World Production of Food Proteins: Situation, Structure, Trends

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ABSTRACT

World production of major food products for 1961 through 1976 with special calculations as to protein content, plus some conclusions about recent tendencies in world protein situations and the role of food and feed high protein additives from plant sources are reviewed.

The problem of sufficient protein production is of global character and is an inseparable part of the world food problem. Yet, lack of true statistical data does not alow us to comprehend the scale of the problem, and therefore one should be cautious in prognoses and conclusions. The recommended protein requirements for man and farm animals are relative and can be applied only with serious reservations: regional aspects of chemical composition of food and traditional rations have been studied insufficiently; there is a lack of a commonly accepted method to determine protein quality for man and livestock.

This paper is based on FAO statistical data on the world production of 70 plant commodities and 13 animal products in 1961-1976, i.e., the world production of practically all basic food groups. We define all products under consideration as potentially edible by man (direct consumption). We admit a certain relativeness of this definition, since more and more of feed grains and oilcakes are used as feed every year. All the above mentioned commodities have been evaluated in terms of protein using crude protein coefficients adopted in the world practice.

Calculations made according to our method show that the average production of protein potentially good for man was 245.9 million tons in 1972-1976, or 196.8 million tons of plant protein and 49.1 million tons of animal protein, an increase of 67.0 million tons, or 37.5%, over 1961-1965 (Table I). Production of potentially edible protein per capita has increased from 56.5 kg in 1961-65 to 62.8 kg in 1972-76.

General uptrend in edible protein production can be noticed for this period, with the production of plant protein outstripping that of animal protein.

If, however, one would take into account the considerable amount of protein in the form of grains and oilseeds that was used as feed during this period, then the total mass of food protein – the food stock – would be less than the total world protein production, and actually the situation was to the contrary. In 1961-76 production of plant protein available for food grew slower than that of animal protein – 25.3% increase vs. 32.4%, correspondingly (Tables II & III).

In 1961-65 33.4 kg per capita of edible protein, excluding proteins from grains and oilseeds used as feed, was produced, and in 1972-76 it was 35.7 kg.

The distribution of world edible protein production for 1961-76 demonstrates predominance of plant protein over animal protein (Table I).

Distribution of the edible protein produced, except for that part which was used to cover the needs of livestock, shows that quality of food protein was actually higher: in 1961-65 animal-to-plant protein ratio was 1 to 1.95, while in 1972-76 this somewhat improved to make 1 to 1.85. This change in food protein quality during this period was due to a larger increase in animal protein production (Table II).

In 1972-76 production of animal protein was meat 36.85%; milk 30.43%; fish and marine products 26.5, eggs 6.16 (Table III). An increase in animal protein production was insured by the growth in meat production: beef, pork, poultry meat. Rates of growth in poultry meat production outstripped that for the rest of animal protein

TABLE I

World Food Protein Production 1961-1976[a]

Commodity name	1961-1965 1,000T	%	1972-1976 1,000T	%	% Increase
Meat	12,810	7.2	18,073	7.4	41.1
Milk	12,570	7.0	14,924	6.1	18.7
Eggs	2,142	1.2	3,022	1.2	41.1
Fish and marine species	9,513	5.3	13,032	5.3	37.0
Animal proteins-total	37,035	20.7	49,051	20.0	32.4
Per capita (Kg)	11.6	---	12.5	---	7.8
Cereals	9,8444	55.0	137,144	55.8	39.3
Pulses	7349	4.1	8370	3.4	13.9
Oilseeds	25,266	14.1	38,792	15.8	53.5
Treenuts	319	0.2	426	0.2	33.5
Vegetables	1,344	0.8	1,801	0.7	34.0
Roots and tubers	7,815	4.4	8,567	3.5	09.6
Fruits and melons	1,304	0.7	1,741	0.7	33.5
Plant proteins-total	141,841	79.3	196,841	80.0	138.8
Per Capita (Kg)	44.9	---	50.3	---	12.0
Proteins total-total	178,876	100	245,892	100	137.5
Per Capita (Kg)	56.5	---	62.8	---	11.2

[a]Calculations made on basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.

