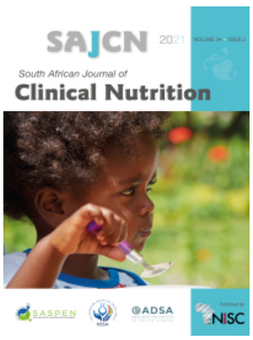

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ARTICLE

Food and beverages promoting elderly health: six food-based dietary guidelines to plan good mixed meals for elderly South Africans

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Studies have shown that the elderly are at a higher risk of developing malnutrition due to physiological and pathological changes. Several studies have confirmed that older South Africans have insufficient dietary diversity, resulting in nutritional deficiencies. Furthermore, poor and uninformed dietary choices are associated with the development of several diseases and increased mortality. Following the Elderly Food Based Dietary Guidelines (EFBDGs) related to promoting elderly health could ensure that the elderly have an adequate intake of nutritious foods. This paper provides an overview of six FBDGs relating to promoting health and is based on the South African Food Based Dietary Guidelines.

Keywords: dietary diversity, elderly, fruit and vegetable intake, legumes, milk and milk products, protein foods, pulses, variety, wholegrain foods, South Africa

Introduction

Dietary diversity has been recognised as one of the components of a high-quality diet and has been recommended in several countries' dietary guidelines, including those for South Africans, Americans, Japanese, Taiwanese and New Zealanders.[1–5] Epidemiological studies indicated that dietary diversity and quality of diet, together with certain lifestyle factors, significantly affect the health status and mortality risk among the elderly.[6]

Many elderly people are at risk of at least one or multiple chronic disease such as hypertension, metabolic disorders, type 2 diabetes (T2D) or cancer. Most of the chronic diseases in the elderly are the result of a complex interaction among behavioural, genetic and environmental factors. Among the behavioural factors, diet contributes most to the development of metabolic disorders.[7] The elderly diets need to provide an adequate amount of energy, protein and micronutrients (vitamins and minerals), which translates to an adequate variety of foods, and a lower amount of fat-containing, or energy-dense foods in their daily diet to ensure healthy ageing.[8] However, studies have shown that dietary intake diversity is low among the elderly in South Africa (SA)[9] making it difficult to achieve this recommendation.

The purpose of this paper is to review recent scientific evidence to support the health benefits of the following guidelines for the elderly: 'enjoy a variety of nutritious foods'; 'wholegrain starchy food, in small portions, could form part of meals'; 'eat plenty of different coloured vegetables and fruit every day'; 'eat dry beans, split peas, lentils and soya regularly'; 'drink or eat milk, maas, cheese or yoghurt every day' and 'include fish, chicken, lean meat or eggs in most meals'. This paper also aims to provide some insight into various factors that can impact on food preparation, food intake and enjoyment of food in the elderly.

How to plan good mixed meals

Definition

The concept of 'dietary diversity' is defined as the number of different food groups – including grains, legumes, nuts, meat and fish, fruits, vegetables, and dairy products – that are eaten over a given reference time period.[10] Dietary diversity is important to maintain mental and physical health.[6,11] Considering the relatively high cost of nutrient-dense food, most low-income and unemployed populations, including the elderly, might choose an unhealthy diet that is more affordable but with limited variety.[12] Dietary diversity is measured using the dietary diversity score (DDS), a user-friendly qualitative measure that provides a good proxy for dietary intake and reflects access to the variety of foods in the household. The highest score is 10 and the lowest score zero. A figure of 4 is considered to be a low DDS. This scientific measure can be used to determine the DDS in a dietary diverse environment.[13]

The importance of addressing dietary diversity among elderly people

Research indicates that adults aged 65 years and older have a higher risk of nutritional vulnerability due to multiple pathologies and decreased appetite and oral function.[14,15] During the ageing process, there are several physiological and pathological changes happening and they might negatively affect the food intake of the elderly.[16]

Thus, consuming a variety of nutrient dense food to ensure the elderly receive sufficient micronutrients and macronutrients is very important to facilitate health. However, there is no specific food or beverage that contains all the nutrients to satisfy a person's nutritional needs. Hence, consuming different foods from different food groups on a daily basis is important to ensure that a person's energy and macro- and micronutrient

needs are met for the maintenance of health. To prevent nutrient deficiencies, health professionals have recommended that consuming a diverse diet is very important to healthy living for the elderly, who are at risk of nutrition-related diseases.[1]

To improve micronutrient deficiencies, mandatory food fortifications have been implemented in SA. For instance, salt has been iodised since the 1970s and bread and maize meal fortified with vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc since early 2003.[1,17] A few supplementation programmes that have been implemented in SA to improve the prevalence of nutrient deficiencies include vitamin A, folate and iron. However, most of the nutrition interventions are designed for infants, young children, and pregnant and lactating women.[18]

In a study undertaken in KwaZulu-Natal, it was found that almost half of elderly households had experienced food poverty due to their inability to afford a diverse diet, and 43% were at risk of malnutrition.[15] Similarly, the diets of resource-poor elderly in Sharpeville and Umlazi also showed poor dietary intakes characterised by high carbohydrate intakes and suboptimal dietary diversity.[11,19] Dietary diversity is of significant importance for older adults' health because they are often nutritionally at-risk due to various factors, including eating alone, decreased appetite and low socioeconomic status.[16,20–22] Hence the desirability of including a guideline for the elderly emphasising the importance of eating a variety of foods.

Barriers to the elderly for inclusion of diversity in the diet

Functional and cognitive disabilities may lead elderly people to require assistance in achieving daily tasks, including tasks related to food purchasing and preparation of meals.[23]

Several studies have shown that the elderly substantially reduce food expenditure at retirement age and that inadequate money and physical disabilities affect food shopping and cooking, impacting on food choices and nutritional intake.[23]

Wholegrain starchy food, in small portions, could form part of meals: a Food Based Dietary Guideline for the elderly in South Africa

Definitions

The definition of wholegrain (WG), according to the American Association of Cereal Chemists International (AACCI), is: 'whole grains consist of the intact, ground, cracked or flaked kernel after removal of the inedible parts such as the hull and husk. The principal anatomical components – the starch endosperm, germ and bran – are present in the same relative proportions as they exist in the intact kernel.[24] Dietary sources of WG include: cereals such as rolled oats, barley, brown rice, wholegrain pasta, bulgur wheat, pearl wheat, quinoa, health/rye breads, wholegrain cereals, legumes (lentils, dried beans and peas, chickpeas). popcorn, millet, sorghum, as well as pseudo-cereals such as amaranth, and wild rice.[25] Adequate WG consumption in the elderly is associated with diminished risk of serious, diet-related diseases including coronary heart disease, certain cancers, inflammatory bowel disease and constipation. A high intake of WG is a key factor of healthy eating for longevity.[26]

