MORE LEGUMES FOR BETTER OVERALL HEALTH

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Objective. This paper reviews the scientific merit and feasibility of the Food-Based Dietary Guideline (FBDG) 'Eat dry beans, peas, lentils and soy regularly'. Beans, peas and lentils are also known as 'pulses'. In this review, legumes refer to pulses and soybeans (which are classified as oilseeds).

Composition and nutrient content. Legumes are rich and economical dietary sources of good quality protein, carbohydrates, soluble and insoluble dietary fibre components and a variety of minerals and vitamins. Pulses have a low energy, fat and sodium content. Although full-fat soy foods are relatively high in fat, they may contribute significantly to polyunsaturated fatty acid intake, including α-linolenic acid, an n-3 fatty acid not commonly found in plant foods.

Non-nutritive compounds. Legumes contain several compounds that have been traditionally considered antinutrients, such as protease inhibitors, phytate, saponins, plant sterols and isoflavones.More recent information suggests, however, that most of these compounds may actually benefit the consumer's health.

Health benefits of legumes. Both protective and therapeutic effects of legume intakes have been documented. Legumes are excellent foods to increase dietary fibre consumption and most individuals can incorporate legumes into their diet without difficulty, particularly if it is done gradually. Including legumes in a health-promoting diet is important in meeting the major dietary recommendations to improve the nutritional status of undernourished as well as overnourished South Africans, and to reduce risk for chronic diseases such as cardiovascular disease, diabetes mellitus, cancer and osteoporosis.

Recommended intakes. The amount of cooked pulses recommended (100 - 200 g / day) should reflect a balance between desirable metabolic effects and possible dietary compliance. Whereas 25 g soy protein per day may be required to obtain a significant hypocholesterolaemic effect, intake of significantly smaller amounts (some soy foods weekly) may provide distinct health benefits.

Conclusion. The time has come for a concerted educational campaign on the health benefits of legumes. Dietitians have an important role to play in this regard.

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The guideline 'Eat dry beans, peas, lentils and soy regularly' aims to improve the overall health of all South Africans. The health benefits of legumes have been known for millennia. People have grown and used legumes as a dietary staple since early biblical times, long before modern nutrition researchers endorsed their significant health virtues.[1] In an age when nutritionists are emphasising the need to decrease fat intake and eat more starchy foods, legumes fit naturally into the Food-Based Dietary Guidelines (FBDGs).

Legumes can be separated into two classes: (*i*) oilseeds such as soybeans and peanuts, which are grown for both their protein and oil content; and (*ii*) grain legumes, including common beans, lentils, lima beans, cowpeas, fava beans, chickpeas (garbanzos) and common peas, which are grown primarily as a protein source. Beans, peas and lentils are also known as 'pulses' from the Latin word 'puls', an ancient bean porridge. The guideline referring to legumes is formulated: 'Eat dry beans, peas, lentils and soy regularly.' This paper focuses on the substantial evidence that increased intake improves health, the amount and frequency of intake needed for beneficial effects, and on practical considerations.

Legumes are unique foods because of their rich nutrient content, including starch, vegetable protein, dietary fibre, oligosaccharides, phytochemicals (especially the isoflavones in soy) and minerals. Their carbohydrate and dietary fibre contents contribute to their low glycaemic indices, which benefit diabetic individuals[2] and reduce the risks of developing diabetes mellitus.[3] Soy protein is now regarded as a 'complete' protein, with a protein digestibility-corrected amino acid score of one, which is equivalent to that of egg albumin.[4] Substituting vegetable for animal protein may reduce urinary calcium excretion and reduce the risk of osteoporosis.[5] The dietary fibre components include both soluble and insoluble fibre, which have many health benefits.[6] The importance of oligosaccharides as prebiotics and their role in the modulation of human colonic microbiotica are widely recognised.[7] The isoflavones genistein and diadzein are unique to soybeans and have several favourable health-promoting effects.[8] Finally, the minerals in legumes are important in reducing the risk of hypertension.[9] Increased consumption of legumes may benefit the undernourished sections of the South African population.

