Effects of Addition of Seaweed (*Kappaphycus alvarezii*), Fish Gelatin and Chicken Feet Gelatin on the Quality Characteristics of Chicken Sausages

Babji, A. S.[1], Ravisangkar, R.[1], and Nor Hidayah, I.[1]
[1]School of Chemical Sciences and Food Technology, Faculty Science & Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor Darul Ehsan, Malaysia
Corresponding email: [1]daging@ukm.edu.my

ABSTRACT

The objective of this study was to investigate the effects of the addition of seaweed (*Kappaphycus alvarezii*), fish gelatin (FG) and chicken feet gelatin (CFG) on the quality characteristics of chicken sausages. Two optimum formulations from the Response Surface Methodology (RSM) T1 (10% seaweed, 3.81% FG, 7.63% CFG) and T2 (2.57% seaweed, 5% FG, 7.63% CFG) were studied and the quality characteristics were evaluated against control chicken sausage (C). The quality aspects of chicken sausage were analysed included texture profile analysis (TPA), proximate analysis and sensory characteristics. Lower TPA values ($P<0.05$) were recorded for T1 and T2 in comparison to C during storage time. The addition of seaweed, fish gelatin and CFG increased ($P<0.05$) ash and protein but reduced ($P<0.05$) fat content. No significant differences ($P>0.05$) were observed between all samples for colour and taste in sensory evaluation. This study showed that addition of seaweed, fish gelatin and chicken feet gelatin mixture at optimum level produced better quality chicken sausages.

Keywords: *Kappaphycus alvarezii*, Fish gelatin, Chicken feet gelatin, Sausage, Optimization

INTRODUCTION

The demand for nutritious food products has increased in recent years because of changes in life style and eating habits. Most industries face many challenges in producing quality products that meet consumer needs, comply with environmental legislation and maximizing profitability (Babji, 2010).

Seaweed incorporation in chicken sausage has potential to develop a healthier meat product. Addition of seaweeds to the meat products is a good strategy to improve the potential health-beneficial properties by providing dietary fibers and other bioactive components such as antioxidant polyphenols or carotenoids (Roohinejad *et al*., 2016). Mixing different types of gelling agents can improve gel properties. However, the uses of combination between edible seaweed with fish gelatin and chicken feet gelatin as an additive in meat products have given less attention. Gelatin was produced from hydrolysis of collagen and soluble protein compound obtained by partial, the main fibrous protein constituent in bones, cartilages and skins (Schrieber and Gareis, 2007). By mixing a few hydrocolloids can improve the quality of meat product.

Therefore, the present study was undertaken to determine the blending of seaweed, fish gelatin and chicken feet gelatin in improving quality of chicken sausage.

MATERIALS AND METHODS

Seaweed (20 g) were placed in a 500 mL heat resistant beaker with 100 mL of distilled water and heated until dissolved. Chicken gelatin was subjected to the cooking process at 100ºC for 20 min. After heating, the samples were filtered through a filter paper typically used for cooking. The chicken feet gelatin were store at 4±1°C until further analysis. Fish gelatin was obtained from Yummie bakeries Sdn Bhd in Bangi Selangor. Chicken sausage preparation was followed Ch'ng *et al*., (2014). Two optimum formulations from the Response Surface Methodology (RSM) T1 (10% seaweed, 3.81% FG, 7.63% CFG) and T2 (2.57% seaweed, 5% FG, 7.63% CFG) were replaced chicken meat in chicken sausage formulation. Textural properties were tested using a texture analyzer (Shimadzu AGS-J 500N, Japan) to measure hardness (N), elasticity (mm), cohesiveness and chewiness (N mm) as described by Bourne (2002). Proximate analysis contents (moisture, ash, protein and fat) of the sausages were determined (AOAC, 2000) in triplicate. A seven point hedonic scale was used for sensory characteristics such as colour, aroma, taste, hardness, juiciness and overall acceptance (Aminah, 2004).