TABLE II

World Food Protein Production, When Protein from Cereals and Oilseeds Used for Feed Was Excluded, 1961-1976, 1000 Metric Tons[a]

Commodity name	1961-1965 1,000T	%	1972-1976 1,000T	%	% Increase
Meat	12,810	11.7	18,073	12.9	41.1
Milk	12,570	11.5	14,924	10.7	18.7
Eggs	2,142	2.0	3,022	2.2	41.1
Fish and marine species	9,513	8.7	13,032	9.3	37.0
Animal proteins-total	37,035	33.9	49,051	35.1	32.4
Per capita (Kg)	11.6	---	12.5	---	7.8
Food Cereals	51,720	47.3	65,870	47.2	27.4
Pulses	7,349	6.7	8,370	6.0	13.9
Oilseeds[c]	2,526	2.3	3,879	2.8	53.6
Treenuts	319	0.3	426	0.3	33.5
Vegetables	1,344	1.2	1,801	1.3	34.0
Roots and tubers	7,815	7.1	8,567	6.1	09.6
Fruits and melons	1,304	1.2	1,741	1.3	33.5
Plant proteins-total	72,377	66.1	90,654	64.9	25.3
Per Capita (Kg)	22.8	---	23.2	---	1.8
Proteins total	109,412	---	139,705	100	27.7
Per Capita (Kg)	34.4	---	35.7	---	3.8

[a]Calculations made on basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.
[b]Calculations made on basis of the statistical data from "The Forth World Food Survey," FAO, Food and Nutrition Series, N 10, 1977, p. 10. Data on cereals for 1961-1963 and 1972-1974.
[c]Calculations made on basis of the statistical data from "FAO Production Yearbook," Rome, Italy, 1977. According to our own estimation 10.0% of world oitseeds protein is used for direct edible purposes.

TABLE III

World Food Protein Production of Animal Origin, 1961-76, 1000 Metric Tons[a]

Commodity name	1961-1965 1000T	%	1972-1976 1000T	%	% Change
Beef and veal	5,476	14.8	7,450	15.2	36.0
Buffalo meat	757	0.4	182	0.4	15.7
Mutton and lamb	804	2.2	863	1.8	07.4
Goat meat	229	0.6	252	0.5	10.4
Pigmeat	3693	10.0	4966	10.1	34.5
Horsemeat	109	0.3	90	0.2	17.2
Poultry meat	2343	6.3	4271	8.7	82.3
Meat - total	12,810	34.6	18,073	36.9	41.1
Sheep milk	345	0.9	406	0.8	17.5
Goat milk	229	0.6	222	0.5	3.1
Buffalo milk	643	1.7	870	1.7	35.3
Cow milk - whole fresh	11,352	30.7	13,425	27.4	18.3
Milk - total	12,570	33.9	14,924	30.4	18.7
Hen eggs	2,107	5.7	2,972	6.1	41.0
Eggs - total	2,142	5.8	3,022	6.2	41.1
Fish and marine species	9,513	25.7	13,032	25.6	37.0
Protein of animal origin - total	37,035	100	49,051	100	32.4

[a]Calculations made on the basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.

categories, due to intensive development of the world broiler industry. Milk protein still plays an important role in protein diet of man. However, its contribution to total production of animal protein decreased from 33.94% in 1961-65 to 30.4% in 1972-76 (Table III).

In 1961-76 the structure of plant protein production potentially edible for man changed but slightly. Grain protein still plays an important role both in plant protein production and in man's diet. The period under consideration saw a growth of protein production for such crops as wheat, barley, maize, soybeans. Protein of oil-bearing crops was produced at the highest rate (Table I & IV).

Protein of oilseeds becomes more and more important in general structure of world protein resources potentially edible for man. In 1972-76 this protein category amounted already to 15.78% of total protein production in the world, or by 1.13% more than the overall production of protein coming from all branches of the livestock industry. In 1961-76 rates of development were the highest for such oil-bearing crops as soybeans, rapeseed, sunflower, safflower (Table V). In 1972-76 soybean protein amounted to 59.4% of the world oil-bearing crops, while cottonseed protein was 12.9%, peanut protein 11.6%, sunflowerseed protein 5.6%, rapeseed protein 4.25%, etc. (Table VI).

Soybean protein is a special case in the distribution of world protein resources because of a certain set of amino-acids appropriate for man's diet possessing high biological value on the one hand, and because of thoroughly developed techniques for production and consumption of soy protein products on the other hand.

