Sains Malaysiana 43(1)(2014): 65–71

Nutritional Composition and Sensory Properties of Oyster Mushroom-based Patties Packed with Biodegradable Packaging

(Komposisi Pemakanan dan Ciri Sensori Burger Berasaskan Cendawan Tiram yang Dibungkus dengan Pembungkus Terurai Secara Biologi)

W.I. WAN ROSLI* & M.A. SOLIHAH

ABSTRACT

The increase use of synthetic packaging films in food products has led to serious environmental problems due to their total non-biodegradability property. Nutrient composition and sensory acceptability of chicken patties formulated with various levels of Pleurotus sajor-caju *popularly known as grey oyster mushroom (OM) and wrapped with degradable plastic were studied. The chicken patties were formulated with either 0, 25 or 50% of fresh OM. The results showed that chicken patty formulated with 25% PSC has protein content of 17.46% lower than the control patty which had 18.13% but it was not significant* ($p>0.05$)*. After storage, cooked chicken patty formulated with 25% OM had protein content of 21.53% lower than the control patty (23.90%) but it was not significant* ($p>0.05$)*. However, incorporation of OM in chicken patties resulted in decreasing of fat content significantly* ($p\leq0.05$) *from 15.58 (control) to 13.33% after storage. On the other nutrient, the concentration of β-glucan were detected at values ranged between 0.70 and 0.76 (g/100 g) after 6 month. Other results showed that patty formulated with 25% OM received the highest scores for all attributes except for aroma. Meanwhile, patty prepared with 50% OM received the highest score of aroma attribute after 6 month of storage. However, the score values for all attributes of all OM-based patties were not statistically different with control patty* ($p> 0.05$)*. In conclusion, the addition of OM at 25% can be recommended for the purpose of lowering fat content while keeping protein and β-glucan unchanged without jeopardizing sensorial properties. This investigation therefore, suggested that biodegradable plastic can be used in packing any type of processed meat-based products.*

Keywords: Chicken patty; nutrient composition; oyster mushroom; sensory evaluation

ABSTRAK

Peningkatan penggunaan filem pembungkus sintetik dalam produk makanan telah menjadi punca kepada masalah persekitaran yang serius disebabkan ketidakupayaan ciri kebolehuraiannya secara biologi. Komposisi nutrien dan penerimaan sensori burger ayam yang diformulasikan dengan Pleurotus sajor-caju *atau lebih dikenali sebagai cendawan tiram (OM) pada paras berbeza dan dibungkus dengan plastik mudahurai telah dikaji. Burger ayam diformulasikan dengan sama ada 0, 25 atau 50% OM segar. Keputusan kajian menunjukkan burger ayam yang diformulasikan dengan 25% OM mengandungi protein sebanyak 17.46% kurang daripada burger kawalan yang mengandungi protein 18.13% tetapi tidak signifikan* ($p>0.05$)*. Selepas penyimpanan, burger ayam masak yang diformulasikan dengan 25% OM mengandungi protein sebanyak 21.53% lebih rendah daripada burger kawalan (23.90%) tetapi tidak signifikan* ($p>0.05$)*. Walau bagaimanapun, penambahan OM dalam burger ayam mengurangkan kandungan lemak secara signifikan* ($p\leq0.05$) *daripada 15.58 (kawalan) kepada 13.33% selepas penyimpanan. Dalam nutrien lain, kepekatan β-glukan dikesan berada pada julat antara 0.70-0.76 (g/100 g) selepas 6 bulan. Keputusan lain menunjukkan burger yang diformulasikan dengan 25% OM menerima skor yang tertinggi untuk semua atribut kecuali aroma. Sementara itu, burger yang disediakan dengan 50% OM menerima skor tertinggi bagi aroma selepas 6 bulan penyimpanan. Walau bagaimanapun, nilai skor untuk semua atribut bagi semua burger berasaskan OM tidak signifikan secara statistik berbanding burger kawalan* ($p> 0.05$)*. Kesimpulannya, penambahan OM pada 25% boleh dicadangkan untuk tujuan mengurangkan kandungan lemak sambil tidak mengubah kandungan protein dan β-glukan serta tidak menjejaskan ciri sensori. Kajian ini menunjukkan plastik mudahurai secara biologi boleh disarankan untuk diguna dalam membungkus produk makanan terproses berasaskan daging yang lain juga.*

