

Water uptake rate of brown rice at 100°C

Sung-Kon Kim and Chung-Sik Suh*

Department of Food Science and Nutrition, Dankook University, Seoul 140-714, Korea, * Department of Food Science and Nutrition, Yeungnam Junior College of Technology, Taegu 705-037, Korea

Abstract : The water uptake rates of thirty-four japonica and twenty-five j x indica brown rices at 100°C were analyzed. The water uptake rates had no correlation with size or volume of brown rice kernel. The regression equations for water uptake rates between brown rice at 100°C(Y) and milled rice at 23°C(X) for japonica and j x indica varieties were $Y = 1.12X - 0.34$ ($r = 0.976$, $p < 0.001$) and $Y = 1.16X - 0.54$ ($r = 0.990$, $p < 0.001$), respectively (Received August 13, 1990 and accepted September 20, 1990).

Attempts for evaluating the quality of milled rices in this laboratory had shown that milled rices could be classified into several hydration groups^{1, 2)}. The milled rices showed characteristic water uptake rate at room temperature and in general japonica varieties hydrated at a slower rate than j x indica ones.

In the breeding programs, only small quantity of rice sample is available for quality evaluation. In this experiment, the water uptake rates of brown rices at 100°C were analyzed to examine the possibility for grouping of rice based on hydration with the brown rices.

Materials and Methods

Rice

Thirty-four varieties of japonica and twenty-five varieties of j x indica type rices were used. The characteristics of these varieties were given in the previous paper²⁾.

Determination of water uptake rate

One gram of brown rice was immersed in constantly boiling tap water for 0.5~10min and the water uptake rate was calculated by the equation :

$$\bar{m} - m_0 = k\sqrt{t}$$

where \bar{m} is the moisture content at a given time(g H₂O/g

solid, db), m_0 is the initial moisture content(g H₂O/g solid, db), t is time and k is water uptake rate constant ($\text{min}^{-1/2}$). \bar{m} was calculated from the weight gain.

Results and Discussion

The water uptake rates of brown rices are tabulated in Table 1. The brown rice samples were arranged in the increasing order of the water uptake rate of milled rice. As evident from this table, each rice variety had characteristic water uptake rate as reported in case of milled rices^{1, 2)}.

The water uptake rate of brown rice at 100°C was about 1.1times faster than that of milled rice at 23°C. The j x indica rice varieties showed higher values for water uptake rate compared with those of japonica counterparts. The initial water uptake rate of brown rice reflects the hydration of bran layer^{3, 4)}. Therefore, the differences in the water uptake rates between japonica and j x indica varieties may indicate the differences in bran structure.

The water uptake rates of brown rices had no correlation with L/W or with volume. In case of milled rices, a negative correlation between the water uptake rate and L/W was reported³⁾. However, the water uptake rates of brown rices were highly correlated with those of milled

