BDA Oncology Specialist Group Myth Busting Resource

Introduction

Diets to combat various health complaints have been promoted for many years. These diets may be alternative i.e. used to replace usual medical treatment; or complementary i.e. used in conjunction with medical treatment. Since the growth of the internet and the rise in social media such diets have grown in popularity and are reaching a wider audience. As a health care professional (HCP) working in cancer care you may be asked about such diets by your clients, their carer's and other HCP's.

People choose to follow complementary or alternative diets for a variety of reasons. They may hope to improve troublesome symptoms or treatment side-effects and improve their quality of life. They may seek to boost their immune system or enhance how effective their standard treatment is. They may even hope to cure their disease or reduce the risk of recurrence. Whatever the reason for following the diet they may be seeking to gain some control over their situation and a sense of empowerment.

When counselling such patients it is important to establish their understanding and beliefs regarding diets and their influence on cancer. If they are interested in or adhere to a cancer diet, their expectations and experiences should be explored. Any lack of knowledge or misconceptions should be discussed and the scientific evidence explained[1].

Individuals have often taken time to research the proposed diet and come armed with knowledge and convincing arguments often based on "pseudoscience" and promoted by persuasive advocates. You may feel confident in answering their queries but if not you are not alone. Only a minority of therapists in oncology feel proficiently qualified to communicate with patients on CAM (complementary alternative medicine)[2]. Even for scientists and clinicians, the question of whether and how nutrition may influence cancer risk and prognosis is controversial as the available data is highly complex.

As a health care professional you may find that your opinion on these subjects is in contrast to that of the person seeking advice. It can be all too easy to present a negative argument against their use but it is

much better to present a more balanced, non-biased case based on the facts and to discuss these with your client in order to allow them to make their own decisions. If a particular diet has no proven benefit but will cause no harm then your role may be to support the individual to follow their wishes. This will in turn aid a better working relationship with your client and they are then more likely to seek further advice from you.

This fact sheet discusses some of the most popular alternative diets relating to cancer and provides information on what the diets each entail in practical terms, the theory behind them and any available evidence relating to them. We hope that this will be a useful resource for you.

References:

1 Heubner J et al (2014) Counseling patients on cancer diets: A review of the literature an recommendations for clinical practice. Anticancer Research 34: 39-48.

2 Frenkel M et al (2010) Communication in cancer care: Discussing complementary and alternative medicine. Interg Cancer Ther 9 (2): 177-185.

Alkaline Diet

(sometimes known as the Acid Alkaline Ash diet, the acid alkaline diet)

History:

The use of diet to try and modify pH and manage conditions such as bone mineral density and kidney stones has been researched for many years. More recently the alkaline diet has been promoted based on claims that it can prevent or cure cancer. A plethora of websites and social media now endorse the diet as part of a lifestyle approach. One major proponent of the diet for its cancer curing properties is Robert O. Young, an American naturopathic practitioner and author of The pH Miracle[3] series of books.

Theory:

It is hypothesised that an acidic environment promotes ill health whereas an alkaline environment is beneficial and promotes good health. The diet is based on the claim that the food you eat can affect the body's pH and that as human blood is naturally slightly alkaline (~pH 7.4) eating foods that produce acid upset the balance. The theory goes that by eating too many acid-forming foods the blood, and other cells, will become too acidic which in turn can cause ill health including increased risk of cancer. Eating more alkaline-forming foods will promote health and reduce risk of cancer and other diseases. Statements such as "Cancer cells thrive in acidity (low pH), but not in alkalinity (high pH), so a diet high in alkaline foods like fruits and vegetables that also limits acidic foods, such as those from animal products, will raise blood pH levels and create an environment in the body that discourages cancer growth" can be found on the internet. Foods are classified based on a calculation (Predicted Renal Acid Load or PRAL score) to predict how acidic the food is which is based on the metabolic products of the foods.