Once regarded in Western countries as food for poor people, dry beans continue to gain recognition for their importance in health and have now become a 'health food' for affluent people. South Africans eat about 2.5 kg of beans per year per person. In comparison with countries such as the USAwith a per capita consumption of 3.5 kg, UK 5.0 kg, Italy 6.7 kg and Canada 7.1 kg, South Africans should include more legumes in their mealplans. Although the demand for dry beans in South Africa exceeds the domestic supply, beans are imported to supplement local shortages. The most important bean types produced in South Africa are red speckled beans, small white canning beans and large white kidney beans. Canned bean products account for approximately 20% of total bean consumption, primarily because of their convenience. Soybeans take longer to soak and cook than the pulses, but they are a welcome addition to any dish which requires the inclusion of cooked pulses. Soy flour, soy milk, soy protein concentrates and soy isolates are widely used. Protein isolated from soy beans is spun into fibres and this textured vegetable protein is used to produce soy chunks, soy crumbs and meat extenders.

NUTRIENT AND NON-NUTRIENT PROFILE OF LEGUMES

Some of the major nutrients provided by dry beans and soybeans are shown in Table I.

Table I. Nutrient composition of dry beans and soybeans, expressed per 100 g dry weight[10,11]

Nutrient	Dry beans	Soybeans
Total fat (g)	1	19
Saturated fat (g)	0.3	2.8
Monounsaturated fat (g)	0.11	4.4
Polyunsaturated fat (g)	0.55	11.2
Ratio of α-linolenic to linoleic acid (mg)	0.252 : 0.301	1.3 : 9.9
Protein (g)	22	36
Carbohydrates	60	30
Stachyose (mg)	1 848	3 300
Raffinose (mg)	336	1 600
Insoluble fibre (g)	11	10
Soluble fibre (g)	6	7
Calcium (mg)	154	276
Magnesium (mg)	172	280
Potassium (mg)	1 140	1 797
Iron (mg)	6.4	16
Zinc (mg)	2.5	4.8
Thiamin (mg)	0.45	0.89
Riboflavin (mg)	0.13	0.87
Niacin (mg)	2.5	1.6
Folate (µg)	370	375

Fat

Most beans are very low in fat, generally containing no more than 5% of energy as fat.[11] The exceptions are chickpeas and soybeans, which contain ~ 15% and 47% of energy as fat, respectively. The predominant fatty acid in beans is linoleic acid, although beans also contain the n-3 fatty acid, α-linolenic acid.[12] The consumption of full-fat soy foods contributes significantly to α-linolenic acid intake (α-linolenic acid makes up ~ 7 - 8% of the total fat).[12] Although soy foods are relatively high in fat, they may still be lower in total fat than the foods they frequently replace, such as meats and cheeses. Soy foods are, however, lower in saturated fat and cholesterol. Furthermore, sterols in soybeans inhibit cholesterol absorption in the small intestine, thereby decreasing serum cholesterol

concentrations.[13] Several plant sterol-enriched table spreads have recently been launched in westernised countries as a heart-health strategy. The structures of plant sterols are similar to that of cholesterol with an extra methyl or ethyl group and a double bond in the ring structure. Saturated plant sterols, referred to as stanols, have no double bond in the ring structure. Free plant sterols are esterified to increase solubility in the spreads. Esterified plant sterols and stanols in spreads lower total cholesterol and low-density lipoprotein cholesterol (LDLC) by about 8% and 13%, respectively.[13] Flora pro.activ is such a product sold in large supermarkets in South Africa at about four times the price of the equivalent without plant sterols.