Importance of consumption of WG starchy food among the elderly

Older adults usually are less active and thus need to reduce energy intake due to the decrease in basal metabolic rate (BMR). However, this does not always happen and thus bodyweight increases during old age due to an energy imbalance.[27] In SA, in the age group 65 years and older, 29.6% of women and 29.8% of men are overweight, and 45.8% of women and 24.5% of men are obese.[28] Research has shown that a high consumption of wholegrains is inversely associated with a high BMI and the prevalence of obesity, as well as abdominal fat.[7,29] This may be due to the lower energy-density of WG foods due to the high fibre content[25] promoting satiety and slowing the starchy digestion and absorption, which may in turn lower the glycaemic and insulin responses.[7] It can also be attributed to fibre increasing gastric distension that may stimulate satiety signals affecting hunger hormones and thus result in lower food intakes,[25,29] as well as increasing the hormones regulating bodyweight, energy homeostasis and glucose control.[25] Prospective studies have also found that people who consume more WG have lower increases in abdominal fat and long-term weight gain.[29,30]

The health benefits of WG consumption for chronic diseases of lifestyle (CDL) have been published widely during the last two decades.[31] A meta-analysis and epidemiological studies have found that high WG consumption is inversely associated with risk of cardiovascular disease (CVD), type 2 diabetes (T2D), cancer and mortality due to the physical structure of WG, specifically the bioactive phytochemicals, dietary fibre, resistant starch and oligosaccharides that assist in reducing glucose absorption,[25,26,29,30,32] thus maintaining glucose and insulin homeostasis[25,33] through the stimulation of intestinal hormones involved in glucose metabolism.[25]

WGs are also good sources of vitamin E and B complex vitamins. Vitamin B complex may contribute to regulating hepatic glucose uptake and the antioxidant properties of vitamin E may be beneficial in reducing chronic low-grade inflammation associated with obesity, insulin resistance and metabolic syndrome (MetS).[25] The phytochemicals, unsaturated fatty acids (oleic and linoleic acid), as well as the fibre, resistant starch and oligosaccharides in WG all play a role in reducing serum total cholesterol and low-density lipoprotein cholesterol (LDL-C) concentrations as well as inflammation and oxidative stress.[32] The effect of WG on non-communicable diseases (NCDs) is thus a result of the synergistic effect of all the WG components such as dietary fibre, antioxidants, polyphenols, micro- and phytonutrients.[32,33]

Antinutrients (phytic acid, tannins and enzyme inhibitors) are also found in WG and may contribute to the overall protective effects by inhibiting oxidative damage and protecting the intestinal epithelium. Also, the phytic acid, phenolic compounds, saponins and protease inhibitors in WG lower the risk of cancer, for example colon and breast cancer.[26,30]

Epidemiological and intervention studies have also found that higher WG intake has been inversely associated with risk of hypertension and C-reactive protein (CRP) levels. CRP, an acute-phase protein and marker of subclinical inflammation, is positively associated with risk of CVD, T2D and cancer.[30]

The gastrointestinal tract (GIT) has an important role in maintaining homeostasis of many physiological processes such as

ensuring adequate digestion and absorption of nutrients.[34] A reduced consumption of specifically hard-textured WGs due to diminished masticatory performance or dentures may further promote the development of gastrointestinal (GI) disorders in susceptible older adults. High fibre can also in some cases aggravate abdominal bloating and cause flatulence, resulting in a decline in consumption.[35] Specific age-related GI changes affect the oesophagus and colon specifically. These include reduced peristaltic pressure in the oesophagus leading to dysphagia, gastroesophageal reflux and reduction in colon motility causing constipation.[36]

Wholegrains play an important role in GIT health due to their soluble and insoluble fibre and phytonutrient content, which has a synergistic effect in improving bowel function as a result of its bulk function and thus reduced intestinal transit times, protecting the GIT against inflammation and other diseases while providing immune support, and strengthening the GI barrier function.[30,37] Fibre is also converted to short-chain fatty acids (SCFAs), including butyrate, that may ameliorate GI inflammation.[37]

Apart from the above-mentioned actions of fibre, another principal function of fibre is its prebiotic effect. Due to the age-related changes in the GIT, as well as in changes in the diet, it inevitably affects the microbia colonic composition.[38] The variation of flora composition may have negative and detrimental effects on the gut itself and on general health of the elderly, resulting in greater susceptibility to disease. Consumption of adequate fibre is therefore important to maintain a healthy gut. It is recommended that the elderly should consume more dietary fibre than younger people to ensure optimal functioning of the intestinal tract.[39]

Wholegrain starchy food consumption among the elderly

Unfortunately, limited data on the intake of carbohydrates and WG of specifically the elderly in SA are available. In a study conducted in Sharpeville, the researchers found that meals consumed during the day were mostly carbohydrate-based and nutrient deficient.[11] The high intake of refined carbohydrate-based foods was supported by a study in Umlazi, Durban, which showed the total carbohydrate intake as a percentage of energy was 65% (recommended 45–65%) for both women and men. The dietary fibre intake was established as 14 g/day for women and 14.4 g/day for men. Furthermore, the mean carbohydrate intake in this study was significantly higher than the minimum daily requirement (100 g/day) in order to provide the brain with an adequate supply of glucose.[19]

Recommendations regarding WG food intake among the elderly

Globally, dietary recommendations for consuming WG food range from 'eat more fruit, vegetables and wholegrain products' to 'consume at least 30 g of fibre per day'.[33] The SA FBDGs do not have specific WG dietary recommendations. Large, population-based, prospective, observational studies have found that 2–3 servings of WGs/day (±48 g) are recommended to reduce NCDs (CVD, T2D, overweight and obesity).[33,40] The Dietary Recommended Intake for total fibre for adults aged 51–70 years and older is 21 g per day. Although it is recommended that the elderly consume more fibre than younger people, not more than 30 g per day is recommended.[39] Consuming a diet of less than 100 g of carbohydrates a day makes achieving a fibre intake of 30 g per day challenging.[41]