RESULTS AND DISCUSSION

Table 1 Texture profile analysis (TPA) of chicken sausage with addition of seaweed, fish gelatin and chicken feet gelatin (CFG) compared to the control sample

	Hardness (N)	Elasticity (mm)	Cohesiveness	Chewiness (N mm)
C	^{a}74.35±3.81	^{a}1.05±0.04	^{a}0.33±0.02	^{a}18.29±0.70
T1	^{b}31.16±2.76	^{b}0.97±0.02	^{b}0.23±0.02	^{b}11.99±3.23
T2	^{b}32.01±1.12	^{c}0.87±0.01	^{a}0.34±0.02	^{ab}14.090±1.93

The texture profile analysis (TPA) such as hardness, elasticity, cohesiveness and chewiness of the chicken sausage sampleswere shown in Table 1. An addition of seaweed, fish gelatin and CFG in treatment samples made softer products but increased the hardness throughout storage ($P<0.05$). López-López *et al*., (2010) found that an addition of seaweed in beef patties made softer products. Elasticity of T1 and T2 were significantly different ($P<0.05$) with C. Cohesiveness of T1 gave lowest ($P<0.05$) cohesiveness value compared to T2 and C. The decrease of protein content and increase of moisture with CFG additions reduced the cohesiveness and hardness because these changes affected the emulsification ability of the formulation (Pereira *et al*., 2011). Chewiness value of T1 was significantly lower ($P<0.05$) than the C and T2.

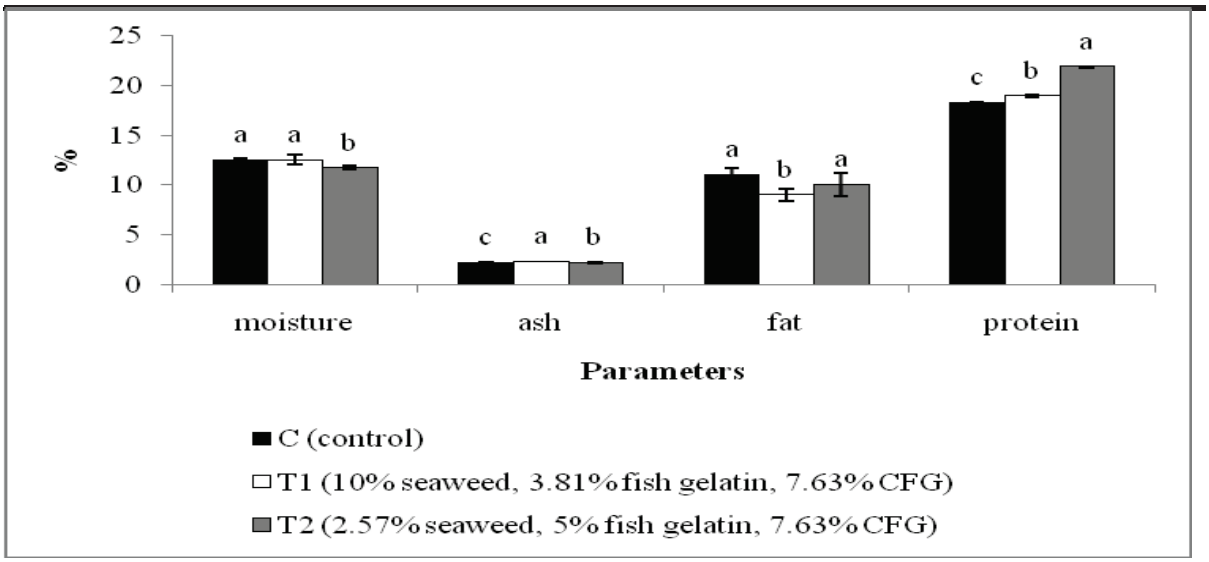

Figure 1 Proximate analysis of chicken sausages treated with seaweed, fish gelatin and chicken feet gelatin. Means indicated with different letters differ significantly (P<0.05).

