Effect of steamed rice flour addition on quality characteristics of dried meat laver

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Abstract—**The aim of this study is to investigate the effects of steamed rice flour (SRF) addition on quality characteristics of dried meat laver which can be used for rice rolls. The experimental batches which had different levels of chopped beef (*semimembranosus* m., SM) and SRF was prepared. The mixtures (control: 100% SM, T1: 95% SM+5% SRF, T2: 90% SM+10% SRF, T3: 85% SM+15% SRF, T4: 80% SM+20% SRF, T5: 75% SM+25% SRF, T6: 70% SM+30% SRF) was spreaded on fabrics and dried for 90 min in a drying oven of 60˚C. SRF affected increasing the yield (from 22.65 to 45.95%) and the contractility (from 19.08 to 39.22%) of meat laver. Moisture (%) and carbohydrate content (%) were also increased with addition of SRF ($p<0.05$). However, crude protein (%) and crude fat (%) of meat lavers containing SRF were significantly lower than those of 100% SM laver ($p<0.05$). SRF influenced on increase of CIE L^* and decrease of CIE a^*. The control and T1 had the highest value of cohesiveness (29.26% and 28.97%, respectively) among the treatments ($p<0.05$), however, T3, T4, T5 and T6 had lower values of cohesiveness (15.48-19.53%), springiness (24.43-31.29%) and gumminess (96.05-182.55%) of textural properties than C, T1 and T2 ($p<0.05$). In conclusion, 5% or 10% level of SRF could be used for making meat laver which had better surface color, contractility and textural properties.**

Keywords— **Dried meat laver; Steamed rice flour; Textural property.**

I. INTRODUCTION

Many researchers have interest in development of new or value-added products using animal materials, because of meat consumption slowdown according to the lake of new product introduction or great interest in functional foods [1].

The rolled foods such as rice roll, laver roll, vegetable roll or tofu skin roll are largely consumed around the world. Dried laver and rice paper among the foodstuff which can be wrapped around savory or sweet ingredients are especially consumed in Asia [2].

We developed a new kind of food: dried meat laver, which can be used to make rolls.

Rice flour is used in making sausages for improvement of color or textural properties of them [3]. In the present study, we investigated the effects of steamed rice flour (SRF) addition on quality characteristics of dried meat laver which can be used for rice rolls.

II. MATERIALS AND METHODS

1. Meat laver process

Minced beef (semimembranosus m.) was homogenized by a Polytron (T25-B, IKA Sdn. Bhd., Malaysia) with 6 times volumn of distilled water at 8,000 rpm for 30 sec and centrifuged at 10,000 x g for 25 min. The lower layer were mixed with different levels (Table 1) of steamed rice flour which were prepared by cookimg with distilled water. The moisture contents of mixtures were adjusted to 65.0 ± 0.3 %. The mixtures were spreaded on cheese cloths (16.5 x 15.0 cm), saperately and dried at 60 ˚C for 90 min by using of drying oven (DS-80-1, Dasol Scientific Co., Hwasung, Korea).

Table 1. Basic formulation of dried meat laver

Ingredients(%)	C	T1	T2	T3	T4	T5	T6
SRF [a]	0	5	10	15	20	25	30
Meat	100	95	90	85	80	75	70
Total	100	100	100	100	100	100	100

[a] Steamed rice flour.

2. Measurements

Proximate compositions (moisture content, %; crude ash, % and carbohydrate, %) were analysed by AOAC (1995) [4]. Crude protein (%) was measured

by a nitrogenanalyzer (Model FP-428, Leco Corp., MI, USA) and crude fat (%) was measured by Folch et al. (1957) [5] method. Surface color (CIE $L^*a^*b^*$) of dried meat laver was analysed by using of chroma-meter (CR-300, Minolta, Japan). Yield (%) was calculated from the difference between the weigh of mixture and dried meat laver mass: Yield (%) = (mixture weight – dried meat weight) / (mixture weight) x 100. Contractility (%) was calculated from the difference between the area (16.5 x 15.0) of mixture and dried meat laver area: Contractility (%) = {(16.5 x 15.0) – area of dried meat laver} / (16.5 x 15.0) x 100. Textural properties such as hardness, cohesiveness, springiness and gumminess were analysed by using of Rheo-meter (Compac-100, Sun scientific Co., Japan).

III. RESULTS AND DISCUSSION

Yield (%) and contractility (%) were significantly ($p<0.05$) increased with increase of SRF addition (Table 2).

Table 2. Yield (%) and contractility (%) of dried meat laver

Treatments [a]	Yield (%)	Contractility (%)
C	21.65±0.81^{E}	19.08±0.27^{B}
T1	21.89±0.23^{E}	22.99±0.76^{F}
T2	26.02±0.78^{D}	27.26±0.36^{E}
T3	26.65±0.43^{D}	29.73±1.03^{D}
T4	31.25±1.03^{C}	32.87±1.23^{C}
T5	39.24±0.98^{B}	35.79±1.12^{B}
T6	45.95±1.07^{A}	39.22±0.41^{A}

[a] 100 % SM, C; 95 % SM+5 % SRF, T1; 90 % SM+10 % SRF, T2; 85 % SM+15 % SRF, T3; 80 % SM+20 % SRF, T4; 75 % SM+25 % SRF, T5; 70 % SM+30 % SRF, T6.
[A-G] Means±SD with different superscripts in the same column significantly differ at $p<0.05$.

