NUTRITIONAL AND FUNCTIONAL QUALITY OF SOUTH AFRICAN DRY-BASED SOYA PROTEIN FOODS

BY

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I declare that the dissertation herewith submitted for the degree of MSc (Agric) Food Science and Technology at the University of Pretoria, has not previously been submitted by me for a degree at any other university or institution of higher education.

NUTRITIONAL AND FUNCTIONAL QUALITY OF SOUTH AFRICAN DRY-BASED TEXTURISED SOYA PROTEIN FOODS

ABSTRACT

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As 780 million people in developing countries still do not have access to enough food to meet their basic daily requirements for nutritional well being the provision of affordable and nutritional foods is an on-going challenge. Animal protein resources, e.g., meat, poultry, fish and eggs, are increasingly becoming unaffordable by the disadvantaged masses and their storage is problematic. Alternative protein sources, e.g., seaweed, plankton, single cell protein, fishmeal and legumes are being researched. Soya beans, having a high protein content of 40% is consequently an ideal vehicle for the supply of protein to consumers that cannot afford conventional sources of protein.

In South Africa, soya beans are processed into flavoured dry-based products and marketed extensively as a meat substitute. This is prepared at home as part of a main meal to be consumed with rice or bread. Their affordability and shelf-stability characteristics make them appealing to South Africans constituting the low-income sector and vegetarians.

The quality of mutton and savoury flavoured dry-based soya products manufactured by three Kwa-Zulu Natal companies were investigated and these three manufacturers were designated A, B and C. Proximate analyses and mineral analyses determined the nutritional components. The protein quality in these products was determined by performing Protein Efficiency Ratio (PER) and Net Protein Utilisation (NPU) studies on chickens as biological models. The functionality of these proteins was determined by Nitrogen Solubility Index (NSI) and Protein Dispersibility Index (PDI) studies. The presence of bacteria, yeast, moulds, and mycotoxic fungi were determined by microbiological assay. Consumer acceptability surveys were also undertaken to ascertain appearance, flavour, texture and overall acceptability profiles. The consumer also ranked the products in order of preference. Finally, economic value of these dry-based soya products was determined by comparing the retail price of these products with beef and chicken on a protein basis.

The carbohydrate content of these products was elevated as a consequence of dilution with starch and/ or maize flour. The polysaccharides, raffinose and stachyose which are regarded as causing flatulence in soya products apparently were eliminated during processing as the soya products investigated were devoid of them.

The negative consequence of the manufacturers adding starch and/ or maize flour was that the protein was diluted. The protein content of 25% was significantly lower than the normal protein content of 40% of soya beans.

A diluting effect occurred in the mineral content of iron, zinc and manganese. Calcium, magnesium and phosphorus was also decreased as a consequence of being lost with the soya oil which was removed in the processing of defatted soya flour. In spite of these reductions, soya products are still a good source of calcium, phosphorus and magnesium. The bioavailability of iron may be constrained by phytic acid, which occurs in soya beans.

Amongst the three manufacturers researched, dietary fibre content was least in products from manufacturer C. Flavour also had a significant influence on dietary fibre content as mutton flavoured products had a higher dietary fibre content compared to savoury flavoured products.

These soya products were a good source of polyunsaturated fatty acids with products from manufacturers A and B having the higher fatty acid level content. Savoury flavoured products had a significantly higher fatty acid content compared to mutton flavoured products.

Protein quality differed significantly amongst the three manufacturers. Products from manufacturer A had very low PER and NPU values. Products manufacturers B and C had acceptable PER/ NPU values, similar to peanuts.

Protein functionality values of products indicated that products from manufacturer A were not exposed to severe heat treatment and consequently their anti-nutritional factors were not denatured or inactivated. Consequently their PER/ NPU was depressed. Protein functionality values of products from manufacturers B and C were low indicating extensive heat treatment of TVP. This treatment denatured the anti-nutritional factors thus producing acceptable PER/ NPU values.

Bacterial loads were minimal in these dehydrated products. Some moulds were found indicating fungal contamination, presumably from the air during processing. An absence of mycotoxins confirmed that mycotoxic fungi are not endemic to dry-based soya products. The processing applied to the ingredients used by manufacturers B and C yielded Salmonella/ Shigella free products.

There was no significant difference in the consumer response to mutton flavoured products from all three manufacturers and savoury products from manufacturers B and C were ranked highest by consumers. With respect to products from manufacturer C this could be linked to them having the least moisture, protein and fat content and the highest soluble carbohydrate and ash contents.

Economically, soya protein is far cheaper than beef and chicken protein. Beef protein was calculated to be 140% of the retail price of soya protein and chicken protein was calculated to be 192% of the retail price of soya protein.

While dry-based soya products seems to be nutritionally acceptable and affordable with an extended shelf life, their protein availability and functionality is dependent on processing parameters. These soya products also received an above average acceptance rating by consumers, although textural and appearance qualities could be improved.

This dissertation is dedicated to my late father,

Arunaghary Padayachi,

who passed away on the 19 February 1999.

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