4.2 Vital Wheat Glutens and Wheat Protein Isolates

The outstanding properties of vital wheat glutens are their high viscoelasticity, high water absorption and rate of hydration. These products are used extensively in the baking industry for dough formation with excellent mixing and rising properties. The meat industry uses gluten for its water binding, nutritional and elastic properties in products such as burgers and meatballs. Gluten is produced by a maturing process after the removal of carbohydrate.

Wheat protein isolates are as a result of further processing of gluten and can be used to provide emulsion stability in a range of food products. Very little is known of these product uses in the meat industry.

4.3 Whey Proteins  (Figure 3)

These are produced as shown in Figure 3, and have a variety of uses in specifically beverages, petfood and meal replacers. Very little is known regarding their emulsifying, gelling and binding properties. Their nutritional function however, is accepted. These products are the subject of intense investigation due to their valuable potential protein contribution to diet. Producing functional whey protein isolates would undoubtedly increase their value considerably for use in the food industry.
FIGURE 3

MILK PROTEIN PRODUCTS FROM SKIM MILK

SKIM MILK
  ↓
 PH
  ↓
 LACTIC/ACID CASEIN
  ↓
  pH
  ↓
 CASEINATE
  ↓
  U/F
  ↓
 WHEY PROTEIN CONCENTRATE

RENNET
  ↓
 PH
  ↓
 RENNER CASEIN

HEAT/Ca/pH
  ↓
 COPRECIPITATE

WHEY
  ↓
 HEAT
  ↓
 LACTALBUMIN
4.4 Egg Albumin

Egg pulp is extensively used in the meat industry for its coagulating and water binding properties. Albumin is used seldom due mainly to cost, but has excellent emulsifying and nutritional functions.

4.5 Soya Protein Products

These products will be considered in detail since they are the most extensively used non-meat proteins. The reason is simply cost related due to the high yield of soya protein/acre of land obtained from U.S.A. As single biggest agricultural crop. See Tables 4, 5, 6 and Figure 4.

5. FUNCTIONAL PROPERTIES AND COMPATABILITY OF NON-MEAT PROTEINS

5.1 Meat Categories

Meat products can be divided into four specific categories as seen in Table 7.

Non-meat protein technology is aimed at one or more of these categories in order to be of benefit in each of these categories. These aspects are discussed and demonstrated.

5.2 Specific Functions for Specific Categories

These are summarised in abbreviated form on pages 19 to 26 and demonstrated in certain products.
TABLE 4

ECONOMICS OF SOY PROTEIN PRODUCTS

U.S.A.

ONE ACRE OF LAND PRODUCES THE FOLLOWING KG OF EDIBLE PROTEIN:

<table>
<thead>
<tr>
<th></th>
<th>KG PROTEIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOYA BEANS</td>
<td>227</td>
</tr>
<tr>
<td>CORN</td>
<td>146</td>
</tr>
<tr>
<td>WHEAT</td>
<td>82</td>
</tr>
<tr>
<td>MILK</td>
<td>44</td>
</tr>
<tr>
<td>BEEF</td>
<td>26</td>
</tr>
</tbody>
</table>
FIGURE 4

SOYA PRODUCTION

INDUSTRIAL

OIL

PAINTS

ETC

ANIMAL FEED

HUMAN CONSUMPTION
### TABLE 5

**APPROX FEED CONVERSION RATIONS**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Conversion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEEF</td>
<td>9.0</td>
</tr>
<tr>
<td>MUTTON</td>
<td>4.0</td>
</tr>
<tr>
<td>PORK</td>
<td>3.5</td>
</tr>
<tr>
<td>POULTRY</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*KG FEED REQUIRED TO PRODUCE 1KG LIVE WEIGHT

### TABLE 6

**PRICE / KG PROTEIN**

<table>
<thead>
<tr>
<th>Protein Type</th>
<th>Protein Content</th>
<th>Price Range (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEEF LEAN</td>
<td>(22%)</td>
<td>+/-R37.00</td>
</tr>
<tr>
<td>POULTRY</td>
<td>(22%)</td>
<td>+/-R15.00</td>
</tr>
<tr>
<td>SOYA FLOUR</td>
<td>(50%)</td>
<td>+/-R 3.00</td>
</tr>
<tr>
<td>SOY CONCENTRATE</td>
<td>(70%)</td>
<td>+/-R 5.71</td>
</tr>
<tr>
<td>ISOLATED SOY PROTEIN</td>
<td>(90%)</td>
<td>+/-R 6.12</td>
</tr>
<tr>
<td>*FROZEN TSC</td>
<td>(23%)</td>
<td>+/-R 6.08</td>
</tr>
</tbody>
</table>

* Note: Values are approximate and subject to market fluctuations.
APPENDIX 1

FUNCTIONAL PROPERTIES OF NON-MEAT AND MEAT PROTEINS

FOUR CATEGORIES OF FUNCTIONALITY IN FOODS:

COLOUR

FLAVOUR

TEXTURE

NUTRITIONAL

COLOUR: RED MEAT COLOUR IS AFFECTED BY:
ADDITIVES; INGREDIENTS; HEAT.

FLAVOUR: IN GENERAL NON-MEAT PROTEINS ALONE ARE UNACCEPTABLE TO WESTERN TASTES, THEREFORE THE TENDENCY IS TO PRODUCE BLAND PRODUCTS WHICH ARE TO BE FLAVOURED.

TEXTURE:

HARDNESS  GUMMINESS  SPREADABILITY
VISCOITY  SPRINGINESS  TOUGHNESS
ADHESIVENESS  MUSHINESS  CRUNCHINESS
COHESIVENESS  CRISPINESS  TENDERNESS
CHEWINESS  CREAMINESS  JUICINESS
<table>
<thead>
<tr>
<th>MEAT TYPE</th>
<th>WHOLE MUSCLE</th>
<th>DICED/MINCED</th>
<th>CHEAPER MEATS OFFAL, FAT, RINDS</th>
<th>MECHANICALLY RECOVERED MEATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON-MEAT PROTEIN TECHNOLOGY</td>
<td>PROTEIN DISPERSION</td>
<td>PROTEIN DISPERSION</td>
<td>STABILISATION OF MEAT AND FAT EMULSIONS</td>
<td>UPGRAADING THROUGH TREATMENT</td>
</tr>
<tr>
<td>TYPICAL PRODUCTS</td>
<td>HAMS</td>
<td>MINCED BEEF IN GRAVY</td>
<td>FRENCH VIENNA LOAF ITEMS PATES</td>
<td>NEW PRODUCTS</td>
</tr>
<tr>
<td>NON-MEAT PROTEIN BENEFITS</td>
<td>INCREASE YIELD IMPROVED SUCCULENCE BETTER SLICING ECONOMY</td>
<td>INCREASE YIELD UPGRADE QUALITY IMPROVE TEXTURE CONTROL FRYING LOSS ECONOMY</td>
<td>FORMULATION FLEXI- (USE CHEAPER CUTS) INSURANCE AGAINST PRODUCT FAILURE ECONOMY</td>
<td>STABILISATION IMPROVE COLOUR, TEXTURE, FLAVOUR AND YIELD</td>
</tr>
</tbody>
</table>
WHOLE MUSCLE MEATS

HAMS
BEEF WELLINGTON

ADDITION OF NON-MEAT PROTEINS ONLY CERTAIN ISOLATED SOY PROTEINS THOROUGHLY RESEARCHED

POSITIVE ATTRIBUTES

(1) INCREASED YIELDS
(2) IMPROVED SUCCULENCE
(3) BETTER SLICING
(4) ECONOMIC EXTENSION
(5) AFFORDABLE