Dry mouth can be caused by using oxygen, nebulisers or inhalers. It can make it difficult to chew and swallow foods, and sometimes it can lead to taste changes

- Choose softer or moist foods, e.g. minced beef in shepherd's pie rather than pieces of dry meat
- Suck fruit sweets, ice lollies made with fruit juice or squash, or chew sugar-free gum
- Your doctor or nurse may prescribe some pastilles or saliva sprays if the problem continues
- If you are finding it difficult to swallow, are frequently coughing during meals or your voice becomes gargly ask your doctor or nurse to refer you to a speech and language therapist who will be able to advise you
- Always make sure you keep your mouth clean and moist to avoid infections. Ask your dentist for advice if needed

Tips for Coping With Taste Changes

If your taste changes you may lose your appetite and may not feel like eating your usual foods

- After using a steroid inhaler rinse your mouth and gargle with water to prevent oral thrush
- Look after your mouth: regularly clean your teeth/dentures, use water and floss
- Focus on the foods you enjoy but don't be afraid to try new foods
- Try sharp or spicy or sugary foods, as they have a stronger taste
- Experiment with different seasonings and sauces
- If you go off a particular food, try it again regularly as your tastes may continue to change

Oral Nutritional Supplements (Nutrition Drinks)

If you are struggling to eat enough you may be given an oral nutritional supplement to try. It is recommended that if you have COPD and a low body mass index (BMI of less than 20kg/m²) your GP or Dietitian should prescribe you oral nutritional supplements

- Oral nutritional supplements provide extra energy, protein, vitamins and minerals and are usually taken in addition to your normal diet, unless advised they should not replace food, drinks or meals
- Your GP or Dietitian will tell you how many to take each day
- There are a range of types and flavours available (e.g. ready-made drinks, powders to be made up with fresh milk, savoury, puddings, milk, juice or yogurt styles). Discuss your preferences with your GP or Dietitian and find one you enjoy taking
- Some oral nutritional supplements contain more of certain nutrients, which may be helpful for some people with COPD (e.g. extra protein or energy)
- Some supplements are available in a smaller bottle, which may be easier to manage if you are breathless, have a poor appetite or struggle to eat or drink large amounts
- If taking part in pulmonary rehabilitation, you may need extra energy in your diet, or oral nutritional supplements to avoid losing weight – ask your healthcare professional for further advice
- If you are prescribed oral nutritional supplements you will be monitored. You may not need them all of the time – perhaps only after a set back with your disease or another illness
- More advice on oral nutritional supplements can be found in the free leaflet 'Nutrition Drinks – Advice for patients and carers' (available from www.malnutritionpathway.co.uk/files/uploads/Nutrition_Drinks_2014.pdf)

Eating and Physical Activity in COPD

It is very important to keep as active as possible to help your lungs and the rest of your body to stay strong. Ask your doctor or nurse for more advice

- Make sure you have high energy snacks throughout the day if you are becoming more active
- Activity does not have to be strenuous – try gentle exercise such as walking or cycling and ask about local activity programmes

11.3 Appendix 3: World Gastroenterology Organisation considerations for patients with coeliac disease

This information was produced by the World Gastroenterology Organisation (WGO) Guidelines and Publications Committee (<http://www.worldgastroenterology.org/>) and is reproduced here with their kind permission.