Features of the diet:

High intake of vegetables and low-sugar fruits, avoidance of sugar, grains, dairy and meat.
Foods are classified as either acid or alkaline (based on a calculation to predict renal acid load or PRAL score).
Acid (forming) foods - to avoid e.g. cheese, milk, yoghurt, eggs, lentils, meat, poultry and fish.
Alkaline (forming) foods -to eat more of e.g. green vegetables e.g. broccoli, kale, courgettes, asparagus; fruit e.g. oranges, lemons, apples, bananas

As there is no common consensus or pool of data on classification of foods many are misclassified which may lead to further confusion and also further limits the scientific credibility of the diet. In addition, certain foods which are perceived as unhealthy can often be deliberately wrongly classified in order to steer followers away.

Alongside the recommended dietary restrictions followers are encouraged to use a variety of specialist products including bottled alkaline waters and water alkalaniser machines.
People following the diet are encouraged to monitor their urine pH to ensure that their body is not too acidic. However, it is important to note that this is not an indicator of blood pH.

What is the scientific basis for the diet and is there any evidence to support its use?

There is no scientific literature establishing the benefit of an alkaline diet for the prevention of cancer at this time. Despite the promotion of the alkaline diet and alkaline water by the media and salespeople, there is no actual research to either support or disprove these ideas[4]. However, basic principles of biochemistry and metabolism can be applied to test the theory of the diet.

Blood pH (7.4) is tightly regulated by several compensatory mechanisms involving the kidneys and respiratory system known as acid-base homeostasis. Any excess acid load is excreted in the urine hence the noted changes in urinary pH. However blood pH is not altered by dietary intake. The only situation in which blood pH is altered is during metabolic acidosis, when an individual is critically ill.

In relation to cancer it is known that some cancer cells favour a more acidic environment, although some others e.g. leukaemias, prefer a more alkaline environment. Proponents of the alkaline diet suggest that eating a more alkaline diet can create a more hostile alkaline environment and therefore kill cancer. However neither cancer cells nor healthy cells can survive in an overly alkaline environment. An alkaline environment may improve the efficacy of some chemotherapy agents but not others[5]. However, tumour cells can adapt to changes in their environment and continue to proliferate. There is no good evidence to prove that diet can manipulate whole body pH, or that of the tumour microenvironment and therefore it's impact on cancer.

Could the diet cause harm?

The diet is highly restrictive and low in protein due to a lack of meat, dairy and pulses and could therefore contribute to malnutrition in a patient population who are already at increased risk of malnutrition due to their disease and treatment side effects.

Whilst there is no available scientific literature to assess any risk involved in following the diet the restrictive nature of this diet may lead to undesirable nutritional consequences. If a person is already struggling with poor appetite and weight loss then imposing further dietary restrictions could make matters worse by limiting intake further and potentially reducing enjoyment of food. Not only this but following such a restrictive diet can be comparatively expensive and time-consuming.

References

[3] Young RO. The pH Miracle -balance your diet, reclaim your health. New York: Warner Books, 2002.

4. Schwalfenburg GK (2012) The Alkaline Diet: Is there evidence that and alkaline pH diet benefits health? Journal of Environmental and Public Helath. Vol. 7.

5. Fenton TR & Huang T (2016) Systematic review of the association between dietary acid load, alkaline water and cancer. BMJOpen. Volume 6; Issue 6.

Ketogenic Diet

History:

First documented in 1911 relating to childhood epilepsy. It was hypothesised the effect of reducing epileptic seizures came from metabolic changes during starvation, with ketone bodies becoming the main fuel for the brain's energy. In 1921 it was claimed the diet could be maintained for longer periods of time by mimicking the body's biochemical response to starvation and devised the 'ketogenic diet' (KD).

Theory:

The KD diet became popular among cancer patients as scientists looked further into the pathways within the tumour cells. Scientists hypothesised that genetic mutations cause cancer and that these cancer cells favourably metabolise sugar (Warburg effect).

Preclinical data suggested that the insulin pathway including insulin, insulin like growth factor (IGF-1) and IGF receptor (IGF-1R) can be associated with cancer initiation and progression. This pathway is up regulated through dietary consumption of carbohydrates. It is therefore thought the implementation of a KD would reduce energy production of cancer cells, thus decreasing tumour proliferation[1].

What is the ketogenic diet?