Protein

Dry beans are inexpensive sources of plant protein with potential to be used as substitutes for animal-protein sources. The protein content of most beans (uncooked) averages 20 - 25% by weight, whereas the protein content of soybeans is ~ 36% by weight.[11] A serving of beans (125 ml, 100 g cooked) provides 7 g protein or ~ 15% of the recommended dietary allowance (RDA) for protein for a 70 kg adult.[14] Although legumes are recognised as being high in protein, the quality of bean protein is often underestimated.[12] Until recently the protein-efficiency ratio, based on the growth of rats, was the standard method of evaluating protein quality. Rats have a methionine requirement that is 50% higher than that of humans. Consequently, because bean proteins are relatively low in sulphur amino acids (SAAs), the protein-efficiency ratios of beans are quite low. However, the WHO and the US Food and Drug Administration have adopted an alternative method for evaluating protein quality, namely the protein digestibility corrected amino acid score (PDCAAS).[15] This method uses the amino acid score (based on the FAO estimated amino acid requirement for 2 - 5-year-old children) and a correction factor for digestibility to arrive at a value for protein quality. The PDCAASs of most beans are reasonably good, although their overall value is reduced somewhat by their lower digestibility.[16] Some types of soy protein products have PDCAASs of close to one, the same score as that of casein and egg protein.[4]

Interestingly, the relatively low SAAcontent of beans may actually provide an advantage in terms of calcium retention. It has been estimated that every gram of protein consumed causes urinary loss of 1 mg calcium[5] (which may appear to be a trivial amount, but may increase dietary calcium requirements markedly, because the average calcium absorption from foods is 30%). The hypercalciuric effect of protein is likely to be at least partially due to the metabolism of SAAs. The skeletal system serves as one of the main buffering systems in the body; as a result, the hydrogen ions produced from the metabolism of SAAs cause demineralisation of bone and excretion of calcium in the urine.[5] According to Messina[12] human studies showed that the consumption of soy protein is associated with a markedly lower urinary calcium excretion compared with the consumption of similar amounts of whey protein or a mixture of animal proteins.

Carbohydrates

The total carbohydrate composition of soybeans and dry beans ranges from 30 - 60% and is primarily structural and storage polysaccharides.[10,11] The main storage carbohydrate is starch with small amounts of monosaccharides and disaccharides such as sucrose. The oligosaccharides — raffinose, stachyose and verbascose — are not hydrolysed in the small intestine because there is no α-galactosidase in the human intestinal mucosa. These saccharides are fermented to short-chain fatty acids (SCFAs) and gas in the colon.[1] Because of the discomfort and social embarrassment associated with flatulence, some people avoid beans entirely. Commercial products such as Beano (AkPharma Inc, Pleasontville, NJ), a digestive aid that contains α-galactosidase, are available so that individuals can eat beans without discomfort. Soy flour derived from a new variety of soybeans that is naturally low in indigestible oligosaccharides produces significantly less gas than that derived from conventional soybeans.[17] Additionally, it is possible to remove substantial amounts of oligosaccharides and to markedly reduce flatulence by changing the water in which beans are boiled one or more times.[12] However, the beneficial effects associated with oligosaccharide consumption will then be diminished. The role of the oligosaccharides found in beans and soybeans in the promotion of bifidobacteria development in the colon is still under study. Favourable effects on gastro-intestinal function (faecal bulking and production of SCFAs)[7,18] as well as on metabolism (reduction of serum cholesterol, improved glucose tolerance[7,18] and mineral absorption[19]) have been found. Because of their potential health benefits, soy oligosaccharides are available as commercial sweeteners in Japan[20] and they can be classified as prebiotics.[7] Prebiotics are defined as nondigestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improve host health. Favourable bacterial populations, such as bifidobacteria, can promote health by inhibiting pathogenic bacteria such as *Clostridium perfringens* and *Escherichia coli*.[7]

Micronutrients

Dry beans and soybeans are low in sodium but are excellent sources of minerals, including calcium, copper, iron, magnesium, phosphorus, potassium and zinc.[10,11] The content and bioavailability of minerals vary according to the processing methods and phytate content.[21] Beans are a good source of iron; one serving (100 g or half a cup cooked) provides 2 mg, which compares favourably with the iron RDAs of 10 mg and 15 mg

for adult men and premenopausal women, respectively.[14] However, iron availability from legumes is poor and thus their value as a source of iron is limited.[22] The availability of zinc and calcium, on the other hand, is relatively good — 25% and 20%, respectively.[12] Calcium bioavailability from soybeans and soy foods is quite good despite the presence of phytate and oxalate.[23]

