



Project synthesis study: Human consumption of soybeans in South Africa – recommendations and challenges

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1. Introduction

Over the last decade there has been rapid growth in South Africa's soya bean crushing capacity (see Figure 1.1) due to the investments made in pursuing the governmental import replacement strategy. However, during this period the human consumption of soya beans remained relatively flat prompting an industry need to develop an improved understanding of the human consumption of soya and the subsequent identification of market growth opportunities.

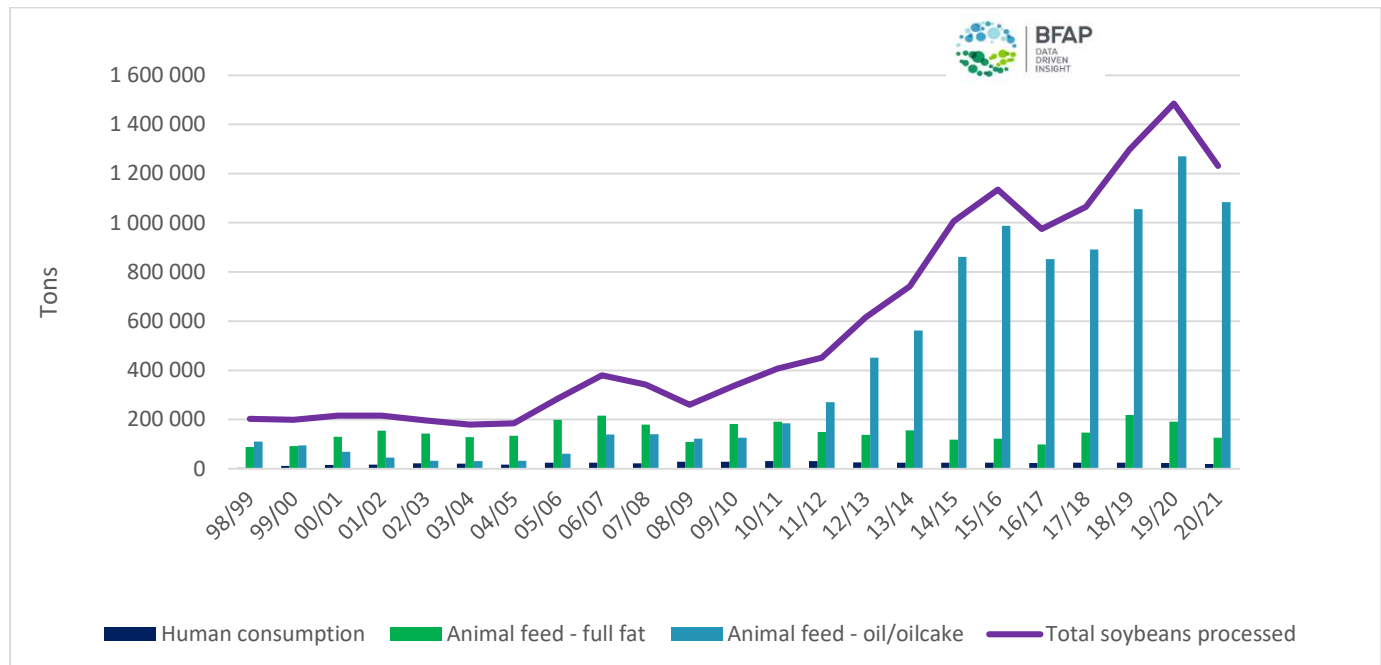


Figure 1.1: Soybean processing South Africa (1998 to 2020)

Source: SAGIS (2021)

Over the last few years several research projects have been funded by the Oilseeds Advisory Committee (OAC), focusing specifically on the potential of soybeans for human consumption in South Africa. The OAC has contracted BFAP to prepare a summary document on the potential and the main challenges of soybeans for human consumption in South Africa based on research that has been completed.

Upon agreement with the OAC, the following studies are included in this synthesis project:

- Supply-chain wide focus:
 - An overview of derived soy products used for human consumption in South Africa (BFAP, 2021).
- Soya within the South African National School Nutrition Programme:
 - The role of soya in the South African National School Nutrition Programme (University of Pretoria) (Van Deventer, Muller, Pretorius & Schönfeldt, 2020).
 - Building an evidence base for soya served in the National School Nutrition Programme (University of Pretoria) (Muller, Van Deventer, Pretorius & Schönfeldt, 2021).
- Consumer research:
 - Developing soya beans as a modern food commodity - Consumer trends in the soya market of South Africa (University of Pretoria) (Muller, Schönfeldt & Pretorius, 2017).
 - Consumers' soya consumption behaviour, knowledge and perceptions (BFAP, 2021).

The objectives of the synthesis report are:

- To synthesise the commercial recommendations and the challenges faced by the industry. (Section 2).
- To prepare a summary (and comparison, where applicable) of the existing knowledge base on the topic. (Section 3).

In addition to these project objectives, Section 4 provides information on soya and protein quality, while Section 5 explores the question: Do South African consumers eat adequate quantities of legumes?

2 Recommendations and challenges to industry

2.1 Soya within the National School Nutrition Programme

The research projects focusing on soya within the NSNP revealed the negative perceptions among many learners towards soya meals served in the NSNP (e.g. regarding product attributes such as taste, appearance and texture), a negative product image (non 'cool' to eat soya) and subsequent widespread unwillingness to eat soya meals within the NSNP. The millions of learners eating meals with soya within the NSNP could represent a significant portion of the soya consumers of the future and significant interventions are needed to re-position soya in their perception framework as a 'trendy', diverse, tasty and healthy / nutritious food. Recommendations to industry focus on product standards, labelling information and recipes.

The research revealed the non- compliance to DOE guidelines (particularly in terms of energy, protein and sodium content) and a general lack of official quantitative DOE guidelines in terms of carbohydrates and the soya content of the packaged product. The research also observed discrepancies between the nutritional claims on soya mince labels supplied to the NSNP and nutritional analyses results (observed for energy, protein, carbohydrates, fat and dietary fibre).

- Recommendation 1: Expansion of the DOE guidelines on the nutritional composition of soya mince to be used in the NSNP to include specifications on carbohydrates and the soya content of the packaged product in addition to energy, protein and sodium content. On a wider platform the specification of quality guidelines for soya mince in national legislation is also recommended.
- Recommendation 2: The current soya mince products tested in the research had a soya content of approximately 50%, however the researchers recommended an ideal soya content in soya mince of 70% to ensure optimal nutrition and improve sensory acceptability.
- Recommendation 3: Routine widespread testing of soya mince products supplied by vendors within the NSNP to ensure adherence to compositional and nutritional composition guidelines. Testing results should also be compared to product labelling claims on a regular and widespread basis.
- Recommendation 4: Product reformulation should consider numerous components including the soya content (increased to 70% to ensure optimal protein content), improved flavour and reduced sodium content.
- Recommendation 5: Roll-out of the new recipes developed within the Muller et al research project (especially Beef Bolognese Soya Mince meal and the Chili con Carne Soya Mince served on rice) and / or development of additional tasty soya mince-based recipes to be prepared at schools within the NSNP. The new recipes were perceived as significantly more acceptable than the traditional soya meal served within the NSNP. Improving the sensory appeal of soya meals is critical, especially regarding the taste, texture and appearance of the meals. A preference for 'more spicy' meals with a stronger and more interesting flavour profile was reported. This can only be achieved if both the soya mince ingredient and the meal preparation (recipe and other ingredients added) are re-formulated to achieve consumer satisfaction among learners.
- Recommendation 6: There is a need for consumer education (aimed at teachers, learners and food preparation workers within the NSNP) focusing on aspects such as what soya is, product health benefits and environmental benefits.

- Recommendation 7: Strategies should be considered to change the ‘poor person’s food’ image of soya among learners. One possible strategy could involve influencers on social media to reach the youth regarding positive soya messages.
- Recommendation 8: There is a definite need for consumer research aimed at learners eating soya within the NSNP, to understand the current perceptions and product knowledge of younger generations, and investigate the potential impact of knowledge interventions (e.g. experimental economics type research)

2.2 A product perspective

Based on the research by BFAP (‘An overview of derived soy products used for human consumption in South Africa’) conducted by means of literature sources and discussions with industry experts, the following take-messages have been identified to inform strategic decisions.

Soya in the processed meat market:

The processed meat market, where polonies and viennas are the leading consumer products, does not seem viable for expanding the market for soy products for human consumption. Not only does South Africans consume relatively small amounts of processed meats (12g per person per day according to FACS (2021)), but soy products included in these products are mainly imported soy concentrates and isolates. These products are currently not produced in South Africa but imported; soy concentrates mainly from Brazil and soy isolates mainly from China. Due to the economies of scale needed to warrant the close to R100 million investment in equipment, the production of soy concentrates, and isolates are currently not feasible in South Africa. Moreover, these products are usually produced with non-GMO soybeans. Investing in equipment to produce soy concentrates and isolates could be feasible if a big enough market exists in Africa, if the GMO product could compete with the non-GMO product and if the South African crushers can compete with Brazil China on quality.

Soya in the butcher meats market:

The butcher meats market where TVPs are added as extenders or absorbents to mince, ‘braai wors’ and hamburger patties could be a feasible option to grow the market for TVPs.

Soya in high-value meat analogue products aimed at vegetarians and flexitarians:

Third; venturing into the production of high-value products explicitly targeted at vegetarians and flexitarians such as plant-based mince, -patties, and -nuggets, to name a few is not viewed as a feasible option. These products make up a small share of the market, are either imported from Europe or contains imported soy concentrates and isolates and contains mostly pea protein and not soy protein.

Significant competition is posed by pea protein products that does not have the typical ‘beany’ taste and the non-GMO label. Pea protein is also a good source of protein and iron, low in carbohydrates and fat and contains no allergens.

For the South African crusher to enter into this market, it will have to make significant capital investment to produce soy concentrates and isolates. The production of wet TVP also comes at a higher cost due to the higher perishability of the product. Subsequently according to interviews with industry roll-players expansion into this market is not currently considered.

Industry experts explained that South Africa produces less than 1% of non-GMO soybeans while many food manufacturers prefer GMO free products, particularly those that export some of their final products.

The potential of meat analogue products produced from a combination of soya and other plant protein sources (such as pea protein) should be explored in future but would most likely require non-GMO soya beans and innovative new technologies to produce suitable soya ingredients.

Soya in low-value (usually TVP-based) foods:

The low-value soy or soy-based product shows the most growth potential from the report's findings. The low-value products, specifically those containing TVPs such as soy mince, hold the most significant growth potential for the local soybean industry. Some of the crushers highlighted the importance of including soy-based products in school feeding programmes and social grants as an excellent but cheaper protein source to support food security. However, it is of critical importance that the quality of these products should be improved and carefully monitored to avoid further negative consumer sentiments.

Industry experts highlighted several challenges in growing the TVP market in South Africa:

- Changing consumer perceptions that soya products is a 'poor person's food'.
- Consumer education targeted at low- and middle-income consumers, to explain the benefits of adding soy-based products to meals to bulk up meals and increase the protein content is needed.
- Consumer education on the health and environmental benefits of soy-based products is also needed to expand the target market and include middle and perhaps high-income consumers.
- Sensory research among low-, middle- and high-income consumers is likely to determine consumers' taste preferences and identify whether the 'beany' taste is a problem. Since school feeding programmes can significantly affect the market for TVPs, it is also essential to understand school children's taste preferences.

Soya milk:

Discussions with industry experts revealed that non-GMO soybeans with a white hilum, a bean not grown in South Africa, are preferred for soymilk production. Thus, expansion into the soya milk market will require the production of appropriate, non-GMO soya bean cultivars as well as investment in processing technology. It is argued that the niche nature of this market in South Africa does not warrant these steps at present.

Africa export opportunities:

The rapid expansion in demand for TVPs in Africa, particularly in Zimbabwe, suggests that TVPs are already part of many African consumers' diets and could be optimally utilised and grown. Although the local market also shows room for expansion, South Africa only imported around 6 000 tons of TVPs per year over the past three years. Optimistically speaking it would be possible for the local crushers to replace the 6 000 tons of imported TVPs if they are not imported for specific characteristics such as non-GMO. The most significant opportunity for growth, however, seems to be the African market. However, a strong possibility exist that the African market will not be keen to accept products produced from GM soya beans – implying the importance of producing non-GMO soya beans in South Africa with separate and traceable supply chain structures.

