THE UTILIZATION OF NEW LACTIC ACID BACTERIA FROM KOREAN *KIMCHI* AS A STATER CULTURE IN FERMENTED SAUSAGE

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I. INTRODUCTION

Recently, increasing concern of consumers for longevity and health leads to an interest in probiotics that are defined as live microorganisms which when administered in adequate amount confer a health benefit on the host [1, 2]. *Weissella cibaria* JW15 is one of lactic acid bacteria that is found in Korean traditional fermented vegetable products, such as *Kimchi*, belongs to the family of Leuconostocaceae, and has better immune-modulatory effects compared to *Lactobacillus rhamnosus*, one of immunity-improving probiotics [3]. However, there is no literature regarding the utilization of *Weissella cibaria* JW15 as a starter culture in fermented sausage. Therefore, this research was conducted to investigate the potential of *Weissella cibaria* JW15 as a starter culture in fermented sausage.

II. MATERIALS AND METHODS

Experimental fermented sausages were made with pork hind leg meat (75.00%), pork backfat (20.00%), refined salt (2.3405%), prague powder (0.1695%; salt 0.1578%, sodium nitrite 0.01%, sodium carbonate 0.0017%), sodium ascorbate 0.05%, black pepper 0.20% and starter cultures. Two commercial starter cultures (CSC1: *Pediococcus pentosaceus*, *Staphylococcus carnosus*; CSC2: *Lactobacillus curvatus*, *P. pentosaceus*, *S. carnosus*, *S. xylosus*, *Debaryomyces hansenii*) and *Wessella cibaria* JW15 (WCJW: Korean Agriculture Culture Collection 91811P) were added at the same level of 10^6 CFU per g meat in each sausage treatment. After first fermented for 18 hr at 15°C / 90-100% RH, all sausages were second fermented for 48 hr at 25°C / 90%, dried for 10 d at 15°C / 80-90%, and then dried for 7 d at 15°C / 70-75%. The pH value and water activity (a_w) of the sample sausage was measured using a pH meter (SevenEasy pH, Mettler-Toledo GmbH, Greifensee, Zürich, Switzerland) and a_w meter (LabMaster-aw, Novasina AG, Lachen, Schwyz, Switzerland), respectively. CIE L*, a* and b* values were determined using a chroma meter (CR-400, Konica Minolta Sensing, Inc., Osaka, Kansai, Japan). Nitrite residue content was performed according to the Korea Food and Food Additives Codex [4] and expressed as mg of sodium nitrite per kg of sausage. Lactic acid bacteria count was measured by incubating on a lactic acid bacteria petri film (3M Corporate, St. Paul, Minnesota, USA). Texture profile analysis (hardness) was conducted using a texture analyzer (Universal Testing Machine 5543, Instron Corporation, Norwood, Massachusetts, USA) equipped with a cylinderical probe. All data were statistically analyzed using SPSS [5] program.

III. RESULTS AND DISCUSSION

The pH value, a_w, CIE values, nitrite residue content and texture profile analysis of fermented sausages with two commercial starter cultures and *Weissella cibaria* JW15 are presented in Table 1. The fermented sausage with WCJW had significantly ($p < 0.05$) lower pH value compared to those with both CSC1 and CSC2. The a_w was not significantly different among all sausage treatments. With regard to CIE values, three sausages were not significantly different for both L* and a* values, but b* value was significantly ($p < 0.05$) lower in the CSC1 and WCJW treatments than in the CSC treatment. Nitrite residue content was significantly ($p < 0.05$) lower in the fermented sausage with WCJW than in those with both CSC1 and CSC2.

Lactic acid bacteria can reduce residual nitrite to nitric oxide with the production of organic acid and nitrite reductase [6]. Honikel [7] reported that excess nitrite residues could convert to nitrosamines that have harmful effects on human body, such as teratogenic, mutagenic and carcinogenic. The fermented sausages with CSC1, CSC2 and WCJW contained more than 8 Log CFU of lactic acid bacteria per one gram. Daily consumption of fermented sausage with probiotics, such as WCJW, could be beneficial to human health. After analyzing the texture, the hardness of the WCJW treatment was significantly ($p < 0.05$) higher compared to that of CSC2 treatment. During ripening, the texture of the fermented sausage is getting harder because of the gelation of meat protein and the escape of moisture with the production of organic acid [8].

Table 1 pH value, a_w, CIE values, nitrite residue content, lactic acid bacteria count and texture profile analysis of fermented sausage with two commercial starter cultures and *Weissella cibaria* JW15

Items	Starter culture[1]		
	CSC1	CSC2	WCJW
pH	4.94[a]	5.05[a]	4.72[b]
a_w	0.81	0.81	0.82
CIE value			
L*	48.11	47.50	48.13
a*	14.28	14.51	14.45
b*	9.52[b]	10.15[a]	9.59[b]
Nitrite (mg $NaNO_2$ / kg sausage)	12.36[a]	13.28[a]	7.88[b]
Lactic acid bacteria (Log CFU / g sausage)	8.25	8.24	8.32
Hardness (kgf)	1.89[ab]	1.62[b]	2.00[a]

[a-b]Means in the same row with different superscripts differ significantly ($p < 0.05$).

[1]CSC1: commercial starter culture1 (*Pediococcus pentosaceus*, *Staphylococcus carnosus*); CSC2: commercial starter culture2 (*Lactobacillus curvatus*, *P. pentosaceus*, *S. carnosus*, *S. xylosus*, *Debaryomyces hansenii*); WCJW: Korean Agriculture Culture Collection 91811P.

IV. CONCLUSION

Wessella cibaria JW15, new lactic acid bacteria from Korean *Kimchi*, showed better acid fermentation ability and nitrite reducing activity compared to the commercial starter cultures. It could be utilized as a starter culture in fermented sausage.

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