DIETARY PATTERN AND SOYBEAN PROCESSING IN JAPAN TODAY

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Abstract

Low intake of animal protein as a whole, high intake of marine products compared to livestock, high intake of edible oil as a whole and strong influence of traditional taste preference, characterize the present food consumption pattern in Japan. These characteristics are considered to be rational and ideal from the nutritional point of view. The demand for soybeans has increased for the past decade in spite of a noticeable dependence upon imported soybeans. In Japan soybeans are processed to supply a wide variety of sophisticated foods, both traditional and modern.

Consumption of soybeans in Japan

Tables 1 to 4 show statistical data on the Japanese food situation presently. Food consumption patterns which changed in the 1960s during the rapid economic growth experienced by the country have resulted in the increase of calorie, protein and fat intake with a corresponding decrease in carbohydrate consumption and such pattern has been maintained since 1970 up to now. The characteristics of the present food consumption patterns in Japan are:

1) low intake of animal protein and high intake of vegetable protein,
2) high ratio of intake of marine products compared to livestock,
3) high intake of edible oil in total fat,
4) strong influence of traditional taste preference.

The intake of animal protein in Japan is comparatively low, in proportion to the relationship between the gross domestic product (GDP) and the intake of animal protein in other countries of the world. The ratio of intake of animal to vegetable protein in Japan is less than 50% (Tables 2 and 4). The high consumption of marine products is partly due to the high price of meat but mainly attributable to the Japanese traditional taste. The ratio of intake of marine products to that of livestock is almost 50% (Table 2). Marine products are consumed fresh but are also processed into many kinds of sophisticated food products. The Japanese have developed a habit of eating a variety of marine vegetables, which is unusual in the world. The Japanese taste preference is highly oriented toward bean foods. The Japanese consume daily 5.4g of soybeans, 2.2g of other legumes and 4.6g of soybeans as miso and soy sauce. Such a consumption pattern corresponds to that of the populations living in Southeast Asia, Central and South America and Africa who also consume a large amount of legumes.

As emphasized by WHO, protein, carbohydrate and fat should account for 11 to 12%, 63 to 67% and 20 to 22% of the total calorie intake, respectively. Thus the Japanese PCF pattern with protein, carbohydrate and fat accounting for 12.5%, 67.3% and 20.2% of the calorie intake, respectively is very near the ideal one. Moreover the quality of fat derived from marine products or vegetable sources helps prevent the occurrence of adult diseases because of their high content in unsaturated fatty acids.

The demand for soybeans has been on the increase, especially for the production of edible oil (Table 5). Also defatted soybean meals are mainly used for feeds and are processed into vegetable protein products. The use of whole soybeans in many traditional food products is still prevalent in Japan (Table 6). I personally find it regrettable that Japan is not self-sufficient in the production

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Table 1 Intake of Kcal/day/person

Kcal

Year	Cereals	Rice	Total CHD	Beans	Vegeta-bles	Fruits	Meats	Eggs	Dairy products	Marine products	Sugars	Lipids	Others	Total
1960	1,439	1,106	1,580	104	84	29	28	27	36	87	157	105	53	2,290
			(69)	(4.5)	(3.7)	(1.2)	(1.2)	(1.2)	(1.6)	(3.8)	(6.9)	(4.6)	(2.3)	
1965	1,398	1,076	1,528	98	89	39	54	49	61	90	196	161	47	2,411
1970	1,238	914	1,351	104	93	53	83	64	81	91	283	229	45	2,478
			(50)	(4.2)	(3.8)	(2.2)	(3.3)	(2.6)	(3.3)	(3.7)	(11.4)	(9.2)	(1.8)	
1973	1,197	873	1,308	103	88	60	108	62	85	98	295	270	45	2,522
1975	1,175	844	1,283	99	87	58	112	60	86	103	263	277	40	2.466
			(52)	(4)	(3.5)	(2.4)	(4.5)	(2.4)	(3.5)	(4.2)	(10.7)	(11.2)	(1.6)	
1976	1,164	829	1,285	94	88	55	117	61	88	105	265	283	41	2,483
1977	1,137	802	1,264	90	91	57	127	62	92	103	280	289	40	2,494
1978	1,120	785	1,250	89	90	56	134	64	96	105	266	311	39	2,500
1979	1,101	765	1,232	91	91	56	143	63	100	101	271	321	39	2,507
1980	1,101	759	1,249	90	92	54	144	63	101	102	245	336	38	2,514
			(50)	(3.6)	(3.7)	(2.1)	(5.7)	(2.5)	(4.0)	(4.1)	(9.7)	(13.4)	(1.5)	
1981	1,083	748	1,242	90	92	53	144	63	105	105	235	356	38	2,520

Figures in parentheses indicate percentage.

