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6. SUMMARY

This study was conducted to prepare surimi from breast and leg spent hen meat and stored at -18°C for 3 months. Spent hen sausage was prepared by replacing spent hen meat in the sausage formula with 10, 20 and 30% breast and leg type surimi and stored at -18°C for 5 months. Spent hen kobeba was prepared by marinating chicken meat separately in three marinating solution with 5% soy sauce (lime juice: water, 1:3, v/v, propionic acid 1% and acetic acid 1%) and stored at -18°C for 5 months. The proximate composition, chemical and physiochemical properties, cooking characteristics, microbiological analysis and sensory properties of prepared products were evaluated.

The obtained results can be summarized as follows:

6.1. Surimi:

6.1.1. Proximate composition of chicken:

Chicken breast had higher protein (21.97%) and carbohydrates (0.27%) contents than chicken leg. However, chicken leg had higher moisture (78.42%), fat (1.54%) and total ash (0.84%) contents than chicken breast.

Moisture content (74.33-77.31-78.30-79.34%) was increased by increasing the washing steps, respectively. However, crude protein (21.52-20.75-20.15-19.42%), crude fat (2.40-1.12-0.73-0.59%), total ash (1.44-0.69-0.59-0.45%) and carbohydrates (0.32-0.27-0.24-0.20%) contents were decreased by increasing washing steps, respectively.

6.1.2. TVN, TBA and pH values of chicken:

Chicken breast had a higher TVN value (10.44 mg N/100g) than chicken leg. However, chicken breast had lower pH (6.52) and TBA (0.23mg malonaldehyd/kg) values than chicken leg.

The pH value (6.17-6.56- 6.76-6.87) was increased by increasing the washing steps of chicken meat. However, TVN (12.40-10.56-9.37-8.58 mg N/100g) and TBA (0.40-0.26-0.20-0.15 mg malonaldehyd/kg) values were decreased by increasing the washing steps of chicken meat.

6.1.3. Microbiological analysis of unwashed and washed chicken breast and leg:

Chicken breast had lower total bacterial, proteolytic bacteria and psychrophilic bacteria counts than chicken leg. Lipolytic bacteria, coliform bacteria, *Staphylococcus aureus, Salmonella spp* and yeast and mold were not detected in chicken breast and leg. Total bacterial,

proteolytic bacteria and psychrophilic bacteria were decreased by increasing washing steps.

6.1.4. Proximate composition of surimi:

Breast type surimi had higher protein content (19.37%) than leg type surimi. However, breast type surimi had lower moisture (72.69%), crude fat (0.43%) and total ash (0.54%) contents than leg type surimi. Moreover, no difference in carbohydrates content was observed between breast and leg type surimi.

Moisture and protein contents of surimi were not significantly affected by storage period. However, crude fat, total ash and carbohydrates contents were significantly affected by storage period. After three months of storage, crude fat, total ash and carbohydrates contents were significantly increased by 7.68, 7.94 and 5.99%, respectively.

6.1.5. TVN and TBA values of surimi:

Breast type surimi had a higher TVN (10.18 mg N/100g) and a lower TBA (0.22 mg malonaldehyd/kg) values than leg type surimi.

The TVN and TBA values of surimi were significantly increased as storage period increased.

6.1.6. Physical properties of surimi:

Breast type surimi had higher WHC (1.56 cm^2/0.3g) and plasticity (3.17 cm^2/0.3g) values and a lower pH value (6.95) than leg type surimi. Water holding capacity and pH values were significantly increased as storage period increased. However, plasticity values were significantly decreased as storage period increased.

6.1.7. Texture profile of surimi:

Breast type Surimi had higher firmness (5.79), gumminess (4.38), chewiness (3.62) and springiness (0.83) values than leg type surimi. However, No difference in cohesiveness values was found between breast type surimi and leg type surimi.

6.1.8. Microbiological analysis of surimi:

Breast type surimi had lower total bacterial, proteolytic bacteria and psychrophilic bacteria counts than leg type surimi. Lipolytic bacteria, coliform bacteria, *Staphylococcus aureus*, *Salmonella spp* and yeast and mold were not detected in breast and leg type surimi. Total bacterial, proteolytic bacteria and psychrophilic bacteria counts of breast and leg type surimi were decreased as storage period increased.

6.2. Sausage:

6.2.1. Proximate composition of sausage:

Sausage formulated with breast type surimi had a higher crude protein (15.68%) and lower moisture content (61.88%) than sausage formulated with leg type surimi. There are no differences in crude fat, total ash and carbohydrate contents among sausages formulated with breast and leg type surimi.