Barriers regarding WG food intake among the elderly

Dietary diversity as an outcome of food insecurity and poverty is a driver for monotonous diets among the elderly, presenting a diet mainly based on maize, rice and bread.[38,40,41] Although WG starchy food is recommended and well documented as the preferred starch option for well-being and health[19] it must be acknowledged that other forms of starchy foods as staples in SA have a role to play in the diet of the elderly. Fortified maize meal is an example of this and although it may not be high in fibre in the refined format it provides some vitamin A, iron and zinc to the diet of the elderly.[1,17,41] Affordability and availability are often cited as reasons for not purchasing WG starchy foods.[38,41]

Eat plenty of different coloured vegetables and fruit every day: a Food Based Dietary Guideline for the elderly in South Africa

Definitions

By definition, a vegetable is the edible part of plants such as the leaves, stems, roots, tubers and bulbs, or the fleshy part of plants that is eaten as food. In contrast, a fruit is the succulent edible part or mature ovary of a plant. Vegetables and fruit (Vs&F) are recognised as nutrient-dense food because Vs&F are a good source of many essential vitamins, minerals, phytochemicals and bioactive compounds.[42]

Importance of consumption of Vs&F among the elderly

There is mounting evidence that Vs&F function as a protective defence against diseases.[43–47] Recent research found a positive association between low intakes of Vs&F and high risk of experiencing chronic diseases such as obesity, hypertension and T2D.[44–47] A variety of coloured vegetables and fruit offers different health benefits and provides various nutrients to the body. These nutritional values are due to the presence of bioactive substances like vitamins, minerals, antioxidants and phytochemicals. A study by Luo *et al*. indicated that orange/yellow, red/purple and white vegetable and fruit colour groups was inversely associated with the risk of colorectal cancer.[48]

As mentioned previously, very few data have been published regarding micronutrient deficiencies among the elderly in SA. However, inadequate intakes of Vs&F are associated with micronutrient deficiencies.[49,50] Although a profile of essential micronutrients was not assessed in surveys such as South African National Health and Nutrition Examination Survey (SANHNES-1) at national level, many research studies conducted in different parts of SA have found a high prevalence of essential micronutrient deficiencies in older adults.[11,44,49]

In addition, Vs&F are rich in many essential nutrients that regulate many important functions in the body; for example potassium and dietary fibre, provided by Vs&F, help to reduce blood pressure.[50,51] Dietary fibre and phytochemicals such as plant sterols, flavonoids and antioxidants in Vs&F play an important role in controlling raised levels of cholesterol and thus can lower the risk of cardiovascular diseases. With increasing age, many older adults have dyslipidaemia, more so than younger adults.[52–56]

At present the global age-specific mortality rate for diabetes is the highest in Africa, but very little research has been done

among the elderly in sub-Saharan Africa (SSA).[50] Fruit and vegetables are a good source of dietary fibre that regulates the function of insulin, consequently lowering the risk factors of T2D.[57]

Antioxidants provided by Vs&F prevent oxidative damage to the cells of the body and thus also play a role in reducing the risks of cancer.[58] Prostate and oesophageal cancers are more common in older men and breast, oesophageal and cervical cancers are the leading cancers in older women in SA. There is growing evidence that Vs&F diminish the risks of breast cancer among elderly women.[59]

Research results showed that older adults who consume a higher amount of Vs&F are less likely to experience dementia, benign prostatic hypertrophy and Alzheimer's disease.[55,60] Increasing the consumption of Vs&F has a positive impact on reducing the incidence of depression.[61] Hence, to reduce risk of chronic diseases and ensure optimal nutrition and health of older adults in SA, it is important to develop and implement FBDGs for older adults focusing on Vs&F.[62]

Vegetable and fruit consumption among the elderly in South Africa

Despite being aware of the well-recognised health benefits of Vs&F, the majority of South Africans including older adults do not consume sufficient amounts of Vs&F.[43,63] The world health survey conducted by the WHO in 52 low- and middle-income countries found that, overall, 77.6% of men and 78.4% of women consumed fewer than five servings per day of Vs&F and 40–59-year-old men and women were more vulnerable to a low intake of Vs&F. The same study also indicated that 72.2% of men and 66.7% of women did not meet the recommended daily intake of Vs&F in SA.[64]

A national population-based cross-sectional study in 2008 further showed that 68.5% of older adults in SA consumed inadequate servings of Vs&F. In addition, in terms of gender, 64.8% of men and 71.4% of women did not meet the daily requirement of Vs&F.[65] The study on global ageing and adult health (SAGE) wave 1 found that men consumed less Vs&F than women, and with increasing age both men and women consumed smaller amounts of Vs&F in SA.[66] Older adults in rural areas or those within the lowest income quintile consumed less than five servings of Vs&F per day.[28,43]

The SANHANES-1 results presented self-reported recall data on daily Vs&F intake and showed poor intakes of Vs&F among the elderly in SA.[43] A review of dietary intake survey among adult South Africans from 2000 to 2015 conducted by Mchiza and co-authors indicated that the most commonly neglected food groups were Vs&F and milk. In addition, Vs&F were not in the first seven food lists that were consumed frequently by the South African adult population.[63] The recent demographic and health survey report noted that 5 in 10 participants did not consume any fruit and 4 in 10 did not eat vegetables on the day prior to the 24-hour recall survey, specifically observed among Black African individuals and low-income households. More than half (52.9%) of the older adults aged 65 years or above did not consume fruit and 38.9% did not eat vegetables the day or night before the survey.[28] Inadequate consumption of Vs&F increases the risk of experiencing many essential micronutrient deficiencies, which may prevent one leading a healthy life.[63]

The majority of South Africans had a low dietary intake diversity and vitamin A rich Vs&F was one of the food groups that was consumed least. Only 17% of participants aged above 50 years old consumed an item from the vitamin A rich F&V group on the day prior to the survey. The authors suggested that the negligence of Vs&F consumption could be due to low coverage of healthy promotional messages or inadequate access to Vs&F by the adults with limited resources.[9] A more recent study in Limpopo province revealed that 80.4% of the older adults aged 65 years or above did not consume the recommended daily intake of Vs&F, and these intakes were significantly lower than those of the younger adult (15–24 years old) group. This study did not find any significant gender difference in the intake of Vs&F.[67] Thus, it can be construed that older adults in SA do not meet the recommended daily intake of Vs&F.