Kata kunci: Burger ayam; cendawan tiram; komposisi nutrient; penilaian sensori

INTRODUCTION

For a long time synthetic polymers have supplied most of common packaging materials due to the present of several preferred features like softness, transparency and lightness. However, increased use of synthetic packaging films has led to serious environmental problems due to their total non-biodegradability property. The rise in the petroleum-based plastic manufacturing in Malaysia and other parts of the world had introduced the world to environmental impacts because most of the plastic materials have remained in the garbage deposits. Globally, there are about 30-50% of plastics made from hydrocarbon are used for packaging. Moreover, the use of hydrocarbon plastic ingredients that are not readily biodegradable has increased. Even though their absolute substitution with eco-friendly packaging films is just almost impracticable to achieve, at least for specific applications like food packaging the use of degradable plastics should be the future. Therefore, there are necessitating efforts to be taken in overcoming these situations. One of the alternatives been considered is to increase the use of natural biopolymer in combating this situation.

Natural biopolymer, such as starch, is excellent degradable polymers that can be applied to substitute the hydrocarbon plastic materials (Waha et al. 2011). Presently, in Europe there is a rising force on the packaging industry to develop environmentally sustainable materials. The use of forest and paper-industry by-products such as wood fibres and tree oils in food packaging is low-cost and can act as an alternative to petroleum resources (Astley 2012).

Presently, the application of degradable packaging plastic in wrapping processed food products including processed meat-based items such as patty is not yet practiced in Malaysia. In addition, there is scanty research and development conducted in this area. However, the innovative effort initiated by a group of Malaysian scientist who invented a biodegradable plastic from fruit skins to replace polystyrene for packing items signals positive finding to the other group of researchers, manufacturing companies and governmental agencies in joint development of biodegradable plastic container for food products. The skins of the tropical fruits are said to be suitable to produce the film for making plastic as they are high in carbohydrates and protein (Zhong et al. 2011). It is hoped that with a little bit goes a long way, no doubt Malaysia will be a greener country within years to come if young Malaysians incorporate reusing and recycling in their daily lives.

Agricultural by-products from fruits and plants are seen to be a potential raw ingredient not only in processing of degradable plastics but it also being formulated in cultivation of oyster mushroom. Saw dust, rubber wood tree, rice straw and other agricultural by-products have been used in the preparation of medium nutrient for growing mushroom. Until now, edible mushrooms are cultivated and consumed as food or food ingredients in various food preparation and processed food products. This fungus is cultivated on a decayed organic material and produce edible portion on the various surface of the substrate.

It is purported that by replacing meat based ingredients with oyster mushroom into patty formulation, a saving on ingredient cost can be purportedly achieved. Recently, we studied the colour, textural properties and cooking characteristics of chicken patty added with OM (Wan Rosli et al. 2011). In addition, the incorporation of PSC as non-meat ingredient was conducted with the focus to enhance the nutritional composition and dietary fibres while reducing formulation cost in food products (Wan Rosli et al. 2012). However, the effect of biodegradable plastic packaging on the nutritional composition and sensory properties of patty added with OM during storage was not investigated before. Thus, the aim of the present study was to evaluate the nutritional composition and sensory properties of oyster mushroom-based patties packed with biodegradable packaging.

