

32. Saio, K., M. Kamiya and T. Watanabe, *Agric. Biol. Chem.* 33:1301 (1969).
33. Moreira, M.A., M.A. Hermodson, B.A. Larkins and N.C. Nielsen, *J. Biol. Chem.* 254:9921 (1979).
34. Siapantas, L., *Food Eng.* 52(3):20 (1980).
35. Brincker, A., *JAOCs* 56:211 (1979).
36. Roberts, H., *Ibid.* 56:206 (1979).
37. Olsman, W.J., *Ibid.* 56:285 (1979).
38. Osborne, T.B., and L.B. Mendel, *J. Biol. Chem.* 32:369 (1917).
39. Hayward, J.W., and F.H. Hafner, *Poult. Sci.* 20:139 (1941).
40. Mitchell, H.H., and R.J. Block, *J. Biol. Chem.* 163:599 (1946).
41. Bowman, D.E., *Proc. Soc. Exp. Biol. Med.* 57:139 (1944).
42. Ham, W.E., R.M. Sandstedt and F.E. Mussehl, *J. Biol. Chem.* 161:635 (1945).
43. Kunitz, M., *Science* 101:668 (1945).
44. Klose, A.A., B. Hill and H.L. Fevold, *Proc. Soc. Exp. Biol. Med.* 62:10 (1946).
45. Westfall, R.J., and S.M. Hague, *J. Nutr.* 35:379 (1948).
46. Chernick, S.S., S. Lepkovsky and I.L. Chaikoff, *Am. J. Physiol.* 155:33 (1948).
47. Lyman, R.L., and S. Lepkovsky, *J. Nutr.* 62:269 (1957).
48. Booth, A.N., D.J. Robbins, W.E. Ribelin and F. DeEds, *Proc. Soc. Exp. Biol. Med.* 104:681 (1960).
49. Rackis, J.J., *Fed. Proc.* 24:1488 (1965).
50. Green, G.M., and R.L. Lyman, *Proc. Soc. Exp. Biol. Med.* 140:6 (1972).
51. Kakade, M.L., D.E. Hoffa and I.E. Liener, *J. Nutr.* 103:1772 (1973).
52. Rackis, J.J., J.E. McGhee, M.R. Gumbmann and A.N. Booth, *JAOCs* 56:162 (1979).
53. Desikachar, H.S.R., and S.S. De, *Science* 106:421 (1947).
54. Westfall, R.J., D.K. Bosshardt and R.H. Barnes, *Proc. Soc. Exp. Biol. Med.* 68:498 (1948).
55. Liener, I.E., H.J. Deuel, Jr., and H.L. Fevold, *J. Nutr.* 39:325 (1949).
56. Graham, G.C., R.P. Placko, E. Morales and A. Cordano, *Am. J. Dis. Child.* 120:419 (1970).
57. Fomon, S.J., and E.E. Ziegler, in "Soy Protein and Human Nutrition," edited by H.L. Wilcke, D.T. Hopkins and D.H. Waggle, Academic Press, New York, 1979.
58. Fomon, S.J., E.E. Ziegler, L.J. Filer, Jr., S.E. Nelson and B.B. Edwards, *Am. J. Clin. Nutr.* 32:2460 (1979).
59. Torun, B., in "Soy Protein and Human Nutrition," edited by H.L. Wilcke, D.T. Hopkins and D.H. Waggle, Academic Press, New York, 1979.
60. Kies, C., and H.M. Fox, *J. Food Sci.* 36:841 (1971).
61. Zezulka, A.Y., and D.H. Calloway, *J. Nutr.* 106:212 (1976).
62. Scrimshaw, N.S., and V.R. Young, in "Soy Protein and Human Nutrition," edited by H.L. Wilcke, D.T. Hopkins and D.H. Waggle, Academic Press, New York, 1979.
63. Van Stratum, P.G., and M. Rudrum, *JAOCs* 56:130 (1979).
64. Thomson, W.A.B., *Ibid.* 56:386 (1979).
65. Food and Agriculture Organization of the United Nations, *FAO Nutrition Meetings, Report No. 52, FAO/WHO "Energy and Protein Requirements,"* Rome, Italy, 1973.
66. O'Dell, B.L., in "Soy Protein and Human Nutrition," edited by H.L. Wilcke, D.T. Hopkins and D.H. Waggle, Academic Press, New York, 1979.
67. Carroll, K.K., M.W. Huff and D.C.K. Roberts, *Ibid.*
68. "Soybean Protein and Human Nutrition," edited by H.L. Wilcke, D.T. Hopkins and D.H. Waggle, Academic Press, New York, 1979.

## Labeling and Compliance Assurance of Soya Protein Foods

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### ABSTRACT

This paper describes two main federal feeding programs: the School Lunch Program and the Military or DOD.

The National School Lunch Act of 1946 empowered the Secretary of Agriculture to set nutritional standards. Section 9 of the Act, as amended, states: "Lunches served by schools participating in the school lunch program under this Act shall meet minimum nutritional requirements prescribed by the Secretary on the basis of tested nutritional research." In the 33 years since the passage of the Act, this power has not been significantly altered.

Section 210.10(a) (1) (ii) of the regulations governing the National School Lunch Program, issued September 4, 1970, outlines the meat and meat alternate requirements for the Type A School Lunch as: (ii) Two ounces (edible portion as served) of lean meat, poultry or fish; or 2 ounces of cheese; or one egg; or one-half cup of cooked dry beans or peas; or 4 tablespoons of peanut butter; or an equivalent quantity of any combination of the above-listed foods.