Recommendations for vegetable and fruit intake

The WHO recommended that an adult individual (18–99 years) should consume a minimum of 400 g, which is the equivalent to five servings, of Vs&F per day to lead a life free of chronic diseases such as cancer, diabetes, hypertension and obesity.[64,68,69] Among the five servings of Vs&F, at least three servings of vegetables and at least two servings of fruit should be consumed on daily basis. Along with consuming at least five servings of Vs&F, eating a variety of coloured Vs&F is also important to obtain many essential nutrients.[47,65]

Vegetables and fruit get their colour from phytochemicals, natural bioactive compounds giving the Vs & F their colour and promoting good health. Green Vs & F are high in carotenoids, potassium and vitamin that can be found in green leafy and other green vegetables. Orange/yellow as well as red Vs & F such as citrus fruits and tomatoes are good sources of vitamin C, vitamin A and potassium.[39,46,65]

Eat dry beans, split peas, lentils and soya regularly: a Food Based Dietary Guideline for the elderly in South Africa

Definitions

Legumes can be broadly classified according to the edible lipid content. Legumes with a high lipid content are termed oilseeds compared with those with a low lipid content that are harvested as dry grains, called pulses. Dry beans, dried peas, chickpeas and lentils are classified as pulses whereas soy is classified as an oilseed.[70] The legume food group also contains alfalfa, clover, lupin and peanuts. Examples of dry beans include kidney, haricot, sugar beans, broad beans, lima, navy and pinto beans. Fresh green beans and peas are also legumes but are nutritionally categorised as vegetables, whilst the dried forms are categorised as pulses.[71]

Importance of consumption of legumes among the elderly

Legumes and soybeans are low in fat and are excellent sources of dietary fibre and a variety of micronutrients and phytochemicals.[72] Three important benefits of legumes are high nutrient density, affordability and accessibility, and they supply economical sources of good-quality protein. Legumes and pulses are also more cost effective to produce, process and procure than animal proteins, and are therefore a healthy alternative to more expensive protein sources in limited-resource settings.[73]

Legumes may be added to meat dishes as replacement of part of the meat, without changing the taste. The soy bean is also a versatile food ingredient as soy milk and soy yoghurt can easily be processed, as well as a variety of ingredients for the soy industry, such as soy protein isolate, defatted soy flour and soy meal. The 'okara' or pulp that is left over after soy milk production is a rich source of fibre and may be used in many other foods such as breads, cereal dishes or vegetables and soups.[73,74]

Legumes and CVDs

Legumes have a protective effect against oxidative stress in the body due to the presence of phytochemicals, and are hence potentially beneficial in the prevention and treatment of diseases that occur due to oxidative stress, such as CVD and cancer.[75] One of the major benefits of legumes is its low-density lipoprotein-cholesterol (LDL-C) lowering effect,[76–78] which in turn has a positive effect on lowering cardiovascular risk.[75,79] A meta-analysis of 38 clinical studies has shown that soy protein has cholesterol-lowering effects, including the significant lowering of serum cholesterol, LDL-C and triglyceride concentrations, and an increase in high-density lipoprotein-cholesterol (HDL-C).[80] A more recent meta-analysis conducted in 2008 in which 30 studies were evaluated found similar results and showed that 25 grams of soy protein per day, with its significant LDL-C and serum cholesterol-lowering effects, may effectively aid in the management of hypercholesterolemia.[80] It has also been shown that dietary soy is more effective in reducing cholesterol levels compared with its isolated forms.[81–83] The findings of the National Health and Nutrition Examination Survey (NHANES) study done ($n = 9\ 632$) in the United States of America (USA) also demonstrated that the consumption of legumes significantly reduced risk factors for CVDs in older adults.[84]

A study conducted in the Qwa-Qwa community in SA, in which a soy and vegetable gardening and a nutrition education programme were implemented, showed that after consuming soy for a period of 18 months, soy consumption resulted in significant beneficial effects on the lipid profiles of both hypercholesterolemia and normocholesterolemic women[85] as well as a decrease in the prevalence of MetS.[86] Clinical studies have shown that soy has a beneficial role on metabolic biomarkers and significantly reduces the risk for cardiovascular disease in the elderly.[87,88]

Legumes and hyperglycaemia

Most legumes have a low glycaemic index, and the consumption of legumes reduces food glycaemic load and thereby aids in maintaining normoglycaemia, and benefits in both the prevention and treatment of diabetes mellitus. Clinical studies have shown that legume consumption as part of the daily diet, or as a meal, improves glycaemic control, and long-term biomarkers of diabetes risk, for example haemoglobin A1c (HbA1c), are also lowered.[89,90] Soluble fibres and slow-release carbohydrates in legumes have been shown to lower insulin resistance in both healthy and insulin-resistant individuals in several studies in a number of countries.[91] Subjects with a higher consumption of chickpeas, lentils and legumes have been shown to have a lower post-prandial blood glucose response compared with subjects with a lower legume consumption.[89,91] In addition, the fibre and magnesium content in the legumes also has a beneficial effect on inflammatory response and in addition improves glucose tolerance.[75]

Legumes and obesity

Lower energy density meals have been proven to be beneficial in the prevention and management of obesity. Reducing weight may aid in the reduction in the risk of all the associated co-morbidities like CVDs, diabetes and MetS as major NCDs in South Africa. Several components present in legumes stimulate gastric secretions, which delay gastric emptying and promote satiety. This effect may result in lower energy intake. Protein, fibre, resistant starch and phytates found in legumes increase satiety.[92] Several clinical studies that investigated the impact of legume diets compared with diets with other protein sources showed a positive relationship between a legume diet and weight loss. Legume diets also compare favourably when compared with other energy-restricted diets.[93,94] Legume diets including beans and peas have also been shown to have a significant reduction in the waist circumference in clinical trials.[95]

Legumes and cancer

Bioactive compounds in legumes, and especially in soy, have protective effects against some types of cancers. Polyphenols in pulses and other legumes have antioxidant and anti-inflammatory effects, which are crucial in cancer prevention. Phytosterols, which are plant sterols that are found in the legumes, especially soy, also have anti-tumour and anti-ulcerative properties and are, therefore, considered as nutraceuticals.[95] Isoflavones in legumes and especially soy have weak estrogenic effect, which helps in the prevention and treatment of breast cancer, and soy foods have been shown to reduce breast cancer risk in Asian women.[96] Phytic acid present in the legumes can regulate and block uncontrolled cell division, which is the primary feature of cancer cells. Hence, phytic acid has an anti-carcinogenic effect, either by reverting malignant cells into normal cells or by causing their apoptosis or cell death. Saponins, also present in legumes, reduce metastasis in cancer or tumour cells and regulate certain enzymes related to the apoptosis process to negatively affect cancer progression.[92]

