[Bull. Tokyo Kasei Daigaku, 23(2) p. 157~161, 1983]

Comparative Studies on Chemical Components in Two Different Types of *Miso*

Tomiko YOSHIHARA* and Chihoko NOZAKI**

(Received September 28, 1982)

Introduction

Miso is the fermented food made from mainly *koji*, soybean and salt. Growth of *koji* fungi, lactic acid bacteria, and leaven are related to the changes of peculiar taste and flavor during maturation. [1] When compare *miso* with raw soy-bean, the rates of digestion and absorption are very high (85%) so that the organization were destroyed by microorganism.[2] The classifications of *miso* are Rice *koji miso*, Malt *miso*, and Soy-bean *miso* according to the materials. Rice *koji miso* is also classified into salty, sweet, and less sweet types in the tastes and colors.

Rice *koji miso* which is made from rice *koji*, soybean, and salt is traditional one, widely used in preparing Japanese soups. Eighty per cents of the total productions are Rice *koji miso*.[3] The ratio of *koji* is very low (5-10) and a large amount of salt, and a long fermented-term (6-12 months) is necessary for the manufacture of *miso*. On the other hand, the ratio of *koji* is very high (8-15) and a small amount of salt, and a short fermented-term (3-6 months) is necessary for the sweet one.[4]

Materials and Methods

The chemical components were investigated using twenty-four commercially packed *miso* with the representative two types, salty and sweet. They were produced and packed from March to July in 1979.

The analyses of chemical components were based on the Official Methods of *Miso* Analysis.[5] In order to analyze the sugar content, it is followed by the Fehling Leman Säuren Method[6] using the filtrate after hydrolysis with 25% HCℓ and neutralization with 10% NaOH and then sugar were calculated as glucose. According to Okada[7], acid I (pH 7.0) was described as organic acid such as the most of lactic acid bacteria and acetic acid, then phosphoric acid and amino acid, and pectid such as the part of disintegration that relate to protein. Acid II (pH 8.3) was described the residue of them. The appearance color was followed by the method of Yoshino[8] by using Color difference meter Model ND-IOI DP (Nippon Denshoku Co.).

Results and Discussion

As shown in Tables I and II, the coefficient of variation was low among several contents such as moisture, protein, crude fat, sodium chloride, ash, and pH in the salty type. In the sweet type, it was obtained acid II. On the other hand, the coefficient of variation was very high in reducing sugar, alcohol, acid I, and color L value in the salty type. The crude fat, color a, b, and a/b ratio values were also recognized as high variations in the sweet type. The mean value of moisture in the salty type was a little high (2%) than sweet one, because it was considered to be due to the difference of the fermented-term or the influence of hydrolysis. In the both types, the minerals showed the high range of content such as phosphorus (111-181 mg%), iron (2.7-4.7 mg%), or calcium (79.1-154.1 mg%). These indicated