Materials and Methods

SAMPLE PREPARATION

Freshly harvested OM was supplied by the National Kenaf and Tobacco Board of Malaysia (NKTB) from Bachok district of Kelantan, Malaysia. Fully-grown OM with the pileus cap diameters between 9 and 11 cm were used throughout the study. The OM was prepared by rinsing with clean water, blanched and chopped coarsely until the uniform sizes ranging from 2-5 mm is obtained. Excess water was drained to avoid patty from becoming mushy. The prepared OM was then incorporated partially to replace chicken breast in patty formulations at 0, 25 and 50% (wet basis), respectively.

CHICKEN PATTY FORMULATION

Three chicken patty formulations were compared. Each of them contained either 0 (control), 25 and 50% of ground OM. The percentages of other ingredients are unchanged compared with the control sample, whereas the percentage of chicken breast decreases with the increase of ground OM content. The chicken used in the present formulation fulfilled Malaysian Food Act 281 and Regulations 1983 (Food Act 1983). The ground OM was incorporated into the chicken patties using the formulations described in Table 1. The finished chicken patties were directly stored in a freezer at -18^{o}C while waiting for further analysis. The OM was prepared in the Nutrition Laboratory of the School of Health Sciences, Universiti Sains Malaysia Health Campus. Chicken breast was purchased from local wet market. Other dry materials were purchased from local suppliers.

PROCESSING

The chicken meat was manually cut using a cleaver and minced using a food processor (Panasonic, Model MK-5086M, Malaysia). The minced chicken was stored at –18^{o}C until processing time. Isolated soy protein was blended with water and shortening at a ratio of 1:5:5 using a Hobart mixer (N-50 Canada). The emulsion prepared (called pre-emulsion) was kept in a chiller (2-5^{o}C) until ready for use. Salt was added to the frozen minced chicken and mixing was carried out using a Hobart mixer for 3 min. Water mixed with spices, potato starch and OM were added and

TABLE 1. Ingredients used in chicken patty formulated with different level of ground oyster mushroom (OM)

Ingredients (%)	OM level (%)		
	Control (0)	25	50
Chicken breast	54.00	40.50	27.00
Fat	9.00	9.00	9.00
Water	26.00	26.00	26.00
Potato starch	6.00	6.00	6.00
Ground PSC	0.00	13.50	27.00
Isolated soy protein	3.00	3.00	3.00
Salt	1.00	1.00	1.00
Spices and seasoning	1.00	1.00	1.00
Total	100.00	100.00	100.00

mixed for another 2 min. The pre-emulsion was then added and mixing continued for another 2 min. The finished chicken batters were then weighed into 70 g portions and then manually moulded to produce a uniform patty with the diameter and thickness of 100 and 10 mm, respectively. The chicken patties were then packed in degradable plastic and frozen in a freezer at –18°C for 6 months until further analyses. Every degradable plastic container occupies six pieces of patties.

PREPARATION OF DEGRADABLE PACKAGING

Sago starch obtained from the Land Custody Development Authority (LCDA), Sarawak (Malaysia) was dried in a vacuum oven for 24 h at 80°C. The sago granular sizes ranged from 9 to 35 μm, with an average granule size of 20 μm was used. The degradable plastic mixture was prepared by premixing sago starch in powder form with 35% liquid glycerol (Ajax Chemicals, Malaysia) in a kitchen blender with a capacity of 200 g. The mixture was considered ready when the starch was fully covered with the liquid glycerol after mixing for 5 min. In case of insufficient mixing, manual mixing was used with spatula. The mixture was kept in a dry place for 24 h at room temperature. After the process, the compound was melt-mixed using heated two-roll mills at 150°C for 10 min (Rohani et al. 2010).

COOKING PROCEDURE

Chicken patties were thawed at 4°C for 12 h. Chicken patties were then cooked on a pan-fried electric skillet (Model KX-11K1, Sharp Corporation, Japan) for 7-8 min until an internal temperature of 72 ± 1°C was achieved.