Table 2 Intake of protein/day/person

g

	Animal protein						Vegetable protein				Total
	Livestock				Marine products	Sub-total	cereals	beans	others	Sub-total	
	meats	eggs	dairy products	total							
1960	1.7 (2.5)	2.2 (3.2)	1.7 (2.4)	5.6 (8.1)	15.6 (22.4)	21.2 (30.5)	28.8 (41.1)	8.0 (11.5)	11.5 (16.6)	48.3 (69.5)	69.5
1965	3.5	4.0	3.0	10.5	16.4	26.9	28.4	7.3	11.2	46.9	73.8
1970	6.0 (7.9)	5.2 (6.8)	4.0 (5.2)	15.2 (19.2)	16.6 (21.7)	31.8 (41.6)	25.8 (33.7)	7.8 (10.2)	11.1 (14.5)	44.7 (58.4)	76.5
1973	8.0	5.0	4.2	17.2	17.7	34.9	25.0	7.8	11.5	44.3	79.2
1975	8.5	4.9	4.3	17.6	18.1	35.7	24.7	7.6	11.1	43.4	79.1
1976	9.1	5.0	4.5	18.4	18.2	36.6	24.6	7.2	11.3	43.1	79.7
1977	9.9	5.2	4.7	19.4	17.9	37.3	24.1	6.9	11.4	42.4	79.7
1978	10.6	5.1	4.9	20.5	18.1	38.6	23.8	6.9	11.3	42.0	80.6
1979	11.2	5.1	4.9	21.2	17.7	38.9	23.4	6.9	11.4	41.8	80.6
1980	11.3 (14.0)	5.1 (6.3)	4.9 (6.1)	21.3 (26.4)	17.8 (22.1)	39.1 (48.5)	23.6 (29.2)	6.9 (8.5)	11.1 (13.8)	41.6 (51.5)	80.7
1981	11.4	5.1	5.1	21.6	18.1	39.7	23.1	6.9	11.0	41.0	80.7

Figures in parentheses indicate percentage.

of the raw materials of such important food products and remains heavily dependent on imported soybeans.

Table 3 Intake of fat/day/person

g

	Vegetable fat	Animal fat	Total	Meats	Eggs	Dairy products	Cereals	Others	Total	Total
1960	8.8 (30.2)	3.1 (10.7)	11.9 (40.9)	1.7	1.9	2.0	3.6	8.0	17.2 (59.1)	29.1
1965	13.7	4.6	18.3	3.7	3.5	3.4	3.5	8.1	22.2	40.5
1970	19.9 (37.9)	5.9 (11.2)	25.8	5.9	4.6	4.5	3.2	8.5	26.7 (50.9)	52.5
1973	23.8	6.6	30.4	7.8	4.4	4.8	3.1	8.9	29.0	59.4
1975	25.2	6.0	31.2	8.0	4.3	4.8	3.0	9.1	29.2	60.4
1976	26.3	5.6	31.9	8.5	4.4	5.0	3.0	8.9	28.8	61.7
1977	27.2	5.4	32.6	9.1	4.4	5.2	2.9	8.7	30.3	62.9
1978	28.6	6.4	35.0	9.6	4.6	5.4	3.0	8.7	31.3	66.3
1979	29.4	6.7	36.1	10.4	4.5	5.6	2.9	8.8	32.2	68.3
1980	30.8 (44.0)	7.1 (10.1)	37.9	10.4	4.5	5.6	3.0	8.6	32.1 (45.9)	70.0
1981	33.2	6.9	40.1	10.4	4.5	5.9	2.9	8.7	32.4	72.5

Figures in parentheses indicate percentage.