Dry beans and soybeans are good sources of water-soluble vitamins, especially thiamin, riboflavin, niacin and folate, but poor sources of fat-soluble vitamins and vitamin C.[10] In terms of meeting the RDAs for adults, a one-cup serving of cooked dry beans can provide 30% of the required folate, 25% of thiamin, 10 - 15% of vitamin B_6 and < 10% of niacin and riboflavin.[1]

Fibre (non-starch polysaccharides)

From Table I it is clear that dry beans are excellent sources of dietary fibre or non-starch polysaccharides because they contain substantial amounts of soluble components, which significantly lower cholesterol and blood glucose concentrations, and insoluble components, which aid gastro-intestinal function because of their bulking properties, hydration capacity, binding properties and fermentability. Legume fibre has more hydration capacity than cereal brans.[1] Soy fibre measurably lowers the postprandial increase in serum glucose concentrations, but has only a modest effect on serum cholesterol concentrations.[24] Most soy foods, including soybeans, soy flour, textured soy protein and tempeh, are rich in fibre. However, isolated soy protein does not contain dietary fibre.[10]

Non-nutritive components

Beans contain several components traditionally considered to be antinutrients, such as trypsin inhibitors, phytate (inositol hexaphosphate) and saponins.[25] More recent information suggests, however, that some of the so-called antinutrients may actually benefit the consumer's health. Trypsin inhibitors from beans can certainly interfere with protein digestion, cause pancreatic enlargement and enhance chemically induced pancreatic tumours in some animal species.[12] However, boiling dry beans generally reduces the trypsin inhibitor content by 80 - 90%.[12] In humans, harmful effects have only been reported in instances where the beans were not properly cooked.[25] In contrast to the trypsin inhibitor, the chymotrypsin and trypsin inhibitor (Bowman-Birk inhibitor) found in beans, especially soybeans, has anticarcinogenic activity in various tissues in animal models.[3,26]

Phytate is largely responsible for the poor iron bioavailability from soybeans.[27] On average, the phytate content in beans is 1 - 2%.[12] However, phytate has antioxidant effects, the phytate content in beans is 1 - 2%.[12] However, phytate has antioxidant effects, and may lower the risk of colon and breast cancer.[28]

The saponins in legumes are triterpene glycosides, which are very poorly absorbed by humans.[25] Most saponins form insoluble complexes with 3-β-hydroxysteroids and are known to form large, mixed micelles with bile acids and cholesterol.[12] Although saponins were shown to lower cholesterol in some animal species, the hypocholesterolaemic effects of saponins in humans are more speculative.[29] Saponins may have anticancer properties, as suggested by a study in mice.[30]

Isoflavones are another group of phytochemicals (plant chemicals) in beans, but the soybean is the only nutritionally relevant source of these compounds. The isoflavones are strikingly similar in chemical structure to mammalian oestrogens.[31] They are currently being studied for their potential role in the prevention and treatment of a range of hormone-dependent conditions, including cancer, menopausal symptoms, cardiovascular disease and osteoporosis.[31] The primary isoflavones in soybeans are genistein and daidzein and their respective β-glycosides genistin and daidzin. Smaller amounts of glycitein and its glycoside, glycitin are present. Although isoflavones are weak oestrogens, the current hypothesis is that isoflavones exert anti-oestrogenic effects in a high-oestrogen environment, such as exists in premenopausal women, and oestrogenic effects in a low-oestrogen environment, such as exists in postmenopausal women.[12] Soy isoflavones also have antioxidant properties[10] and are now being extracted and sold as supplements.