PROXIMATE COMPOSITION

Proximate composition was conducted using AOAC (1996) for moisture, ash, soluble dietary fibre (SDF), insoluble dietary fibre (ISF), total dietary fiber (TDF), protein by nitrogen conversion factor of 6.25 (Kjeldahl method) (AOAC 1996) and crude fat content using the semi-continuous extraction (Soxhlet) method (AOAC 1996). All measurements were carried out in triplicate (n = 3). Total carbohydrates were calculated by the difference: total carbohydrates = 100 – (g moisture + g protein + g fat + g ash). On the other analysis, β-glucan were measured using Megazyme enzymatic kits Mixed-Linkage β-glucan (Streamlined Method) AACC Method 32-23.

SENSORY EVALUATION

All samples were evaluated by each untrained consumers according to the hedonic scaling method outlined by Aminah (2000). Sensory evaluations were carried out by 60 untrained consumers consisting of students and staff of the School of Health Sciences, Universiti Sains Malaysia Health Campus. The cooked patty samples were equally divided into 6 portions. Each portion of product sample was placed in sensory cups with lids coded with 3 digit random numbers. Permutation sample presentation is applied to the patties before presented to the panellists. They evaluated samples for aroma, colour, springiness, juiciness, flavour and overall acceptance on a 7 point scale (1 = dislike extremely and 7 = like extremely). Significance was established at $p \leq 0.05$ using statistics outline below.

STATISTICAL ANALYSIS

Data obtained were tested for significance using ANOVA and Duncan multiple range test with SPSS version 19.0 (USA). All measurements were carried out in triplicate (n=3). The experiments were replicated twice. Significant level was established at $p \leq 0.05$.

RESULTS AND DISCUSSION

NUTRIENT COMPOSITION OF OYSTER MUSHROOM (OM)

The nutrient composition of dried OM is shown in Table 2. The OM used in this study recorded protein concentration of 23.3% (dry basis). This value is close to the percentage range with those reported by Hung and Nhi (2012) and Dikeman et al. (2005). Dikeman et al. (2005) reported that the protein content of 6 dried various selected mushroom varieties were ranging from 23.4 to 43.5%. Recently, Hung and Nhi (2012) found that the protein content of dried fruiting body of edible mushroom is at 25%. On the other part, fat concentration in

TABLE 2. Chemical compositions of ground oyster mushroom (OM)

Chemical compositions	Concentration (%)
Moisture	90.20±0.30
Protein (dry basis)	23.30±0.90
Fat (dry basis)	3.00±0.60
Ash (dry basis)	3.20±0.01
Carbohydrate	65.50
Soluble dietary fibre	0.2 (g/100 g)
Insoluble dietary fibre	35.4 (g/100 g)
Total dietary fibre	35.6 (g/100 g)

OM used in the present study was 3.0%. This value is close to the fat content of enokitake mushroom *(Flammulina velutipes)* which had 3.7% fat (Dikeman et al. 2005) while Hung and Nhi (2012) found fat content at 5.7%. Total ash content recorded in OM used in this study was 3.2%.

Apart from that, dried OM contains 35.6 g/100 g of TDF with IDF being the highest component (35.4 g/100 g) while SDF had the lowest value (0.2 g/100 g). The present results were in agreement with the dietary fibre content of the fruiting body of other mushroom species which ranged from 30-40% dry weight (Kurasawa et al. 1982). In addition other study has revealed that other mushroom species such as *Poria cocos* also contain the dietary fiber content in this range (Cheung 1997). The carbohydrate content of ground PSC (dry basis) measured in the present study was 65.5%. This value was supported by Chirinang and Intarapichet (2009) who reported that carbohydrate content (dry basis) in OM was 65.14%.

In our previous article, chicken patty containing 50% ground OM had the highest IDF at 4.90 g/100 g while chicken containing 0% ground OM had the lowest value at 1.9 g/100 g. Even though chicken patty containing 50% ground OM recorded higher value of β-glucan but was not different with chicken patty containing 25% ground OM (Wan Rosli et al. 2011).