Legumes and osteoporosis

Legumes also play an important role in bone health. An increase in dietary protein intakes from animal sources results in increased urinary calcium excretion and, therefore, increases the risk for osteoporotic fractures, especially in the elderly. The replacement of animal protein with plant protein sources such as legumes does not increase urinary calcium excretion.[97] Clinical trials performed on post-menopausal women have shown that subjects on soy supplementation had significantly smaller reduction in bone mass density than those in control groups.[75,98] A double-blinded clinical trial that compared isoflavone-rich soy, isoflavone-poor soy and whey protein consumption in peri-menopausal women showed that isoflavones present in the soy affected bone mass density positively, mainly by preventing bone mineral losses.[99] X-rays and urinary deoxypyridinoline (UDPYR) assays performed on post-menopausal women in Tokyo, Japan demonstrated that a soy-rich diet was associated with a higher bone mineral density and a lower level of bone resorption.[100] A similar finding was found in a study conducted in Chinese post-menopausal women with high levels of isoflavone intakes (with similar calcium intakes to those who did not consume soy).[101–103]

It has been reported that soy may reduce other symptoms related to menopause such as hot flushes, skin problems and depression symptoms.[73,103,104]

Legume consumption among the elderly in South Africa

Although there is limited evidence regarding the actual legume consumption patterns of the elderly population in SA, evidence from FAOSTAT food balance sheets shows an increased pulse intake due to a 16% rise in bean consumption. However, the consumption of peas and other pulses has declined.[105] The general African diet is mostly plant based and comprises cereals and starchy roots and tubers. Smaller research studies showed poor legume, pulses and soy intakes. A study among the elderly in Sharpeville showed that the majority of respondents did not consume any legumes or pulses, with a mean food group diversity score of 0.17 for a one-week period.[106] No legumes or pulses appeared in the top 20 most common food items consumed by these elderly.[44] These finding were consistent with a study conducted among the elderly from Umlazi.[19] The SA FBDGs recommend at least one serving of cooked dry beans (½ cup), cooked split peas, lentils (½ cup) or 30 g dry soya a day.[9]

Include fish, chicken, lean meat or eggs in most meals: a Food Based Dietary Guideline for the elderly in South Africa

Definitions

Proteins are derived from both animal and plant sources. Animal sources of protein include seafood, meats, poultry and eggs. The term 'meats' includes all forms of beef, pork, lamb, veal, goat and non-bird game. Poultry refers to all forms of chicken, turkey, duck, geese, guineas and game birds. Plant sources include nuts, seeds and soy products. Legumes (plants with seed pods that split into two halves, such as dry beans, peas, lentils and soybeans) can be considered both a plant source of protein and a vegetable.[107,108] While both animals and plants act as sources of protein in the diet, they differ in the quantity and quality of protein they provide. Animal-based foods, in general, contain the highest amount of protein per unit of energy. Furthermore, protein from animal sources is considered the best quality of protein, as it provides all essential amino acids in the proper proportions.[107]

The definition of protein quality takes into consideration protein digestibility and absorption, as well as the role of certain amino acids in the regulation of cellular processes using the Digestibility-Corrected Amino Acid Score (PDCAAS), which corrects for faecal nitrogen.[109–111]

The importance of protein foods in the elderly diet

Beyond being an important source of proteins, protein foods are also a source of a variety of vital nutrients, such as B vitamins (niacin, vitamin B_{12}, vitamin B_6 and riboflavin), iron, selenium, choline, phosphorous, copper, zinc, vitamin D and vitamin E, among others. As the protein food group contains a wide variety of foods, different types of protein food sources contain different nutrients.[107] Fish, for example, in addition to its high protein content (17–20%), is a good source of vitamin B_{12}, vitamin D, polyunsaturated omega-3 fatty acids, eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA).[107,112] Chicken, one of the most widely consumed meat products in SA, is both high in protein and nutrient-dense. Lamb and mutton are rich in unsaturated fatty acids and conjugated linoleic acid (CLA), a naturally occurring trans-fatty acid that has been shown to offer protection against cancer, heart disease and high cholesterol. Pork is a rich source of thiamine (vitamin B_1) and niacin (vitamin B_3) and majorly contains unsaturated fatty acids. Lastly, offal is rich in iron, copper and some B vitamins, and generally contains more of these nutrients than lean meats. Meat, especially organ meat, is also well recognised as a source of bioavailable iron and zinc.[112] While meat provides a multitude of nutrients, it can also be a source of excessive saturated fat, solid fat and cholesterol in the diet, which can contribute to adverse health effects. Polony and other processed meat high in saturated fats is more affordable per kilogram than chicken or red meat, possibly contributing to the consumption rates in SA and in doing so possibly contributing to colon cancer.[113]

Thus, lean meat is a better choice in order to limit the intake of such substances.[107] Lastly, eggs are a more abundant source of protein and essential nutrients, such as vitamin A, B vitamins, vitamin D, selenium and choline than other protein foods. In fact, eggs have traditionally been utilised as a standard for protein quality due to their optimal essential amino acid profile and high digestibility.[112]

Obtaining protein from animal sources is also vital in order to receive nutrients not found in other food sources. Animal-based protein foods contain heme iron, which, unlike non-heme iron (the only form of iron in plant-based protein foods), is minimally affected by the presence of other dietary factors (such as the presence of soluble enhancers or inhibitors that affect the absorption of iron). Similarly, vitamin B_{12} (found in high amounts in red meat, fish and milk) is only naturally found in animal-based foods. For this reason, vegetarians or others with inadequate animal protein intake must seek alternative food sources in order to obtain these nutrients.[112]

Dietary protein intake has been shown to play a role in a number of bodily processes. Unlike vitamins, minerals, glucose and fatty acids, protein cannot be stored in the body for future use.[109,114] Thus, adequate, consistent protein intake is extremely important to ensure the maintenance of good health. This is especially true for the elderly: evidence shows that older adults have higher dietary protein needs than younger individuals in order to support good health, promote recovery from illness, and maintain bodily functions. This increased need is due, in part, to metabolic changes associated with ageing. Researchers largely agree that, after eating, older adults experience an impairment of the muscle protein anabolic response to meal intake. Abnormal muscle protein anabolism may be due to insufficient nutritional intake (lower anabolic signal) or anabolic resistance (i.e. impaired response to nutrients and hormones and lower sensitivity).[109] Lack of anabolic response in muscle to a complete meal, over a long period of time, is likely to contribute to the development of sarcopenia (age-related loss of muscle mass and function) in the elderly.[115,116] Older individuals may compensate for changes in muscle anabolism by increasing dietary protein/amino acid intake.[113] When anabolic drive is no longer present (after age 30), diet quality also becomes a limiting factor in the maintenance of optimal protein turnover for repair, remodelling and recovery, so high-quality protein (such as that found in animal sources) should be sought in order to optimise protein intake.[109] High-quality protein, combined with other micronutrients in animal-derived proteins, has been shown to facilitate repair in older adults with sarcopenia. High-quality protein, such as that found in eggs, may also prevent the degeneration of skeletal muscle and protect against other health risks associated with ageing.[112] Timing of protein intake and amino acid supplementation may also be taken into consideration as a means to increase muscle anabolism. Lastly, protein ingestion,

coupled with exercise training (resistance and aerobic), has been shown to increase synthesis of skeletal muscle.[109]