The KD is a low-carbohydrate diet. However, there are variations, with specific proportions of macronutrients depending on the type of diet followed. The four major variations are shown in the table below, with macronutrient breakdown expressed as a percentage of total estimated energy requirements[2].

Macronutrient	Classic KD	MCT Diet	Modified Atkins	Low GI Diet
CHO	4%	10-19%	10%	40-60g (GI<50)
Fat	90%	71-80%	60%	60-70%
Protein	6%	10%	30%	20-30%

What is the evidence?

When looking at the evidence of the effect of ketosis on cancer cells, the vast majority of the existing research is on animals and in brain tumours. Human data are mostly based on single case reports and a smattering of preliminary clinical studies with small study cohorts, heterogenous study designs, poor compliance to the diet, noncomparable regimens, or without standardized dietary guidance[3]. These human studies demonstrate no difference in disease outcome but did report weight loss in those following a KD, which may be a concern in the cancer population, especially among malnourished or sarcopenic patients.

A recent review of the literature found low adherence to the KD which was reported due to variance in macronutrient intakes to maintain ketosis with no pre-defined limits to maintain a state of ketosis due to lack of pre-existing data[4]. It has been suggested a high protein intake may counteract ketosis by providing glucogenic amino acids for production of glucose when the level of protein consumed exceeds the normal non starvation protein turnover.

The review reported symptoms of constipation, diarrhoea and fatigue. Some of which may be attributed to cancer treatment side effects, however as the KD is low in fibre patients following the KD are likely to experience constipation[4].
Adherence may be low due to palatability, prolonged dietary restrictions and lack of delivery and monitoring of the KD by a dietitian.

Dairy

Cancer link: Breast and prostate cancer

History/Theory

It was believed that hormones used in the production of milk would promote hormone related cancerous tumour growth.

What is the evidence?

There is no clear link between dairy containing diets and risk of cancer or promoting cancer growth as a result of hormones.

In terms of prevention, there is more evidence suggesting the protective role of dairy in the development of breast cancer through increase in intakes of anticarcinogenic properties of calcium, vitamin D, butyrate, conjugated linoleic acid and lactoferrin (Jiajie Zang et al 2015). High fat options increases intake of saturated fat which has been linked to increase the risk of developing breast cancer, therefore should be avoided.

However, World Cancer Research Fund notes that there is limited (suggestive) evidence emerging to demonstrate that diets high in calcium and dairy can increase the risk of developing prostate cancer.

Recommendations

A dairy free diet is not recommended for cancer prevention or treatment. Aim for three portions of low fat dairy per day to provide calcium, protein and some vitamins as per healthy eating guidance.

For cancer prevention, encourage lower fat options to reduce overall saturated fat and to maintain a healthy weight. Men to avoid high intakes of calcium, greater than 700mg/day.

Soya

Cancer link: Hormone related cancers e.g. Breast and Gastrointestinal cancers e.g. oesophageal, gastric and colorectal

History/Theory

Isoflavones, a type of polyphenol, that are found in soy products have a similar chemical structure to the hormone oestrogen. As oestrogen can stimulate some cancers to grow, some people worry whether foods or soy supplements containing isoflavones might have the same effect as oestrogen and stimulate tumour growth.

What is the evidence?

Current evidence suggests that a diet containing naturally occurring Isoflavones is safe. Additionally, there is now increasing evidence to suggest that increased intake of isoflavones may be beneficial in colorectal, breast and prostate cancers; polyphenols have shown anti-cancer properties, such as anti-inflammatory, reduction damage to cells and stimulation of DNA repair in animal studies. In colorectal cancers Isoflavones may be active before and after food absorption by the gut, therefore protecting the gut (Rothwell et al, 2017).

In breast and prostate cancer, isoflavones may reduce the risk of cancer returning by blocking oestrogen being absorbed by cancer cells. However, these studies are based on Asian diets where Soy is a much larger part of their normal diet. Soy supplements did not have the same protective effect (Rothwell et al, 2017).

Recommendations

Soya foods can be used as part of a healthy balanced diet as a non-meat source of protein and can provide additional fibre.

There, is no current evidence to suggest the use of soy dietary supplements.