Not permitted in a gluten-free diet	Permitted in a gluten-free diet
<ul style="list-style-type: none"> • Barley • Bran • Bulgur • Couscous • Durum flour • Einkorn (Triticum monococcum)* • Emmer (Triticum dicoccum)* • Farro* • Gluten, gluten flour • Graham flour • Kamut™ (Khorasan wheat)* • Malt, malt extract, malt flavouring, malt syrup • Oats, oat bran, oat syrup — not labelled as gluten-free (Pure oats free of contamination are available in some countries and these are allowed in certain quantities.) • Rye • Semolina (durum wheat)* • Spelt (dinkel wheat, Triticum spelta) • Triticale • Wheat germ, wheat starch, wheat bran • Any item with wheat, barley or rye in its name 	<ul style="list-style-type: none"> • Amaranth • Arrowroot • Bean flours • Buckwheat • Corn • Garbanzo beans • Seeds • Millet • Montina flour (Indian rice grass) • Nut flour and nut meals • Oats (uncontaminated, labelled as gluten-free) • Potato flour, potato starch • Quinoa • Rice, all forms (brown, white, sweet, wild, jasmine, basmati, glutinous rice, polished rice, rice bran) • Sorghum flour • Soy flour • Tapioca • Teff flour
Other foods for a basic gluten-free diet <ul style="list-style-type: none"> • Dairy • All fresh meats and gluten-free preserved meat • Seafood • Eggs • Legumes: lentils, chickpeas (garbanzo beans), peas, beans, nuts, seeds — packaged, not loose • Fruits (fresh, frozen, canned) and plain fruit juices • Vegetables (fresh, frozen, canned) and plain vegetable juices • Liquid vegetable oils 	
Miscellaneous items allowed in a gluten-free diet <ul style="list-style-type: none"> • Sweets: honey, corn syrup, sugar (brown and white) • Snack foods: plain popcorn, nuts, plain pickles, olives, gluten-free potato chips (potato crisps) • Condiments: natural herbs, pure black pepper, vinegars (apple, grape, or wine) 	
Other considerations <ul style="list-style-type: none"> • Cooking and food preparation: patients should be instructed not to contaminate gluten-free food (e.g., using separate cooking utensils, cooking surfaces and toasters.) • The majority of industrially produced foods contain non-allowable ingredients — attention to labelling is important, and available lists should be checked for allowable foodstuffs. • A gluten-free diet is low in fibre. Patients should be advised to eat a high-fibre diet supplemented with whole-grain rice, maize, potatoes and ample vegetables. Any dietary deficiencies such as iron, folic acid, calcium and (very rarely) vitamin B12 should be corrected. 	

*Varieties of wheat

11.4 Appendix 4: National Institutes of Health — Office of Dietary Supplements: Common ingredients in weight-loss dietary supplements²²⁸

Ingredient	Proposed mechanism of action	Evidence of efficacy**	Evidence of safety**
African mango (<i>Irvingia gabonensis</i>)	Inhibits adipogenesis and reduces leptin levels	Few clinical trials, all with small sample sizes Research findings: Possible modest reduction in body weight and waist circumference	No safety concerns reported for up to 3,150mg/day for 10 weeks Reported adverse effects: Headache, difficulty sleeping, flatulence and gas
Beta-glucans	Increases satiety and gastrointestinal transit time, and slows glucose absorption	Several clinical trials with weight loss as a secondary outcome Research findings: No effect on body weight	No safety concerns reported for up to 10g/day for 12 weeks Reported adverse effects: Flatulence
Bitter orange (<i>Citrus aurantium</i> L.)	Increases energy expenditure and lipolysis, acts as a mild appetite suppressant. Synephrine is the proposed active constituent.	Small clinical trials of poor methodological quality Research findings: Possible increase in resting metabolic rate and energy expenditure; inconclusive effects on weight loss	Some safety concerns reported, especially for combinations with other stimulants Reported adverse effects: Chest pain, anxiety, headache, musculoskeletal complaints, and increased blood pressure and heart rate
Caffeine (as added caffeine or from guarana, kola nut, yerba maté or other herbs)	Stimulates central nervous system, increases thermogenesis and fat oxidation	Short-term clinical trials of combination products Research findings: Possible modest effect on body weight or decreased weight gain over time	Safety concerns not usually reported at intakes less than 400–500mg/day for adults, significant safety concerns at higher doses Reported adverse effects: Nervousness, jitteriness, vomiting and tachycardia
Calcium	Increases lipolysis and fat accumulation, decreases fat absorption	Several large clinical trials Research findings: No effect on body weight, weight loss, or prevention of weight gain based on clinical trials	No safety concerns reported at recommended intakes (1,000–1,200mg/day for adults) Reported adverse effects: Constipation, kidney stones, and interference with zinc and iron absorption at intakes above 2,000–2,500mg/day for adults
Capsaicin and other capsaicinoids	Increases energy expenditure and lipid oxidation, increases satiety, and reduces energy intake	Several clinical trials, mostly focused on energy intake and appetite Research findings: Might reduce energy intake but no effect on body weight	Few safety concerns reported for up to 33mg/day for 4 weeks or 4mg/day for 12 weeks Reported adverse effects: Gastrointestinal distress, increased insulin levels, and decreased high-density lipoprotein levels
Carnitine	Increases fatty acid oxidation	Several clinical trials with weight loss as a secondary outcome Research findings: Possible modest reduction in body weight	No safety concerns reported for up to 2g/day for 1 year or 4g/day for 56 days Reported adverse effects: Nausea, vomiting, diarrhoea, abdominal cramps, and a “fishy” body odour; might increase trimethylamine N-oxide levels, which are linked to greater cardiovascular disease risk
Chitosan	Binds dietary fat in the digestive tract	Small clinical trials, mostly of poor methodological quality Research findings: Minimal effect on body weight	Few safety concerns reported for 0.24–15g/day for up to 6 months; could cause allergic reactions Reported adverse effects: Flatulence, bloating, constipation, indigestion, nausea and heartburn