Soya bean quality requirements:

According to interviews with industry role-players the following soya bean quality requirements were identified:

- Large soybeans are preferred compared to smaller beans, with consistency in bean size critical.
- Beans need a clear hilum, a yellow, and thin but strong seed coat and a yellow cotyledon.
- In terms of its composition soybeans should ideally contain:
 - A high protein content ($\geq 43\%$),
 - A high oil to protein ratio,
 - Lower levels of the trypsin inhibitor to enhance protein digestibility,
 - Lower activity of lipoxygenase to reduce the "beany" flavour during the oxidation process,
 - High sucrose levels,
 - Raffinose and stachyose below 1% to reduce flatulence,
 - Reduced polyunsaturated fatty acid content to improve oxidative stability.
- Some crushers noted that beans with a white hilum are sometimes preferred to produce certain products.

- Although non-GMO beans are preferred to produce soy protein isolates. As locally produced GMO soybeans are widely used to produce TVPs, consumer perceptions and acceptance of GM food (and GM soya beans specifically) should be carefully monitored as potential future negative attitudes towards GM soya beans and subsequent product rejection, could have a significantly negative impact on the TVP market in South Africa.

SWOT analysis for the South African soya bean industry for human consumption:

Table 2.1: SWOT analysis for the South African soybean industry for human consumption: Strengths and weaknesses

STRENGTHS: (Internal to industry)	WEAKNESSES: (Internal to industry)
Well-structured and effective industry organisations like the Protein Research Foundation (PRF), the Oilseed Advisory Committee (OAC) and Grain SA are strategically aligned to foster research, growth and overall development and investment in the soybean industry. Investments in crush capacity enabled the industry to increase the production of soy products for animal feed and human consumption. The area under soybean production has increased fivefold over the past decade and in the current production season is projected to exceed 1 million ha. Research and trials of new cultivars, improved farming practices etc. have resulted in consecutive increases in national average yields. The introduction of the South African Cultivar and Technology Agency (SACTA) offers the critical incentive for companies to invest their latest germplasm and seed technology in South Africa.	High entry and exit barriers. The high cost of equipment to produce concentrates and isolates makes it challenging to enter the concentrate and isolates market. A rough investment estimate to produce concentrates and isolates according to one of the crushers is R100 million.
Investments in the crushing capacity stimulated the local production of soybeans which supports the crushing margin through the availability of more affordable local beans.	Undesirable “beany” taste of soy-based products that is difficult to eliminate.
Proximity to the growing African market. Our two biggest crushers are situated in the Northern parts of South Africa; Nedan Oil Mills (Mokopane) and Majesty Oil Mills (Krugersdorp).	Perceived lower quality of soy derivatives; specifically, soy-based meat alternatives.
	“Poor-man’s meat” stigma around soy-based meat alternatives.
	Some food manufacturers demand non-GMO soy derivatives, but South Africa produces less than 1% non-GMO soybeans. Some food products such as soymilk are produced from white helium soybeans that are not produced in South Africa.

Table 2.2: SWOT analysis for the South African soybean industry for human consumption: Opportunities and threats

OPPORTUNITIES: (External to industry)	THREATS: (External to industry)
Expansion into the growing African market. South African exports to Africa increased by 80% in 2020, with Zimbabwe being the most significant growth driver.	During times of drought, the high cost of beans puts crushing margins under pressure, even when crushing for human consumption at higher output prices.
Improving the quality of soy derivatives and educating the consumer on the benefits of using soy-based products opens further growth opportunities, even in middle-income consumer groups.	Electricity fluctuations and 'load shedding' increase the cost of crushing and increase product quality variability.
The growing population of environmentally conscious consumers opens opportunities to market soy-based products as more environmentally friendly than animal proteins.	The increasing global demand for products made from pea protein instead of soy protein can potentially spill over to South Africa. Pea-based products are 'green label' products as it contains no allergens.
Crushing soybeans for human consumption supports the crush margin. Some crushers indicated that the crush margins when producing for the human market, are three times better due to the higher prices realised for TVPs compared to soybean meal for animal feeds.	The relatively high cost of doing business in Africa. Time delays and other barriers that make cross border trade difficult. The high cost of transport (fuel and tolls), and poor road infrastructure makes exports to Africa relatively more expensive.
	Cheaper imports of soy-based products from China.

2.3 A consumer perspective

2.3.1 Satisfying consumers' needs – Product characteristics

To satisfy consumers' needs, soya-based foods in the South African market have provide consumers with a satisfactory product offering in terms of products offering a positive experience in terms of taste, smell / aroma, cooking ease, healthiness, texture, affordability, and appealing appearance. Intangible product attributes such as animal welfare concerns and environmental sustainability concerns are growing in the South African context and will most likely be more important to affluent consumers than lower-income consumer segments.

Consumers revealed that soya consumption could increase if the taste / flavour, affordability and availability of these foods can be improved, by gaining a better understanding of the healthiness of soya and the availability of (new and delicious recipes). The improvement of the 'beany' taste of soy products is critical through, for example, improved cultivars or processing innovation. Sensory consumer research could yield a more detailed understanding of consumers' taste preferences and product perceptions, also among lower-income children in the context of school feeding programmes.

In terms of soya country-of-origin, most consumers indicated a preference for food produced in South Africa rather than eating food imported from other countries. Thus, local food origin could be a valuable marketing angle for soya-based foods where applicable.

2.3.2 Focusing on the health benefits of soya-based foods

The health and nutritional benefits of soya-based foods are viewed as a key pillar of the marketing strategy for soya-based foods, particularly when considering the double burden of disease prevalent in South Africa. Research revealed the most consumers acknowledge that soya can be viewed a part of a healthy diet.

Even though certain health benefits of soya-based foods are well-recognised (e.g. low in carbohydrates, high in protein) the need was identified to educate consumers with science-based information regarding additional health benefits of soya-based foods focusing on aspects such as fibre content, protein quality, Glycaemic Index of soya, anti-cancer properties, omega 3 and 6 fatty acids, vitamin E content and being cholesterol free. An improved consumer understanding of the protein content and protein quality of soya is of critical importance among all socio-economic sub-segments, as soya can play a functional role in the human diet and could contribute to the alleviation of protein energy malnutrition. Well-designed and executed consumer education can help to improve the knowledge of consumers and form positive perceptions towards soya – also among consumers with no or limited knowledge regarding certain aspects related to the healthiness of soya-based foods.

Consumer education regarding the health attributes of soya-based foods can be viewed in two groupings: ‘preventative’ attributes (i.e. eating healthy to prevent illness) and ‘treatment’ attributes.

Another point of view could be based on ‘less negative’, ‘more positives’ and product alternatives:

- Less or no ‘negatives’: e.g. low content of saturated fat, contains no cholesterol.
- More ‘positives’: e.g. high in good quality protein, high content of polyunsaturated fats, high content of omega 3 and 6 fatty acids, good source of fibre, lower glycaemic index, anti-cancer properties and is a good protein substitute to traditional protein sources such as meat, but also a good extender in processed meat products.
- Soy-based foods offer consumers a healthy alternative or supplementary food to animal-protein foods.

The protein content and protein quality of soya could be viewed as one of the most important selling points of soya-based foods – being important to both nutritionally vulnerable and more affluent health-conscious consumers as alternative or supplementary protein source. Consumer education on the health attributes of soya-based foods must be based on scientific evidence. It is critical to establish a baseline on the nutritional profile (and protein quality / amino acid profile) of current soya cultivars in South Africa, to prioritise the future improvement of the nutritional profile. Translating the knowledge on the nutritional profile of soya beans into such tangible recommendations to meet dietary needs is also needed

As mentioned earlier in this report, TVP-based products in South Africa are often produced from GMO soya beans. To facilitate pro-active production and marketing strategies consumers insights are required into aspects such as:

- Do South African consumers know that they are consuming GMO soya beans in TVP-based foods?
- Do South African consumers value the farm-level and environmental benefits associated with GM soya beans?
- Nature of perceptions regarding GM soya beans related to aspects such as health concerns and environmental concerns.

The formulation and implementation of the content and execution of nutritional education programmes for soya will have to be based on a solid understanding of consumers’ reaction to nutritional / health attribute messages. For example, among a low-income community in Qwa-Qwa (Free State Province), Oldewage-Theron and Egal (2012) concluded that consumer education regarding soya gardening, some nutrition aspects and uses caused a significant improvement in respondents’ knowledge on the topic.

2.3.3 Dealing with consumers’ perceptions regarding soya-based foods

Consumers were most positive about soya in terms of:

- Product usage: cooking and usage convenience, ease of cooking / preparation, preparation knowledge and role as a meat extended.
- Sensory appeal: taste, texture and smell.
- Cost: affordability.
- Product image: no shame in eating soya and not perceived as a poor person’s food.
- Healthiness: soya is part of a healthy diet.

In the overall sample respondents were least positive about soya-based food, perceiving the products as less environmentally sustainable than animal-protein foods, causing allergies, being produced from genetically modified soya beans and causing flatulence.

Recommendation 1: Product innovation

Product innovation should be applied to develop a larger variety of soya-based foods that are sensory appealing, priced right and satisfying consumers' needs for variation and convenience. In addition to the general commercial soya consumer market, this recommendation is also applicable to the soya mince products supplied for school feeding in South Africa.

For which soya-based foods would consumers like to see product improvement and product innovation? (food items presented in order of importance) Soya mince, meat alternatives, soup or soup powder, sausages, burger patties, soya milk, soya beans, bars / snacks / sweets, instant porridge / ProNutro / Future Life and polony. Other products mentioned included high-quality frozen goods that is tasty and quick to make, vegetarian convenience meals, soy sauce, beef alternatives, more sweet treats, Knorrox, soya-based sausages or viennas, to have longer shelf life, dairy free smoothies, soya purity and ready rice or parboiled rice added to soya-based meals such as soya mince. Adding dried vegetables to soya mince was also suggested.

Recommendation 2: Product convenience

Soy-based products can be viewed as a more convenient alternative for the poor and those living in rural areas with access to limited infrastructure and cold storage facilities for food and fresh meat at home. Therefore, in addition to being a cheaper, more nutritious, and protein-dense option, soy-based proteins' longer shelf life also makes it more convenient and less expensive to store.

From the perspective of wealthier consumers, soy-based products such as snack products, bars, and nutritional shakes offer consumers a convenient and healthy product offering to supplement their diets.

Recommendation 3: Recipes

Even though consumers were very positive about their soya preparation knowledge the need was expressed for innovative, easy and interesting soya-based recipes. Thus, the development and communication of recipes is important to potentially increase soya consumption in South Africa. Studying the role of tasty and innovative recipes for the at-home preparation of soya among low-income rural households, Duvenage et al. (2012) developed tasty recipes (e.g. healthy crumpets, soy bread, green bean soy fritters, fish cakes with spicy relish, malva soy pudding, soy meatballs with curry sauce) and observed high acceptance of the new dishes among respondents. However, a lack of knowledge/ skills in the preparation of the dishes was identified as a major limiting factor to increased soya intake.

Opinion leaders / social media influencers could also be useful to persuade consumers to eat more soya and/or to eat soya in more interesting and appealing ways – making consumers aware of new recipes and establishing positive perceptions and 'intentions to try' new recipes.

Recommendation 4: Soya as a meat extender

Consumer education can help consumers to understand the potential role of soya as a meat extender across the socio-economic spectrum and the potential monetary and health benefits of such actions. However, considering the importance of sensory product appeal this should be accompanied with tasty recipes to illustrate the concept of extending meat dishes with soya to consumers.

Recommendation 5: The pea-protein threat

Despite various positive perceptions towards soya-based foods, 39% of the 2021 BFAP study sample prefers pea-protein based foods to soya-protein based foods. Technological innovation to improve the non-desirable 'beany' taste of soya (absent in pea protein) is important. Furthermore consumer education can play a role in educating South African consumers regarding the comparative health / nutritional qualities of soya protein versus pea protein as a plant-protein source. Competing with pea-protein foods will most likely also require

Recommendation 6: Culture-specific food

Protein-rich plant foods (such as soya bean-derived foods) are important protein sources within cultures with restrictions on the consumption of certain animal-protein foods.