NUTRIENT COMPOSITION OF COOKED CHICKEN PATTIES FORMULATED WITH OM

The nutrient compositions of cooked chicken patties formulated with ground OM were shown in Table 3. Moisture content of cooked chicken patties ranged from 50.74 to 61.80%. However, after 6 months of storage, moisture significantly decreased ($p< 0.05$) in all treatments. Control cooked chicken patties contained lower moisture content than patties formulated with OM. They recorded 50.74% moisture while chicken patties containing 50% OM recorded the highest moisture content (61.80%). After storage, reduction in moisture content of control chicken patties during cooking were as high as 24.0% (reduced from 50.74 to 38.49%) compared with chicken patty added with 50% ground PSC which was 23.3% (from 61.80 to 47.38%). These findings are in agreement with other studies on different mushroom species.

The concentration of protein decreased slightly with the level of OM used in cooked chicken patty. Even though chicken patty formulated with 25% OM ha protein content of 17.46% lower than the control patty which had 18.13% but it was not significant ($p> 0.05$). Cooked chicken patties formulated with 50% OM significantly ($p< 0.05$) showed the lowest protein concentration (14.16%). After 6 months of storage, protein content increased in all patties ranging from 19.88-23.90%. However, protein content in patty prepared with 25% OM was not significant ($p> 0.05$) compared with control, after 6 months of storage.

Meanwhile, both cooked chicken patties containing 25 and 50% OM significantly ($p< 0.05$) recorded lower concentration of fat at 10.67 and 7.15%, respectively, compared with control. Similar trend was recorded in all patty samples after 6 months of storage. Cooked chicken patties containing 25 and 50% OM significantly ($p< 0.05$) recorded slightly lower concentration of fat compared with control at 14.33 and 13.33%, respectively, after 6 months. The percentage of ash in all cooked chicken patties range from 2.13 to 2.40% and not significant ($p> 0.05$)

TABLE 3. Nutrient analyses of cooked chicken patty containing different levels of oyster mushroom (OM) wrapped with degradable packaging

Composition (%)	Storage time (mth)	0 (control)	OM Level (%)	
			25	50
Protein	0	$^{q}18.13±0.39^{a}$	$^{q}17.46±0.47^{a}$	$^{q}14.16±0.57^{b}$
	6	$^{p}23.90±0.94^{a}$	$^{p}21.53±0.88^{a}$	$^{p}19.88±0.11^{b}$
Fat	0	$^{q}12.92±0.02^{a}$	$^{q}10.67±0.46^{b}$	$^{q}7.15±0.02^{c}$
	6	$^{p}15.58±0.44^{a}$	$^{p}14.33±0.32^{b}$	$^{p}13.33±0.04^{c}$
Moisture	0	$^{p}50.74±0.82^{a}$	$^{p}57.91±0.19^{b}$	$^{p}61.80±0.09^{c}$
	6	$^{q}38.49±2.04^{c}$	$^{q}41.35±0.90^{b}$	$^{q}47.38±1.24^{c}$
Ash	0	$^{p}2.13±0.09^{c}$	$^{p}2.40±0.05^{a}$	$^{q}2.27±0.08^{b}$
	6	$^{p}2.27±0.12^{a}$	$^{p}2.41±0.13^{a}$	$^{p}2.18±0.14^{a}$
Carbohydrate	0	$^{q}16.08±0.33^{a}$	$^{q}13.56±0.30^{b}$	$^{q}14.62±0.29^{b}$
	6	$^{p}19.76±0.42^{a}$	$^{p}20.38±0.34^{a}$	$^{p}19.23±0.28^{a}$

$^{a-c}$ Mean values within the same row bearing different superscripts differ significantly (p<0.05)
$^{p-q}$ Mean values within the same column bearing different superscripts differ significantly (p<0.05)

among treatments. Similarly, after 6 months of storage, the percentage of ash in all cooked chicken patties range from 2.18 to 2.41% and was also not significant (p> 0.05).

