The role of soya in human nutrition for South Africa

By Prof Wilna Oldewage-Theron and Prof Abdulkadir Egal, Vaal University of Technology

In South Africa, 22.3% of the population still has insufficient food for an active and healthy life, and 11.8% experience chronic hunger. Undernourishment is characterised by protein-energy malnutrition (stunting, wasting and underweight) as well as micronutrient deficiencies (e.g. vitamins A, D, B6, B12, zinc and iron).

On the other hand, South Africa has the highest prevalence of overweight and obesity in sub-Saharan Africa with approximately 70% and 33% of women and men categorised as either overweight or obese respectively. Women are affected most with 40% being obese. However, this is not only an adult problem as 25% of girls and 20% of boys, aged 2-14 years old, are overweight or obese.

Obesity is often associated with non-communicable diseases (NCDs) such as heart disease, type 2 diabetes, cancer and high blood pressure. Behavioural and modifiable risk factors, namely a sedentary lifestyle, an unhealthy diet, and substance (mainly alcohol and tobacco) use contribute to approximately 45% of all NCD deaths globally. In 2017, 48% of all deaths in SA were due to NCDs, many of which were associated with nutrition and lifestyle.

Prevalence rate
The South African National Health and Nutrition Examination Survey (SANHANES-1) indicated self-reported family history of 30.9% high blood pressure, followed by 20.7% high blood sugar, 8.9% stroke and 7.6% heart disease.

Nationally, a prevalence rate of 31.8% for high blood pressure, 9.5% diabetes, and 23.9% and 24.6% with abnormally high serum total cholesterol (TC) and low-density lipoprotein-cholesterol (LDL-C) respectively and 47.9% with abnormally low high-density lipoprotein-cholesterol (HDL-C) was measured. The situation of under- and over nutrition may sometimes occur in the same population or household and is called the double burden of disease.

The benefits associated with the regular consumption of soya, in combination with other healthy foods, have been scientifically proven and are becoming more relevant to prevent or address the negative consequences of this double burden. High-quality protein is often missing from undernourished children’s diets.

Not only does soya contain all the essential amino acids children need to grow, but it also provides some of the essential micronutrients such as folic acid, vitamins B1, B2 and E, zinc, iron, magnesium and calcium to the diet. It is lactose free and can be used instead of cow’s or goat’s milk when infants or children have a lactose intolerance or are allergic. Soya is also gluten free and can be included in gluten free diets.

Incorporated into recipes
A study was undertaken in QwaQwa, where a baseline survey was conducted to determine the main challenges to be addressed in the community. A household soya gardening programme was

Heart-healthy food
Soya is not only beneficial for the undernourished, but is a heart-healthy food because of the low content of saturated fat and high content of omega-3 and omega-6 fatty acids. Soya further contains no cholesterol and protects against heart disease by assisting with the reduction of both blood cholesterol levels and -pressure. It is also a good source of dietary fibre that promotes not only gut health, but also provides a feeling of satiety and fullness.

Soya has a lower glycemic index that keeps blood glucose levels more stable and is therefore also recommended as a diabetic food. The anti-cancer properties of soya (isoflavones and phytochemicals) provide protection against various cancers such as breast, prostate, skin, stomach and colon cancer.

Besides all the health benefits, soya is an affordable and very versatile food for use in South Africa. Soya protein is much cheaper compared to other high-quality protein sources such as eggs, chicken and beef. Soya beans are also more economical to farm and can be produced by small scale farmers. It is versatile and can be used on its own as soya milk, yoghurt or tofu or as an ingredient in high-protein meat replacements, energy bars, protein-enriched cereals and baked goods.
implemented and soya recipes developed and tested for sensory acceptability.

Minced whole soya beans, soaked for more than eight hours, were incorporated into 20 household recipes most frequently prepared in QwaQwa.

Skills training in 2010 included teaching the women to prepare the soya recipes, which contained 40g of whole soya beans per person per day, and how to include the recipes in the household menu planning. The soya consumption intervention was undertaken over 18 months.

Ninety women were randomly recruited for the intervention study to measure the impact of soya consumption on lipid profile and risk factors of Metabolic syndrome (MetS). These include high blood pressure, obesity (measured by waist circumference (WC)), low serum high-density lipoprotein-cholesterol (HDL-C) (good cholesterol), high LDL-C (bad cholesterol) and high glucose levels.