Recommendation 7: Dealing with uncertainty

In the 2021 BFAP survey a larger group of uncertain respondents were observed, thus indicative of a need for consumer education regarding the following aspects to inform consumers' knowledge gap in terms of soya allergies, GMO soya beans in South Africa, soya causing flatulence and environmental sustainability. Particularly in developed countries, but also among more affluent consumers in developing countries, are increasingly concerned about the environmental impact of animal-protein foods production, often associated with the increased consumption of plant-source protein foods.

A sustainability index takes the nutrient density as well as the carbon emission of the product into account in order to predict which products emits the least amount of carbon in comparison to the nutrients it contributes to the diet. The development of such an index will assist industry in the implementation of policies and programmes as well as assisting in marketing endeavours and consumer education campaigns

Recommendation 8: Product pricing and affordability

From an affordability perspective, soya-based products are a more affordable alternative compared to other protein-rich foods – especially from animal-source foods. This offers a strong price-based competitive advantage to soya from a consumer perspective, even though a good price alone will not satisfy the complex needs of consumers.

The 2021 BFAP consumer survey investigated consumers' WTP for various soya-food options after being informed about selected health and environmental product benefits of soya. Only the snack bar with soya 'smart' protein revealed a stated price premium (of 11% above the reference price). However, respondents' stated WTP implied a discount to the R100 reference price for beef mince with added soya (12% discount compared to pure beef mince), beef patties with added soya (16% discount compared to pure beef patties), soya patties (19% discount compared to pure beef patties) and soya mince (35% discount compared to an equivalent quantity of pure beef mince). The share of the 2021 BFAP sample willing to pay a premium for soya-based foods ranged between 18% for soya mince to 42% for a snack bar with soya.

Recommendations regarding the health / nutritional role of soya are addressed in the Section 2.3.2.

The South African soybean industry operates in a complex, dynamic, competitive and globalised environment. Survival and growth in this competitive environment, particularly in the soy product market for human consumption, requires a high level of skills and knowledge (including understanding consumers in the target market), entrepreneurial innovation, and the development and adoption of new technologies.

3. Summary of research findings

3.1 Research with a supply-chain wide focus

3.1.1 'An overview of derived soy products used for human consumption in South Africa'

In 2020 BFAP conducted a study to better understand the derived soya industry with a specific focus on soya consumed by humans. The study was based on secondary data, observations and discussions with industry experts (specifically soya crushers, producers of soya bean products and importers of soya proteins). The report covered the following topics:

- Main reasons for the growing popularity of soya-based foods.
- The South African soyabean value chain with specific attention to soyabean production, processing, trade and final products.
- Consumption of soya-based products.
- Soybean crushing and manufacturing for the human market.
- Trade of soya proteins for the human market.
- Situation analysis of soyabeans for human consumption.

Sections 3.1.1.1 to 3.1.1.4 present a summary of the findings.

3.1.1.1 Introducing derived soya products

- The main soy derivative products produced for the human food market are full fat soyabean meal, white flakes (defatted soyabean meal), textured vegetable protein (TVP), soya concentrates, soya isolates and soya oil.
- Full fat soybean meal is used to increase the protein content of blended breakfast cereals.
- White flakes and TVP are typically used as meat analogues, as absorption agents and extenders to increase the protein content. TVP can also be added to meals to increase the protein content of the meal. Other applications in South Africa include processed meats, cold meats, soy mince, soymilk, other beverages such as smoothies, milkshakes, yoghurt, infant formulas, baked goods, bread flour, baked good pre-mixes, porridges, soups, sauces, nutritional shakes, and meal replacers.
- Concentrates (90% protein with sugars removed) and isolates (90%+ protein with sugar and fibre removed) are generally used to enhance the protein levels in products such as breakfast's cereals and health supplements.
- The report described a wide range of commonly consumed soya-based products and their uses including non-fermented soya foods (e.g. soya milk, tofu, soya sprouts, soya film, edamame and roasted soybeans), fermented soya foods (e.g. miso, tempeh, soya sauce, natto), products derived from the soya oil fraction (e.g. soyabean oil and lecithin) and products derived from the soya meal fraction (e.g. soyabean meal for animal feed, defatted soyabean flours and grits, extrusion-textured soyabean protein, textured soya protein and soya fibre).
- Table 3.1 presents examples of different types of soya found in food.

Table 3.1: Different types of soya in the food aisle

(Source: Schönfeldt et al., 2021)

Soya-based ingredient:	Food products	Function
Lecithin	Baked goods (wafer cookies), milk powder, baby formula, chocolate spread, hard candies, chocolates and sweets	Natural form of emulsifier in food Can improve texture as well as shelf life Assist in mixture of sugar, fats and oil, prevents greasiness and graininess
Bean	Mince, burger mix, beef wors, pork bangers, breakfast cereal (Pronutro, Future Life)	Meat extender and replacer as it has similar textural properties and is an excellent source of protein
Vegetable protein (reconstructed / hydrolysed)	Polony, beef burger patties, pies, soup powder, peanut butter, fish spread	Meat extender and replacer as it has similar textural properties and is an excellent source of protein Assists in the emulsification process
Flavourings	Instant pasta, maize chips (Doritos)	Gives meaty flavour to products and aids in emulsification
Flour	Coating, baked goods (Tinkies)	Improves texture and flavour to baked goods

3.1.1.2 The South African soyabean value chain

The South African soybean value chain (see Figure 3.1) involves a complex combination of key players and processes to move the soybean from seed to feed or from seed to food for human consumption and furthermore the soyabean value chain is also linked to. What makes the soybean value chain even more complex is that it also linked into many other value chains such as livestock value chains, food value chains as well as textile and industrial value chains.

The report describes more detail regarding the following value chain nodes: soyabean production, processing (crushing), trade and soyabean final products:

- **Soyabean production:**
Dominated by commercial production of GM soyabeans, with growth driven by investment in crushing capacity over time. Production volumes over time included in original report.
- **Soyabean processing:**
The report presents information on the largest crushing plants and plants producing soya oil (with estimated crushing market shares), data in total human consumption of soya over time.
Over the past decade, there has been a rapid growth in South Africa's soybean crushing capacity due to the investments made in pursuing the governmental import replacement strategy (Figure 1.1 in Section 1). In 2020, South Africa crushed a total of 1 230 399 tons of soybeans compared to 406 900 tons 10 years ago – representing a 202% increase over 10 years. According to industry discussions, two crushing plants account for approximately 90% of the soybeans destined for the human market.
- **Soyabean trade:**
The report presents information on soyabean imports and exports in terms of trading partners and volumes traded over time. Despite the increasing soybean production levels over time, South Africa still imports soybeans to satisfy oilcake demand from the animal feeds sector - driven by increases in the demand for high protein food, specifically meats, within the growing middle class and more affluent market segments. In 2020, soybean imports amounted to 62 063 tons, mainly originating from Brazil (88.9%), followed by Zambia (6.7%), Mozambique (2.6%) and Malawi (2.1%). South Africa generally exports small amounts of soybeans, mainly to neighbouring African countries (e.g. Botswana (63.1%), Mozambique (34.8%), Lesotho (1.1%), Eswatini (0.8%) and Zimbabwe (0.2%), in 2020). Aside from whole soybeans, South Africa, at times, also imports soybean oil cake for the animal feeds market. TVPs, soy protein concentrates, and soy protein isolates, mainly destined for the food market, are also imported.

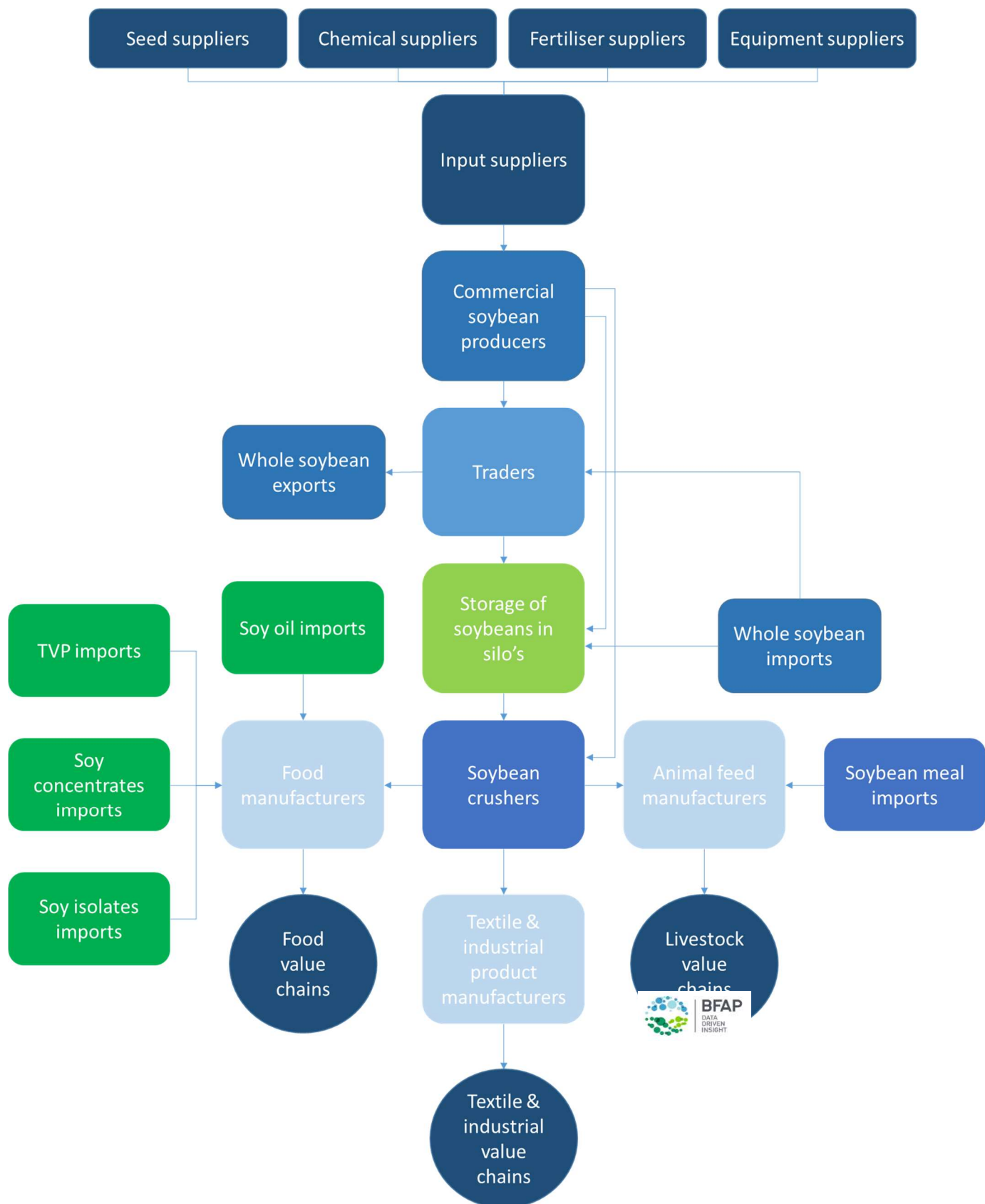


Figure 3.1: The South African soyabean value chain

- *Soyabean final products:*
Less than 2% soyabeans crushed in South Africa are destined for the human market either as white flakes or as TVPs to be used in food value chains. The report presents information on product yields, product

prices, industry role-players using white flakes and TVP's, as well as role-players using imported (usually non-GM) soya derivatives such as full-fat soyabean meal, isolates and concentrates.

According to industry discussions one ton of soybeans yield 180kg oil, 630kg white flakes, or just over 500kg TVP. In January 2021, industry experts reported the price of white flakes as between R8.50 and R10/kg, the price of TVPs at R35/kg, the price of soy concentrates at R48/kg and the price of isolates at R50/kg. Soy derivatives such as full-fat soybean meal, isolates and concentrates used in the South African food manufacturing sector are imported either because the market demands non-GMO products or because the specific soy derived product is not produced in South Africa.

