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ARTICLE

Extruded food products and their potential impact on food and nutrition security

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Food insecurity, leading from insufficient dietary intakes to nutritional insecurity and ultimately to malnutrition, is a persistent problem in developing countries and also South Africa. One of the strategies that can be employed to address food insecurity is the provision of affordable, nutrient-dense, culturally acceptable foods that are safe for human consumption. Even though there is limited literature on food and nutrition security with this technology, extrusion is an ideal processing method for the manufacturing of a wide range of affordable foods with a long shelf life. Furthermore, the beneficial nutritional effects of extruded foods range from increased protein and starch digestibility to retention of various micronutrients. This will result in nutrient-dense meals being consumed. Extruded foods thus may benefit food and nutrition insecurity through availability of affordable, nutrient-dense, safe foods that are easily accessible to both urban and rural food-insecure households as well as poorer disadvantaged communities.

Keywords: extruder technology, food and nutrition security

Introduction

Food extrusion processing is a process in which a combination of food ingredients such as maize, soy, wheat, sorghum and many others are forced to flow under pressure through several conditions of mixing, heat application and shear, through a perforated plate or die with a design specific to the food that is being shaped with desired ingredients. This extrusion process formulates a new cooked food product loaded with intended nutrient contents that is culturally acceptable. During the cooking phase of the extrusion process with high temperature, but short time (HTST) heating process, degradation of heat-sensitive food nutrients is minimised, but at the same time the digestibility of proteins (denaturation) and starches (gelatinising) is improved whilst the anti-nutrients such as trypsin inhibitors, gossypol, hemagglutinins, and undesirable enzymes such as lipases, lipoxidases and micro-organisms are destroyed.[1,2]

Development of extrusion food processing

As early as 1797, the first extrusion process was patented by Joseph Bramah for metal alloys.[3] Food extrusion has a long history. It started as early as the 1870s with meat extruders that were used to make sausages. In the 1930s, the mass production of extruded dry pasta and breakfast cereals was implemented and adopted by many bakeries. Since then, food extrusion technology has become popular in many food-processing industries such as confectionery, breakfast cereals and porridges, bakery products, instant drinks, meat processing and many others.[4]

Extrusion food processing in Africa and South Africa

Extrusion processing started in South Africa in the 1980s and has developed and expanded to include many commercial food-processing industries.[5] Examples are ready-to-eat breakfast cereals and instant porridges, pastas, health bars, nutritious pre-cooked food mixtures, grains and flours, processed meat products, meat analogues, infant formulae, nutritional bars, soup and gravy powders, texturised vegetable protein, snack foods such as cheese curls, confectionery, sweets and gums, reformed fruit bits and sheets, instant rice, noodles and beans, and corn soy blend (CSB) for food assistance programmes, as well as various food ingredients. Filli and co-authors have found that several researchers in Africa have also made significant progress regarding extruded food product development.[2]

Advantages and disadvantages of extrusion processing

Extrusion processing has continued to gain popularity as one of the most energy efficient and environmentally friendly processes for a wide range of food products.[2–5] Extrusion cooking is thus one of the preferred food-processing techniques due to its continuous process with high productivity, high temperature and short time cooking period while destroying both harmful microbial organisms and anti-nutrient enzymes, resulting in significant nutrient-retention products with longer shelf life.[1,3] Furthermore, nutritious foods can be designed through extrusion to meet societal needs in addressing malnutrition and food and nutrition insecurity.[2] Disadvantages of extrusion food processing include a costly initial financial investment, and careful selection of process parameters such as moisture content, feed particle size, feed rate, screw speed, temperature, screw configuration and die shape to avoid reactive and harmful substance formation.[2] Apart from the initial seed funding, the bulk of the disadvantage is purely technical know-how that can be obtained through short training courses. Thus the advantages of extrusion food processing far outweigh the disadvantages.

Food and nutrition insecurity

Food insecurity and its resultant malnutrition are widely described in the literature. Food security is of utmost importance for an individual to be nutritionally secure for maintaining good health. Nutrition security includes all of the following: access to a

variety of good quality and safe foods to ensure growth of children and an active, healthy life for children and adults; adequate knowledge and skills to procure, prepare and consume a nutritionally adequate and safe diet; and access to health services and a healthy environment for effective biological utilisation of consumed foods.[6]

Global strategies to address food insecurity and malnutrition include: supplementary feeding, micronutrient supplementation, food fortification, food diversification, including agricultural interventions like community and home gardening, as well as nutrition education and food product development. However, the use of specific foods and food processes as a solution to food security is not described adequately.

The main aim of this communication is to outline recent key developments in food extrusion and to open an academic discourse on how South African food extrusion technology can play a vital role in mitigation efforts against the scourges of food and nutrition in South Africa and beyond.

Conclusion

Food and nutrition insecurity, leading to insufficient dietary intakes and ultimately malnutrition, is a persistent problem in developing countries. A sustainable solution is thus needed to address food and nutrition insecurity. One of the strategies that can be employed is the provision of affordable, nutrient-dense, culturally acceptable foods that are safe for human consumption through extrusion technology.

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