OPTIMIZING THE SENSORY ACCEPTANCE OF CHICKEN BALL BLENDED WITH PALM OIL AND RED PALM FAT (CAROTINO®)

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Background

Animal fat is an essential component in processed meat products such as frankfurters, hamburgers, nuggets and sausages. However, animal fats are high in cholesterol and saturated fat contents. Therefore, substituting animal fat with palm fats which is rich in natural carotenes and vitamin E can be an alternative for meat products (Babji et al 2001; Wan Sulaiman et al 2001; Tan et al 2001). Palm fats used to substitutes animal fat in meat products can be tailored to suit the functional and economic demands of the users. Babji et al (1988) reported that there was no significant difference in texture, juiciness, aroma, oiliness and overall acceptance between the burgers prepared with palm fats and the conventional ones with beef fat.

Objective

Mixture design was used to optimize the sensory acceptability (color, chicken flavor, off flavor, hardness and overall acceptance) of chicken balls containing palm oil (PO) and red palm fat (RPF).

Methods

Chicken trimming mix and chicken fat were purchased from Dinding Poultry Processing (Kajang, Selangor). Palm oil (PO) and red palm fat (RPF) were provided by Malaysian Palm Oil Board (MPOB) and Carotino Sdn. Bhd. (Pasir Gudang, Johor), respectively. A three component simplex lattice mixture design (Cornell 1990) was used to study the effect of both PO and RPF on the sensory acceptance of chicken ball. The three mixture components consisted of chicken fat (X_1), palm oil (X_2) and red palm fat (X_3) which made up 15.57% of the total formulation. A balanced incomplete block design (Plan 11.16, t=10, k=4, r=6, b=15, λ=2, E=0.83, type III) as described by Cochran and Box (1957) was used because an individual consumer would find it increasingly difficult to evaluate a product as the number of samples increased. This design allowed each consumer to evaluate 4 sample out of 10. Each of the 10 experimental formulations was evaluated 48 times (48 consumer responses). Sensory technique used is a hedonic test using seven-point scale. Attributes evaluated include color, chicken flavor, off flavor, hardness, oiliness and overall acceptability. Samples were presented in sample cups coded with three-digit random numbers and samples were presented to panels using random numbers of permutation. Sensory evaluation was conducted in a sensory evaluation laboratory equipped with six isolated booths, clear lighting and air conditioned room.

Results and Discussions

Results of sensory evaluation are presented in Table 1. Mean score for external color of chicken balls were influenced by the presence of red palm fat (RPF). Color scores for all chicken ball were > 4.00 except F5 (3.81). This indicates that consumer could not accept chicken balls which are yellow in color, as a result of RPF subtitution. However, partial replacement of chicken fat (CF) with RPF in products is still acceptable as no significant differences ($p>0.05$) were observed for consumers preference in color when palm oil (PO) was used to substitute in chicken ball. Statistical analysis also show no significant difference ($p>0.05$) among formulations for chicken flavor attribute (Table 1). However, F1 (100%CF) had recorded the highest score for chicken flavor (score=5.15). Chicken balls cointained a fat mixture of 50%CF and 50%PO was rated second for chicken flavor acceptance. Among all products, chicken flavour of chicken ball subtituted with 100%RPF (F5) was least acceptable (score=4.03) to the consumers. This could be due to reduced chicken flavor as a result of chicken fat subtitution with RPF. Table 1 shows that chicken flavor rating of chicken balls generally decreased with the reduction of CF in the formulation. Therefore, CF is essential to maintain the chicken flavor in chicken ball. Table 1 indicates that off flavor attribute was significantly influenced by CF in the formulation. Off flavor score for chicken ball decreased as amount of CF in formulation decreased. No significant difference ($p>0.05$) was observed among F1, F2, F7 and F8 for off flavor attribute. Replacement with 100%PO (F3) or 100%RPF (F5) produced chicken ball with off flavor and cause product to be become less acceptable than control (F1). However, no significant difference ($p>0.05$) was shown between F3 and F5. The panels preferred products with a fat mixture of 66%CF + 17%PO + 17%RPF (F8) compared to other formulations as shown by the highest score in hardness. Statistical analysis showed no significant difference ($p>0.05$) among F1, F2, F7, F8 and F10. As shown in Table 1, subtitution of PO and / or RPF to chicken ball formulations up to 100% decreased hardness acceptability. When compared among F2, F3, F5, F6, F9 and F10, mean scores for hardness acceptability increased when PO was used as fat replacers instead of RPF. The hardness of chicken ball containing 50%PO (F2) was more acceptable (score=5.11) than chicken ball containing 50%RPF (F6) (score=4.53). No significant difference ($p>0.05$) was observed for oiliness among F1, F2, F3, F4, F7, F8 and F10. The highest score for oiliness acceptability was observed in F1 (control). Oiliness was adversely affected by the addition of PO and RPF. Substituting chicken fat with 100%RPF (F5) and fat blend of 66%PO+17%RPF (F9) caused significant difference with control (F1) in oiliness acceptance. Furthermore, F6 (50%CF+50%RPF) also showed significantly lower score for oiliness attribute as compared to control. Substitution of 50%PO or 50%RPF lowered the overall acceptability score, however these products were still within the acceptable range. Overall acceptability of chicken ball containing 50%PO was higher (score=4.96) than chicken ball containing 50%RPF (score=4.48). The lowest overall acceptability score was observed in chicken ball containing 100%RPF (score=4.11). However, no significant difference ($p>0.05$) was showed for overall acceptance among control (F1), F2, F8 and F10. Beside the control, chicken balls substituted with 50%PO (F2) were most acceptable (score=4.96) compared to other formulations.

