

## Note

# An Improvement of Quality Preservation of Unboiled Japanese Buckwheat Noodle "Nihon-soba"

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**Unboiled Japanese buckwheat noodle "Nihon-soba" is a perishable product when stored at room temperature. In order to find effective food additives for the quality preservation of this noodle, commercial food additive A-N was tested, together with lactic acid. A-N was a mixed compound of lysozyme 23.7%, glycine 49.8%, fumaric acid 17.5%, sodium caseinate 1.5%, and glycerol-fatty acid ester 7.5%. Although no inhibitory effect on microbial growth was observed at 0.2% lactic acid, and the control 0.5% A-N and the mixed use of 0.5% A-N and 0.2% lactic acid showed inhibitory effects on microbial growth. This combination use of 0.2% lactic acid and 0.5% A-N had clearly much more inhibitory effect than their individual effects. In semi-dried samples, 0.5% A-N and 0.2% lactic acid, as well as their combination uses, appeared to have considerable effect on maintaining the quality of the buckwheat noodles compared with the control.**

Keywords: Japanese buckwheat noodle, lactic acid, lysozyme, food additives, quality preservation

In Japan, many kinds of noodles are available in the market boiled or unboiled Japanese noodle, Chinese-type noodle, and Japanese buckwheat noodle "Nihon-soba" etc. "Nihon-soba" is prepared from buckwheat flour and wheat flour. It is difficult to preserve in an unboiled raw condition because of its rapid putrefaction, caused by microbial growth, compared with other noodles (Miyao & Satoh, 1985).

There are many studies on the quality preservation of both boiled and unboiled noodles by the addition of food additives (Toda, 1980; Naruse, 1985; Toyama *et al.*, 1994; Shirakawa, 1979). However, practically advantageous methods for quality preservation of unboiled noodles remain uncertain.

Among organic acids tested, lactic acid was reported to have weak antimicrobial effect on noodles (Tanada & Uchida, 1974), and it was also reported that 0.2% lactic acid showed an inhibitory effect on microbial growth and had no sensory disadvantage such as off-flavor or acidic taste in the product (Toda, 1980). However, no detailed studies of lactic acid, especially the combined effect of lactic acid and other food additives, on the quality preservation of Japanese buckwheat noodle have been reported.

The objectives of this work are to study the effect of lactic acid and the commercial lysozyme-containing food preservative which contains fumaric acid coated by lipid and the mixed effect of these food additives on the preservation of raw Japanese buckwheat noodles.

## Materials and Methods

### Preparation of Japanese buckwheat noodles White

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wheat flour and buckwheat flour (1 : 1) were mixed with a fry mixer at 20°C for 1 min. Five hundred grams of flour were mixed with 150 ml of aqueous 2% sodium chloride solution (30% of wheat flour) in a dough mixer (Tokyo Menki, Urawa) at 20°C for 5 min. The mixture was then subjected to sheeting machine (Ohtake Menki model 180) to make noodle sheet at a final thickness of 1.5 mm. After the noodle sheet was cut into noodle string of approximately 20-cm length by a cutting machine, fifty grams of the noodles were packaged in KOP pouch (polyvinylidene chloride coated polypropylene of 20- $\mu$  thickness)/(polyethylene of 40- $\mu$  thickness). All the experimental samples were stored at 25°C and 75% relative humidity (RH).

*Analytical methods* A part of the each sample of the noodles treated under the the various experimental conditions was withdrawn at appropriate intervals and subjected to analyses.

Water activity (*A<sub>w</sub>*) of raw and semi-dried buckwheat noodles was measured by Rotronic Hydrskop DT at 25°C. Moisture content of the product was measured by the oven method. Briefly, 3 grams of the sample were weighted and flattened in an aluminum foil cup (8×14 cm) and dried at 135°C for 2 h.

For enumeration of microbial viable counts, the samples (10 g) were agitated with 90 ml of 0.85% NaCl solution for 1 min. Serial 10-fold dilutions were subjected to the standard agar plate method (Daigo) in duplicate and incubated at 37°C for 48 h.