Sausages formulated with different replacement levels of surimi had higher moisture (62.0-62.06-62.14%) and carbohydrate (4.2-4.58-5.01%) contents than control sausage. However, control sausage had higher crude protein (15.92%), crude fat (15.45%) and total ash (2.94%) than sausages formulated with different replacement levels of surimi.

Proximate composition of all sausages was not affected up to the second month of storage. From the third month of storage, moisture content was decreased, while crude protein, crude fat, total ash and carbohydrates were increased.

6.2.2. TVN and TBA values of sausage:

Sausages formulated with breast type surimi had higher TVN (12.33 mg N/100g) and lower TBA values (0.64 mg malonaldehyd/kg) than sausages formulated with leg type surimi.

Sausage formulated with different replacement levels of surimi had lower TVN (11.67-10.73-10.37 mg N/100g) and TBA (0.67-0.61-0.58 mg malonaldehyd/kg) values than control sausage. Total volatile nitrogen and TBA values were decreased by increasing the replacement levels of surimi. However, TVN and TBA values of sausages were gradually increased with the storage period.

6.2.3. Water holding capacity, plasticity and pH values of sausage:

Sausages formulated with breast type surimi had higher WHC (3.96 cm^2/0.3g) and lower plasticity (2.27 cm^2/0.3g) and pH (6.24) values than sausages formulated with leg type surimi.

Sausage formulated with different replacement levels of surimi had higher plasticity and pH values and a lower WHC values than control sausage. Water holding capacity values were decreased and plasticity values increased by increasing the replacement levels of

surimi. However, pH values were not affected by the replacement levels of surimi.

Water holding capacity values of sausages were gradually increased and plasticity gradually decreased with the storage period. However, pH values of sausages were not affected up to the first month of storage. From the second month of storage, pH values of sausages were increased.

6.2.4. Cooking Characteristics of sausage:

Sausages formulated with breast type surimi had a higher cooking loss (25.48%) and lower fat retention (46.26%) and water retention (67.52%) than sausages formulated with leg type surimi.

Sausage formulated with different replacement levels of surimi had a lower cooking loss and higher fat retention and water retention than control sausage.

Cooking loss values of sausages were gradually increased with the storage period. However, fat retention and water retention of sausages were not affected up to the third month of storage. From the fourth month of storage, fat retention and water retention of sausages were decreased.

6.2.5. Microbiological analysis of sausage:

Sausage formulated with surimi had lower total bacterial, proteolytic bacteria, lipolytic bacteria and psychrophilic bacteria counts than control sausage.

Sausage formulated with breast type surimi had lower total bacteria, proteolytic bacteria, lipolytic bacteria and psychrophilic bacteria and higher total yeast and mold counts than leg type surimi. Coliform bacteria, *S. aureus* and *Salmonella spp* were not detected in all formulated sausages.

Total bacterial, proteolytic bacteria, lipolytic bacteria, psychrophilic bacteria and total yeast and mold counts were decreased by increasing breast and leg type surimi replacement levels.

Total bacterial, proteolytic bacteria and lipolytic bacteria counts of sausages were decreased up to the second month of storage followed by gradual increased up to the fifth month of storage. Psychrophilic bacteria counts were decreased up to the third month of storage followed by gradual increased up to the fifth month of storage. However, total yeast and mold were gradually decreased during storage period.

6.2.6. Sensory properties of sausage:

Sausages formulated with breast type surimi had a higher color and lower taste and texture scores than sausages formulated with leg type surimi. However, odor and overall acceptability were not affected by surimi type.

Sausages formulated with different replacement levels of surimi had higher sensory properties than control sausage. Sausages formulated with 20% followed by 10% replacement levels of surimi had higher rating scores ranged between 7.32 and 8.22for all sensory properties than 30% replacement level . All sensory properties were gradually decreased during storage period.

6.3. Kobeba:

6.3.1. Proximate composition of Kobeba:

Marinated kobeba had higher crude protein, crude fat, total ash and carbohydrates contents and lower moisture content than control. Kobeba treated with lime juice had higher crude protein (14.03%), crude fat (7.78%), total ash (3.18%) and carbohydrates (8.69%) contents and lower moisture (66.41%) content than kobeba treated with propionic acid and acetic acid. There was no difference in

proximate composition between kobeba treated with propionic and acetic acid.