Through 1972-76 the volume soybean protein amounted to 23.0 million tons every year, or exceeded the production of protein from all meat categories and eggs by about 2.0 million tons. Production of soy protein is equal to almost half of that of all animal protein (fish included). Soybean protein together with animal protein made up almost one-third of all protein resources in 1972-76, thus having drastically changed relationship between biologically valuable proteins and plant proteins obtained from grains and several other crops in the category of less valuable proteins.

TABLE IV

World Food Protein Production of Plant Origin, 1961-76

Commodity name	1961-65 1000T	%	1972-76 1000T	%	% Change
Cereals - total	98,444	69.4	137,144	69.7	39.3
Food grains - total	57,641	40.6	77,648	39.5	34.7
Wheat	31,040	21.9	45,323	23.0	46.0
Rice	18,993	13.4	24,498	12.5	29.0
Feed grains - total	40,803	28.8	59,496	30.2	45.8
Corn	20,027	14.5	29,794	15.1	48.8
Barley	10,969	7.7	18,411	9.4	67.9
Pulses - total	7,349	5.2	8,370	4.2	13.9
Oilseeds - total	25,266	17.8	38,792	19.7	53.5
Soybeans	12,340	8.7	23,027	11.7	86.6
Treenuts - total	319	0.2	426	0.2	33.7
Vegetables	1,344	0.9	1,801	0.9	34.0
Roots and tubers	7,815	5.5	8,567	4.3	09.6
Potatoes	5,674	4.0	5,879	2.9	03.6
Fruits and melons	1,304	0.9	1,741	0.9	33.5
Plant protein - total	141,841	100	196,841	100	38.8

[a]Calculations made on the basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.

TABLE V

World Oilseeds Production 1961-1976, 1000 Metric Tons[a]

Commodity name	1961-1965	1972-1976	% Increase
Soybeans	32,474	60,596	86.6
Groundnuts in shell	15,786	17,650	11.8
Coconuts	26,757	29,985	12.1
Palm kernels	1,081	1,315	21.7
Olives	7,196	8,475	17.8
Castor beans	688	907	31.7
Safflower seed	7,349	10,394	41.4
Rapeseed	4,293	7,417	72.8
Saflower seed	446	753	68.7
Sesame seed	1,692	1,950	15.2
Cotton seed	20,203	24,785	22.7
Linseed	3,425	2,466	72.0
Hempseed	56	32	57.5
Oilseeds-total	121,455	166,726	37.3

[a]Calculations made on basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.

TABLE VI

World Oilseeds Protein Production 1961-1976, 1000 Metric Tons[a]

Commodity name	1961-1965		1972-1976		%
Soybeans	12,340	48.8	23,027	59.4	86.6
Groundnuts in shell	4,041	16.0	4,518	11.7	11.8
Coconuts	1,097	4.3	1,229	3.2	12.1
Palm kernels	---	---	---	---	---
Olives	108	0.4	127	0.3	17.8
Castor beans	124	0.5	163	0.4	31.7
Sunflower seed	1,543	6.1	2,183	5.6	41.4
Rapeseed	953	3.8	1,647	4.3	72.8
Safflower seed	56	0.2	95	0.3	69.6
Sesame seed	306	1.2	353	0.9	15.2
Cotton seed	4,081	16.2	5,007	12.9	22.7
Linseed	617	2.4	444	1.2	72.0
Hempseed	---	---	---	---	---
Oilseeds - total	25,266	100	38,792	100	53.5

[a]Calculations made on basis of the statistical data from FAO Production Yearbook, Rome, Italy, 1977.

Our estimate for present direct consumption of soy protein by man is ca. 10.0%. The remaining quantity, or more than 20 million tons of soybean protein, is still used for the needs of livestock industry. It is this portion of protein we believe to be the most important reserve and a key to solving the problem of adequate protein diet for man. It appears worthwile to begin now to increase the share of soybean protein in man's diet, gradually substituting its place in feed by less valuable protein-containing means (oilcakes and oilmeals except for soy); inedible resources of animal protein; such nontraditional protein sources as single-cell protein; synthetic amino acids; nonprotein nitrogenous compounds, etc.