Conclusion

This study pointed to the potential of palm oil products, especially palm oil, to be used as fat replacers in the production of processed meat products. Among extended products, those containing a mixture of 50%CF and 50%PO were as acceptable as control and showed market potential. Scale-up production and further sensory, consumer and marketing researches are essential to confirm the demand for this prototype product.

Pertinent Literature

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Acknowledgements
The autors are most grateful to MPOB and Carotino Sdn. Bhd. for providing the palm fats, IRPA 03-02-02-0055 for funding of this project.

Table 1 Mean hedonic scores (n=48) of various sensory attributes as influenced by the addition of palm oil and red palm fat

Formulation	X_1 (CF)	X_2 (PO)	X_3 (RPF)	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
1	1.00	0	0	4.44^{ab}	5.15^{a}	4.86^{a}	5.07^{a}	5.13^{a}	5.19^{a}
2	0.50	0.50	0	4.67^{a}	4.78^{a}	4.29^{ab}	5.11^{a}	5.06^{ab}	4.96^{ab}
3	0	1.00	0	4.59^{ab}	4.36^{a}	4.11^{b}	4.53^{bc}	4.69^{abc}	4.53^{bcde}
4	0	0.50	0.50	4.23^{ab}	4.13^{a}	3.94^{b}	4.28^{c}	4.73^{abc}	4.36^{cde}
5	0	0	1.00	3.81^{b}	4.03^{a}	3.80^{b}	4.56^{bc}	4.38^{c}	4.11^{e}
6	0.50	0	0.50	4.61^{ab}	4.38^{a}	4.11^{b}	4.53^{bc}	4.42^{bc}	4.48^{bcde}
7	0.34	0.33	0.33	4.61^{ab}	4.42^{a}	4.13^{ab}	4.78^{ab}	4.61^{abc}	4.57^{bcde}
8	0.66	0.17	0.17	4.63^{ab}	4.53^{a}	4.27^{ab}	5.13^{a}	4.71^{abc}	4.88^{abc}
9	0.17	0.66	0.17	4.53^{ab}	4.57^{a}	3.73^{b}	4.46^{bc}	4.13^{c}	4.19^{de}
10	0.17	0.17	0.66	4.76^{a}	4.21^{a}	4.17^{b}	4.81^{ab}	4.75^{abc}	4.71^{abcd}

a-e: Mean values within the same row bearing different superscripts differ significantly ($p<0.05$).
CF = Chicken fat
PO = Palm oil
RPF = Red palm fat
Y_1: Color
Y_2: Chicken flavor
Y_3: Off flavor
Y_4: Hardness
Y_5: Oiliness
Y_6: Overall acceptance