Protein and amino acid metabolism are also affected by conditions commonly faced by ageing individuals, such as reduced physical activity levels, acute and chronic illness, and injury. Hospitalisation and hospital-induced physical inactivity leads to increased muscle loss in the elderly.[117] Muscle mass decrease causes a change in body composition that favours a higher percentage of body fat. Research indicates that the inflammatory cytokines produced by adipose tissue, namely visceral fat, increase muscle catabolism.[118] The presence of acute illness, post-surgical trauma, diseases and medications is also likely to cause catabolic effects on muscle.[119]

Sufficient dietary protein intake plays an important role in attaining peak muscle mass in young adulthood and increasing dietary protein intake may be important for the preservation of muscle mass in old age.[111] Higher protein intake (above 1.5 g/kg BW/d) has been shown to stimulate protein synthesis to a greater extent than lower protein intake levels.[116] In a recent three-year longitudinal study, individuals who had the highest protein intake (approximately 1.2 g/kg BW/d) lost 40% less lean mass and appendicular lean mass than those who had the lowest protein intake (approximately 0.7 g/kg BW/d).[120] Another study conducted to determine whether a high muscle mass was associated with animal or vegetable protein intake found that animal protein intake, of all variables studied, was the only predictor of muscle mass index.[121] Other studies have shown a positive association between dietary protein intake and maintenance of protein status (measured by serum protein and upper arm mass) in the elderly community.[111]

Branched-chain amino acids (BCAAs), nutrients within protein, are believed to play an important role in protein synthesis and are thought to have a positive effect on signalling pathways for muscle protein synthesis.[111] The BCAA leucine, for example, serves as a building block for endogenous proteins and plays a role in stimulating muscle protein synthesis.[119] Protein and amino acids contribute to multiple metabolic roles beyond simple substrates for protein synthesis, however. Dietary protein influences cell signalling, satiety, thermogenesis, and glycaemic regulations; each of these roles is initiated by increases in plasma and intracellular amino acid concentrations.[111]

Multiple epidemiological studies have found a positive correlation between high dietary protein intake and higher bone mass density, slower bone loss rate, and muscle mass and strength.[111] Higher density protein intakes have been associated with the preservation of skeletal muscle mass and the reduction of effects of age-related sarcopenia, higher bone mineral content, reduced fracture risk and reduced risk of bone loss.[122,123]

Along with improvements in muscle and bone health, increased protein intake may also improve elderly individuals' ability to recover from disease and trauma, which leads to better health outcomes and reduced medical costs.[120] Research evidence supports the idea that supplemental protein or higher dietary protein intake for elderly individuals hospitalised for hip fracture may reduce the risk of complications and reduce rehabilitation time.[111] Diets with increased protein have also been shown to contribute to health improvements and can assist in treatment and prevention of obesity, osteoporosis, T2D, MetS and cardiovascular disease.[116]

Besides playing an important role in elderly individuals' health status, protein intake can be utilised as a conduit for addressing larger-scale health problems, such as nationwide nutrient deficiencies or common health problems.[124] One of the areas for concern for the elderly population is the inadequate consumption (i.e. consumption below recommended levels), of animal-based proteins, namely fish, lean meat, chicken and eggs.[62] Under-consumption of animal-sourced foods can result in low protein, iron, zinc, calcium, vitamin A and vitamin B_{12} in the diet, which can lead to anaemia, vitamin deficiencies, and poor physical and cognitive function.[124] The promotion of consumption of animal-based protein foods could also help to combat micronutrient deficiencies in SA.

Animal protein consumption among the elderly in South Africa

Much like the rest of the world, urbanisation in SA has been accompanied by an increase in consumption of food from animal sources. Nationwide, meat and fish are among the most commonly consumed food groups in terms of the percentage of people consuming food from each group at least once per day. Chicken, as mentioned previously, is one of the most popular meat products in the nation. Eggs are consumed less often.[124] A study conducted to determine the food consumption changes in SA from 1994 to 2014 found that total meat consumption increased during that period, largely due to the significantly increased consumption of poultry and pork from 1994 to 2009. Egg consumption also increased by more than 50% during that period while beef, goat and mutton consumption remained relatively the same.[105]

A review of dietary surveys conducted among South African adults between 2000 and 2015 found that the protein percentage of total energy fell between 10% and 15% in all studies; this represents the lower end of the acceptable macronutrient nutrition range (AMDR) for protein, which is 10–35% of energy intake.[63] However, the average total energy for both men and women in SA (with the exception of those living in KwaZulu-Natal and North-West provinces) is often lower than the recommended level. Thus, although protein intake may proportionately fall within the appropriate range of total energy, consumption of sub-optimal total energy may still leave some South Africans with insufficient total protein intake. This study also observed that dietary intake was typically higher in urban areas than in rural areas and linked to the socioeconomic status of households.[63]

In a study among the elderly in Umlazi, 63.1% of the women and 91.1% of the men had inadequate protein intakes.[19] Similarly, a study among the elderly from Sharpeville found that the majority of participants (53%) had total protein levels below the daily recommended intake (DRI).[11] The majority of foods consumed in both these elderly communities were carbohydrate-based. Although chicken and beef, as well as cooked eggs (Sharpeville) and pilchards (Umlazi), were among the top 20 most frequently consumed items, these animal food items were consumed by less than 50% of the study participants.[11,19] The mean food variety score of 0.4 for flesh foods (meat, poultry, fish) among the Sharpeville elderly further revealed that the majority of participants ate between zero and one kind of flesh food item over the course of a week.[11,106]

Protein recommendations for the elderly

The current recommended daily allowance (RDA) for protein, according to the WHO, is 0.8 g protein per kilogram of

bodyweight each day (g/kg BW/d), regardless of age or gender.[110,112,116] This corresponds to about 56 g/day for men and 46 g/day for women and comprises 10% of total energy intake, when based on a 8 400–9 200 kJ diet.[116] Emerging evidence, however, has led many to argue that this recommendation does not consider age-related changes in metabolism, immunity, hormone levels, muscle and fat mass, food intake, physical activity or progressing frailty.[107,110,122,125] Furthermore, the nitrogen-balance studies from which the current RDA is derived have been criticised for their inability to accurately quantify all routes of nitrogen intake and loss, and lack of measurement of physiological endpoints associated with healthy ageing, among other limitations.[110,122] The technical drawbacks of the nitrogen balance technique may result in requirement values that are too low.[109]