※食品学第1研究室
※※調理学第3研究室

Table 1 Chemical components in two different types of *miso*

Samples		Moisture	Protein	Fat	Reducing Sugar	Ash	Calcium	Phosphorus	Iron	Sodium chloride	Alcohol	Acid I	Acid II	pH
		%					mg%			%		ml		
Salty-type	1	44.1	11.1	6.2	9.3	13.6	79.1	181	3.2	12.3	2.9	20.8	22.9	5.9
	2	44.8	16.1	6.4	14.7	13.3	102.1	150	2.7	11.4	4.2	26.1	28.7	6.0
	3	35.8	11.3	6.8	18.4	12.9	106.5	137	3.3	11.5	2.2	15.0	17.2	6.0
	4	36.8	11.3	5.4	13.9	12.3	104.2	150	4.2	9.8	1.1	16.6	15.7	5.9
	5	41.5	13.7	4.9	19.4	13.5	142.1	141	3.9	11.7	2.5	17.2	16.3	6.1
	6	36.8	15.6	5.0	17.3	12.7	106.5	157	3.1	11.7	2.1	13.5	15.3	5.9
	7	39.8	13.9	5.1	9.8	14.0	104.2	170	4.7	12.2	1.7	19.1	18.4	6.1
	8	37.1	14.0	4.8	17.3	13.2	142.1	166	4.0	12.1	3.2	15.2	14.1	6.0
	9	37.9	13.7	3.9	18.3	12.9	102.8	167	3.7	10.5	2.8	17.2	13.9	5.9
	10	38.1	14.1	4.7	19.6	13.8	120.7	159	2.8	10.5	2.3	17.9	12.2	5.9
	11	42.4	13.3	5.7	17.2	13.1	154.1	129	2.8	14.3	2.3	23.6	20.2	5.9
	12	46.4	14.7	5.9	19.8	14.6	120.5	111	3.0	12.1	2.2	20.2	17.7	6.1
	M±SD	40.1 ± 3.5	13.6 ± 1.6	5.4 ± 0.8	16.3 ± 3.5	13.3 ± 0.6	115.4 ±20.5	151.5 ±18.8	3.5 ± 0.6	11.7 ± 1.1	2.5 ± 0.7	18.5 ± 3.5	17.7 ± 4.3	6.0 ± 0.1
	C.V.	9.0	11.9	15.4	22.2	4.7	18.6	12.9	18.6	9.8	31.7	19.8	25.5	1.5
Sweet-type	1	38.4	9.6	3.4	29.1	5.2	44.1	101	3.0	4.2	1.1	15.9	13.7	5.9
	2	40.7	10.5	1.0	30.8	6.9	54.7	112	3.9	4.2	1.8	15.2	17.6	5.8
	3	40.3	9.0	2.7	30.3	6.0	75.0	135	2.6	4.8	1.2	15.9	13.7	6.1
	4	39.3	11.4	3.7	37.9	5.8	63.0	120	3.1	5.1	1.1	15.2	13.6	6.0
	5	41.9	10.7	1.4	30.1	6.9	77.2	109	2.9	5.3	1.1	17.6	19.2	5.8
	6	37.7	10.4	2.3	32.9	7.0	66.6	97	2.0	4.9	1.3	13.6	16.2	6.2
	7	38.2	10.6	4.4	27.2	5.9	49.1	124	2.2	6.1	1.1	19.2	20.1	5.8
	8	39.6	10.4	1.8	26.8	6.1	70.1	101	3.0	5.3	1.2	13.8	14.7	6.0
	9	42.1	10.6	1.8	20.8	6.8	70.9	93	2.9	5.1	1.1	15.2	11.0	5.9
	10	40.6	9.2	2.8	30.0	5.9	60.9	127	2.8	4.9	1.1	16.2	19.5	6.1
	11	32.7	8.6	3.3	38.3	6.3	63.0	120	3.1	5.0	1.7	15.5	19.7	5.8
	12	30.8	11.2	3.7	37.4	6.7	54.7	102	2.6	5.5	1.3	16.2	13.2	5.9
	M±SD	38.5 ± 3.3	10.2 ± 0.8	2.7 ± 1.0	31.0 ± 4.9	6.3 ± 0.5	62.4 ± 9.8	111.8 ±12.8	2.8 ± 0.5	5.0 ± 0.5	1.3 ± 0.2	15.8 ± 1.5	16.0 ± 3.0	5.9 ± 0.1
	C.V.	9.0	8.4	39.3	16.5	9.1	16.4	12.0	16.9	10.3	19.1	9.6	19.4	2.4

M;mean S.D.;Standard Deviation

C.V.; Coefficient of variation

the additions of minerals. Depending on the fermented-term, fat was protected from separation or oxidation because they were covered with cell. According to the materials, these characteristics were obviously determind so that the reducing sugar and sodium chloride contents differed very much compared with the two types. The reducing sugar content was very high (31.0 %), on the contrary, the sodium chloride content was very low (5.0 %) in the sweet type. The findings are determined that some *miso* were trially made by addition of ethyl alcohol to protect overmultiplication during fermentation.

Table 2 shows the appearance color of *miso*. The Hunter's a/b ratio value was tended to the first part as + side in read and yellow colors. The mean values of a/b ratio were 0.6 in the salty type and 0.4 in the sweet.

Table 3 lists the correlation coefficients.

The best negative correlation was obtained between sodium chloride and color a/b ratio values in the salty type. The negative correlation also was obtained between moisture and calcium, acid I and color L value and alcohol and color a value. Reducing sugar and ash showed positive correlation. On the other hand, the positive correlation was obtained between ash and iron in the sweet type. The fat and color a/b ratio showed a positive correlation, then pH and color a/b ratio were a negative correlation in the sweet type. The data were statistically analyzed to indicate a significantly differences in each chemical component of two types *miso* respectively using the Students' t test. The significant differences was obtained between protein, crude fat, reducing sugar, ash, phosphorus, color L value, and color a value at 1% level, then, iron at 5%. There were no significant differences between moisture, sodium chloride, pH, calcium, alcohol, acid I, and also color b value.