3.1.1.3 Consumption of soya-based products

Consumption motivations of soya-based products include the following:

- Health benefits, for example: low content of saturated fat, a high content of polyunsaturated fats, a high content of omega 3 and 6 fatty acids, contains no cholesterol, is a good source of fibre, high protein content, has a lower glycaemic index and anti-cancer properties. The consumption of soya-based snacks is often based on health and convenience motivations.
- Cost considerations: Less expensive (per gram of protein in the food item) compared to meat and eggs, thus being a cost-effective protein substitute for lower-income consumers.
- Convenience: Less perishable than meat and can be stored in low-income homes with lacking cold-storage facilities.
- Religious or dietary restrictions on certain animal products.
- Sustainability considerations: Some degree of replacing animal-source protein foods with plant-source protein foods based on health and/or sustainability considerations.
- Consumer benefits of soya oil, for example: (i) Clean and neutral taste and smell, (ii) is adaptable because of its high emulsifying ability, (iii) is ideal for frying, baking, confectionery, shortening and margarine, (iv) provides vitamin E and essential fatty acids, and (v) is cholesterol free, low in polyunsaturated fat, trans-fat free, and low in hydrogenated fat.
- It is also important to note that many consumers are not aware that they are consuming food products fortified or supplemented with soya-based products, or containing ingredients derived from soya beans.

The affordability of soya-based foods compared to animal-source foods:

- Soy-based products are a more affordable alternative compared to other protein-rich foods from animal sources.
- For example (in April 2021) the estimated cost of a single serving (SS) of cooked soya beans was R1.40, a SS of soya mince R1.90, a SS of eggs R4, a SS of canned pilchards in sauce R5, a SS of IQF chicken R8 and a SS of lean beef mince R13.

International demand:

- In the section on 'Consumption of soya-based products' the report presents an overview of international demand for soya food products pointing out the dominant role of Asia pacific (e.g. countries like China, Indonesia and India) and European countries like Germany and France.

Soya foods available in South Africa:

- Locally produced: Mainly flavoured soya mince made from TVP (targeting low-income consumers) and soy concentrates added to processed meats (e.g. polony, viennas, hamburger patties) and butcher meat (e.g. mince and sausages) as meat extenders to improve protein levels while improving the consumption experience.
- Increase in the high-value soya-based product offering in the fresh, frozen and dairy aisles of retail stores, mainly driven by motivations such as health, sustainability and/or animal welfare concerns – part of the growing popularity of vegetarianism and to a larger extent flexitarianism. These products are often imported or manufactured from important soya-based ingredients. Product examples observed in South African retailers:

- 'Fresh' (non-frozen) products: e.g. plant-based mince, nuggets and patties (made from wet TVP if soya-based, but often pea protein-based) displayed in fridges in either the meat section or the vegetable section of stores - imported mainly from the Netherlands.
- The frozen soya products: e.g. patties, nuggets, sausages and mince, produced in South Africa with imported soy products (mainly concentrates) from Argentina, China or European countries.
- Plant-based milk alternatives: e.g. soya milk mainly imported from Europe.

3.1.1.4 Industry situation analysis – applying Porter's five forces model to TVP production

(1) Threat of new entrants: (Low to medium impact)

The soybean crushing industry in South Africa is highly competitive, with high barriers to entry due to the high capital investments required at the processing stage of the value chain as well as adherence to regulations in terms of food safety and hygiene standards. The threat of new soybean crushers entering the soy for human consumption market is relatively low. However, the threat of existing crushers expanding their operations to also produce soy for the human market is relatively higher, since expansion into the human market supports crushing margins significantly.

(2) Bargaining power of suppliers: (Medium to high impact)

The two biggest soybean crushers for the human market, receive revenues from animal feed and food value chains. Although many alternatives for TVPs exist in the form of animal proteins, legumes, canned fish, eggs, and dairy products, TVPs remain the cheapest protein alternative, and not many substitutes can compete on price per gram of protein. The buyers of TVPs, however, do not incur high switching cost and therefore often switch between suppliers.

(3) Bargaining power of buyers: (High impact)

The three primary buyers of TVPs in South Africa are known to often switch between the two main crushers for the human market. These companies' products are also standardised and of similar quality, which means competition is high between the two crushers to close sales. Compared to the bargaining power of suppliers, the bargaining power of the buyers is higher.

(4) Threat of substitute products: (Low impact)

There are no substitutes for TVPs at similar prices, but rivalry between role players remains high as there are only a few local buyers of TVPs in South Africa. The competitive pressure supports continuous improvement in product quality and consumer satisfaction.

(5) Rivalry among industry role-players: (High impact)

Given limited product differentiation or expansion to other markets to increase the number of buyers, rivalry in the production of TVPs for human consumption is expected to remain high.

3.2 Soya within the National School Nutrition Programme

The South African National School Nutrition Programme (NSNP) is a government programme that provides two nutritious meals to learners in less affluent primary and secondary schools throughout the country, to improve their ability to learn. Soya mince (Textured Vegetable Protein products) is served as a key protein source in the NSNP.

3.2.1 'The role of soya in the South African National School Nutrition Programme'

The main **project objective** was to investigate the role of soya in the NSNP. The research addressed the following specific objectives:

- To investigate the utilisation of the product at a selection of schools.

- To develop and test new recipes for use in the NSNP in an attempt to increase learner's acceptability of the product.

The **methodology** involved four phases. The literature review (Phase 1) focused on four main components: International school feeding schemes, the South African NSNP, current soya recipes in the NSNP and soya suppliers to the NSNP. The researchers also visited three secondary schools in Gauteng where semi-structured interviews were conducted with the school principals and the NSNP coordinators (Phase 2). The outcomes of Phases 1 and 2 were applied to develop four new recipes that could potentially be more appealing to school going children (Phase 3). In Phase 4 the developed recipes were tested using a sensory panel to evaluate their acceptability in comparison to soya as currently served in the NSNP. The sensory evaluation involved 100 university students aged 18 to 21 years old, screened with selected home languages (Ndebele, Northern Sotho, Sotho, SiSwati, Tsonga, Tswana, Venda, Xhosa and Zulu).

Summary of research findings:

- For literature-based information on international school feeding schemes, the South African NSNP, current soya recipes in the NSNP and soya suppliers to the NSNP please refer to Section 6.1 of the original research report.
- School visits:
 - Personnel and product procurement: Similarities were observed in terms of the structure of personnel responsible for the NSNP, food preparation facilities, a lack of dining infrastructure and the food supply process. Not all schools used the same soya suppliers.
 - Recipes applied: The schools follow the same general menu guidelines as set out by the GDE (e.g. soya meal on Fridays), but each school has created their own recipe and moved away from the prescribed methods and recipes as supplied in an effort to increase product acceptability.
 - Food waste: In an attempt to make the soya more appealing to the learners the kitchen staff sieves the soya to eliminate some of the powder. This leads to food waste as a large percentage (50%-60%) of the food is not used. It is unclear exactly what happens to the powder, but it is assumed that it is disseminated between the volunteers and taken home.
 - Product dislike: All the schools reported that the learners do not enjoy the soya meal for reason such as taste dislike, a lack of flavour / spices in the soya meals, the 'sludge-like' texture, unappealing appearance and it not being 'cool' to eat soya. Thus, across schools the consumption of the soya meals is low and even the food preparation workers reported that they do not want to eat it.
 - Product knowledge gaps: From a product knowledge perspective none of the workers knew what soya is, implying a gap for consumer education.
- New recipe development and sensory testing:
 - Four new soya-based recipes were developed: Beef Bolognese [**BB**], Chicken Curry [**CC**], Chili con Carne [**CCC**] and one pot Biryani [**OPB**] – with recipes described and adjusted to serving 50 / 100 / 200 / 500 / 1000 people. Recipe formulation was based on students' preferences and the schools' available resources.
 - Respondents' awareness and past exposure to the NSNP? Just over half (54%) of respondents knew about the NSNP, and about two thirds (69%) of the 'aware' respondents consumed soya meals as part of the NSNP in the past.

- Overall enjoyment / liking (sorted most to least liked with average liking rating out of 7¹ in () brackets):
 - [CCC] (5.5) > [BB] (5.2) > [OPB] (5.0) > [CC] (4.3) > Original soya NSNP meal [OM] (3.2).
- Willingness to consume: (sorted most to least willing to consume with average willingness rating out of 5² in () brackets):
 - [BB] (4.1) > [CCC] (4.0) > [OPB] (3.6) > [CC] (3.3) > [OM] (2.3).
 - % of sample 'definitely willing to eat': [BB] (approximately 50%) > [CCC] (approximately 40%) > [OPB] (approximately 30%) > [CC] (approximately 25%) > [OM] (approximately 2%).
- Resemblance to dish made with meat: (sorted from highest meat resemblance to lowest meat resemblance, with scale ranging from (1) 'Strongly disagree that there is a meat resemblance' to (7) 'Strongly agree that there is a meat resemblance', with average agreement rating out of 7 in () brackets):
 - [BB] (5.5) > [CCC] (4.9) > [OPB] (4.5) > [CC] (4.1) > [OM] (3.7).
- Respondents' favourite starch-rich food:
 - Rice (54% ranked product in most preferred position) > Pasta (32% ranked product in most preferred position) > Pap (maize) (14% ranked product in most preferred position while 67% ranked the product as third choice).
 - Rice was thus the most preferred starch-rich food and also part of the most popular meals – the Beef Bolognese Soya Mince meal and the Chili con Carne Soya Mince meals which are served with rice. Although maize porridge (pap) is the most frequently consumed food in South Africa, two thirds of the students indicated that pap was only their third choice.

3.2.2 'Building an evidence base for soya served in the National School Nutrition Programme'

The **project objective** was to evaluate the compliance to guidelines by the suppliers as set out by the DBE for Soya mince (Textured Vegetable Protein products) served in the NSNP.

The **methodology** involved the laboratory analysis of six soya products (n=5 vendors of soya mince to NSNP; n=1 supplier of soya chunks to vendors) supplied to be served in the NSNP, to evaluate adherence to guidelines in terms of energy, protein, carbohydrates, fat, dietary fibre, sodium and the percentage of soya in the product.

Summary of research findings:

- Table 3.2 presents an overview of the research findings.
- The best adherence to guidelines were observed for:
 - Fat and dietary fibre (5/5 soya mince samples & soya chunks adhered to guidelines).
 - Moisture content (4/5 soya mince samples & soya chunks adhered to guidelines).
- The worse adherence to guidelines / recommendations were observed for:
 - Sodium (none of the soya mince samples adhered to guidelines).
 - Energy content (1/5 soya mince samples adhered to guidelines).
 - Protein content (2/5 soya mince samples adhered to guidelines).

¹ Scale: (1) Dislike extremely; (2) Dislike moderately; (3) Dislike slightly; (4) Neither like nor dislike; (5) Like slightly; (6) Like moderately; (7) Like extremely.

² Scale: (1) Definitely will not eat; (2) Probably will not eat; (3) Not sure; (4) Probably will eat; (5) Definitely will eat.

These observations are of particular concern considering the critical nutritional role of adequate energy and protein intake for growing children, as well as the negative health impacts of excessive sodium intake.

- Even though meat does not contain carbohydrates, meat alternatives like soya mince do contain carbohydrates derived from the carbohydrates in the soya beans. The DBE does not specify guidelines for the carbohydrate content of soya mince for NSNP, however observed values differed from label claims for four of the five soya mince samples.
- The DBE does not state a quantitative guideline for the percentage of soya in the soya mince for the NSNP, only stating “The SPP shall remain the main ingredient of the final product”. Only one of the soya mince samples had a soya content of higher than 50%, with all samples below the recommendation level of 70% mentioned by the report authors.
- Discrepancies between nutrition values claimed on product labels and observations occurred within all nutritional components and within all product samples – raising questions regarding the trustworthiness of the nutritional claims of the sampled products.
- All the different soya products had different cooking guidelines to prepare the soya, resulting in a cooked product with a “slush-like” consistency. The report states that “this is an unappealing meal and is most likely the reason for low consumption of food on days that soya is served in the NSNP”.