Evidence List

Jiajie Zang, Meihua Shen, Sufa Du, Tianwen Chen and Shurong Zou (2015) The Association between Dairy Intake and Breast Cancer in Western and Asian Populations: A Systematic Review and Meta-Analysis. J Breast Cancer. Dec; 18(4): 313–322.

Kanti Bhooshan Pandey and Syed Ibrahim Rizvi. (2009) Plant polyphenols as dietary antioxidants in human health and disease. Oxid Med Cell Longev. 2009 Nov-Dec; 2(5): 270–278.

Rothwell, Joseph A.[a]; Knaze, Viktoria[a]; Zamora-Ros, Raul. (2017) Polyphenols: dietary assessment and role in the prevention of cancers. Current Opinion in Clinical Nutrition and Metabolic Care. Volume 20, Issue 6 - p 512–521

Tanja Kongerslev Thorning,[1] Anne Raben,[1] Tine Tholstrup,[1] Sabita S. Soedamah-Muthu,[2] Ian Givens,[3] and Arne Astrup (2016) Milk and dairy products: good or bad for human health? An assessment of the totality of scientific evidence. Food Nutr Res. 60: 10.3402

World Cancer research fund: continuous update project. (2018) Meat, Fish and Dairy products and the risk of cancer. https://www.wcrf.org/sites/default/files/Meat-Fish-and-Dairy-products.pdf Accessed 2/10/18

Fasting during cancer treatment

Diets based on intermittent fasting and other types of periodic calorie restriction have been gaining popularity as ways to improve health, lose weight and reduce cancer risk. Different types of popular fasting regimes include water fasting, dry fasting, time-restricted, intermittent and short term fasting. However, it is still unclear whether clinical evidence is strong enough to support such regimes.

Short term fasting (STF) and chemotherapy

Early experimental data in laboratory and animal studies indicates that short term fasting (also termed short term starvation) could have a protective effect on healthy cells whist leaving cancer cells exposed to the toxic effects of chemotherapy.[1] This is based on a mechanism called *differential stress resistance* (DSR), which suggests that the susceptibility to chemotherapy treatments differs between normal cells and cancer cells. It is this difference in response to stress-like conditions such as fasting, which is thought to increase the effectiveness of chemotherapy and reduce treatment related side-effects. [1,3,10]

Background – the science

When deprived of nutrients, the body responds by withdrawing energy from growth and reproduction in favour of maintenance and repair systems. This is thought to induce metabolic changes in normal cells, causing them to switch off signals for growth and enter a 'protective mode'. Studies in mice have shown that fasting causes a reduction in growth factors, such as *insulin-like growth factor-1* (IGF-1), which plays a key role in certain nutrient signalling pathways.[8,10] Reduced levels of IGF-1 are associated with decreased growth of healthy cells, making them more resistance to oxidative stress and other toxins. In contrast, cancer cells are able to grow independently of growth signals due to mutations in so called oncogenes and therefore do not show any resistance to stress. This can prevent the switch to a 'protective mode' in response to starvation, potentially making tumour cells more sensitive to chemotherapy.[8,5]

Evidence so far

Chemotherapy treatments are frequently limited by toxicity related side-effects, which can have severe consequences and are a major cause of treatment interruptions and delays. Whist there is some evidence that STF might increase the efficacy and tolerability of chemotherapy, most of the available studies are still pre-clinical and based on cellular or animal models.[5,10]

Limited evidence from several early human studies has shown potential benefits of short term fasting, including increased treatment tolerance, reduced chemotherapy related side-effects such as fatigue and gastrointestinal symptoms and improved quality of life.[1,8,12] However, these preliminary studies are based on small, selected patient groups and tumour sites (mostly breast and ovarian cancer patients). Whether fasting is a suitable or safe option for a wider population of cancer patients is still uncertain.