*Effects of lactic acid and food additive A-N* Lactic acid and lysozyme-containing commercial food additive (A-N) were tested. A-N contains lysozyme 23.7%, glycine 49.8%, fumaric acid 17.5%, sodium caseinate 1.5%, and ester of glycerol-fatty acid 7.5%. The test substances were added to the

sample as percent of the flour base. The samples without the food additives were defined as the control.

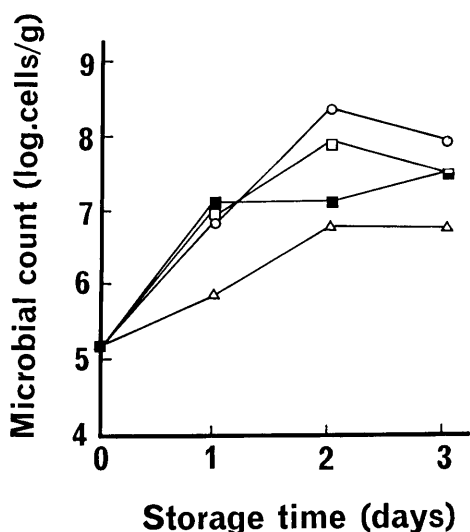
**Results and Discussion**

*Effects of lactic acid and A-N* As shown in Fig. 1, when the initial microbial loads in the samples were  $10^5$  cells/g, they increased up to the level of  $10^8$  cells/g in the samples to which were added 0.2% lactic acid and the control (without the addition of food additives) after 2 days of storage. The samples to which were added 0.5% A-N and the mixture of 0.5% A-N and 0.2% lactic acid did not reach  $10^8$  cells/g after 3 days of storage. The results suggested that the combined effect of 0.2% lactic acid and 0.5% A-N was more effective in maintaining the quality of raw Japanese buckwheat noodles than their sole use.

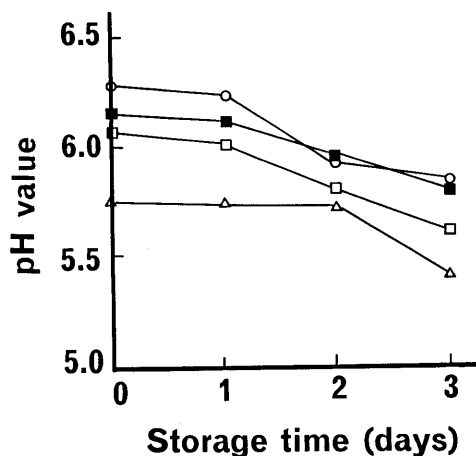
It is known that the inhibitory effects of organic acids on microbial activity in foods largely depend upon their low pH values at the initial stage of the storage period (Nakayama & Hino, 1980). Similarly, as shown in Fig. 2, the sample to which was added the mixture of 0.2% lactic acid and 0.5% A-N had clearly lower initial pH value than the control. Accordingly, the inhibitory effect of this mixture on the microbial growth could be due to the initial low pH value. Fumaric acid coated with lipid is one of the compositions of A-N which does not work as an acidic component in the raw Japanese buckwheat noodle because of its hydrophobic property. However, the addition of 0.2% lactic acid resulted in the partial disruption of the lipid layer, causing the release of fumaric acid into the sample (Mitani & Kitagawa, 1985).

In general, the pH of the food brings about changes under the balance of acidic and basic substances produced by microbial activity during the preservation. In the present experiment, it is suggested that the pH values of the samples gradually decreased by the formation of acidic products from the microbial fermentation of carbohydrates in the noodle.

*Effect of combination use of 0.2% lactic acid and 0.5% A-N on the quality preservation of semi-dried Japa-*



**Fig. 1.** Changes in microbial count in the sample to which were added different food additives. ○, Control; ■, A-N 0.5%; □, Lactic acid 0.2%; △, Lactic acid 0.2%+A-N 0.5%.



**Fig. 2.** Changes in pH of the sample to which were added different food additives. ○, Control; ■, A-N 0.5%; □, Lactic acid 0.2%; △, Lactic acid 0.2%+A-N 0.5%.