Table 3.2: Summary of findings – ‘Building an evidence base for soya served in the National School Nutrition Programme’

Component:	DBE guideline:	Observations range:	Guideline adherence:	Discrepancy between product label claim and observation value
Energy	1365 kJ/100g	1232 to 1454 kJ/100g	Only one of the five soya mince products adhered to the guideline.	Observed values were lower than values claimed on product labels for three of the soya mince products.
Protein	24g/100	Soy mince: 21.2 to 28.2 g/100g Soy chunks: 47.6 g/100g	Only two of the five soya mince products and the soya chunks adhered to the guideline.	Observed values were lower than values claimed on product labels for four of the five soya mince products.
Carbohydrates	Not specified	42.8 to 50.9 g/100g	Not applicable.	Observed values were lower than values claimed on product labels for two of the five soya mince products, as well as for the soya chunks. Observed values were higher than values claimed on product labels for one of the five soya mince products.
Fat	Less than 10% from other sources than soya protein product or poly unsaturated vegetable oil	2.3 to 7.8 g/100g	All the soya mince products and the soy chunks adhered to the guideline.	Observed values were lower than values claimed on product labels for three of the five soya mince products. Observed values were higher than values claimed on product labels for one of the five soya mince products.
Dietary fibre	4 g/100	Soya mince: 8.0 to 8.6 g/100g Soya chunks: 17.8 g/100g	All the soya mince products and the soy chunks adhered to the guideline.	Observed values were lower than values claimed on product labels for four of the five soy mince products, as well as for the soya chunks. Observed values were higher than values claimed on product labels for one of the five soya mince products.
Sodium	< 1500 mg/100g	Soya mince: 1798 to 3220 mg/100g	None of the soya mince products adhered to the guideline.	Observed values were higher than values claimed on product labels for all of the soya mince products.
Moisture	< 9 g/100	6.6 to 9.8 g/100g	Four of the five soya mince products and the soya chunks adhered to the guideline.	Not addressed in report
Percentage of soya in pack	No official DBE guideline, but a ratio of 70:30 soya to additives is mentioned in the report.	41% to 53% for the soya mince products, 100% for the soya chunks.	None of the soya mince products adhered to the suggested ideal value of 70% soya.	Not addressed in report

3.3 Consumer research

3.3.1 Overview of consumer research projects covered in the synthesis report

In this section the research findings from two industry-funded consumer studies focusing on soya and South African consumers are presented:

- Project 1: 'Developing soya beans as a modern food commodity - Consumer trends in the soya market of South Africa' (Muller et al., University of Pretoria, 2017)
- Project 2: 'Consumers' soya consumption behaviour, knowledge and perceptions' (Vermeulen, BFAP, 2021)

Scope overview of Project 1: 'Developing soya beans as a modern food commodity - Consumer trends in the soya market of South Africa' (University of Pretoria, 2017):

The project objective was to conduct a review of the South African soyabean industry along with the supply and demand of soya in the South African market. The report coverage included literature-based information on the South African soya bean industry (see Section 4 of the Muller et al., (2017) report), the South African consumer landscape (see Section 4.1 of the Muller et al., (2017) report), unfavourable consumer aspects of soya (see Section 4.1.1 of the Muller et al., (2017) report), the South African National School Nutrition Programme (see Section 4.2 of the Muller et al., (2017) report), the nutritional value of soya in terms of macronutrients, micronutrients and protein quality (see Section 5 of the Muller et al., (2017) report), soya and sustainable agriculture (see Section 6 of the Muller et al., (2017) report). A description of soya-based products and ingredients was also included based on a combination of a market investigation and literature sources (see Section 7 of the Muller et al., (2017) report).

The consumer survey results were presented (see Section 8 of the Muller et al., (2017) report) and is summarised in Section 3.3 of this report. The study involved 100 respondents reached through an online convenience sample survey. The sample consisted of respondents from the following age groups: 18-24 years 4%; 25-34 years 28%; 35-44 years 14%; 45-54 years 20%; 55-64 years 22%; 65 years and older 12%. In terms of ethnic composition, the sample was strongly dominated by white respondents (87%) with the remainder of the sample consisting of: African/Black 5%; Coloured 1%; 'Prefer not to answer' / Unknown 7%. A gender split of 50/50 was applicable to the sample. The income / socio-economic level characteristics of the sample was not included in the 2017 report. Results were presented for the total aggregate sample with no sub-group comparisons reported.

Scope overview of Project 2: 'Consumers' soya consumption behaviour, knowledge and perceptions' (BFAP, 2021):

BFAP was contracted by the Oilseeds Advisory Committee (OAC) to investigate South African consumers' knowledge and perceptions regarding selected soya products, to inform marketing and future growth recommendations.

The consumer research project covered the following aspects:

- Identification of most commonly consumed (i.e. most popular) soya-based foods.
- Typical intake frequencies of a wide range of soya-based foods.
- Relative importance of different purchase factors when buying soya-based foods.
- Low-income, middle-income and affluent consumers' knowledge regarding soya-based foods:
 - Product containing soya or soya-derived ingredients; Health / nutritional benefits.
- Low-income, middle-income and affluent consumers' perceptions regarding soya-based foods:
 - Origin (locally produced versus imported); Consumption of textured vegetable protein (TVP) as a meat substitute / extender; Product preparation (preparation knowledge, cooking ease); Sensory appeal (taste, smell, texture); Affordability and related product images; Convenience; Environmental sustainability; Genetically modified soya; Health (role in a healthy diet, food allergies and other negative consumption consequences).
- Stated willingness to pay (WTP) for selected products after creating awareness of certain health benefits of soya: Beef mince with added soya; Burger patties made from a combination of beef and soya extract;

Vegetarian soya-based burger patties; Healthy snack bar containing soya-based 'smart protein'; Soya mince.

- For which soya-based foods would consumers like to see product improvement and product innovation?
- How can the eating experience of soya mince be improved?
- What would motivate consumers to eat more soya-based foods?
- Formulation of marketing and future growth recommendations.

In August and September 2021, a sample of 121 low-income consumers and 125 middle-income consumers were interviewed (one-on-one facilitated personal interviews in the larger Gauteng area based on an online Microsoft Forms survey instrument), while a sample of 135 affluent consumers completed the survey online (non-specific geographical location). The sample had the following demographic characteristics:

- Gender of respondent: 71.3% females and 28.7% males. The dominance of females was expected given their traditional more prominent role in food purchasing and preparations within households.
- Age of respondent: 18-34 years 38.6%, 35-64 years 48.2% and 65 years and older 13.2%. The age distribution of the sample compared well to population characteristics.
- Ethnic group of respondent: African/Black 70.6%, Coloured 7.2%, White/Caucasian 14.7%, Indian 7.5%. The total sample contained a slightly lower percentage of African and Coloured respondents, as well as a slightly higher percentage of White and Indian respondents compared to population statistics.
- The average household size in South Africa was 3.4 people in 2019 (Stats SA General Household Survey, 2019), comparing well with the sample average of 3.5 people.

Results were presented for the total aggregate sample with sub-group comparisons in terms of socio-economic sub-groups, ethnic sub-groups and age sub-groups reported.

Additional (literature-based) research on soya and South African consumers included in this report:

Article 1: Bosman, M.J.C., Ellis, S.M., Bouwer, S.C., Jerling, J.C., Erasmus, A.C., Harmse, N. & Badham, J. 2009. South African consumers' opinions and consumption of soy and soy products. *International Journal of Consumer Studies*. Volume 33(2009):425–435.

- Study objective: To assess South African consumers' opinions and beliefs regarding the health benefits of soy and soy products using different statements.
- Consumer target group: National sample (n=2437).

Article 2: Bosman, M.J.C., Ellis, S.M., Jerling, J.C., Badham, J. & Van der Merwe, D. 2011. South African consumers' opinions and beliefs regarding the health benefits of soy and soy products. *International Journal of Consumer Studies*. Volume 35 (2011):430–440.

- Study objective: To assess South African consumers' opinion of soy and soy products through different statements on consumption, taste, protein value and healthiness.
- Consumer target group: National sample (n=2437).

Article 3: Duvenage, S.S., Oldewage-Theron, W.H. & Egal, A.A. 2012. Acceptance of home-prepared soy dishes in low-income rural Qwa-Qwa communities. *International Journal of Home Economics*. Volume 5, no 2: 151-166.

- Study objective: To test acceptance of home-prepared soy dishes among low-income households with home-grown soy beans.
- Consumer target group: Low-income households in rural Qwa-Qwa (Free State province) communities (n=101).

Article 4: Oldewage-Theron, W. & Egal, A.A. 2012. Impact of a soy nutrition education programme on knowledge in a low-income community in Qwa-Qwa, South Africa. *International Journal of Consumer Studies*. Volume 36(2012):480-485.

- Study objective: The objective of this study was to measure the knowledge of the South African food-based dietary guidelines (FBDG), as well as of soy gardening and uses of soy, before and after a nutrition education training programme.

- Consumer target group: Low-income community (caregivers in households) in Qwa-Qwa (Free State province), South Africa (n=75).

Article 5: Szejda, K., Stumpe, M., Raal, L. & Tapscott, C.E. 2021. South African consumer adoption of plant-based and cultivated meat: A segmentation study. *Frontiers in Sustainable Food Systems*. Volume 5 (2021). <https://www.frontiersin.org/articles/10.3389/fsufs.2021.744199> .

- Study objective: To assess consumer adoption of plant-based and cultivated meat in South Africa.
- Consumer target group: National sample of South African consumers representative across age, gender, race and income levels (n=959).

3.3.2 Synthesis of finding: South African consumer research on soya foods

3.3.2.1 Most popular soya-based foods

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.1 in Appendix 1

The most popular soya-based food was soya mince / toppers (listed as ‘popular’ by 62% of respondents), followed by soya beans (21%), ProNutro (16%), soya milk (14%), Future Life (14%), soup powder (13%), sausage (9%), patties (6%) and oil / margarine (5%). The popularity of product such as soya beans, soup powder and soya-based oil / margarine decreases with rising socio-economic status. More expensive products such as soya milk, ProNutro and Future Life are more popular among the middle-income and affluent respondents. Socio-economic sub-groups were the best segmentation basis for this component.

(Source: BFAP survey 2021)

3.3.2.2 How often do households typically eat soya / soya-based foods?

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.2 in Appendix 1

In the total weighted sample weekly consumption of soya / soya-based foods dominated (68%), followed by monthly consumption (22%). More frequent intake of soya / soya-based foods is more common among lower income consumers and the Black / African and Coloured sub-groups. The most frequently consumed soya-based foods are soya mince / toppers (consumed at least once a week or more often by 39% of sample), Future Life / ProNutro (41%) and cooked soya beans (24%).

With rising socio-economic status, the intake frequency of more affordable soya-food options decreases, while the intake frequency of more expensive soya-food options increases. Socio-economic sub-groups were the best segmentation basis for this component.

(Source: BFAP survey 2021)

3.3.2.3 The perceived importance of purchase factors when buying soya-based foods

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.3 in Appendix 1

The most important purchase factors pertaining to soya-based foods are taste, smell / aroma, ease of preparation, healthiness / nutritional value, texture, price, colour and naturalness. More intangible soya product attributes such as animal welfare and environmental impact are growing in importance within South Africa, but not ‘mainstream’ yet.

Regarding product origin, the 2021 BFAP study found that most respondents indicated a preference for food produced in South Africa rather than eating food imported from other countries. Thus, local food origin could be a valuable marketing angle for soya-based foods where applicable.

(Sources: BFAP survey 2021; Szejda et al., 2021)

Socio-economic sub-groups were the best segmentation basis for this component. Dominant purchase factors for socio-economic sub-groups (presented in order of importance):

- Low-income consumers: Taste, cooking ease, smell / aroma, price, texture.
- Middle-income consumers: Taste, smell / aroma, cooking ease, healthiness, texture, price.
- Affluent consumers: Taste, healthiness, smell / aroma, cooking ease, texture.