**Figure 1: MetS classification of the women before and after the intervention.**

MetS is a condition where three or more of the risk factors are prevalent. During the 18-month intervention study, the respondents were instructed to follow their usual diet, but to replace one of the recipes with a soya-based one each day to ensure the intake of at least 40 grams of whole soya beans per person.

**Significant differences**

The researchers visited the women every month to measure compliance, checking on the availability of soya beans and discussing problems regarding soya recipe preparation and side-effects. Dietary intake, anthropometric and blood pressure measurements were recorded and blood was drawn once each week and before one week after the 18-month period.

The results in Table 1 indicate statistically significant differences in the lipid parameters between the hypercholesterolaemic (HC) and normcholesterolaemic (NC) groups at baseline. The HC group showed abnormal mean values for all the lipid parameters at baseline whereas the NC group showed TC and LDL-C values in the normal range, but abnormally low mean HDL-C and high mean triglyceride (TG) levels.

The HDL:LDL ratio is a good indicator of cardiovascular disease (CVD) risk than the individual HDL- and LDL-C levels. The observed HDL:LDL ratio was significantly lower in the HC group than in the NC group. However, the HDL:LDL ratio was lower than the recommended >0.4 ratio in both groups, thus indicating a high risk for CVD in this sample of women.

At follow-up, the HC group had significantly improved HDL-C, LDL-C and TG levels. A similar trend was observed in the NC group, but no significantly improved TG values were observed. The HDL:LDL ratio improved in both groups, but was only significant in the HC group at follow-up. In both groups, the HDL:LDL ratio was still lower than the recommended >0.4.

**Beneficial effect**

The results in Figure 1 show a significant reduction in the prevalence of MetS after the intervention and an improvement in all the risk factors for MetS. The soya consumption intervention therefore had a beneficial effect on blood pressure, blood glucose, HDL-C and TG levels as well as obesity (WC).

Although our research has proved that soya protein has a beneficial effect on TG and LDL-C, the daily consumption of 40g of whole soya bean, equivalent to 15g soya protein, had no significant positive effect on TC, but had a beneficial effect on LDL-C of the HC and NC women in QwaQwa.

The HDL:LDL ratio was also improved in both groups, consequently reducing the risk for CVD. It was thus proven that soya consumption has a beneficial effect on HC in women. In addition, the soya consumption intervention also proved to be effective for the treatment of MetS.

To conclude, soya has been identified as an economical and versatile food item that will not only provide essential nutrients for under-nutrition, but also add additional and unique health benefits addressing the increasing prevalence of over-nutrition in developing countries.

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**Table 1: Descriptive statistics for anthropometric and biochemical parameters measured.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit of measure</th>
<th>Normal range</th>
<th>Cholesterol group (HC n=36, 40%)</th>
<th>Normcholesterol group (NC n=54, 60%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline Mean±SD</td>
<td>Follow-up Mean±SD</td>
</tr>
<tr>
<td>Height</td>
<td>metre (m)</td>
<td></td>
<td>1.6±0.1</td>
<td>1.6±0.1</td>
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<tr>
<td>Weight</td>
<td>kilogram (kg)</td>
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<td>77.2±14.9</td>
<td>77.4±17.2</td>
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<tr>
<td>BMI</td>
<td>kg/m²</td>
<td></td>
<td>30.0±6.5</td>
<td>30.4±9.0</td>
</tr>
<tr>
<td>Serum cholesterol</td>
<td>mmol/L</td>
<td>&lt;5.2 mmol/L</td>
<td>6.8±1.9</td>
<td>7.2±2.2</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>mmol/L</td>
<td>&gt;1.68 mmol/L normal</td>
<td>0.8±0.5</td>
<td>1.4±0.5</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>mmol/L</td>
<td>&lt;3.3 mmol/L normal</td>
<td>5.4±1.8</td>
<td>3.9±1.9</td>
</tr>
<tr>
<td>Serum triglycerides</td>
<td>mmol/L</td>
<td>&lt;1.7 mmol/L normal</td>
<td>2.7±0.9</td>
<td>2.0±1.0</td>
</tr>
<tr>
<td>HDL:LDL ratio</td>
<td></td>
<td></td>
<td>&gt;0.4</td>
<td>0.18±0.14</td>
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</tbody>
</table>