Carbohydrates were among the predominant macronutrients and ranged from 13.56-16.08% in cooked chicken patty formulated with and without OM. The present data are supported by the previous work done by other scientists. Barros et al. (2007) reported that carbohydrate content of cooked parasol mushroom (*Macrolepiota procera)* was 16.40 g/100 g and 80.38 g/100 g in the corresponding dried sample. In the present study, the carbohydrate content of patty added with 25 and 50% OM showed lower content compared with patty without OM (0%). This situation may possibly be due to the high moisture content (57.91-61.80%) presented in cooked OM-based patties. After storage for 6 months, carbohydrate content in all patties present ranged from 19.23-20.38% and was not significant (p>0.05) for all treatments. Cooking may promote a loss of nutrient due to interactions among constituents, chemical reactions and solubility in cooking medium and thermal degradation (Manzi et al. 2004).

After storage, the losses of moisture were obviously recorded in all patty samples. Temperature fluctuations during frozen storage lead to a partial migration of moisture from interior of patty towards the surface of either patty or degradable plastic wrapper and formed frost. Moisture migration causes weight losses during freezing and frozen storage. The present study was in agreement with Hanenian et al. (1989). The moisture losses were seen increased with frozen storage time, caused by higher evaporative losses due to increased storage time (Hanenian et al. 1989). Lower content of moisture due to the moisture migration during storage has resulted in increment of protein, fat and carbohydrate content in all chicken patty samples after 6 months of storage.

β-GLUCAN CONTENT OF CHICKEN PATTIES FORMULATED WITH OM

The concentration of β-glucan was not significant in all patties before (0 month) and after 6 months of storage (Table 4). The concentration of β-glucan were detected at values ranged from 0.70-0.76 (g/100 g) after 6 month. However, patty without OM (control) also contained β-glucan. This might be due to the natural β-glucan present in soya and potato starches used in the patty formulation. It was reported that high temperature and pressure processing would break down the β-glucan molecules and make them lose their effectiveness (Wolever et al. 2010). In this present study, it was suggested that cooking and frozen storage did not affect the concentration of β-glucan.

SENSORY EVALUATIONS OF CHICKEN PATTY FORMULATED WITH OM

Table 5 shows the sensory assessment scores for cooked chicken patties incorporated with OM before and after storage. Before storage, the scores of all sensory attributes were in the range between 4.02 and 5.15 values. The score values however were not much different compared with when the patties were stored for 6 months (4.35-5.15). Among cooked OM-based chicken patties, chicken patty containing 50% OM received the highest score for all attributes except for aroma and colour as perceived by 60 untrained panellists. The present sensory data also shows that all chicken patties formulated 25 and 50% OM were not significantly different (p>0.05) compared with control chicken patty for all attributes. Among all PSC-based patty treatments, patties containing 50% OM had the highest score for all sensory attributes but not significant. Chicken patty containing 25% OM had 4.88 and 4.85 score values of aroma and colour, respectively, but was not significant (p>0.05) compared to other treatments. Even though chicken patties formulated with 50% OM has slightly higher scores (4.67 and 4.72) for both springiness and juiciness but were not significantly different with that of control.

Interestingly, after 6 months of storage, the patty formulated with 25% OM received the highest scores for all attributes except for aroma. This treatment received the highest score for overall acceptance and colour attributes at 4.95 and 4.93, respectively, but not significantly different among treatments. On aroma attribute, patty prepared with 50% OM received the highest score at 5.15 after 6 month of storage. However, the score values for all attributes of all OM-based patties were not statistically different with control patty (p > 0.05). This present study suggested that biodegradable plastic wrapper does not affect all sensory attributes perceived by consumers before and after storage. It is hoped that this present finding will attract more attention from processed food manufacturer in venturing and applying biodegradable packaging systems in their finished products.