Varieties and processing of soybean foods

Figures 1 to 4 show the processing methods of the main traditional soybean foods which have already acquired a reputation worldwide. Apart from the products listed, a new soybean product such as soy milk is becoming increasingly popular in the market. The production of soy milk which totalled less than 5,000 tons in 1975 increased 10 times and amounted to 50,000 tons in 1982. The growing interest of the consumers in health foods is no doubt responsible for this considerable increase. It should also be emphasized that modern food technology has contributed to such success in making soy milk acceptable to the public by removing the unpleasant beany flavor and sterilizing it for wider and safer distribution (Figure 5). The vegetable protein products listed in Figure 6, are presently being used by 73% of the food processors and have already been accepted as food ingredients due to their functionalities. The Japanese Agricultural Standards (JAS) for vegetable protein products were established in 1976 and those for soy milk in 1981, respectively.

Traditional technology for modern products and emerging technology applied to traditional foods

Flow sheets shown in Figures 1 to 4 include several improved aspects for the standardization, mechanization and/or mass-production of soybean derivatives. Herein, tofu and miso can be produced with slightly different processing methods. On the ohter hand, foods of more local nature are still produced on a small scale, such as yuba: surface-induced film on soybean milk, rokujotofu: salted and dried tofu, shimitofu: classical products of kori tofu obtained by natural freezing, tofukan: hard tofu conditioned with soy sauce, hoshiaburage: deep-fried tofu largely expanded, confectionery, etc. Recently food industries have reevaluated traditional soybean food technology. On the other hand, vegetable protein products are being introduced in traditional foods (for example delicacies for home use).

We are happy to observe that traditional and modern technologies are applied to modern and traditional foods in keeping a dynamic interaction between them.

Table 4 Comparison of intake of nutrients among various nations

	Calorie		Protein			Lipids		
	Kcal	ratio J=100	g	ratio J=100	animal protein / total protein (%)	g	ratio J=100	edible oil / total lipid (%)
Sweden	2,871	114	96	119	73	133	183	26
West Germany	3,397	135	98	122	68	178	246	30
France	3,340	133	112	139	68	168	231	30
Netherlands	3,421	136	97	120	67	184	254	45
England	3,150	125	89	110	62	140	193	33
USA	3,393	135	106	132	70	166	230	38
Canada	3,138	125	98	122	67	151	208	35
Denmark	3,369	134	97	120	71	179	247	36
Switzerland	3,358	133	103	128	66	163	225	26
Italy	3,363	133	109	135	50	137	189	44
New Zealand	3,121	124	111	138	70	145	201	13
Japan	2,520	100	81	100	49	73	100	55
Argentina	3,110	123	109	136	64	115	159	38
Brazil	2,514	100	62	77	37	49	68	42
China	2,343	93	62	77	18	39	54	28
Korea	2,615	104	72	89	19	27	37	23
Pakistan	2,281	91	63	78	25	42	57	53
India	1,919	76	47	59	10	30	41	51
Indonesia	2,112	84	43	54	12	33	45	42

Kcal, g of protein or lipid/day/person.
From OECD: Food consumption statistics and FAO: Food balance sheets

Table 5 Supply and demand of whole soybeans in Japan

1,000ton

Year		1970	1974	1975	1976	1977	1978	1979	1980	1981
Supply		3,477	3,705	3,614	3,801	3,954	4,617	4,754	4,984	4,978
Demand	edible oil	2,505	2,729	2,620	2,701	2,878	3,297	3,401	3,453	3,495
	fermented foods	187	206	190	193	193	188	205	208	785
	foods	522	520	526	537	552	565	572	578	
	feeds	10	30	30	30	30	40	55	55	55
	export							20	30	40

