# Vegetable Proteins in Snacks

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## ABSTRACT

Snack foods can be highly engineered products. Vegetable proteins may be manipulated by the food scientist to match the challenge offered by this extremely diverse group of foods. The two-fold practical problems of performance and nutritional value can usually be solved; economy in use is an extra bonus.


## INTRODUCTION

Snacks constitute a rather loosely defined area of foodstuffs and include a wide range of product types. Almost by definition, one thing that all snack products have in common is a high degree of convenience. Many snack foods are ready to serve or consume direct from their wrappers. Others may require simple preparations such as the addition of hot or cold water and perhaps a brief period for their rehydration.

The nutritional content or value of snacks is as varied as the range of product types. At one end of the spectrum are the typical corn curl or potato crisp (chip) materials in their many shapes, sizes, colors and flavors (vitally important flexibility to the marketing departments). These items could generally be considered as having low nutritional value. Usually in cereal form, fried or oil-coated, they will have a calorific contribution to make with very little else. Even the calorie count in a pack may be surprisingly low as the extremely high expansion rates given to products can result in very low unit pack weights. The expansion is of course a necessary process to achieve the final texture demanded by the consumer. Although an initial reaction to low nutrition might be one of concern, it is important to remember that these products are usually consumed in addition to normal meals, rather than at their expense. Bearing in mind the overweight problem many people have, one might even speculate that in the western world there would be a good market for negative nutrition foodstuffs. One day we may be adding antinutritional factors to certain foods instead of ensuring their absence! Many people might find this easier than reducing their food intake!

At the other end of the snack food spectrum is a group of products designed as quick or ready meals. Here the nutritional aspects are obviously more important. Where meal replacement is a target, manufacturers must strive to ensure that the alternative snack is equally nourishing.

High convenience, nutritional value, and consumer appeal are all topics touched on briefly as relevant to snack foods. These parameters will impose their individual and sometimes conflicting demands on the ingredients used. Product flexibility on the part of the ingredient supplier has to be of great value to the snack food processor. Of course, this is in no way unique to snack items, but makes the point that technological input in this area should not be underestimated. Some of the simplest products to use rate with the most complex to manufacture. With the aid of examples, it can be shown how vegetable proteins, (with emphasis on soy in this paper) can make valuable snack ingredients.

## PRODUCT APPLICATIONS

The first and very obvious example of a soybean snack food derives completely and directly from the bean itself. Sound harvested beans are dried to a predetermined moisture content, carefully cleaned and then subjected to a patented flash frying technique which causes them to expand, although not to the same degree as more conventional fry-expanded snacks. The most important feature of this process is the resulting marked textural change. While the native bean is quite difficult or tough to chew, beans processed by this method have a shorter eating characteristic virtually indistinguishable from roasted nuts. By selection of cooking oil, process time and postflavoring, it is possible to arrive at a highly acceptable quality snack with novelty appeal and excellent nutritional properties. The protein content of the product is of the order of 35%. Antioxidants and suitable packaging ensure adequate shelf stability for the 25% oil content, most of which is soy origin and present in the bean prior to processing.

Such a product is currently on sale in a limited section of the British Retail Market, where it is in the form of the whole bean. For manufacturing purposes, a kibbled or particulate material would probably be more desirable.

Soy protein is made available by the processor in many different forms. These range from the bean through full-fat and defat flours to textured proteins, concentrated proteins and the almost pure protein of soybean isolates. The protein contents of this range of materials vary from 40% up to 90% or more. It is feasible to boost the protein nutritional value of conventional extruded starch-based snacks by the use of certain of these soy products.

Without going into great detail on the technology of direct expanded snacks, it would appear that substantial protein increase can be readily achieved by a simple addition to the extrusion premix. A short barrel machine will usually be employed in this direct expansion role. It may be found necessary to add extra moisture to the feedstock to allow for the hydrophilic nature of soybean protein. Results suggest that purified protein in the form of soybean isolate will give excellent results. This is assuming that the criterion for judgment is similarity to conventional cereal snacks in degree of expansion, color, etc.

Defatted soy flour added at a level of 20 to 25% will certainly reduce expansion and give a considerably tougher product. This represents a marked change from the all-starch extrusion, though perhaps these new properties could be exploited by a different marketing approach. Full-fat soy flour should not be used at high levels in direct expanded snacks, as fat or oil inhibits expansion markedly.

One way to circumvent expansion difficulties is to consider the two stage process of mild extrusion usually in a long barrel extruder cooker followed by fry expanding the pellets.

A very different set of extrusion conditions is used to make textured vegetable protein. The conditions are designed to produce a continuous protein network in the final expanded product where cereal or potato snacks rely on a starch system which seems to be formed more

readily. Textured vegetable protein is now familiar to us all. It is a most flexible material and can be made in a wide variety of shapes, sizes, colors, densities, etc.

More complex manipulations involving such things as textural modification and hydration speed are also within the processor's grasp. Again the availability of a wide range of flavors, colors, shapes, and sizes lends itself to incorporation in a whole product range rather than single items.

Textured vegetable proteins find application in many snack foods. In Britain a popular item is the meat pie, which is regarded as either a snack or used as part of a meal. In this particular example, we have a regulatory requirement for a minimum of 25% meat of which half must be lean. This gives a meat protein level of around 2½% in the filling. Where as little as 2½% of textured protein has been used in the filling to improve its meat fleck appearance, this is contributing a protein boost of 50%, a surprisingly high increase.

Less British examples include such snack foods or ready meals as the pizza. Here the meat portion of a beef and tomato topping can be entirely replaced with T.V.P. with no difficulty.

Away from extruded vegetable proteins, but remaining in the extruders province, pasta can provide an example of vegetable protein application. The basic raw material is of course a wheat flour, having a protein content perhaps as high as 14% (subject to variation with the grade of pasta being made). The protein level can be increased by addition of soy protein, probably in the form of defatted flour. Higher protein additives could be used but would not be so economic.

Other easily enriched snack foods include cakes and biscuits. Protein levels are elevated by the use of soy flour usually in the form of heat processed, full-fat soy flour in the U.K. If an actual marketing or advertising claim is to be made for "high protein" or "protein enriched," care should be taken to check on legislative requirements. In the U.K. a minimum of 12½% of the food calories must derive from proteins before any such claims may be made.

However, there are other forms of enrichment that may take place at the same time as protein addition. A significant factor brought to prominence relatively recently has been fibre in the diet. Advertising campaigns backing retail products have made the public at large increasingly aware of the importance of fibre or roughage to their correct bodily function. Papers have been published implicating a low residue diet with many forms of malaise and illness. The list includes intestinal cancer, gall stones, diverticular disease, varicose veins and other sundry disorders. Most of the evidence linking lack of dietary fiber with these problems is epidemiological in that it involves comparison between different societies and often between different races. Though on occasion circumstantial, the evidence is certainly too much to ignore and has been in some part responded to by the food industry.

Whole grain wheat flour and a hypothetical whole bean soy flour could be useful sources of dietary fiber. Wheat bran or soy bran (very high in fiber content) are of course, even richer sources. On sale in Britain is a range of biscuits with additions of soy flour and soy bran. These are marketed for their fiber contribution, but could very easily be sold with both a high fiber and high protein claim, if so desired.

Another useful attribute is often overlooked in the course of applying this range of protein ingredients. That is the evaluation of essential unsaturated fatty acid levels in the snack food, particularly where a full-fat soy flour has been used – most often in baked goods.