trophy in chicks and rats; the hypersecretion caused by trypsin inhibitor; the negative feedback mechanism for control of pancreatic secretion; and the contribution of trypsin inhibitors and protein digestibility to growth inhibition. One of the participants commented on the absence of pancreatic hypertrophy in swine and monkeys.

Several important developments in human nutritional studies of soya proteins are: the absorption and retention of nitrogen and the growth rates for protein isolates plus methionine are equal to those for cow's milk in infant studies; methionine supplementation of isolates may be unnecessary for growing children; methionine may be limiting at low soya protein intakes, but adequate at 38 to 45 g/day for adults; soya isolate was equivalent to 80% of egg protein; and mineral metabolism was normal for adults fed a soya concentrate diet. One of the participants commented that calcium was readily available when added to soya proteins. Research needs in soya protein nutrition are: long-term studies with humans; resolving the need for methionine supplementation; elucidating the mechanism of trypsin inhibitor action for soya and other foods, development of rapid methods for measuring protein quality; and investigations to resolve vitamin and mineral fortification needs.

A discussion developed on the question of whether a young child could consume enough corn or wheat to satisfy protein requirements–the response was negative. Additional comments were made regarding clinical results on needs for methionine supplementation, which had been previously discussed.

Enzymatic digests are sometimes used for therapeutic feeding, and further research is needed in the area of predigested proteins.

One of the participants stated that fabricated foods would have to cost about 50% of their natural food counterparts in order to change consumer eating habits. He attributed the major problems of acceptance to food customs and organoleptic differences.

A comment was made regarding the importance of calories in the diet relative to plant protein utilization. It was suggested that the USDA guidelines for minimum caloric content of Blended Food Supplements be increased. Subsequent discussion indicated that caloric density of Blended Food Supplements had been increased by USDA; However, clinical studies with infants had shown the importance of caloric availability to protein utilization.

One participant spoke about people under stress and why they tend to lose nutrients. One observation indicated this was caused by a marked increase in energy requirements, along with increased losses of nitrogen in the urine.

There appeared to be a lack of consensus on the protein requirements for elderly people, but there was support for the proposition of maintaining the same protein consumption while decreasing caloric intake by about 5%/year.

It was concluded that nutritional objectives can be met for all age groups throughout the world with soya proteins.

SESSION VI C–Labeling and Compliance Assurance of Soya Protein Foods

G.N. BOOKWALTER, Recorder, Northern Regional Research Center, Agricultural Research, Science and Education Administration, USDA, Peoria, IL 61604

Session was cochaired by E.W. Lusas, Texas A & M University, U.S., and B. Torun, INCAP, Guatemala. The panelists were round table speakers Douglas Hagg, Dawson Foods, U.S.; John Vanderveen, FDA Bureau of Foods, U.S.; C.E. Bodwell, USDA; Arthur Eldridge, USDA, and Ed Lusas.

Requirements for soya protein products purchased by the U.S. Government for the School Lunch Program and for the Department of Defense were discussed. The proportion of hydrated textured vegetable protein to meat, poultry or fish is set at a 30% maximum when used in the Type A school lunch program. Compositional requirements for textured vegetable proteins were said to include standards for protein, fat, magnesium, iron, thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, pantothenic acid and protein efficiency ratio. Labeling requirements specify inclusion of the phrase "textured vegetable protein" on the carton. The Department of Defense has approved the use of granular soya protein concentrate to extend ground beef. Soya protein concentrate granules must meet specifications for protein, moisture, crude fiber, ash and fat. The beef and hydrated soya protein concentrate granules are ground and blended in 80 to 20 ratio. Flavor characteristics of the granular protein concentrate are critically tested. It was pointed out that this soya protein must receive a flavor score of 6.0 or higher when tested by the USDA Northern Regional Research Center flavor evaluation methodology. Rigorous military testing disclosed no significant differences in sensory traits of the ground beef product with or without added granular soy protein concentrate. The military has saved about $18 million annually by using granular soya protein concentrate. Feedback information confirms justification of the use of this soy protein by the military as a cost-reducing extender.

Provisions of the U.S. tentative regulations for Plant Protein Products were discussed. The objective of the regulations, according to one participant, is to define primary products, name finished products, provide for guidance in ingredient testing and establish guidelines for nutritional equivalence. The foods covered by the regulations are: breakfast and lunch meats, seafood, poultry and other meats, eggs, cream cheese, cottage cheese, and other cheeses. Primary products are defined as flour when they are less than 65% protein, protein concentrate when they are between 65 and 90% protein, and protein isolate when above 90% protein. The product must be named according to which ingredient predominates. Nutrient requirements are simple for some products, such as cream cheese, but are more complex for others. The nutrients listed for each of the six product classes are primarily those recognized in FDA regulations relative to U.S. recommended daily allowances. Substitutions of up to 30% can be made if the protein quality of the vegetable protein is equal to or 80% that of casein. Substitutions above 30% are allowed if the protein quality is equal to or above that of casein. It was pointed out that USDA has not yet finalized regulations for the use of vegetable proteins, but directives allow vegetable proteins at levels up to 3½% as binders in most processed meats. In products covered by standards, vegetable proteins can be used if the requirements of the standard for the valued ingredient are first met. If the added vegetable protein looks like meat and is present in amounts greater than 10% in either raw meat or cooked products, it must be included in the name of the product.