(Source: BFAP survey 2021)

3.3.2.4 Knowledge regarding the health benefits of soya-based foods

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.4 in Appendix 1

- The 2021 BFAP study revealed that 87% of the sample perceived soya as being part of a healthy diet.
- The most well-recognised health / nutritional benefits of soya-based foods were: low in carbohydrates, high in protein, good source of fibre and contains high quality protein (Source: BFAP study 2021). Other studies also confirmed that soya as a good quality protein source is a well-established attribute in consumers' minds.
- The least well-recognised health / nutritional benefits of soya-based foods were: Low GI, anti-cancer properties, high in Omega 3 & 6 fatty acids, high in Vitamin E and cholesterol free (Source: BFAP study 2021).
- The average respondent only selected 3.4 of the 11 possible health / nutrition attributes applying to soya, indicative of lacking knowledge regarding the health attributes of soya (Source: BFAP study 2021).

3.3.2.5 Consumers' perceptions regarding soya-based foods

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.5 in Appendix 1

Consumers were most positive about soya in terms of:

- Product usage: cooking and usage convenience, ease of cooking / preparation, preparation knowledge and role as a meat extended.
- Sensory appeal: taste, texture and smell.
- Cost: affordability.
- Product image: no shame in eating soya, not a poor person's food.
- Healthiness: soya is part of a healthy diet.

In the overall sample respondents were least positive about soya-based food, perceiving the products as less environmentally sustainable than animal-protein foods, causing allergies, being produced from genetically modified soya beans and causing flatulence.

Despite these positive perceptions, 39% of the sample prefer pea-protein based foods to soya-protein based foods, particularly among low-income consumers.

Based on a larger indecisive group of respondents observed, there seems to be a need for consumer education on soya-related topics such as environmental sustainability, allergies, GM crops, flatulence and the differences (sensory and nutritionally) between difference plant-protein sources.

Socio-economic sub-groups were the best segmentation basis for this component. Low-income consumers (followed by middle-income consumers) and African / Black consumers generally revealed the most positive attitude towards soya-based foods.

(Source: BFAP survey 2021)

Considering the addition of soya to animal-source meat products such as mince and sausages, the 2021 BFAP survey showed that consumers' approval (liking) of the concept increased significantly with decreasing socio-economic status, applying to 91% of low-income respondents, 74% of middle-income respondents and 49%

of affluent respondents. After considering soya product benefits (increased palatability and higher protein content), 13% more of the total weighted sample moved into the group approving of the concept, with the most significant increase in approval observed among affluent followed by middle-income respondents.

3.3.2.6 Reasons for not eating soya / soya-based foods

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.6 in Appendix 1

Muller et al. (2017) concluded that taste dislikes, inadequate soya preparation / cooking knowledge and product availability were the dominant reasons preventing consumers from eating soya, with other factors such as allergies, unfamiliarity with product, flatulence and long cooking times also mentioned.

3.3.2.7 Motivating consumers to eat more soya / soya-based foods?

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.7 in Appendix 1

Which factors / product improvements will motivate consumers to eat more soya?

In general, the main improvement factors related to improved taste / flavour, improved affordability, gaining a better understanding of the healthiness of soya, the availability of (new and delicious recipes) and product availability improvement. (Source: BFAP survey 2021).

Socio-economic sub-groups were the best segmentation basis for this component. Even though improved taste / flavour and affordability are widespread motivations to increase soya intake, a significantly larger share of affluent respondents followed by middle-income respondents mentioned the health aspect. (Source: BFAP survey 2021).

For which soya-based foods would consumers like to see product improvement and product innovation?

According to 2021 BFAP survey (in order of importance): soya mince, meat or meat alternatives, soup or soup powder, sausages, burger patties, soya milk, soya beans, bars / snacks / sweets, instant porridge / ProNutro / Future Life and polony.

How can the eating experience of soya mince be improved?

According to the 2021 BFAP survey the main improvements to soya mince relate to flavour / taste, texture, improved consumer awareness and product variety. An interesting suggestion was to add dried vegetables to soya mince.

3.3.2.8 Exploring consumers' willingness to pay for selected products containing soya

NOTE: For a more detailed summary of results from the various consumer studies reviewed, please refer to Section A1.8 in Appendix 1

The 2021 BFAP consumer survey investigated consumers' WTP for various soya-food options, after presenting respondents with the following statement: "Reputable scientific evidence has shown that soya is high in good quality proteins, has anti-cancer properties and it is a good source of fibre. The production of soya products is also more environmentally sustainable than animal-based protein-rich foods."

For a snack bar with soya 'smart' protein, the average respondent was willing to pay a premium of 11%. However, respondents' stated WTP implied a discount to the R100 reference price for beef mince with added soya (12% discount compared to pure beef mince), beef patties with added soya (16% discount compared to pure beef patties), soya patties (19% discount compared to pure beef patties) and soya mince (35% discount compared to an equivalent quantity of pure beef mince).

Among a large representative sample of South African consumers, Szejda et al. (2021) found that only 31% of respondents revealed a high likelihood to pay more for plant-based meat than for animal-based meat. In the 2021 BFAP survey the share of the total sample willing to pay a premium for the various options ranged from 18% for soya mince to 42% for a snack bar with soya.

4. Soya and protein quality

“Protein quality focuses on the relative composition of amino acids present in a protein source compared to a protein pattern than is considered to represent the highest quality protein” (Yu & Fukagawa, 2020). Quality proteins should be readily digestible and contain the essential amino acids in quantities that correspond to human nutritional needs (Boutrif, FAO, date unknown).

A commonly used indicator of protein quality is the Digestible Essential Amino Acid Score (DIAAS). A DIAAS of 1.0 or larger than 1.0 is an indication that the dietary protein would be fully utilised in the human body. Table 4.1 presents the DIAAS values for various foods.

“Even though soya contains all the essential amino acids, which are required in order to be classified as a complete protein, it does not contain these amino acids in the correct ratio, due to the low methionine content of plant products.” (Muller et al., 2018). Soya has a DIAAS of 0.91 with cysteine and methionine as limiting amino acids.

Table 4.1: Protein quality scores for selected foods

(Source: Herreman, et al., 2020)

Protein source:	DIAAS:	Limiting amino acids:
Corn	0.36	Lysine
Rice	0.47	Lysine
Wheat	0.48	Lysine
Fava bean	0.55	Methionine + Cystine
Oats	0.57	Lysine
Rapeseed	0.67	Lysine
Lupin	0.68	Methionine + Cystine
Pea	0.70	Methionine + Cystine
Canola	0.72	Lysine
Whey	0.85	Histidine
Soy	0.91	Methionine + Cystine
Potato	1.0	N/A
Egg	1.01	N/A
Casein	1.17	N/A
Pork	1.17	N/A

“Mixtures of different plant protein sources may be complementary, with one source providing the amino acid that is limiting in another source and *vice versa*, thereby making the mixture of plant proteins 'complete' sources of amino acids. Dietary approaches that combine complementary foods, e.g. a cereal and a legume such as maize and soya beans, will meet protein requirements.” (Muller et al., 2018).

5. Do South African consumer eat adequate quantities of legumes?

The South African Food-based Dietary Guidelines specify “Eat dry beans, split peas, lentils and soya regularly” (Venter et al., 2013). According to consumer guidelines published for the National Nutrition Week in 2012 based on the ‘Guidelines for Healthy Eating’³, a daily serving of dry beans / split peas / lentils / soya is recommended, thus equivalent to approximately 11kg/capita/year on a dried product basis. A single serving consists of, for example, half a cup (approximately 75g) cooked dry beans / lentils / split peas, or 30g dried soya mince.

Figure 5.1 illustrates an analysis of the estimated ideal intake level of legumes in South Africa, contrasted with the estimated human intake of dry beans (according to the Abstract of Agricultural Statistics, 2022) and soya (SAGIS data). No time series data on legumes such as lentils and split peas are available. The analysis illustrates the severe inadequacy of legume consumption in South Africa, with the average gap between ‘ideal’ and actual per capita intake from 2016 to 2021 at an average of 86%, or stated differently: South African consumers should consume approximately seven times more legumes than is currently the case.

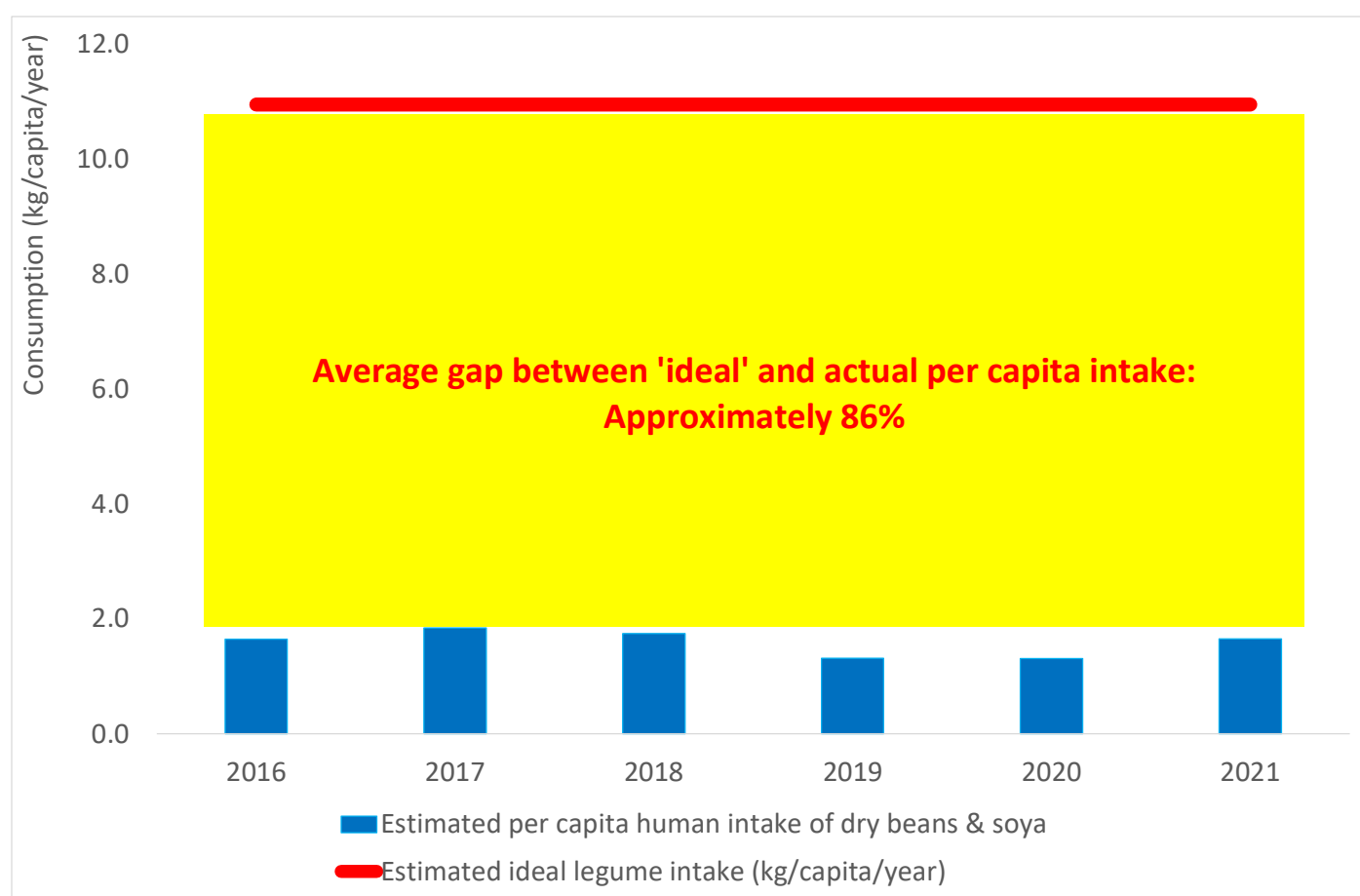


Figure 5.1: Analysing the inadequacy of legume consumption in South Africa

(Source: BFAP calculations based on data obtained from SAGIS and the Abstract of Agricultural Statistics)

³ National Nutrition Week 2012: Information available at <https://www.nutritionweek.co.za/NNW2012/20intro.html>; Source for the Guidelines for Healthy Eating: South African National Department of Health (2013). Guidelines for Healthy Eating Information for nutrition educators. <https://www.nutritionweek.co.za/NNW2014/docs/NNW-2013-Nutrition%20Educators%20Guideline.pdf>

Considering the wide range of food types within the legumes category (dried beans of various types, split peas and lentils in addition to soya) future growth in this product category towards the ideal level (of at least a serving per day) could provide growth opportunities for various legume types.