**Table 1.** Drying effect on the storage life of buckwheat noodle containing food additives.

Food additives	Raw noodles			Semi-dried noodles		
	M (%)	Aw	SL	M (%)	Aw	SL
Lactic acid	32.1	0.95	2	17.0	0.93	12
A-N	31.1	0.95	4	27.4	0.91	12
Lactic acid+A-N	32.1	0.95	7	25.2	0.92	13
Control	31.8	0.95	2	25.0	0.92	5

Raw buckwheat noodles were dried at 50°C and 65% RH for 90 min. Samples were stored at 25°C and 75% RH, and storage life was estimated by the days when viable microbial count reached  $10^8$  cells/g. M; moisture (%), Aw; water activity, SL; storage life of the sample (days).

*nese buckwheat noodles* The effect of semi-drying of the noodle containing 0.2% lactic acid and 0.5% A-N on the quality preservation was tested. Semi-dried buckwheat noodles were prepared by drying raw noodles at 50°C and 65% RH for 90 min. The water activity, moisture content, and microbial count were determined according to the method previously mentioned. Table 1 shows the storage life of semi-dried buckwheat noodle. The moisture contents decreased from 31–32% to 17–27%, and Aw decreased from 0.95 to 0.91–0.93. Although semi-dried buckwheat noodles still maintained high water activity which could cause spoilage by microorganisms, storage life estimated by the microbial growth showed that 0.5% A-N, 0.2% lactic acid, and their combination use as food additives were highly effective for the quality preservation of semi-dried buckwheat noodles compared with the control.

In conclusion, raw Japanese buckwheat noodles are high-moisture foods. Therefore, the main effects of the change in quality arise from microbial spoilage (Troller, 1980). The storage lives of high-moisture food products such as raw noodles are known to be limited to only 1 or 2 days under the open air or room temperatures. Commercial food additive A-N had inhibitory effect on the microbial growth in raw Japanese buckwheat noodles, but the mixed use of 0.2% lactic acid and 0.5% A-N showed stronger inhibitory effect than

their individual use. Their usefulness was also indicated by increasing the storage life after semi-drying of the samples.

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#### References

- Mitani, Y. and Kitagawa, A. (1985). Food additives for the quality preservation of Japanese buckwheat noodle. *Shokuhin to Kagaku*, Suppl. vol. 2, 97-102 (in Japanese).
- Miyao, S. and Satoh, T. (1985). Studies on microbiological putrefaction of "Nihon-Soba" (Japanese buckwheat noodles). *Tokyo Nogyo Shikenjou Kenkyu Hokoku*, **18**, 97-105 (in Japanese).
- Nakayama, S. and Hino, Y. (1980). Effect of rice vinegar on preservation of cooked noodle. *Kagawaken Shokuhin Hakkou Shikenjou Nenpou*, **73**, 63-66 (in Japanese).
- Naruse, H. (1985). Utilization of ethyl alcohol to Namamen. *New Food Ind.*, **27**, 32-36 (in Japanese).
- Nosaka, N. (1980). Development of quality preservation of boiled noodle by pH control. *New Food Ind.*, **22**, 20-25 (in Japanese).
- Shirakawa, T. (1979) The improvement of preservation of non-boiled Japanese noodle (Part 1). Effect of ethyl alcohol and pasteurization. *Kagawaken Shokuhin Hakkou Shikenjou Nenpou*, **72**, 78-85 (in Japanese).
- Tanada, M. and Uchida, H. (1974). Studies on noodles. Part VII. Antimicrobial effect of food additives or natural materials on noodles. *Nippon Shokuhin Kogyo Gakkaishi*, **21**, 345-350 (in Japanese).
- Toda, Y. (1980). Utilization and effect of ester of glycerol fatty acid on the quality life of noodles. *New Food Ind.*, **22**, 1-5 (in Japanese).
- Toyama, R., Sekimura, T. and Sekizawa, N. (1994). Remaining in manufacturing and preservative effect of ethanol added to "Reimen" (Korean noodle). *Nippon Shokuhin Kogyo Gakkaishi*, **41**, 299-303 (in Japanese).
- Troller, J.A. (1980). Influence of water activity on microorganisms in foods. *Food Technol.*, **34**, 76-82.