Table 6 Detailed use of whole soybeans supplied for food

1,000ton

Year	1975	1976	1977	1978	1979	1980	1981	(1982)*
For tofu analogues								
IOM	350	365	380	393	389	390	400	410
Howkeye and Beeson	27	23	22	21	20	22	25	25
Canada	6	6	8	10	3	3	5	5
Brazil	1	3	2	2	0.5	0.3	—	—
China	20	10	5	5	10	10	10	10
Domestic	10	10	10	15	30	35	30	30
Total	414	417	427	445	452	460	470	480
For kori tofu								
IOM	25	26	28	29	26	25	28	28
China	5	3	2	1	3	3	—	—
Total	30	29	30	30	29	28	28	28
For natto								
China	61	37	15	15	40	27	30	25
IOM and others	3	24	45	46	8	20	27	35
Domestic	4	8	10	10	25	28	20	20
Total	68	69	70	71	73	75	77	80
For miso								
China	160	90	60	55	120	94	89	60
Domestic	11	11	10	7	17	22	15	20
variety	10	27	50	30	25	40	50	60
IOM	5	63	65	90	20	30	30	40
Total	186	191	185	182	181	185	183	180
For shoyu								
IOM	11	10	9	6	7	7	7	6
For other foods	16	16	16	16	17	18	20	23
Total	725	731	737	750	759	773	785	797

* Projected values.

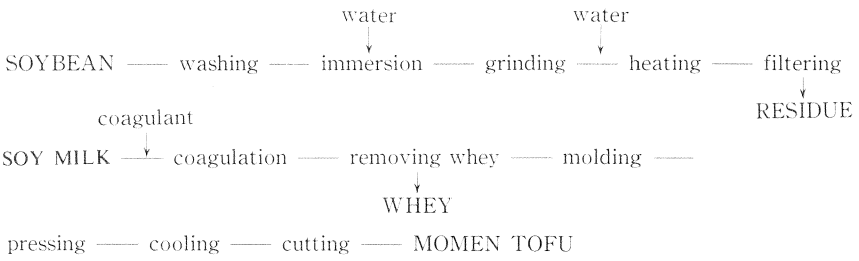

Fig. 1 Flow sheet of Momen Tofu preparation.

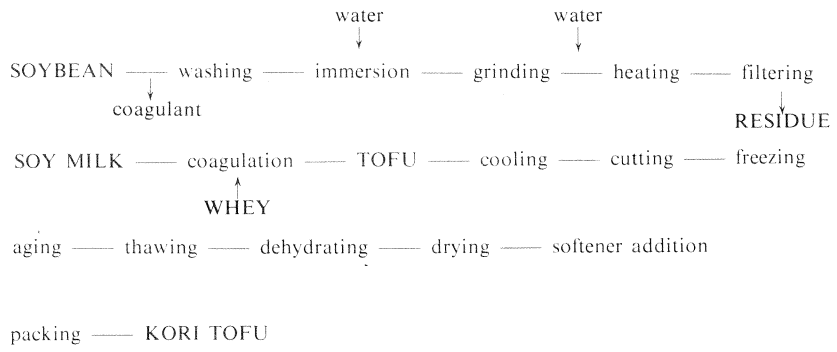

Fig. 2 Flow sheet of Kori Tofu preparation.

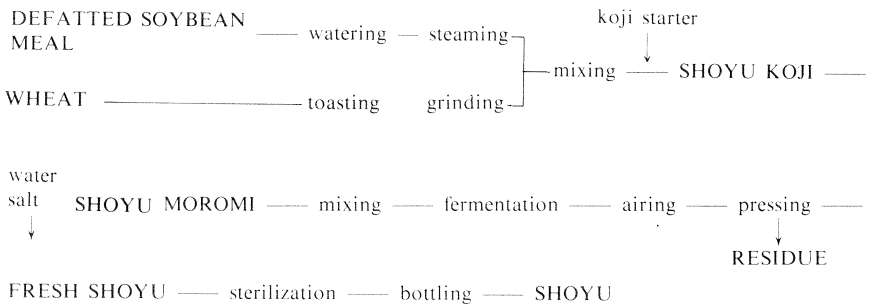

Fig. 3 Flow sheet of Shoyu (soy sauce) preparation.

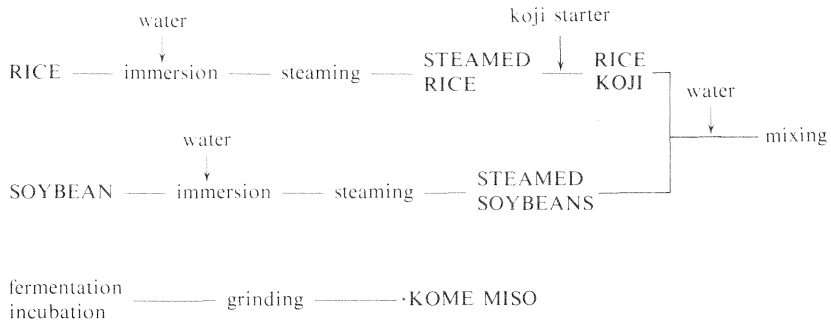

Fig. 4 Flow sheet of Kome Miso preparation.