Currently the per capita human soya intake in South Africa equates to approximately 0.25 servings per capita per week.

Table 5.1 presents market growth estimations (i.e. expansion into the 'yellow zone' in Figure 5.1).

Table 5.1: Market growth potential estimations

(Source: BFAP calculations)

Scenario: Increase in soya consumption		Estimated total soya human consumption if target intake is achieved:
Estimated current intake:	Target intake per week:	
(1) 0.25 servings/capita/week	0.5 servings/capita/week	46 912 tons per annum
(2) 0.25 servings/capita/week	1 servings/capita/week	93 823 tons per annum
(3) 0.25 servings/capita/week	2 servings/capita/week	187 646 tons per annum
(4) 0.25 servings/capita/week	3 servings/capita/week	281 469 tons per annum
(5) 0.25 servings/capita/week	4 servings/capita/week	375 292 tons per annum

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Appendix 1: Findings summary - ‘Consumers’ soya consumption behaviour, knowledge and perceptions’ (BFAP, 2021)

A1.1 Most popular soya-based foods

How familiar are South African consumers to purchase plant-based meat?

According to Szejda et al. (2021) 44% of their sample revealed a high familiarity with plant-based meat, followed by 39% with a medium familiarity and 17% with no familiarity with these foods. Familiarity with plant-based meat generally increased with age, being higher among respondents aged 28 years and older. However, this survey focused on plant-based meat in general, not specifying the type of plant protein.

How likely are South African consumers to purchase plant-based meat?

According to Szejda et al. (2021) 59% of respondents indicated a high likelihood to purchase plant-based meat, with a higher likelihood among respondents aged 18 to 41 years. Overall, only 7% of the sample indicated ‘no likelihood’ of purchasing plant-based meat, particularly among Generation X respondents (aged 42 to 61 years) with 9%. Note that this survey focused on plant-based meat in general, not specifying the type of plant protein.

Most popular soya-based foods in general? (BFAP survey, 2021)

The most popular soya-based food (i.e. mentioned by the largest number of respondents) was soya mince / toppers (62% of respondents), followed by soya beans (21%), ProNutro (16%), soya milk (14%), Future Life (14%), soup powder (13%), sausage (9%), patties (6%) and oil / margarine (5%).

Most popular soya-based foods among socio-economic sub-groups? (BFAP survey, 2021)

- Socio-economic sub-groups were the best segmentation basis for this component.
- Soya mince / toppers dominate for all the socio-economic sub-groups, being significantly more important among middle-income consumers, followed by low-income consumers (See Table A1.1).
- The popularity of product such as soya beans, soup powder and soya-based oil / margarine decreases with rising socio-economic status.
- The popularity of product such as soya milk, ProNutro and Future Life are significantly higher among the middle-income respondents, followed by the affluent respondents.

Table A1.1: Most popular soya-based foods among the socio-economic sub-groups (BFAP, 2021)

Low-income sample (n=121)	Middle-income sample (n=125)	Affluent sample (n=135)
(% of sub-group mentioning product)		
<u>Soya mince / toppers</u> (65%)	<u>Soya mince / toppers</u> (72%)	<u>Soya mince / toppers</u> (38%)
<u>Soya beans</u> (35%)	ProNutro (27%)	<u>Future Life</u> (19%)
<u>Soup powder</u> (17%)	<u>Future Life</u> (25%)	<u>Soya milk</u> (18%)
<u>Oil / margarine</u> (9%)	<u>Soya milk</u> (21%)	ProNutro (17%)
<u>Soya milk</u> (6%)	<u>Soya beans</u> (15%)	<u>Sausages with soya</u> (15%)
<u>Pro Nutro</u> (5%)	<u>Sausages with soya</u> (14%)	<u>Patties with soya</u> (13%)
	<u>Soup powder</u> (13%)	<u>Snack bars with soya</u> (8%)
	<u>Patties with soya</u> (7%)	<u>Soya beans, snacks with soya & soya sauce</u> (7% each)
	<u>Polony & Snacks</u> (6% each)	

Note: Underlined items indicate that a higher % of respondents in the sub-group indicated the item as a popular soya-based food.

Most popular soya-based foods among ethnic sub-groups? (BFAP survey, 2021)

- Soya mince / toppers dominate for all the ethnic sub-groups, being significantly more important among the Indian and Coloured respondents.

Table A1.2: Most popular soya-based foods among the ethnic sub-groups (Source: Survey results)

African / Black (n=243)	Coloured (n=29)	White / Caucasian (n=77)	Indian (n=31)
(% of sub-group mentioning product)			
Soya mince (58%) <u>Soya beans</u> (28%) Soya milk (19%) <u>Future Life</u> (18%) <u>ProNutro</u> (17%) <u>Soup powder</u> (12%) Sausage with soya (7%) Patties (6%)	<u>Soya mince</u> (79%) <u>ProNutro</u> (21%) Future Life (10%) <u>Soya milk</u> (10%) <u>Soup powder</u> (10%) Sausage with soya (10%) Bars (7%) Polony (7%)	Soya mince (39%) ProNutro (14%) <u>Sausage with soya</u> (14%) <u>Future Life</u> (13%) <u>Patties with soya</u> (10%) Soup powder (9%) Bars & sauce (8%) Snacks & bread (7%) <u>Oil / Margarine</u> (5%)	<u>Soya mince</u> (84%) <u>Sausage with soya</u> (29%) <u>Patties with soya</u> (19%) ProNutro (13%) <u>Soya milk</u> (13%) Future Life (7%) Soup powder (7%) <u>Oil / Margarine</u> (7%) <u>Bread with soya</u> (7%)

Note: Underlined items indicate that a higher % of respondents in the sub-group indicated the item as a popular soya-based food.

A1.2 How often do households typically eat soya / soya-based foods?

Typical intake frequency of soya / soya-based foods?

According to the BFAP (2021) survey:

- In the total weighted sample weekly consumption of soya / soya-based foods dominated (68%).
- More frequent intake of soya / soya-based foods is more common among lower income consumers and the Black / African and Coloured sub-groups.

Table A1.3: Typical intake frequency of soya / soya-based foods

Focus:	Group:	Typical soya food intake frequency:			
		Weekly	1 to 3 times /month	Occasionally	Never
Total sample	Total sample (BFAP, 2021)	68%	22%	9%	1%
Socio-economic sub-groups	Low-income consumers (BFAP, 2021)	76%	17%	7%	0%
	Middle-income consumers (BFAP, 2021)	66%	21%	13%	0%
	Affluent consumers (BFAP, 2021)	64%	27%	8%	1%
Ethnic sub-groups	African/Black consumers (BFAP, 2021)	72.4%	19.3%	8.2%	0.0%
	Coloured consumers (BFAP, 2021)	69.0%	17.2%	13.8%	0.0%
	White consumers (BFAP, 2021)	63.6%	23.4%	10.4%	2.6%
	Indian consumers (BFAP, 2021)	45.2%	41.9%	12.9%	0.0%

Note: Bold red indicates sub-groups with most frequent soya food intake

Typical intake frequency of specific soya / soya-based foods:

According to the BFAP (2021) survey:

- Socio-economic sub-groups were the best segmentation basis for this component.
- The most frequently consumed soya-based foods are soya mince / toppers (consumed at least once a week or more often by 39% of sample), Future Life / ProNutro (41%), cooked soya beans (24%), snack bars with soya (14%), soya milk (18%) and vegetarian meat alternatives (13%), while only 2% of respondents consumed tofu at least once a week.
- With rising socio-economic status, the intake frequency of more affordable soya-food options such as cooked soya beans and soya mince / toppers decreases, while the intake frequency of more expensive soya-food options such as soya milk, vegetarian meat alternatives, Future Life / ProNutro and snack bars with soya increases (see Table A1.4).

Table A1.4: Most frequently consumed soya-based foods among the socio-economic sub-groups (Source: BFAP, 2021)

Low-income sample:	Middle-income sample:	Affluent sample:
Soya mince / toppers (69%)	Future Life, ProNutro (52%)	Future Life, ProNutro (50%)
Cooked soya beans (36%)	Soya mince / toppers (34%)	Soya milk (21%)
Future Life, ProNutro (18%)	Cooked soya beans (24%)	Snack bars with soya (21%)
Soya milk (12%)	Soya milk (21%)	Soya mince / toppers (18%)
Vegetarian meat alternatives (6%)	Vegetarian meat alternatives (20%)	Cooked soya beans (14%)
Snack bars with soya (2%)	Snack bars with soya (17%)	Vegetarian meat alternatives (14%)

Note: Percentage in brackets – share of sample with weekly consumption of food item

The most frequently consumed soya-based foods among the ethnic sub-groups were:

- African / Black respondents: soya mince / toppers, Future Life / ProNutro and cooked soya beans.
- White respondents: Future Life / ProNutro and snack bars with soya.
- Coloured respondents: Future Life / ProNutro, soya mince / toppers and snack bars with soya.
- Indian respondents: Future Life / ProNutro, soya mince / toppers and vegetarian meat alternatives.

The Mullet et al., (2017) survey also explored the question: How often do you think can soya be consumed? Most of the sample (74%) perceived that soya can be consumed weekly to daily. Almost a fifth of the sample did not know the answer to this question, suggesting a role for consumer education regarding the ideal frequency of soya intake.

A1.3 The perceived importance of purchase factors when buying soya-based foods

According to the BFAP (2021) survey the most important purchase factors pertaining to soya-based foods are taste (perceived as ‘important’ by 96% of the sample), followed by smell / aroma (88%), cooking ease (86%), healthiness (85%), texture (81%) and price (74%), while colour (64%) and naturalness (60%) are least important. Szejda et al. (2021) found that the most desired product characteristics of plant-based meat (presented in order of importance) are taste, better nutrition, easy to prepare, fits with usual meals and texture – thus showing significant overlap (in terms of the importance of taste, healthiness/nutritional value, cooking ease and texture) with the results from the BFAP (2021) study.

Table A1.5: The most important purchase factors among socio-economic sub-groups (Source: BFAP, 2021)

Product attribute:	Low-income sample:	Middle-income sample:	Affluent sample:
	% Of sub-sample perceiving attribute as ‘important’		
Taste	97% (1)	98% (1)	91% (1)
Smell / Aroma***	92% (2)	89% (2)	77% (3)
Cooking ease***	97% (1)	82% (3)	73% (4)
Healthiness	90% (3)	82% (3)	81% (2)
Texture***	88% (5)	80% (4)	70% (5)
Price***	82% (4)	79% (5)	48% (7)
Colour***	74% (6)	64% (6)	45% (8)
Naturalness***	73% (7)	50% (7)	52% (6)

*** Statistically significant differences at $p < 0.01$; Factor ranking in brackets

In general, low-income consumers attached the most value to the various purchase factors. The factor rankings of low-income and middle-income consumers were more similar than for the affluent consumers.

The most important purchase factors pertaining to soya-based foods among the ethnic sub-groups (perceived as ‘important’ by 70% or more of the sub-group, mentioned in order of importance) are:

- African / black respondents: taste, healthiness, smell / aroma, ease of cooking, texture and price.
- Coloured respondents: taste, smell / aroma, texture, ease of cooking, price and health.
- White / Causation respondents: taste, smell / aroma and cooking ease.
- Indian respondents: taste, healthiness, texture, smell, cooking ease and price.

Szejda et al. (2021) investigated the importance of motivations for consuming plant-based meat and found that in the general population, all the tested motivations were perceived as 'very important', with the strongest motivating factors being animal welfare, health, the environment and food security.

A1.4 Knowledge regarding the health benefits of soya-based foods

The 2021 BFAP study revealed that 87% of the sample perceived soya as being part of a healthy diet. The survey also tested respondents' ability to recognise the potential health / nutritional benefits of soya-based foods.