After storage, the slightly higher score (no different) received by patty prepared with 25 and 50% for juiciness and overall acceptance. Several authors reported that the dilution effect of nonmeat ingredients in meat protein

TABLE 4. Beta-glucan content of chicken patty wrapped with degradable packaging (g/100 g)

Month of storage	OM Level (%)		
	0	25	50
0	$^{p}0.75\pm0.06^{a}$	$^{p}0.77\pm0.10^{a}$	$^{p}0.80\pm0.05^{a}$
6	$^{p}0.70\pm0.07^{a}$	$^{p}0.74\pm0.02^{a}$	$^{p}0.76\pm0.05^{a}$

[a] Mean values within the same row bearing different superscripts differ significantly (p<0.05)
[p] Mean values within the same column bearing different superscripts differ significantly (p<0.05)

TABLE 5. Sensory attributes of cooked chicken patties as influenced by the addition of OM (n= 60) wrapped with degradable packaging

Sensory attributes		OM Level (%)		
		0	25	50
Aroma	0 mth	4.98±1.28[a]	4.88±1.07[a]	4.57±1.05[a]
	6 mth	4.83±1.28[a]	4.82±1.26[a]	5.15±1.28[a]
Colour	0 mth	5.15±1.18[a]	4.85±1.10[a]	4.47±1.21[a]
	6 mth	4.75±0.98[a]	4.93±1.02[a]	4.90±1.17[a]
Springiness	0 mth	4.53±1.14[a]	4.28±1.13[a]	4.67±1.04[a]
	6 mth	4.47±1.03[a]	4.65±1.17[a]	4.65±1.16[a]
Juiciness	0 mth	4.28±1.11[a]	4.02±1.12[a]	4.72±1.02[a]
	6 mth	4.35±1.10[a]	4.57±1.15[a]	4.50±1.18[a]
Flavour	0 mth	4.67±1.14[a]	4.33±1.06[a]	4.53±1.09[a]
	6 mth	4.72±1.14[a]	4.78±1.14[a]	4.62±1.14[a]
Overall acceptance	0 mth	4.90±1.04[a]	4.47±1.12[a]	4.72±1.04[a]
	6 mth	4.65±1.15[a]	4.95±1.11[a]	4.77±1.18[a]

[a] Mean values within the same row bearing different superscripts differ significantly (p<0.05)

systems primarily accounted for soft texture (Tsai et al. 1998). Juiciness is improved after the starches disperse within the meat to set up moisture-forming matrixes during and after processing. Moisture is retained within the meat avoiding water purge and helping to preserve the flavours of both the protein and the matrixes (Aleson-Carbonella et al. 2005).

This data indicated that consumers accepting the patties prepared with OM packed with biodegradable plastic. These findings are in line to our previous study where the OM being used to partially replace meat in beef patty formulations (Wan Rosli et al. 2012).

CONCLUSION

After storage, protein content in chicken patty prepared with 25% OM was not significant compared with control. Meanwhile, both cooked chicken patties containing 25 and 50% OM significantly recorded lower concentration of fat at 10.67 and 7.15%, respectively, compared with control. However, the score values for all sensory attributes of all OM-based patties were not statistically different with control patty. In summary, the addition of OM partially in chicken patty packed with biodegradable packaging can be recommended for the purpose of lowering fat content while unchanging protein and not jeopardizing sensorial properties.

ACKNOWLEDGEMENTS

The authors appreciate the funding from Universiti Sains Malaysia Delivering Excelllence APEX Budget 2011 (1002/PPSK/910314), Aishah, Nurhanan and other staffs at School of Health Sciences who participated in sensory evaluation of PSC-based chicken patty products. The authors would also like to thank the National Kenaf and Tobacco Board of Malaysia (304/PPSK/6150118/L120) and Anjaad Industries (M) Sdn Bhd for their technical assistance in the research.

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School of Health Sciences
Universiti Sains Malaysia Health Campus
16150 Kubang Kerian, Kelantan
Malaysia

*Corresponding author; email: wrosli@kck.usm.my

Received: 1 August 2012
Accepted: 10 March 2013