Textured vegetable protein products, when prepared and served in combination with meat, poultry, or fish, may be used as a meat alternate to meet part of the minimum requirement of two ounces of cooked meat for the Type A school lunch. It would also meet part of the meat and meat alternate requirement for the Special Food Service Program for Children. Textured vegetable protein products are food products made from edible protein sources and are characterized by having a structural integrity and identifiable

texture such that each unit will withstand hydration, cooking, and other procedures used in preparing the food for consumption.

The textured vegetable protein product shall be made from food-grade oilseed or cereal flours, protein concentrate, or isolates, edible fats or oils, carbohydrates, binders, stabilizers, natural or artificial flavors, colors, amino acids, vitamins and minerals. The proportion of hydrated vegetable protein to meat in the combination shall not exceed 30%. The hydration level of the rehydrated vegetable protein shall be 60-65%.

Compositional requirements for the textured protein expressed on a dry basis are:

	Minimum
Protein (wt %) <sup>a</sup>	50.0
Fat, 30% max by wt	—
Magnesium (mg/100 g)	70.0
Iron (mg/100 g)	10.0
Thiamin (mg/100 g)	0.3
Riboflavin (mg/100 g)	0.6
Niacin (mg/100 g)	16.0
Vitamin B <sub>6</sub> (mg/100 g)	1.4
Vitamin B <sub>12</sub> (mcg/100 g)	5.7
Pantothenic acid (mg/100 g)	2.0

<sup>a</sup>Nitrogen times 6.25

The protein efficiency ratio (PER) of the textured vegetable protein shall be not less than 1.8 on basis of PER = 2.5 for casein. Labeling requirements are: (a) the phrase

“textured vegetable protein” must appear on the carton wherever the brand name is displayed on the carton. The brand name alone can appear in the text on the carton; (b) an ingredient statement must appear on the carton, with the ingredients listed in the order of their dominance in the product; (c) “Meets Nutritional Specifications of FNS Notice 219” must appear on the carton.

Food and Nutrition Service insures compliance with regulations by: (a) requiring that finished label copy be submitted; (b) submission of independent laboratory results to substantiate: analytical analysis including protein, fat, iron, magnesium and vitamins; (c) limited monitoring of school lunch program on a spot basis.

The Department of Defense has approved soya protein concentrate for the extension of ground beef. The consumption of ground beef by the military services has steadily increased over the past few years. Well over 50% of all beef products consumed by the Armed Forces is in the form of ground beef. In FY78, the military services procured over 55 million pounds of ground beef for troop-issue dining facilities. The cost of the ground beef has significantly increased over the past years.

Chemical characteristics specifications for soya protein for the extension of ground beef are (%): (a) protein (N x 6.25) mfb, 70.0 min; (b) moisture, 8.8 max; (c) crude fiber, 4.5 max; (d) ash, 6.0 max; (e) fat (AOCS Method BE 3-49), 1.0 max.

Physical characteristics of the approved form of soya protein are: (a) at least 95% shall pass through a U.S. Standard No. 14 sieve; (b) not more than 10% shall pass through a U.S. Standard No. 60 sieve; (c) shall be in a dry form.

#### Hydration of Soya Protein

The moisture content of the hydrated, granular soya concentrate shall be such that when hydrated, the mixture shall have a minimum of 18% protein, by weight. To determine the ratio of water to be mixed with the dry granular soya concentrate to provide 18% protein in the mixture, the following equation shall be used:

$$\frac{\% \text{ protein in dry product (moisture-free basis)}}{0.18 (\% \text{ protein in hydrated product})} - 1$$

= lb of water required to add to each lb of dry product

Beef and hydrated soya protein are ground and blended in an 80:20 part ratio of beef to hydrated soya.

The average fat content (4 samples) cannot average more than 22% for the finished product.

#### Flavor Characteristics

(a) The extended beef shall receive a flavor score of 6.0 or higher when tested in accordance with the provisions of the USDA Northern Regional Research Laboratory Odor and Flavor Intensity Scoring Scale of the Cereal Panel Odor and Flavor Evaluation System; (b) the extended beef shall have no additional flavor added.

Tests were made by the Food Engineering Laboratory meat technologists to determine whether the addition of soya protein concentrate at as much as a 5% level (moisture-free basis) by weight could detract from the palatability of the ground beef. It was determined by military and civilian consumer testing at NARADCOM, and military installations located throughout the U.S., that there were no significant differences in sensory traits of the ground beef product with or without the addition of the soya protein. If anything, the consumers preferred the juiciness of the ground beef containing the soya concentrate. In addition, the product did not shrink as much as plain ground beef when grilled or cooked as a meat loaf.

During 1979, the Department of Defense, faced with a significant rise in cost of beef for troop feeding and supported with the test data from the NARADCOM studies, ordered the procurement of ground beef with 20% rehydrated soya concentrate (ca. 5% on a moisture-free basis) for all military troop issue facilities.

At today's market, the annual savings accrued by this decision will reduce the military ground beef costs by \$18 million (APPEC, July 1979).

Feedback from the military users strengthens the belief that the use of soya protein as a cost reducing extender for ground beef has been truly justified.

The only soya product approved for inclusion into meat (ground beef) thus far is soya protein concentrate. There is on-going evaluation with the textured soya flours. There is an indication that 5 or 5½ on the Peoria Flavor Scale may be acceptable. Work is also being done on modifying the Peoria flavor profiling technique.

Compliance with the standards set up by DOD are determined by manufacturers' labels attached to the product. In addition, the DOD is working on a new method based on fluorescence to detect vegetable protein in ground beef.