Overall, the most well-recognised health / nutritional benefits of soya-based foods were:

- (1) Soya is low in carbohydrates (82% of sample)
- (2) High in protein (61%)
- (3) Good source of fibre (44%)
- (4) Contains high quality protein (40%)

Overall, the least well-recognised health / nutritional benefits of soya-based foods were:

- Low GI (13% of sample)
Has anti-cancer properties (14%)
High in Omega 3 & 6 fatty acids (18%)
High in Vitamin E (19%)
Cholesterol free (29%)

The average respondent only selected 3 of the 11 possible health / nutrition attributes applying to soya, with middle-income and affluent respondent revealing more knowledge than low-income consumers. Thus, there seems to be a significant knowledge gap among all socio-economic sub-groups (being worse for lower socio-economic levels) regarding the health and nutritional attributes of soya.

Comparatively, Muller et al. (2017) found that 87% of the study sample perceived soya as a high protein food that can form part of a healthy diet – thus more comparable to the knowledge level of middle-income and affluent consumers in the 2021 BFAP study. Bosman et al. (2009) found that 68% of the study sample perceived soya as a good source of protein – comparable to the BFAP (2021) value observed. In terms of protein quality Bosman et al. (2009) found that 28% of the sample perceived the protein in soy is as good as the protein in meat, compared to 40% of the BFAP (2021) sample perceiving soya as a good quality protein.

Bosman et al. (2011) concluded that most respondents in the total study population as well as within all race groups agreed that soy is good for you (75% agree); soy has many health benefits (72% agree); soy is good for growing children (67% agree); soy is good for people with a milk allergy (61% agree); soy helps keep your heart healthy (60% agree); soy is good for diabetes (51% agree) and soy lowers cholesterol (50% agree). For certain soya health attributes, a larger 'uncertain' group of consumers was observed by Bosman et al. (2011): relief of menopausal symptoms, prevent cancer, lowers cholesterol, diabetes, cure diseases, role in weight loss, heart health, milk allergy, strong bones

A1.5 Consumers' perceptions regarding soya-based foods

In the 2021 BFAP survey consumers were most positive about soya in terms of:

- Product usage: cooking and usage convenience (91% in agreement), ease of cooking / preparation (91%), preparation knowledge (90%)⁴ and role as a meat extended (76%)⁵.
- Sensory appeal: taste (88%), texture (86%) and smell (83).
- Cost: affordability (87%).
- Product image: no shame in eating soya (83%), not a poor person's food (79%)⁶.
- Healthiness: soya is part of a healthy diet (87%)⁷.

Despite these positive perceptions, 39% of the sample prefer pea-protein based foods to soya-protein based foods, particularly among low-income consumers.

⁴ Bosman et al. (2009): 57% agree that they know how to prepare soya products - lower percentage than found by BFAP 2021.

⁵ Bosman et al. (2009): 57% agree that they associate soya with meat substitutes - lower percentage than found by BFAP 2021

⁶ Muller et al. (2017) found that 81% of respondents did not perceive soya as a poor-person's food – similar result to BFAP 2021.

⁷ Bosman et al. (2009): 72% agree that 'Soy has many health benefits' – lower percentage than found by BFAP 2021.

In the overall sample respondents were least positive about soya-based food, perceiving the products as less environmentally sustainable than animal-protein foods, causing allergies, being produced from genetically modified soya beans and causing flatulence.

What about the origin of soya-based foods? In the BFAP 2021 study 86% of respondents indicated a preference for food produced in South Africa rather than eating food imported from other countries. Thus, local food origin could be a valuable marketing angle for soya-based foods where applicable.

In the 2021 BFAP survey a larger group of uncertain respondents were observed (32% to 55), thus indicative of a need for consumer education regarding the following aspects to inform consumers' knowledge gap:

- "Soya products are more environmentally sustainable than animal-protein foods"
- "Soya food allergies rarely occurs"
- "Most soya beans produced in South Africa are not from genetically modified plants (i.e. non-GMO)"
- "Soya does not cause flatulence"
- "My household prefer soya-based protein foods to pea-based protein foods"

Low-income consumers (followed by middle-income consumers) and African / Black consumers generally revealed the most positive attitude towards soya-based foods.

In the 2021 BFAP survey the various socio-economic sub-groups were most positive⁸ about soya-based foods in terms of:

Low-income consumers:

Taste
Preparation knowledge
Ease of cooking
Smell
Texture
Convenience
Affordability
Use as a meat extender
Healthy
No shame in eating

Middle-income consumers:

Convenience
Ease of cooking
Preparation knowledge
Taste
Texture
Healthy
Smell
Affordable
No shame in eating

Affluent consumers:

No shame in eating
Healthy

Considering the addition of soya to animal-source meat products such as mince and sausages, the 2021 BFAP survey showed that consumers' approval (liking) of the concept increased significantly with decreasing socio-economic status, applying to 91% of low-income respondents, 74% of middle-income respondents and 49% of affluent respondents. After considering soya product benefits (increased palatability and higher protein content), 13% of the total weighted sample moved into the group approving of the concept, with the most significant increase in approval observed among affluent followed by middle-income respondents (with 27% of affluent respondents, 14% of middle-income respondents and only 5% of low-income respondents moving into the group approving the concept of soya added the meat products).

A1.6 Reasons for not eating soya / soya-based foods

Muller et al. (2017) concluded that consumers' reasons for not eating soya were:

- 'It has a funny taste' (17%)⁹.
- 'Just do not like it' (13%).
- 'Do not know how to cook it' (10%).
- 'Do not know where to find it' (7%).
- 'Allergies' (3%).

⁸ With 80% or more of sub-sample positive about the particular aspect.

⁹ Bosman et al. (2009) found that 33% of respondents disliked the taste of soya products.

- ‘Don’t know what soya is / unfamiliar with product’ (3%).
- ‘Causes flatulence’ (1%).

Thus, taste dislikes, inadequate soya preparation / cooking knowledge and product availability were the dominant reasons preventing consumers from eating soya. Based on literature, the Mullet et al. (2017) report also identified certain features of soya beans make them unfavourable in the consumer market, aspects such as flatulence (Suarez & Springfield, 1999), their beany taste (Bringe, 2015), tough skin and long cooking time (Barrett, 2006).

According to the 2021 BFAP survey affluent consumers were most negative about soya-based foods in terms of sensory attributes (taste, smell and texture), soya as part of a healthy diet, cooking knowledge, environmental sustainability and convenience. Low-income consumers were most negative about soya-based foods in terms of product image (poor-person’s food) and causing allergies. These negative perceptions could translate into soya product reduction or avoidance in the marketplace.

A1.7 Motivating consumers to eat more soya / soya-based foods?

According to consumers, which factors / product improvements will motivate them to eat more soya?

In general, the main improvement factors related to improved taste / flavour, improved affordability, gaining a better understanding of the healthiness of soya, the availability of (new and delicious recipes) and product availability improvement. See Table A1.6 for a more detailed summary.

Table A1.6: Consumers perceptions regarding potential motivations to eat more soya-based foods

(Sources: BFAP, 2021; Muller et al., 2017; Bosman et al., 2009)

Sensory appeal	Improved taste / flavour. Improved smell. Improved texture. Improved appearance / look more appetising.
Price	Improved affordability
Recipes & food preparation	Availability of (new and delicious) recipes. Knowledge on how to cook soya. Make it easy to prepare.
Health/nutrition	Better understanding of the healthiness of soya. The appealing protein content of soya. Consumed as part of a weight loss eating plan.
Availability	Make it available / easy to obtain.
Consumer education / awareness	Better consumer education. Advertisement to rise product awareness.
Product variety	Improved product variety.
Packaging and labelling	Improved packaging and labelling of soya-based foods.
Environmental considerations	Better understanding of the benefits to the environment associated with soya in South Africa.
The role of opinion leaders	If someone I know uses it.

Note: **Bold red** indicates dominant motivations.

The dominant motivations mentioned by the various socio-economic sub-groups were (BFAP, 2021) (percentage in brackets indicate the share of sample mentioning the motivational factor):

Low-income consumers:

Price / affordability (24%).
Taste / flavour (22%)
Variety (6%)
Availability / accessibility (5%).

Middle-income consumers:

Price / affordability (32%)
Taste / flavour (19%)
Health (16%)
Consumer education (6%).
Accessibility (6%).
Preparation ease (6%).

Affluent consumers:

Taste / flavour (32%).
Price / affordability (30%).
Health (20%).
Consumer education (8%).
Advertisement / rising awareness (7%).
Protein (5%).

Even though improved taste / flavour and affordability are widespread motivations to increase soya intake, a significantly larger share of affluent respondents followed by middle-income respondents mentioned the health aspect.

For which soya-based foods would consumers like to see product improvement and product innovation?

Result from the BFAP (2021) survey: Soya mince (mentioned by 26% of the overall sample), meat or meat alternatives (11%), soup or soup powder (11%), sausages (7%), burger patties (7%), soya milk (5%), soya beans (3%), suggestion to add dried vegetables to soya mince (3%), bars / snacks / sweets (2%), porridge / ProNutro / Future Life (2%) and polony (1%). Other products mentioned included high-quality frozen goods that is tasty and quick to make, vegetarian convenience meals, soy sauce, beef alternatives, more sweet treats, Knorrox, soya-based sausages or viennas, to have longer shelf life, dairy free smoothies, soya purity and ready rice or parboiled rice to be added.

Among a large representative South African sample of consumers, Szejda et al. (2021) observed that 59% of consumers revealed a high likelihood to purchase plant-based meat in the future, followed by 35% with a medium likelihood of future purchasing.

How can the eating experience of soya mince be improved?

According to the 2021 BFAP survey the main improvements to soya mince relate to flavour / taste, texture, improved consumer awareness and product variety:

- Sensory appeal: Improved flavour / taste (32%), texture (11%), smell (3%) and colour (3%),
- Consumer awareness: Marketing / awareness / promotions / consumer education (14%).
- Added ingredients: 'more meat' (3%), added vegetables in soya mince (2%).
- Improved product variety (7%).
- Improved product healthiness (2%)
- Improved product affordability (2%)
- Improved packaging (2%)
- General quality improvement (1%).

A1.8 Exploring consumers' willingness to pay for selected products containing soya

Among a large representative sample of South African consumers, Szejda et al. (2021) found that even though 59% of respondents indicated a high likelihood to purchase plant-based meat, only 31% of respondents revealed a high likelihood to pay more for plant-based meat than for animal-based meat.

The 2021 BFAP consumer survey investigated consumers' WTP for various soya-food options, after presenting respondents with the following statement: "Reputable scientific evidence has shown that soya is high in good quality proteins, has anti-cancer properties and it is a good source of fibre. The production of soya products is also more environmentally sustainable than animal-based protein-rich foods."

The WTP evaluations were phrased as:

- "Assume that a 1kg packet of lean 100% beef mince costs R100. Thinking about the health and environmental benefits of soya, how much would you be willing to pay for a kilogram of lean beef mince where soya has been added to the product?"
- "Assume that a 600g packet of 100% beef burger patties costs R100. Thinking about the health and environmental benefits of soya, how much would you be willing to pay for a 600g packet containing burger patties made from a combination of beef and soya extract?"
- "Assume that a 600g packet of 100% beef burger patties costs R100. Thinking about the health and environmental benefits of soya, how much would you be willing to pay for a 600g packet containing vegetarian burger patties made from soya?"

- “Assume that a 1kg packet of lean 100% beef mince costs R100. Thinking about the health and environmental benefits of soya, how much would you be willing to pay for a 250g packet of dried soya mince (thus enough dried soya mince to prepare 1kg of cooked soya mince)?”
- “Assume that a portion-sized 40g healthy snack bar costs R10. Thinking about the health and environmental benefits of soya, how much would you be willing to pay for a 40g healthy snack bar which contains soya-based 'Smart protein'?”

For a snack bar with soya 'smart' protein, the average respondent was willing to pay a premium of 11%. However, respondents' stated WTP implied a discount to the R100 reference price for 1kg pure beef mince / 600g pure beef burger patties, with the following average values:

- R88/kg (12% lower than the R100 reference price) for beef mince with soya;
- R84/600g (16% lower than the R100 reference price) for beef patties with soya;
- R81/600g (19% lower than the R100 reference price) for soya patties;
- R65 for a 250g packet of dried soya mince (35.3% lower than the R100 reference price of beef mince).

Thank you



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