Proximate compositions of dried meat laver were presented in Table 3. The dried meat lavers which processed with addition of SRF had more moisture content than C (without SRF) ($p<0.05$). SRF affected decreases of protein and fat content on dried meat laver, however carbohydrate content was increased as increase of SRF addition level ($p<0.05$).

Table 3. Proximate compositions of dried meat laver

Treatments [a]	Moisture	Crude ash	Crude protein	Crude fat	Carbohydrate
C	11.29^{G} (0.13)	0.41^{C} (0.01)	78.48^{A} (0.54)	8.08^{A} (0.11)	0.08^{F} (0.01)
T1	13.92^{F} (0.11)	0.40^{C} (0.01)	71.82^{B} (0.21)	6.44^{B} (0.39)	4.23^{E} (0.06)
T2	19.64^{E} (0.18)	0.52^{A} (0.03)	60.80^{C} (0.77)	4.99^{C} (0.11)	12.68^{D} (0.26)
T3	23.87^{D} (0.40)	0.36^{BC} (0.03)	55.55^{D} (0.18)	4.98^{C} (0.07)	13.92^{C} (0.11)
T4	29.31^{C} (0.18)	0.34^{C} (0.03)	44.82^{E} (0.61)	3.46^{D} (0.17)	19.66^{B} (0.13)
T5	35.15^{B} (0.14)	0.28^{D} (0.02)	38.70^{F} (0.34)	3.10^{DE} (0.07)	20.95^{A} (0.13)
T6	43.08^{A} (0.08)	0.28^{D} (0.01)	31.36^{G} (0.59)	2.80^{E} (0.11)	20.99^{A} (0.07)

[a] 100 % SM, C; 95 % SM+5 % SRF, T1; 90 % SM+10 % SRF, T2; 85 % SM+15 % SRF, T3; 80 % SM+20 % SRF, T4; 75 % SM+25 % SRF, T5; 70 % SM+30 % SRF, T6.
[A-G] Means±SD with different superscripts in the same column significantly differ at $p<0.05$.

As shown in Table 4, lightness (CIE L*) was increased with addition of SRF ($p<0.05$) but redness (CIE a*) was lowever in dried meat laver added SRF ($p<0.05$).

Table 4. Surface color of dried meat laver

Treatments [a]	CIE L^*	CIE a^*	CIE b^*
C	47.01±1.28^{B}	11.14±0.78^{A}	15.94±0.50^{B}
T1	38.72±8.45^{CD}	6.63±0.83^{C}	11.86±1.62^{C}
T2	35.88±4.64^{D}	4.54±0.79^{D}	10.43±1.55^{C}
T3	44.68±3.96^{BC}	9.26±2.21^{B}	15.42±1.89^{B}
T4	43.92±5.40^{BC}	6.67±2.24^{C}	14.78±2.00^{B}
T5	49.61±3.11^{AB}	10.58±0.94^{AB}	19.91±2.33^{A}
T6	55.40±3.85^{A}	7.26±0.57^{C}	15.62±1.40^{B}

[a] 100 % SM, C; 95 % SM+5 % SRF, T1; 90 % SM+10 % SRF, T2; 85 % SM+15 % SRF, T3; 80 % SM+20 % SRF, T4; 75 % SM+25 % SRF, T5; 70 % SM+30 % SRF, T6.
[A-G] Means±SD with different superscripts in the same column significantly differ at $p<0.05$.

Textural properties were presented in Table 5. The meat laver processed with addition of 30 % SRF had the lowest value of hardness. However, the meat lavers which were treated with high levels (more than 15 %) of SRF addition showed poorer cohesiveness, springiness and gumminess than those of C, T1 or T2 ($p<0.05$).

Table 5. Textural properties of dried meat laver

Treat-ments[1)]	Hardness (kg/cm^2)	Cohesiveness (%)	Springiness (%)	Gumminess (g)
C	151.36±8.59^{C}	29.26±0.45^{A}	37.49±1.38^{A}	200.60±22.06^{BC}
T1	213.27±13.82^{A}	28.97±0.37^{A}	34.09±1.07^{B}	361.50±53.03^{A}
T2	205.29±0.22^{AB}	22.64±1.84^{B}	36.29±0.64^{A}	263.25±35.71^{B}
T3	205.28±0.83^{AB}	15.48±1.35^{D}	24.43±0.74^{D}	96.05±12.66^{D}
T4	190.41±6.68^{B}	17.51±0.39^{CD}	31.29±0.75^{C}	177.80±26.59^{C}
T5	161.11±2.45^{C}	19.53±0.06^{C}	31.05±0.28^{C}	99.35±17.89^{D}
T6	126.39±11.94^{D}	17.36±1.95^{CD}	30.25±0.72^{C}	182.55±21.99^{C}

[a] 100 % SM, C; 95 % SM+5 % SRF, T1; 90 % SM+10 % SRF, T2; 85 % SM+15 % SRF, T3; 80 % SM+20 % SRF, T4; 75 % SM+25 % SRF, T5; 70 % SM+30 % SRF, T6.
[A-G] Means±SD with different superscripts in the same column significantly differ at $p<0.05$.

IV. CONCLUSIONS

Addition of steamed rice flour affected increases of yield, moisture content and carbohydrate of dried meat laver. Surface color of meat laver was improved by addition of steamed rice flour. However, excessive addition (15 ~ 30 %) of steamed rice flour was a bad influence on textural properties such as cohesiveness, springiness or gumminess. Therefore, 5 ~10 % level of steamed rice flour could b used for making meat laver which had better surface color and textural properties.

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