Meetings between the FDA and USDA are continuing, and the two major issues still unresolved are: the difficulty in naming products, and the requirements pertaining to substitute food status. One participant criticized the substitute concept, because equivalency may never be achieved. Another participant raised the question of procedures to be followed for marketing a new ingredient, which was answered by a description of procedures to be followed when a food material either is generally recognized as safe (GRAS) or is not GRAS. It was emphasized that the FDA should be involved prior to marketing because of possible problems and costs involved in a recall.

Assessment of soya protein nutritional quality included the discussion of extensive methodology that has evolved in this technological area. Procedures include human bioassays, rat bioassays, and chemical, enzymatic and microbiological methods. Rat bioassays were said to be of limited value for predicting the nutritive value of soya protein for humans. Reasonable agreement between estimates of protein nutritional value as obtained in human studies, and as predicted by several different amino acid scores, can be demonstrated. The best agreement is obtained when the reference amino acid pattern is based on estimates of human amino acid requirements. A comment was made that labeling might also include levels of selected essential amino acids contained in a food material along with corresponding % RDA values.

Considerable interest was generated by a discussion on the determination of levels of added soy protein in processed foods. Government regulations in most countries require that the composition of certain foods be defined, which has prompted the development of methods to detect and quantitate soya protein products in foods. One participant described procedures that have this potential, including: a microscopic method to identify the characteristic palisade cells in the soya meal residue after extraction with KOH; microscopic detection after selective staining; immunological techniques; electrophoresis; soya peptide isolation and analysis after autoclaving and trypsin digestion; computer comparison of amino acid patterns; and measurement of the fluorescence at 440 nm. Each of these techniques has limitations, and research is continuing.

The necessity for determining levels of different soya products in food materials prompted lively group participation. Differentiating isolates of gluten or casein was said to be possible with electrophoresis. However, laboratory-to-laboratory variability is a problem, and no attempt had been made to standardize. Infrared methodology was also mentioned as a possible approach. One participant said that thin-layer chromatography was used to measure the stachyose content of mixtures to estimate levels of soya flour. However, different types of soya proteins and processing methods complicate assay procedures. Another participant discussed a detection method that involves tagging isolate with 0.1% titanium dioxide, which is used in some processed meats. Phytic acid and trypsin inhibitors were also mentioned as tracers, but difficulties had been encountered with them. One suggestion was made to consider measurement of meat muscle instead of soya protein, but variability of muscle protein relative to fat complicates this approach. It was mentioned that, in the absence of detection methods, regulatory agencies still maintain record inspection authority.

Quality assurance was discussed and considered a vital part of the food production operation. One participant emphasized the need for the project manager to be aware of current laws concerning good manufacturing practices, labeling, and other aspects of the work to avoid regulatory agency problems. Positive recommendations were made regarding the importance of an adequate data base that is provided by comprehensive final product standards coupled with a complete record system.

SESSION VI D

J.J. RACKIS, Recorder, Northern Regional Research Center, USDA-SEA, Peoria, IL 61604

In this session, primary concerns were exemplified by discussions on protein-nutrition, safety aspects, measurement of protein quality in animal bioassay with respect to human needs, evaluation of the significance of anti-nutritional factors in soybeans, and formation of deleterious factors during processing. Some of the lively discussions focused on the need for more research to provide recommendations on processing parameters and dietary treatments that may be necessary to produce safe, nutritious soya foods. Probably the most significant conclusion to be drawn is the fact that the continuous changes in processing conditions to improve yield, to reduce cost of production and to modify protein functionality (i.e., solubility, flavor, texture, emulsification properties, etc.) raise new questions concerning optimal destruction of trypsin inhibitors (TI), effects on protein digestibility and mineral availability, and formation of anti-nutritional substances. Two papers described how mineral availability can be affected by the processing of soybeans into flours, concentrates and isolates. In addition, knowledge is available on how to control flatulence and the formation of lysinoalanine through proper choice of processing parameters.

A 300-day rat bioassay demonstrated that residual TI activity in edible grade soya flour, concentrate or isolate did not produce any deleterious effects. Additional ongoing, long-term feeding trials are justified, as evidenced by the comments on whether high-protein, high-fat diets can place added stress on the pancreas. A debate to explain why vitamin B_{12} supplementation stimulated growth of rats during continuous consumption of soya protein products, but did not affect rats fed casein diets, remained unresolved. A relationship between tests based on animal bioassay and comparable nutritional effects in humans, particularly the young and elderly, remains elusive.