In addition, total fasting periods (24-120 hours) and allowed daily energy intakes varied greatly between studies and it is uncertain how well patients complied with fasting regimes.[1,7] Whist some studies allowed patients to consume juice, broth and small amounts of food, others were based on water only. Reported side-effects included: headaches, hunger, weakness, nausea, light-headedness and weight loss. Patients with certain conditions, such as such as heart disease, diabetes, eating disorders as well as low body mass index (BMI) and a history of recent weight loss (of more than 10% body weight) were excluded from studies due to safety reasons. [1,5,7,12]

Safety of fasting during cancer treatment

Weight loss and malnutrition are common in cancer patients and are strongly associated with reduced response to treatment, increased susceptibility to infections, delayed wound healing, fatigue and overall reduced quality of life.[2] Many patients with cancer face multiple disease and treatment related symptoms, which can make eating and drinking difficult and negatively affect their nutritional status. Any calorie or nutrient restrictive diets should therefore only be considered with caution. Clinical guidelines do not currently recommend fasting before or during chemotherapy, particularly in patients who may be at nutritional risk. This includes patients who are underweight, have recently experienced significant unintentional weight loss, are struggling to eat and drink normally, have swallowing difficulties or patients weakened by surgery as well at those with other pre-existing health conditions.

In summary

Although early trials have shown some positive effects of STF around chemotherapy treatment, it should be remembered that the evidence from human studies is still very limited. There are many concerns regarding the potential risks associated with prolonged fasting periods and it is not considered appropriate for all cancer patients. It is widely agreed that further clinical evidence is required to evaluate the potential risks and benefits. Currently it is still unknown for which types of cancers and at what stage fasting may be a feasible option. In addition, questions regarding how long to fast for and how fasting should be timed around chemotherapy still need to be addressed.

The growing interest in fasting and calorie restrictive diets has led to a wealth of information available in the press and online resources, which promote STF in relation to cancer treatments. Patients wishing to consider fasting during their treatment are advised to consult their healthcare professionals or seek advice from a registered dietitian.

References

1. Bauersfeld, S., Kessler, C., Wischnewsky, M., Jaensch, A., Steckhan, N., Stange, R., Kunz, B., Brückner, B., Sehouli, J. and Michalsen, A. (2018). The effects of short-term fasting on quality of life and tolerance to chemotherapy in patients with breast and ovarian cancer: a randomized cross-over pilot study, *BMC Cancer*, 18(1):476.
2. Caccialanza, R., Cereda, E., De Lorenzo, F., Farina, G. and Pedrazzoli, P. (2018). To fast, or not to fast before chemotherapy, that is the question, *BMC Cancer*, 18(1):337.
3. Couzin, J. (2008). CANCER RESEARCH: Can Fasting Blunt Chemotherapy's Debilitating Side Effects?, *Science*, 321(5893), pp.1146a-1147a.
4. Dan, T. and Simone, N. (2015). Not so fast: dietary restriction improves chemotherapy-related toxicity, *Cell Cycle*, 14(16), pp.2554-2555.
5. de Groot, S., Vreeswijk, M., Welters, M., Gravesteijn, G., Boei, J., Jochems, A., Houtsma, D., Putter, H., van der Hoeven, J., Nortier, J., Pijl, H. and Kroep, J. (2015). The effects of short-term fasting on tolerance to (neo) adjuvant chemotherapy in HER2-negative breast cancer patients: a randomized pilot study, *BMC Cancer*, 15(1).
6. Dorff, T., Groshen, S., Garcia, A., Shah, M., Tsao-Wei, D., Pham, H., Cheng, C., Brandhorst, S., Cohen, P., Wei, M., Longo, V. and Quinn, D. (2016). Safety and feasibility of fasting in combination with platinum-based chemotherapy, *BMC Cancer*, 16(1).
7. Horne, B., Muhlestein, J. and Anderson, J. (2015). Health effects of intermittent fasting: hormesis or harm? A systematic review, *The American Journal of Clinical Nutrition*, 102(2), pp.464-470.
8. Naveed, S., Aslam, M. and Ahmad, A. (2014). Starvation Based Differential Chemotherapy: A Novel Approach for Cancer Treatment, *Oman Medical Journal*, 29(6), pp.391-398.
9. Naveed, S., Aslam, M. and Ahmad, A. (2014). Starvation Based Differential Chemotherapy: A Novel Approach for Cancer Treatment, *Oman Medical Journal*, 29(6), pp.391-398.
10. Raffaghello, L., Lee, C., Safdie, F., Wei, M., Madia, F., Bianchi, G. and Longo, V. (2008). Starvation-dependent differential stress resistance protects normal but not cancer cells against high-dose chemotherapy', *Proceedings of the National Academy of Sciences*, 105(24), pp.8215-8220.
11. Safdie, F., Dorff, T., Quinn, D., Fontana, L., Wei, M., Lee, C., Cohen, P. and Longo, V. (2018). Fasting and cancer treatment in humans: A case series report, *Aging (Albany NY)*, 1(12),pp.998-1007.
12. Schulmeister, L. (2018). Fasting During Cancer Treatment. Oncology Nursing News, [online]. Available at: http://www.oncnursingnews.com/publication/oncology-nurse/2018/april-2018/fasting-during-cancer-treatment [Accessed 3 Sept 2018].