The total amount of isoflavones in soy products varies with the type of soybean, geographic area of cultivation and processing.[10] Products that contain most of the bean, such as roasted soybeans, soy flour and textured soy protein are excellent sources and provide 5.1 - 5.5 mg isoflavones / g protein. Alcohol-extracted products such as soy-protein concentrate, have lower amounts (≤ 0.3 mg / g protein). The threshold intake of dietary oestrogens necessary to achieve a biological effect in humans appears to be 30 - 50 mg / day, which is readily attainable by the inclusion of modest amounts of soy foods in the average Western diet.[12]

PUBLIC HEALTH PROBLEMS ADDRESSED BY THE GUIDELINES

From the above discussion of the nutrient content of legumes, it is clear that their contribution of protein, carbohydrate and micronutrients will contribute to address undernutrition. But the total composition of legumes also makes them ideal foods to include in diets that aim to reduce risk of chronic disease or therapeutic diets to treat these diseases.

Atherosclerotic cardiovascular disease

Cardiovascular disease (CVD) is a major medical and public health concern in all population groups in South Africa.[32] Dietary interventions to reduce the risk of CVD include

attention to the consumption of types of fatty acids, dietary fibre, isoflavones and antioxidants.[1] Dry beans and soy foods contribute to all these areas.

The role of fatty acids

Dry beans are essentially fat-free and act to displace fat from the diet. Many soy foods have moderate amounts of oil that is predominantly unsaturated, as discussed above. Although the effects of the different fatty acids in foods on the risk of CVD are much more complex than previously recognised, the low saturated-fat content of soy, and the presence of α-linolenic acid (an n-3 fatty acid not commonly found in plant foods)[12] makes soy foods a good choice for a heart-healthy diet.

The role of dietary fibre

Dietary fibre has major protective effects against CVD.[33] Epidemiologic data suggest that the intake of carbohydrates and dietary fibre is inversely related to CVD.[33] Whereas soluble fibre clearly decreases total serum cholesterol and LDLC concentrations,[6] the inverse relation between dietary fibre intake and CVD appears to be independent of serum cholesterol concentrations.[6] It seems more closely related to cereal fibre intake (which predominantly reflects insoluble wheat fibre) than to fruit and vegetable sources of soluble fibre.[34] There is relatively little support from epidemiological studies that dried beans, peas or soybeans may prevent CVD.[35] Glore *et al.*[36] reviewed the results of clinical studies in humans on the effect of soluble fibre on serum lipids and reported significant reductions in total cholesterol (TC) and LDLC levels in 88% and 84% of the studies reviewed, respectively. Most clinical trials in humans have used either high-fibre food or fibre supplements.[6] The hypocholesterolaemic effects of dry beans have been demonstrated repeatedly.[1] Studies using a variety of dry beans (brown beans, lima beans, chickpeas, kidney beans, navy beans and pinto beans) in amounts varying from 75 g to 200 g dry weight daily confirmed that dry bean consumption significantly lowers serum cholesterol concentrations in humans.[1] The changes in TC were consistent and statistically significant, with a median of - 9.7% and a range from - 5.2% to -18.7%. Bean intake lowered cholesterol most effectively in inpatient studies (median: -14.1%) v. outpatient studies (median: - 8.5%), and most effectively in persons whose initial serum cholesterol levels were highest.[1] Canned beans in amounts varying from 69 g to 150 g daily decreased TC in the range of -1.4% to -16.3%, with a median of -11.7%.[1]

Soy-fibre supplementation has a modest hypocholesterolaemic effect in humans.[6,24] Because most of the studies have used isolated soy protein that does not contain soy fibre, the hypocholesterolaemic effects of soy protein were unrelated to soy-fibre intake.[37] Soybeans, with or without their fibre, appear to decrease serum cholesterol concentrations through their protein or isoflavone contents.[37] In a meta-analysis, Anderson *et al.*[37] reviewed 38 controlled clinical trials examining the effect of soy protein, either textured or isolated, on serum lipid concentrations. Soy-protein intake averaged 47 g / day in these studies. Of the 38 studies, 34 (89%) reported improved serum lipid and lipoprotein profiles (TC - 9.3%, LDLC -12.7%, triglyceride -10.5%, HDLC + 2.4%). According to these studies changes in lipid concentrations were independent of changes in body weight and dietary intake of total fat, saturated fat and cholesterol. An intake of 25 g of soy protein is generally regarded as sufficient to lower TC concentrations in individuals with initial cholesterol concentrations > 5.7 mmol / l.[37] Furthermore, substituting soy protein for animal protein enhances the hypocholesterolaemic effect of the National Cholesterol Education Program (NCEP) Step 1 diet in both normocholesterolaemic and hypercholesterolaemic men.[38]