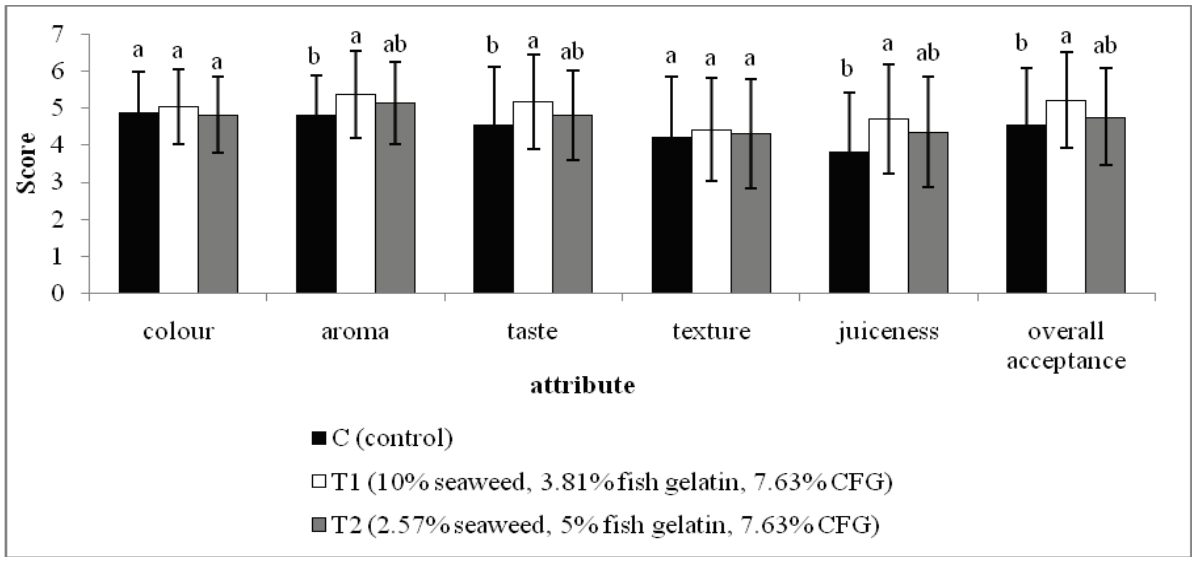

Figure 2 Mean score of sensory evaluation (b) of chicken sausages treated with seaweed, fish gelatin and chicken feet gelatin. Means indicated with different letters differ significantly (P<0.05).

The results of proximate analysis of chicken sausage with addition of various seaweeds, fish gelatine and chicken feet gelatine levels compared to the control sample were presented in Figure 1(a). The moisture content of sample T1 was significant higher (p<0.05) than that of T2 but was not significantly different with C. The moisture content is the important constituent of cooked buffalo meat sausage and it was one of its physicochemical characteristics which decide the important sensory attributes like juiciness of sausage samples (Khan and Ahmad, 2015). The addition of seaweed, fish gelatin and CFG increased (P<0.05) ash and protein but reduced (P<0.05) fat content. The high content of seaweed contributes the increment of ash in chicken sausage. Cofrades *et al*. (2008) was suggested that the larger the amount of added algae, the greater was the increment of ash in the gel/emulsion system. The

total lipid content in seaweed (Ahmad *et al*., 2012) and gelatin (Schrieber and Gareis, 2007) were very low but higher in protein is normally recommended for use in foodstuffs to enhance protein levels useful in body-building foods.

Figure 1 (b) showed summarized the mean scores of colour, aroma, taste, hardness, juiciness and overall acceptability of chicken sausage. T1 received the highest ($P<0.05$) aroma, taste, juiciness and overall acceptability scores and control sample received the lowest aroma, taste, juiciness and overall acceptability scores. No significant differences ($P>0.05$) were observed between all samples for color and texture in sensory evaluation. Therefore, the panelists were unable to detect the addition of seaweed as an off-flavour (seaweed-like) and gelatine (fishy-flavour) in chicken sausage. Work carried out by Ch'ng *et al*. (2014) showed that the higher hardness values do not necessarily mean better in quality. The juiciness increased when the chicken sausage contained 10% seaweed, 3.81% fish gelatine and 7.63% CFG could be due to CFG and seaweed high in moisture content. Chang and Carpenter (1997) reported that the addition of water increased juiciness in frankfurter. Panellist prefer to choose T1 (10% seaweed, 3.81% fish gelatin, 7.63% CFG) as the best product.

CONCLUSIONS

Addition of seaweed, fish gelatin and chicken feet gelatin influenced the physicochemical properties of the chicken sausage. Combination of seaweed, fish gelatin and chicken feet gelatin significantly decreased the texture profile analysis of T1 and T2 compared to control. This study showed that addition of seaweed, fish gelatin and chicken feet gelatin mixture at optimum level produced better quality chicken sausages. Panelists prefer to choose T1 (10% seaweed, 3.81% fish gelatin, 7.63% CFG) as the best product.

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