Dietary supplements

Many cancer patients use complementary alternative medicines (CAMs) but may be unaware of the potential risks. The common reasons given by patients as to why they take CAMs include increase survival and reduce recurrence, optimise treatment, alleviate side effects, boost immune system and have better control over disease[1]. Therefore, we cannot simply argue that hope away just by saying 'Don't take it'.

Supplement use has been shown to increase after diagnosis and to be higher in certain tumour groups, with 82% of breast cancer patients reporting taking an alternative supplement[2].

A cross sectional survey of patients (n=318) showed the most common alternative supplements or vitamins taken were Multivitamin (n=104), Vitamin ACE combination (n=53), Echinacea (n=35), cod liver oil (n=34), evening primrose oil (n=33)[3].

Supplements and cancer treatment

Some vitamins and minerals could interfere with how well cancer drugs work. High dose antioxidants (coenzyme Q10, selenium, vitamins A, C, E) may help prevent cell damage but may stop oncological treatments from working as efficiently.

Below is a brief overview of some of the evidence:
***Antioxidants*:** In vitro, animal and human studies have shown that antioxidants reduce cancer cell growth through a variety of mechanisms, including an increase in cell differentiation and apoptosis, as well as the inhibition of protein kinase C and adenylate cyclase activity in neoplastic cells[4].

Selenium: The Nutritional Prevention of Cancer trial showed a significant protective effect of selenium supplementation (200 mg/day of selenium in 0.5-g high-selenium yeast) on the overall incidence of prostate cancer in men with history of non-melanoma skin cancer, although the effect was restricted to those with lower baseline PSA and plasma selenium concentrations[6].

A systematic review of RCTs and observational studies on adults concluded no beneficial effect of selenium supplements in reducing cancer risk with some RCTs raising concerns by reporting a higher incidence of high-grade prostate cancer and type 2 diabetes in participants with selenium supplementation[7].

Vitamin C*:* Recommended nutrient intake (RNI) is 40mg per day and was set to prevent scurvy. However, it is often taken in much higher doses in oral or IV preparations. Gastrointestinal disturbance, renal stones, acute haemolysis, haemachromatosis are some of the side effects reported from vitamin C toxicity (Expert

Group on Vitamins & Minerals, 2003). There is no high quality evidence that oral or IV vitamin C enhances antitumor effects of chemotherapy or reduces its toxicity (Jacobs et al. 2016).

Vitamin D: A systematic review reported 31% of cancer patients were identified as deficient and 67% as insufficient. It identified the efficacy of cholecalciferol supplementation for raising the concentration of circulating calcidiol is unclear; standard supplement regimens of <1,000 IU D_3 /day may not be sufficient to maintain adequate concentrations or prevent decreasing calcidiol. Bone mineral density (BMD) loss was reported by Datta and Schwarts in prostate[8] & breast[9] patients using commonly used doses (500–1500 mg calcium; 200–1000 IU vitamin D) & found supplementation did not prevent BMD loss.

Dose-response studies on vitamin D status and musculoskeletal and survival outcomes in cancer patients are lacking. There is no definitive guidance for cancer patients, and clinical practice guidelines are derived from the non-cancer setting.

Multivitamin

ESPEN 2017 Guidelines on Cancer and Nutrition: recommend that vitamins and minerals be supplied in amounts approximately equal to the RDA[10] discouraging the use of single high-dose micronutrients in the absence of specific deficiencies[11,12].