The proposed mechanisms for cholesterol reductions by beans and soybeans are reviewed by Geil and Anderson,[1] Venter,[8] Anderson *et al.*[10] and Lo *et al.*[24] The soluble fibre in foods such as beans alters cholesterol metabolism at gastro-intestinal, hepatic and peripheral sites. Possible explanations for the hypocholesterolaemic effects of fibre include changes in cholesterol and bile acid absorption and reabsorption, effects of SCFAs, and decreased serum insulin levels.[1] The hypocholesterolaemic mechanisms of soy foods are still under investigation. Small peptide components, individual amino acid ratios, non-protein components such as isoflavones or a combination of factors may alter lipoprotein metabolism. Possible mechanisms include enhancement of bile acid excretion, reduced cholesterol metabolism, increased thyroid hormones, and reduced insulin-to-glucagon ratios.[10] The isoflavone genistein inhibits atherosclerotic lesion development by inhibiting cell adhesion, altering growth factor activity and inhibiting cell proliferation.[39] Furthermore, genistein inhibits thrombin formation and platelet activation[39] and LDLC oxidation *in vitro*.[10]

Diabetes mellitus

Dry beans and soy foods offer benefits in the prevention of diabetes and in the clinical management of established diabetes. Legumes reduce the risk of developing diabetes because of their high-fibre, low-fat content and low glycaemic indices. In carefully controlled studies, a significant inverse association between total dietary fibre intake and risk of type 2 diabetes was reported.[40] Additional observations suggest that foods with low glycaemic indices (GIs) such as legumes were protective whereas foods with high GIs had a positive correlation with risk.[3] Legumes are slowly digested and produce low glycaemic and insulin responses. Vorster *et al.*[41] reported a GI of 29 for butter beans with a small increase in GI when 15 g of sugar was added. The mean GI for kidney beans reported by various authors is 27, for lentils 29, chickpeas 33,

canned baked beans 48 and for soy beans a very low 18.[42] Legumes are rich in soluble fibre, phytates and tannins, all of which correlate inversely with carbohydrate digestion and glycaemic response.[2] In subjects with glucose intolerance, dry beans,[43] soy protein isolate[43] and soy-fibre[24] improve glucose tolerance and insulin response.

Substituting soy protein for animal protein may further protect diabetic individuals from diabetic nephropathy.[44] Anderson *et al.*[44] recently proposed, on the basis of available evidence, that the increased glomerular filtration rate (GFR) after the ingestion of animal protein is absent or mild with soy protein. Limited evidence suggests that protein from dry beans may also have renal protective effects, but more investigation is required to confirm this.[45]

Cancer

The role of legumes in cancer prevention is unclear. Most reviews on this topic generally indicate that among epidemiological studies, about as many studies suggest an inverse association as a positive association between intake of legumes and cancer risk.[46] In a recent report concerning the association of legumes with cancer risk, it was noted that 58 epidemiological studies have examined this association.[47] Of these, 29 reported a decreased risk with higher intake whereas 22 reported an increased risk. Overall, no conclusions concerning the role of legumes in cancer risk could be reached based on this literature.[47]

The evidence indicating that soy food intake has a protective effect against various types of cancer is stronger than for dry beans.[26,48] However, on the basis of these reviews, including *in vitro*, animal and epidemiological results, it is clear that the data are insufficient to conclude that soy consumption is protective, and yet the data certainly warrant continued investigation of this relation. The data suggesting that soybeans may reduce risk of prostate cancer are more encouraging than for postmenopausal breast cancer.[12] Besides isoflavones, there are a number of phytochemicals in soybeans with demonstrated anticarcinogenic activity. These include phytosterols, phytates, saponins, protease inhibitors and a variety of phenolic acids.[12,26] However, most of the data point toward the isoflavones as being responsible for the hypothesised anticancer effects of soy.