The authors wish to express to Professor Y. Saito and Dr. U. Yoshino, for helpful advice on this work.

Table 2 The appearences color of two different types of *miso*

		L	a	b	a/b
Salty-type	1	32.3	9.2	15.1	0.6
	2	35.0	8.3	16.6	0.5
	3	29.5	8.6	12.4	0.7
	4	29.4	9.6	14.0	0.7
	5	31.1	10.0	14.9	0.7
	6	30.8	9.9	14.9	0.7
	7	23.3	8.4	10.8	0.8
	8	35.0	10.2	16.0	0.6
	9	20.0	8.1	12.1	0.7
	10	19.4	5.4	9.6	0.6
	11	20.4	8.3	13.0	0.6
	12	35.1	7.6	15.3	0.5
	M±SD	28.4±5.8	8.6±1.3	13.7±2.1	0.6±0.1
	C.V.	21.3	15.3	15.7	12.7
Sweet-type	1	41.8	8.6	19.5	0.4
	2	40.0	8.3	19.0	0.4
	3	41.5	7.7	19.2	0.4
	4	51.2	5.1	20.7	0.3
	5	40.9	8.5	19.0	0.5
	6	40.2	8.2	13.9	0.6
	7	50.7	5.9	10.1	0.6
	8	49.9	7.6	10.7	0.7
	9	51.2	4.9	19.6	0.3
	10	39.8	7.3	18.0	0.4
	11	40.8	7.3	17.7	0.4
	12	51.9	5.0	8.9	0.6
	M±SD	45.0±5.1	7.0±1.4	16.4±4.1	0.4±0.2
	C.V.	11.9	20.2	26.0	38.6

Summary

The chemical components were investigated using twenty-four commercially packed *miso* with the representative two types, salty and sweet. The main objective of this study was to clarify the influence of the materials, sodium chloride contents, and a fermented-

Table 3 Coefficient of correlation between each chemical component in two different types of *miso*

	Moisture	Protein	Phos-phorus	Iron	Fat	Reducing suger	Sodium chloride	Ash	pH	Calcium	Alcohol	Acid I	Acid II	L	a	b
Protein	0.26 −0.16															
Phosphorus	−0.33 0.06	−0.15 −0.46*														
Iron	−0.40 0.21	0.01 −0.21	0.37 0.47*													
Fat	0.39 0.09	−0.27 −0.04	−0.19 0.27	−0.39 −0.46*												
Reducing suger	−0.16 0.16	0.32 −0.01	−0.60** 0.28	−0.37 0.05	−0.25 0.40											
Sodium chloride	0.45* −0.23	0.09 0.13	−0.26 0.09	−0.24 −0.57**	0.30 0.42*	−0.11 0.14										
Ash	0.65** −0.01	0.29 0.33	0.21 −0.40	−0.17 8.06**	0.09 −0.60**	2.62** −8.27**	0.30 0.10									
pH	0.35 0.15	0.25 −0.14	−0.36 0.06	0.35 −0.47*	0.15 0.26	0.06 −0.51*	0.18 −0.16	0.62** −0.09								
Calcium	−4.96** 0.39	0.24 0.38	−0.50* 0.03	−0.04 −0.08	−0.25 −0.55**	0.59** −0.15	0.45* 0.12	0.07 0.45*	0.22 0.26							
Alcohol	0.40 −0.37	0.44* 0.30	0.17 0.04	0.96** 0.52**	0.15 −0.28	0.05 −0.22	0.16 −0.38	0.13 0.40	0.04 −0.32	−0.02 −0.14						
Acid I	0.69** 6.45**	0.22 −0.03	−0.45* 0.44*	−0.43* −0.20	0.14 0.42*	−0.28 −0.10	0.09 0.50*	0.35 −0.20	0.07 −0.54**	0.09 −0.28	0.48* −0.28					
Acid II	0.69* −0.35	0.13 −0.31	−0.05 0.46*	−0.34 −0.02	0.69** 0.04	−0.49* 0.19	0.36 0.20	0.13 −0.27	0.12 −0.28	0.02 −0.17	0.55** 0.29	0.80** 0.46*				
Color L	0.32 −0.19	0.12 0.46*	−0.16 −0.17	−0.04 −0.16	0.48* 0.38	−0.07 −0.13	0.01 0.64**	0.09 −0.09	0.39 −0.16	−0.16 −0.10	0.34 −0.29	−3.14** 0.11	0.39 −0.48*			
a	−0.17 −0.07	−0.16 −0.48*	0.10 0.04	0.45* 0.17	0.04 −0.47*	−0.25 −0.05	0.14 −0.57**	−0.47* 0.03	0.11 −0.26	0.05 0.08	−3.83** 0.26	0.17 −0.16	0.08 0.40	0.55** −0.85**		
b	0.42* 0.53**	0.22 −0.29	−0.16 0.21	−0.15 0.50*	0.33 −0.31	−0.04 −0.04	0.18 −0.65**	−0.09 −0.13	0.17 −1.42**	0.03 0.23	0.48* 0.03	0.18 −0.11	0.47* −0.10	0.88** −0.45*	0.65** 0.24	
a/b	0.62** −0.30	−0.42* 0.07	0.37 −0.21	0.78** −0.36	−0.23 2.40**	−0.33 −0.02	−8.57** 0.32	−0.39 0.09	0.12 0.09	−0.03 −0.14	−0.56** 0.07	−0.51* −0.05	−0.37 0.27	−0.37 0.04	0.42* 0.30	−0.41* −0.84**