Ingredient	Proposed mechanism of action	Evidence of efficacy**	Evidence of safety**
Chromium	Increases lean muscle mass; promotes fat loss; and reduces food intake, hunger levels, and fat cravings	Several clinical trials of varying methodological quality Research findings: Minimal effect on body weight and body fat	No safety concerns reported for recommended intakes (20–45µg/day for adults) Reported adverse effects: Headache, watery stools, constipation, weakness, vertigo, nausea, vomiting and urticaria (hives)
<i>Coleus forskohlii</i>	Enhances lipolysis and reduces appetite. Forskolin is the proposed active constituent.	Few short-term clinical trials Research findings: No effect on body weight	No safety concerns reported at typical doses of 500mg/day for 12 weeks Reported adverse effects: More frequent bowel movements, loose stools
Conjugated linoleic acid	Increases lipolysis, reduces lipogenesis, and promotes apoptosis in adipose tissue	Several clinical trials Research findings: Minimal effect on body weight and body fat	Few safety concerns reported for 2.4–6g/day for up to 12 months Reported adverse effects: Abdominal discomfort and pain, constipation, diarrhoea, loose stools, dyspepsia, and (possibly) adverse effects on blood lipids and glucose homeostasis
Fucoxanthin	Increases energy expenditure and fatty acid oxidation, suppresses adipocyte differentiation and lipid accumulation	Studied only in combination with pomegranate-seed oil in one trial in humans Research findings: Insufficient research to draw firm conclusions	No safety concerns reported from one clinical trial that used 2.4mg/day for 16 weeks, but not rigorously studied Reported adverse effects: None known
<i>Garcinia cambogia</i> (hydroxycitric acid)	Inhibits lipogenesis, suppresses food intake. Hydroxycitric acid is the proposed active constituent.	Several short-term clinical trials of varying methodological quality Research findings: Little to no effect on body weight	Some safety concerns reported Reported adverse effects: Headache, nausea, upper respiratory tract symptoms, gastrointestinal symptoms, mania and liver damage
Glucomannan	Increases feelings of satiety and fullness, prolongs gastric emptying time	Several clinical trials of varying methodological quality, mostly focused on effects on lipid and blood glucose levels Research findings: Little to no effect on body weight	Significant safety concerns reported for tablet forms, which might cause oesophageal obstructions, but few safety concerns with up to 15.1g/day of other forms for several weeks Reported adverse effects: Loose stools, flatulence, diarrhoea, constipation and abdominal discomfort
Green coffee bean extract (<i>Coffea arabica</i> , <i>Coffea canephora</i> , <i>Coffea robusta</i>)	Inhibits fat accumulation, modulates glucose metabolism	Few clinical trials, all of poor methodological quality Research findings: Possible modest effect on body weight	Few safety concerns reported for up to 200mg/day for as long as 12 weeks, but not rigorously studied; contains caffeine Reported adverse effects: Headache and urinary tract infections
Green tea (<i>Camellia sinensis</i>) and green tea extract	Increases energy expenditure and fat oxidation, reduces lipogenesis and fat absorption	Several clinical trials of good methodological quality on green tea catechins with and without caffeine Research findings: Possible modest effect on body weight	No safety concerns reported for use as a beverage, contains caffeine; some safety concerns reported for green tea extract Reported adverse effects (for green tea extract): Constipation, abdominal discomfort, nausea, increased blood pressure and liver damage
Guar gum	Acts as bulking agent in gut, delays gastric emptying, increases feelings of satiety	Several clinical trials of good methodological quality Research findings: No effect on body weight	Few safety concerns reported with currently available formulations containing up to 30g/day for as long as 6 months Reported adverse effects: Abdominal pain, flatulence, diarrhoea, nausea and cramps