OTHER HEALTH CONSIDERATIONS

Osteoporosis

Soy isoflavones are proposed to preserve bone mineral density.[12] Animal studies support the potential benefits of soy isoflavones on bone mineral density and preliminary human studies also support the potential role of soy isoflavones in increasing bone mineral density in postmenopausal women.[12] Potter *et al.*[49] recently reported a significant increase of 2% in both bone mineral content and density in the lumbar spine of postmenopausal women after 6 months on a diet including 40 g protein per day from isolated soy protein containing 2.25 mg isoflavones/g protein. Isoflavones may to some degree inhibit osteoporosis, but as a single prevention strategy may be insufficient for complete protection.[50] Demonstrating effects on bone density requires long-term studies, and compliance to soy foods is a major problem that must be addressed in the design of human studies.

Menopausal symptoms

It has been claimed that diet can offer potential relief of the symptoms of the menopause, with vegetarians reporting fewer symptoms, although much of the evidence is anecdotal. Hypothetically, soy isoflavones have the potential to provide an exogenous source of oestrogen. The lower incidence of menopausal symptoms in women in countries consuming soy as a staple has been attributed in part to the intake of isoflavones.[31] A number of clinical trials of soy foods have been conducted in postmenopausal women aimed at evaluating the effects on hot flushes and vaginal cytology. Results and conclusions have been variable but promising with regard to an oestrogenic effect. However, a strong placebo effect has been observed.[31,51] Further studies must address the issue of dose response. Given the difficulty of compliance to soy diets, probably this could best be done using supplements.[51]

PRACTICAL CONSIDERATIONS

Legumes are ideally suited to meet two major dietary recommendations for good health — intake of starches and decreased consumption of fat. Dry beans and soybeans are also good sources of quality protein and can be substituted for animal protein sources. Soybeans provide unique isoflavones which may be of benefit in the prevention of many of the common diseases seen in Western populations in which the diet is typically devoid of these bioactive non-nutrients. Numerous studies have shown the beneficial effects of an intake of 100 - 200 g cooked dry beans per day on the risk markers of chronic diseases of lifestyle without any harmful effects.[25] Whereas 25 g soy protein per day may be required to obtain a significant hypocholesterolaemic effect,[37] intake of significantly smaller amounts of isoflavone-rich foods (some soy foods weekly) may provide distinct health benefits as well.[10] A guide to using legumes in practical ways is provided in Table II. Most consumers can find ways of incorporating legumes into their daily diets. The health advantages far outweigh the slight inconvenience involved in changing shopping habits and eating patterns. The key to dietary change is the repetition of dietary education by health professionals. Dietitians should take up the challenge of a concerted campaign to educate all South Africans on the health benefits of dry beans, peas, lentils and soy.

Table II. Practical applications of legumes*

Food and serving size	Application
Dry beans, peas and lentils (100 g, 1/2 cup canned or cooked)	Use in soups, salads, stews, casseroles, samp and beans, lentils and rice, pork and beans, baked beans, three-bean salad, 'sousbone', chili con carne, curried butter beans, chakalaka with beans
Soymilk/beverage (250 g, 1 cup)	Lactose free, available plain or flavoured, used in much the same ways as cow milk
Isolated soy protein (30 g)	Found in many commercially prepared products; the powder can be added to almost any recipe or beverage
Textured soy protein (250 g, 1 cup)	Compressed soy flour; the protein fibre changes the structure; rehydrate with 7/8 cup boiling water; replace part or all of the meat in any recipe
Concentrates (90 - 120 g)	In packaged convenience foods, e.g. frozen burgers, sausages, meat analogues
Tofu (120 g)	The result of curdling hot soymilk with a coagulant — absorbs flavour of other ingredients; use in stir-fries, soups, casseroles, salads, dips and salad dressings

* Adapted from Anderson *et al.*[10]

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