Other supplements

Fish oils have been hypothesised to affect platinum based chemotherapy after results from studies in mice. As fish oils may be taken for certain medical conditions, then the benefit of taking a fish oil supplement may outweigh this possible low risk.

Oestrogen based supplements such as red clove, milk thistle, liquorice, isloflavones, ginseng and soya may provide oestrogen in quantities greater than a normal diet which may exacerbate hormone-sensitive conditions such as breast, uterine, and ovarian cancer.

Should you recommend taking a vitamin supplement?

If a balanced diet is unable to be maintained orally or a low level of a particular nutrient has been identified a dietary supplement may be necessary. However, at a high level it could be toxic or harmful to health.

Ideally, a balanced diet with a variety of food rather than a supplement is preferred as multivitamin supplements will not contain all the beneficial substances found naturally in foods (such as fibre).

For patients who are unable to eat a diet with enough nutrients and want to take a supplement, then a standard multivitamin and mineral supplement that contains approximately 100% of the daily requirements can be considered.

Based on the safe upper levels of vitamin and minerals produced by the Expert Vitamin and Mineral (EVM) group we would recommend the following brands that can be purchased: Boots® General Health A-Z, Centrum® Advance Complete A to Zinc, Sanatogen® A – Z Complete and Superdrug® A – Z multivitamins and minerals. Forceval can be prescribed or purchased.

If patients ask about vitamin supplements that exceed the daily recommend nutrient intake there could be possible interactions with oncology treatments. It would be advisable to check with a pharmacists that there are no contraindications.

1. Huebner, J. *et al.* Online survey of patients with breast cancer on complementary and alternative medicine. *Breast Care* **9,** 60–63 (2014).
2. Greenlee, H. *et al.* Changes in vitamin and mineral supplement use after breast cancer diagnosis in the Pathways Study: a prospective cohort study. *BMC Cancer* **14,** 382 (2014).
3. Werneke, U. *et al.* Potential health risks of complementary alternative medicines in cancer patients. *Br. J. Cancer* **90,** 408–413 (2004).
4. Gröber, U., Holzhauer, P., Kisters, K., Holick, M. F. & Adamietz, I. A. Micronutrients in oncological intervention. *Nutrients* **8,** 1–30 (2016).
5. Bjelakovic, G., Nikolova, D., Gluud, L. L., Simonetti, R. G. & Gluud, C. Mortality in Randomized Trials of Antioxidant Supplements for Primary and Secondary Prevention. *JAMA* **297,** 842 (2007).
6. Duffield-Lillico, A. J. *et al.* Selenium supplementation, baseline plasma selenium status and incidence of prostate cancer: an analysis of the complete treatment period of the Nutritional Prevention of Cancer Trial. *BJU Int.* **91,** 608–612 (2003).
7. Vinceti, M. *et al.* Selenium for preventing cancer. *Cochrane Database Syst. Rev.* (2018). doi:10.1002/14651858.CD005195.pub4
8. Datta, M. & Schwartz, G. G. Calcium and vitamin D supplementation during androgen deprivation therapy for prostate cancer: a critical review. *Oncologist* **17,** 1171–9 (2012).
9. Datta, M. & Schwartz, G. G. Calcium and vitamin D supplementation and loss of bone mineral density in women undergoing breast cancer therapy. *Crit. Rev. Oncol. Hematol.* **88,** 613–624 (2013).
10. Arends, J. *et al.* ESPEN guidelines on nutrition in cancer patients. *Clin. Nutr.* **36,** 11–48 (2017).
11. Lawson, K. A. *et al.* Multivitamin Use and Risk of Prostate Cancer in the National Institutes of Health-AARP Diet and Health Study. *JNCI J. Natl. Cancer Inst.* **99,** 754–764 (2007).
12. Ng, K. *et al.* Multivitamin Use Is Not Associated With Cancer Recurrence or Survival in Patients

With Stage III Colon Cancer: Findings From CALGB 89803. *J. Clin. Oncol.* **28,** 4354–4363 (2010).