Table 1. Dimension and water uptake rate of brown rice

Hydr- ation group ^a	Japonica variety	L/W ^b	Volume (mm ³)	Kx10 ² (min ^{-1/2})		Hydr- ation group ^a	J x indica variety	L/W ^b	Volume (mm ³)	Kx10 ² (min ^{-1/2})		
				Milled rice (23°C) ^c	Brown rice (100°C)					Milled rice (23°C) ^c	Brown rice (100°C)	
I	Songjunbyeo	1.74	23.6	6.77	7.43	I	Kayabyeo	2.18	7.59	18.9	7.79	
	Pungok	1.18	21.4	6.91	7.74		II	Seogwangbyeo	2.31	8.21	21.5	8.78
	Kwanakbyeo	1.63	21.5	7.24	7.84			Mansukbyeo	2.22	8.33	18.3	8.91
	Suwon 320	1.72	19.9	7.71	8.32			Yushin	2.07	8.41	20.6	9.21
	Nonglim 6	1.80	20.9	7.82	8.37			Yonugpunbyeo	2.40	8.42	20.9	9.21
	Odaebyeo	1.78	22.9	7.91	8.46		Taebaegbyeo	2.61	8.43	16.6	9.19	
II	Jinjubyeo	1.71	22.2	8.12	8.79	III	Pungsanbyeo	2.41	8.60	20.0	9.65	
	Sangpunbyeo	1.67	21.0	8.13	8.77		Shihgwangbyeo	2.19	8.60	22.7	9.55	
	Sasanishiki	1.70	20.5	8.19	9.03		Iri 357	2.49	8.65	21.1	9.57	
	Chucheongbyeo	1.74	19.6	8.27	9.01		Milyang 42	1.93	8.75	20.7	9.60	
	Sulakbyeo	1.76	21.3	8.39	9.12		Chupunbyeo	2.53	8.87	16.8	9.68	
	Tamakeum	1.78	21.9	8.39	9.21		Baegyongbyeo	2.05	8.95	20.5	9.43	
	Chugwangbyeo	1.07	22.3	8.40	8.94		Iri 360	2.05	8.98	22.4	9.86	
	Suwon 306	nd	nd	8.41	9.09		Milyang 23	2.33	9.00	21.4	9.83	
	Sobaegbyeo	1.76	21.8	8.45	9.20		IV	Suwon 312	2.30	9.20	20.7	10.21
	Taechangbyeo	1.60	22.2	8.48	8.90			Nampungbyeo	2.30	9.29	19.1	10.21
	Namyang 1	1.57	24.2	8.49	9.02		Milyang 30	2.00	8.31	19.0	10.30	
III	Palkeum	1.75	20.9	8.56	9.13		Suwon 318	2.23	9.34	26.0	10.38	
	Nakdongbyeo	1.66	21.9	8.58	9.17	V	Sujeongbyeo	2.35	9.51	18.0	10.85	
	Bonggwangbyeo	1.71	22.4	8.68	9.30		Samgangbyeo	2.17	9.64	18.6	10.85	
	Sumjinbyeo	1.74	22.4	8.73	9.38		Iri 382	2.07	9.82	23.2	11.09	
	Yeomyungbyeo	1.67	22.1	8.85	9.60	VI	Suwon 317	1.90	10.39	21.8	11.33	
Tongjinbyeo	1.68	22.0	8.86	9.76	Cheongcheongbyeo		2.00	10.72	23.1	11.86		
Koshihikary	1.73	24.0	8.90	9.76	Baegunchalbyeo(W)		2.00	12.32	21.9	13.68		
IV	Samnambyeo	nd	nd	9.05	9.84		Hankangchalbyeo(W)	2.32	12.93	23.0	14.19	
	Boggwangbyeo	1.79	23.4	9.15	9.12		Japonica Min	1.57	6.77	19.0	7.43	
	Seonambyeo	1.72	21.5	9.10	9.86		Max	1.83	10.56	24.2	11.94	
	Chiakbyeo	1.61	21.5	9.20	10.17		Mean	1.72	8.47	21.9	9.16	
	Nongbaeg	1.66	21.8	9.20	10.21		SD	0.08	0.72	1.1	0.78	
	Olchal(W)	1.61	21.8	9.21	10.28		J x indica Min	1.98	7.59	16.0	7.79	
	Nonglim 8	1.83	21.3	9.40	10.40		Max	2.61	12.93	26.7	14.19	
V	Tobongbyeo	1.75	21.0	10.24	11.19		Mean	2.23	9.00	20.8	10.21	
	Nonglimna11(W)	1.78	24.0	10.26	11.12		SD	0.15	0.70	2.6	1.42	
	Shinsunchalbyeo(W)	1.73	21.4	10.56	11.94							

a : Based on the water uptake rate of milled rice(see ref.2), b : Length/width, c : Data from ref. 2, nd : Not determined, w : Waxy rice.

rices at 23°C²) and the regression equations were as follows :

for japonica varieties

$$Y = 1.12X - 0.34 (r = 0.976, p < 0.001)$$

for j x indica varieties

$$Y = 1.16X - 0.54 (r = 0.990, p < 0.001)$$

where Y and X are the water uptake rate of brown and milled rices, respectively.

The above regression equations indicate that at a given water uptake rate of brown rice the water uptake rate of japonica milled rice would be higher than that of j x indica milled rice.

The study demonstrated that the water uptake rates of brown rices at 100°C were highly correlated with those of milled rices at 23°C, which suggested that brown rices could be used for classification of rices based on hy-

dration property. The bran structures of japonica and j x published later.
indica rice varieties are under investigation and will be

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100°C에서의 현미의 수분 흡수 속도

김성곤 · 서충식* (단국대학교 식품영양학과, * 영남공업전문대학)