A review of evidence-based recommendations for dietary protein intake was recently undertaken by an international study group (PROT-AGE Study Group). Based on the results of epidemiological studies, clinical trials, short-term metabolic studies and long-term protein intake studies, an average daily intake of 1.0–1.2 g/kg BW/d was recommended for healthy elderly individuals to maintain and build muscle.[122] In addition to quantity of protein consumed, studies have also noted the potential need to take protein source, timing of intake and amino acid supplementation into consideration when making dietary protein intake recommendations. However, more studies are needed to develop recommendations regarding these aspects of protein consumption.[110,125]

Certain populations among the elderly, such as those with acute or chronic diseases, severe illness, injury or malnutrition, require protein intake levels higher than the general recommendation for healthy elderly individuals.[110] Protein needs also become more important for the elderly during periods of reduced food intake, such as weight loss programmes or periods of recovery after illness or as a result of ageing.[114] Studies conducted among populations facing hospitalisation, frailty, hip fracture, osteoporosis, stroke, pressure ulcers, chronic obstructive pulmonary disease (COPD) and cardiac disease have demonstrated the benefits of increased protein in combating such conditions. From these studies, researchers concluded that elderly people suffering from acute or chronic diseases have increased protein needs and should therefore consume 1.2–1.5 g/kg BW/d. For elderly individuals with severe illness, injury or malnutrition, these needs are even higher; intake as high as 2.0 g/kg BW/d may be beneficial to support good health, promote recovery from illness and maintain functionality.[110,119] The exact amount of protein needed in these individuals will vary depending on the disease and its severity and people's nutritional status before and during illness. Thus, these factors should be considered when making recommendations.[110] However, adequate, consistent protein intake of at least 0.8g/kg/day in healthy elderly is extremely important to maintain good health, and normal bodily functions.[110]

Drink or eat milk, maas, cheese or yoghurt every day: a Food Based Dietary Guideline for the elderly in South Africa

Definition

Milk, maas/fermented milk, yogurt, low-fat soft cheese and other dairy products provide essential nutrients in the diet. Milk and milk products are known as nutrient-dense foods and provide more bone-beneficial nutrients, such as protein, calcium, magnesium, potassium, zinc and phosphorus, per unit energy than any other typical food found in the adult diet.[126] Many other foods contain lower amounts of calcium, including tinned fish (with bones), legumes and wholegrain breads and cereals.[126,127]

Importance of addressing milk and milk product intake among the elderly

In a review of 53 global dairy FBDGs, all included milk, and most (46) included milk products, yogurt and cheese.[128] Adequate quantities of milk provide all the essential amino acids for muscle health and strength.[129] It is thus recommended that an individual who is lactose intolerant should not avoid milk completely, but rather consume other milk products such as yoghurt or fermented milk products.[126,130,131] Milk and milk products are often used to complement other foods. Staple foods such as maize and bread lack lysine amino acid and therefore milk is used with maize or bread to acquire all essential amino acids from the diet.[131] Many milk and milk products, including low-fat cheese, can be easily consumed by the elderly and even by those who have dental problems.[131]

High intakes of sodium along with low intakes of potassium are associated with high blood pressure.[5,11,19] Dairy products (such as milk, yoghurt) contain a high amount of potassium and a low amount of sodium.[8,131,132] The majority of the elderly in SA do not meet the requirement for potassium intake.[124] A higher ratio of potassium to sodium in milk helps to control blood pressure.[132] Therefore, to derive optimum health benefits, low-fat milk or milk products have been included in the dietary approaches to prevent high blood pressure (DASH diet).[8,130,132] To reduce the salt intakes, the revised South African Dietary Guidelines of 2013 suggested not to include hard cheeses with a high salt content (e.g. Blaaukrantz, parmesan, Roquefort and feta cheese) but to rather only consume low-fat cottage cheese in small amounts.[130,133]

Lana and co-authors found in a prospective cohort study that elderly people who consumed seven or more servings per week of low-fat milk and milk products such as yoghurt had a lower incidence of frailty compared with those who consumed less than one serving per week. The study results also showed that higher consumption of low-fat milk or milk products contributed to a lower risk of slow walking speed and weight loss during ageing.[134]

Bone health is a common health issue during ageing, especially for women.[135] Exclusion of milk or milk products from the daily diet has potential negative effects on bone health.[136] Elderly people are more vulnerable compared with other-aged population groups in terms of osteoporosis. Osteoporosis is a bone health problem characterised by low bone mass and microarchitectural deterioration, and increases the risk of bone fragility and fracture.[134] There are many risk factors that include both irreversible and modifiable factors, which contribute to low bone density. The risk of osteoporosis has a positive association with increased age, family history, female gender, oestrogen deficiency, amenorrhea, vitamin D deficiency, low intakes of calcium, chronic diseases, leading a sedentary lifestyle, and excessive smoking and alcohol consumption. Among the many factors that affect bone health and healthy ageing, healthy lifestyle behaviours (dietary intake and physical activity) are recognised as modifying factors to improve bone health in the elderly.[136,137]

The incidence of osteoporosis is more common among white, Asian and mixed-race populations compared with the black populations. However, there is no standard treatment for osteoporosis.[135] Sufficient intakes of calcium (500 mg per day or more) and vitamin D help to reduce fracture risks. Furthermore, optimal sun exposure and physical activity may strengthen bones and muscles.[135,136,137]

A prospective study on a Mediterranean population showed that an increase in the consumption of low-fat milk or milk products reduces the risks of MetS in the elderly with cardiovascular risks.[138] Milk protein and calcium as dietary components function as a preventative measure in people with MetS.[139] Although no national data are available for the prevalence of MetS, a prospective cohort study showed a consistently high prevalence (48.8% in 2004 and 63.4% in 2014) of MetS among the elderly in Sharpeville.[140] Although no association between calcium intake and MetS had been investigated, previous studies showed low calcium intakes in 100% of the same population.[19]

The incidence rate of breast cancer in women and prostate cancer in men is higher in the elderly than in other age groups in SA.[141] It has been hypothesised that nutrients, namely calcium, vitamin D, butyric acid and sphingolipids in milk and milk proteins, play an important protective role against cancers such as colorectal, breast and prostate cancers.[141]