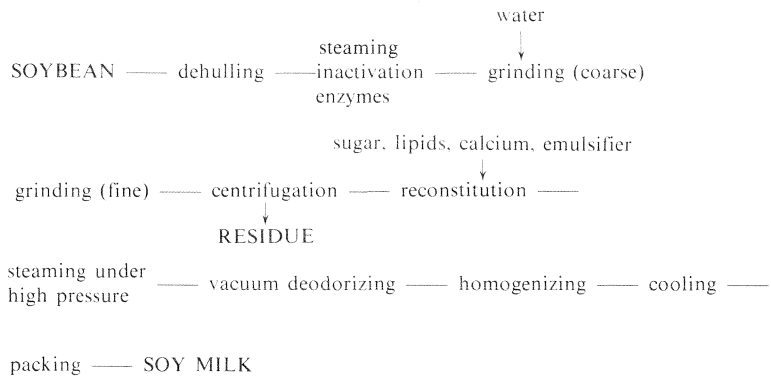

Fig. 5 Flow sheet of soy milk preparation.

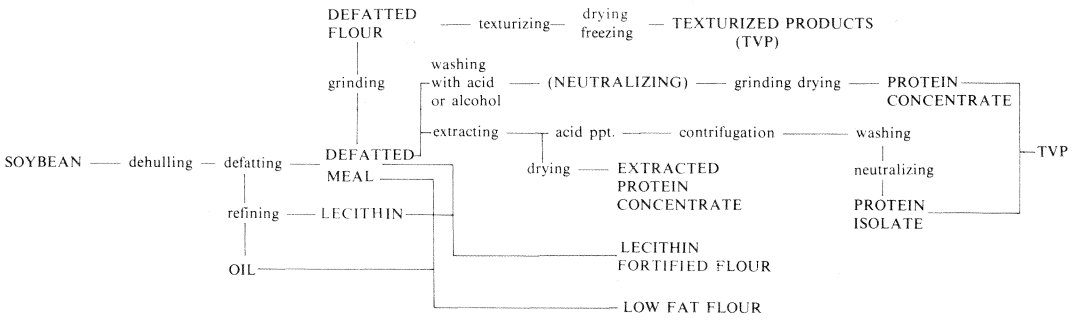

Fig.6 Manufacture of vegetable protein products.

Reference

1) Japanese Food Consumption Yearbook, 1981, Ministry of Agriculture, Forestry and Fisheries.

Discussion

Palaniyappan, K. (India): 1. What are the products that you add for the reconstitution of soy milk ? 2. What is the shelf life of soy milk ? 3. We would like to have more information about the soya products which are being marketed in Japan so as to introduce them to the Indian public. Could you assist us in this regard ?

Answer: 1. The chemical composition of reconstituted soy milk is very similar to that of cow milk. We therefore add sugar, honey, dextran, malt, vegetable oil and Ca in the colloidal state to avoid the precipitation of proteins. 2. Since the conditions of sterilization of soy milk are very strict, soy milk can be preserved at room temperature for more than 3 months. 3. This information will be supplied to you on the occasion of your visit of the National Food Research Institute after the symposium.

Bhatnagar, P.S. (India): 1. Is it possible to prepare tofu from defatted soy flour or soy meal ? 2. We have observed that when we boil the slurry from soy meal, it often sticks at the bottom of the pan and chars in spite of frequent stirring. Could you indicate us how to avoid this problem ?

Answer: 1. It is possible to prepare tofu or soy milk from defatted soy flour. However the taste of tofu or soy milk is not as good as when these products are prepared from whole beans. In Japan, most of tofu and soy milk is prepared from whole beans. 2. You may overcome the difficulty you described in preparing soy milk from soy meal. After heating, tofu can be obtained.