**; Significantly different at $p<0.01$ level
*; Significantly different at $p<0.05$ level
The first line of values are salty type
The second line of values are sweet tvpe

term on two different types *miso*.

The results were obtained as follows:

1. The coefficient of variation was low among moisture, protein, crude fat, sodium chloride, ash, and pH in the salty type and acid II in the sweet type.
2. The coefficient of variation was very high in reducing sugar, and acid I, and color L value in the salty type. The crude fat, color b value were also showed high variations in the sweet type.
3. The additions of minerals were supposed in some samples.
4. According to the materials, it was determined the characteristics obviously so that the reducing sugar and sodium chloride contents differed very much pare the two types. The reducing sugar contents compared with the two types. The reducing sugar contents were very high and sodium chloride contents were low in the sweet type.
5. Some *miso* were trially made by addition of ethyl alcohol to protect overmultiplication during fermentation.
6. The Hunter's a/b ratio value was tended to the first part as + side in red and yellow colors.
7. The negative correlation was obtained between sodium chloride and color a/b ratio value in the salty type. The positive correlation was obtained between ash and iron in the sweet type.
8. From these considerations, there were significant differences between protein, crude fat, reducing sugar, ash, phosphrus, color L value, and color a value at 1% level and iron at 5% level.

References

1) W. Kawamura, H. Tatsumi; *Miso,* Shibata, Tokyo, (1972), p. 27
2) K. Miyazaki; *Jyozo Kyokai Shi,* **71, 909** (1976)
3) Institute of *Miso* Technologists; in printing, p. 20
4) Ibid., p. 42
5) Official Methods of *Miso* Analysis; Institute of *Miso* Technologists, (1970)
6) H. Iwao; Food Analyses, Kenpakusha, Tokyo, (1972) p. 222
7) Y. Okada, Y. Yokoo, T. Takeuchi; *Nippon Shokuhin Kogyogakkaishi,* **22, 222** (1975)
8) U. Yoshino; *Tokyo Kasei Daigaku Kenkyukiyo,* **20, 27** (1980)

米麹味噌二種の化学的成分における比較研究

吉原富子　野崎千穂子

(昭和57年9月28日受理)

麹歩合、食塩含有量、醸造期間の違いにより味噌の化学的成分および色調にどのくらい影響があるか市販の赤色系辛口米麹味噌と淡色系甘口米麹味噌24試料を分析し比較検討した結果、次のような結果が得られた。

1. 試料間の変動の少ない成分は、二種とも水分、蛋白質、脂肪、食塩含有量、灰分、およびpHであった。
2. 醸造期間の違いにより蛋白質、脂肪含量に影響があった。
3. アルコール含有量は、再発酵防止のため高めていることが認められた。
4. 各化学成分間には、相関関係が認められた。赤色系辛口米麹味噌において食塩含有量と色調(a/b)に、また、淡色系甘口米麹味噌において還元糖と灰分にそれぞれ高い負の相関関係が認められた。
5. 二種　各成分における平均値の差の検定結果、蛋白質、還元糖、脂肪、リン、鉄、灰分、L値、a値において有意差が認められた。