Milk contains numerous nutrients and functions with some nutrients involved in more than one biological process. For example, although adequate consumption of milk or milk products reduces the risks of many non-communicable diseases (NCDs) such as obesity, osteoporosis, colorectal cancer and T2D, a possible association between consumption of full-fat milk or milk products and increased risk of cardiovascular diseases exists.[130,139]

Milk and milk product consumption among the elderly in South Africa

It has been reported that consumption of milk and milk products (such as yoghurt, maas/sour milk and cheddar cheese) increased among South African adults from 1999 to 2012; however, it was not mentioned whether the intake was optimal or not or if affordability and availability could have influenced this trend.[105]

The possible reasons could be increased affordability of milk and ultra-high temperature (UHT) processed milk, and improved marketing conducted by the milk industries.[105] It was reported that the consumption of milk was low among the Black Africans in the tribal and urban informal areas. Cultural taboos and some specific religious practices (e.g. fasting) inhibit consumption of milk and milk products.[132,50] Research conducted by Labadarios and co-authors indicated that 62% of participants aged 50 years or above consumed an item from the milk and milk products group on the day prior to survey.[9] However, there is a paucity of research dedicated to assessing the amount of milk and milk products consumed by the elderly to know whether they meet the recommended intake.

Negin and co-authors conducted a study in different parts of Africa, and the results showed that milk and milk products consumption was lower among older adults compared with younger adults in SA.[142] The elderly participants (100%) had inadequate intakes of calcium when comparing the mean daily intakes (219.3 ± 215.2 mg) with the estimated average requirement (EAR) of calcium (1 200 mg).[44] A cross-sectional study at a senior centre in Sharpeville found that 47.5% of the participants did not consume milk or milk products within 24 hours prior to the survey. The mean daily intake of milk or milk products for the participants who consumed milk or milk products was 67 g and this was equivalent to milk used to prepare 2–3 cups of tea.[11] Furthermore, in a recent study, Saha and co-authors showed that 23.8% of participants at the same senior centre in Sharpeville did not consume any milk or milk products in a day before the survey.[143] In addition, a study undertaken in Umlazi among older adults found no milk or milk products appearing in the top 20 most commonly consumed food items. This result was confirmed by 99.5% of the women and 98.0% of the men having inadequate calcium intakes.[19]

The Prospective Urban and Rural Epidemiological (PURE) study suggested that the consumption of milk and milk products was below the recommended level in SA. Findings also showed that the mean intakes of fresh milk and yoghurt were lower in men than women, and lower in rural areas compared with urban areas.[144] Steyn and co-authors found that the portion size for milk and milk products in 2009 was lower than the portion size consumed in 1990 among the urban Black population in Cape Town. In addition, the nutrient adequacy ratio (NAR) was much lower for calcium among the participants aged 45–64 years in SA.[145] These results indicated the need to assess and promote milk or milk products consumption among the elderly in SA.[11]

Recommendations for milk and milk product intakes

Recommendations for daily consumption of milk or milk products vary from country to country or region to region. The required dietary reference intake for calcium among the elderly is 1 000–1 200 mg per day irrespective of gender.[146] A person will obtain 480–610 mg calcium by consuming 400–500 ml of low-fat milk, maas/fermented milk per day, which represents 48–50.33% of the intake of the recommended daily calcium requirement.[146,147] Calcium intake is low among the elderly in SA.[105] A healthy and diversified diet including milk or milk products can promote nutritional well-being of the elderly due to increased calcium intakes.[133,147] Therefore, promotional strategies guided by the FBDG are the best approach to improve consumption of milk or milk products.[147–149] However, it is generally more common to advocate consumption of fat-free or low-fat milk or milk products.[124]

Research has identified demographic factors as barriers associated with low milk and milk-product intake including ethnicity, low socioeconomic status, increased bodyweight and older age.[8,150] Nutrition education material for the consumer should include guidance on low-fat and salt options in this food group, specifically cheese for the elderly.

Food environment, preparation, food intake and enjoyment in the elderly

Older adults have declined physiological mechanisms and environmental stimuli that normally regulate and stimulate intake.[151,152] Social environments, economics, time of the day and visual presentation all impact on food intake.[152] A good eating environment is important to stimulate eating in the elderly, and a variety of foods, interaction with others and atmosphere can impact on the enjoyment and stimulation of food

intake. Various studies provide evidence that a dedicated and enjoyable space at home to consume food will encourage better food intake.[151] It is also suggested by these studies that eating while watching television provides a distraction and can increase food intake, which may lead to weight gain in adults. Background music during mealtimes could increase time spent at the dining table and it is documented that older adults use music or the radio for distraction and enjoyment.[151,152]

Having access to prepared food has been shown to increase intake in the elderly,[151] but we know that in the SA context a large group of elderly do not live in an environment where prepared food is readily available and that people living at subsistence level often have no choice but to consume monotonous diets.[11] Declining sensory ability and responsiveness impact on the enjoyment of food and therefore a reduced intake.[151,152] Meals or food products targeted at the elderly should not only taste good but also be presented in an attractive way.[153,154] Purchasing foods from informal markets such as spaza shops and street vendors contributes to low nutrient adequacy in the diet.[11]

Households with elderly individuals who are not able to go food shopping and or prepare meals due to mobility impairment are associated with malnutrition and poor health. Cooking skills are related to physical health, mortality, adequate fruit and vegetable consumption, and overall food intake in the elderly.[151]

Conclusion

The quality of the diet is a principal factor contributing to the health and well-being of the elderly. An adequate intake of Vs&F, WGs, legumes, milk and milk products, and protein foods is a key factor of healthy eating for longevity in the elderly and this is linked to weight control, reduced risk of CVD events, optimal functioning of the intestinal tract and prevention of micronutrient deficiencies. Due to the health benefits associated with a diverse diet, it is therefore important that the elderly are encouraged to include a variety of food in their daily eating pattern.

Programmes and interventions also need to focus on improving availability, accessibility and affordability of a variety of foods and beverages. Environmental strategies to improve food intake in the elderly such as cooking skills and improved environment can have a positive impact on the nutritional status of the elderly. The demographic transition in SA has impacted the national socioeconomic and social welfare, and therefore government's attention is required to tailor policies and nutrition-promotion strategies for the elderly as they are recognised as a vulnerable group in terms of health and nutritional status. Research is needed to comprehensively explore the enablers and barriers to consuming a variety of foods among the elderly in SA in terms of regions, gender and ethnicity.

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