Moisture and crude protein contents were significantly decreased from the third month up to the end of storage. However, crude fat, total ash and carbohydrates had an opposite trend.

6.3.2. TVN and TBA values of kobeba:

Marinated kobeba had lower TVN values than control. Lime juice (9.54 mg N/100g) followed by acetic acid (10.22 mg N/100g) were more affected in reducing TVN values than propionic acid (11.42 mg N/100g). The TVN values of kobeba were significantly increased as storage period increased.

Marinated kobeba had lower TBA values than control. Lime juice was more affected in reducing TBA values (0.360 mg malonaldehyd/kg) than acetic acid (0.406 mg malonaldehyd/kg) and propionic acid (0.444 mg malonaldehyd/kg). The TBA values of kobeba were significantly increased as storage period increased.

6.3.3. Water holding capacity, plasticity and pH values of kobeba:

The lowest water holding capacity (highest value, 3.41cm2/0.3g) was recorded for lime juice kobeba. On the other hand, the highest

water holding capacity (lowest value, 3.17cm2/0.3g) was recorded for control kobeba. Water holding capacity values were increased after marinating process. Water holding capacity value did not significantly change until the first month of storage. While, from the second month of storage gradual increases in WHC values were observed until the end of storage period.

Plasticity was significantly increased by marinating process. Lime juice kobeba (2.30cm2/0.3g) followed by acetic acid kobeba (2.17cm2/0.3g) had higher ($p \leq 0.05$) plasticity values than propionic acid kobeba (2.09cm2/0.3g). Plasticity values did not significantly change until the first month of storage. While, from the second month of storage gradual decreases in plasticity values were observed until the end of storage period.

The pH values were significantly decreased by marinating process. Lime juice kobeba (pH 5.96) followed by propionic acid kobeba (pH 6.17) had lower ($p \leq 0.05$) pH values than acetic acid kobeba (pH 6.27). The pH values of kobeba were gradually increased during storage period.

6.3.4. Cooking Characteristics of kobeba:

Cooking loss values were increased after marinating process. Lime juice and acetic acid kobeba had higher cooking loss values than propionic acid kobeba. There is no difference in cooking loss between Lime juice and acetic acid kobeba.

Cooking loss values did not significantly change until the first month of storage. While, from the second month of storage increases in cooking loss values were observed until the end of storage period.

Water retention did not significantly change by marinating process and during storage period. However, fat retention was significantly decreased by marinating process but not by storage period. There is no significantly difference in fat retention among marinating process

6.3.5. Texture profile of kobeba:

Firmness, gumminess and chewiness values were reduced after marinating process. However, cohesiveness and springiness of kobeba did not affect by marination type. Lime juice kobeba had lower firmness, gumminess and chewiness values than propionic acid and acetic acid kobeba. No significant differences in gumminess and

chewiness were observed between propionic acid and acetic acid kobeba. However, propionic acid kobeba had a higher firmness than acetic acid kobeba. Firmness, cohesiveness, gumminess, chewiness and springiness values were increased by cooking process.

6.3.6. Microbiological analysis of kobeba:

Marinated kobeba had lower total bacterial, proteolytic bacteria and psychrophilic bacteria counts than control kobeba. Lime juice was more affected in reducing total bacterial and psychrophilic bacteria counts than acetic acid and propionic acid. Lipolytic bacteria, *S. aureus*, *Salmonella Spp* and coliform bacteria did not detect in all kobeba.

Proteolytic bacteria were not detected in kobeba treated with lime juice and acetic acid. Kobeba treated with propionic acid had lower proteolytic bacteria than control kobeba. Kobeba treated with lime juice, propionic acid and acetic acid had higher total yeast and mold counts than control kobeba.

Total bacterial, psychrophilic bacteria and yeast and mold counts of all kobeba were reduced until the second month of storage followed by slight increase up to the end of storage period. However, proteolytic

bacteria counts were reduced until the first month of storage followed by slight increase up to the end of storage period.

6.3.6. Sensory evaluation of kobeba:

Marinated kobeba had higher rating scores for all sensory properties than control kobeba. Lim juice kobeba had higher rating scores for all sensory properties than propionic acid and acetic acid kobeba. However, no significant differences for all sensory properties were observed between propionic acid and acetic acid kobeba.

All sensory properties did not significantly change until the first month of storage. While, from the second month of storage gradual decreases in all sensory properties were observed until the end of storage period.