Ingredient	Proposed mechanism of action	Evidence of efficacy**	Evidence of safety**
Hoodia (<i>Hoodia gordonii</i>)	Suppresses appetite, reduces food intake	Very little published research in humans Research findings: No effect on energy intake or body weight based on one study	Some safety concerns reported, increases heart rate and blood pressure Reported adverse effects: Headache, dizziness, nausea and vomiting
Probiotics	Alters gut microbiota, affecting nutrient and energy extraction from food and altering energy expenditure	Several clinical trials Research findings: Inconsistent effects on body fat, waist and hip circumference, and body weight	No safety concerns reported for healthy individuals Reported adverse effects: Gastrointestinal symptoms, such as gas
Pyruvate	Increases lipolysis and energy expenditure	Few clinical trials, all of weak methodological quality Research findings: Possible minimal effect on body weight and body fat	Few safety concerns reported for up to 30g/day for as long as 6 weeks, but not well studied Reported adverse effects: Diarrhoea, gas, bloating, and (possibly) decreased high-density lipoprotein levels
Raspberry ketone	Alters lipid metabolism	Studied only in combination with other ingredients Research findings: Insufficient research to draw firm conclusions	No safety concerns reported in one 8-week study, but not well studied Reported adverse effects: None known
Vitamin D	None proposed; associations exist between low vitamin D status and obesity	Several clinical trials Research findings: No effect on body weight	No safety concerns reported at recommended intakes (600–800IU/day for adults); toxic at very high intakes; tolerable upper intake level of 4,000IU/day for adults Reported adverse effects: Anorexia, weight loss, polyuria, heart arrhythmias, and increased calcium levels leading to vascular and tissue calcification
White kidney bean (<i>Phaseolus vulgaris</i>)	Interferes with breakdown and absorption of carbohydrates by acting as a “starch blocker”	Several clinical trials of varying methodological quality Research findings: Possible modest effect on body weight and body fat	Few safety concerns reported for up to 3,000mg/day for as long as 12 weeks Reported adverse effects: Headache, soft stools, flatulence, and constipation
Yohimbe (<i>Pausinystalia yohimbe</i>)	Has hyperadrenergic effects. Yohimbine is the proposed active constituent.	Very little research on yohimbe for weight loss Research findings: No effect on body weight; insufficient research to draw firm conclusions	Significant safety concerns reported, especially for yohimbine doses of 20mg or higher Reported adverse effects: Headache, anxiety, agitation, hypertension, and tachycardia, myocardial infarction, cardiac failure and death

* Additional information to support statements in this table are provided on the National Institutes of Health Office of Dietary Supplements website, cited here.²²⁸

**The evidence of efficacy and safety is for the individual ingredients. The efficacy and safety of these ingredients might be different when they are combined with other ingredients in a product.

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