The Effect of *Pleurotus sajor-caju* (PSC) Addition on the Nutritional Composition and Sensory Properties of Poultry-Based Patty

W. I. Wan Rosli, M. A. Solihah., N. A. Nik Fakurudin, M. S. Aishah and S. S. J. Mohsin

***Abstract*—**The nutrient composition and sensory properties of poultry-based patties (PBPs) incorporated with various levels of grey oyster mushroom (*Pleurotus sajor-caju*, PSC) were studied. The PBPs were formulated with either 0%, 25% or 50% of fresh ground PSC. Results show poultry patty formulated with 25% PSC had protein content of 17.46% lower than the control patty which had 18.13% but it was not significant. Meanwhile, both cooked poultry patties containing 25% and 50% PSC significantly recorded lower concentration of fat at 10.67% and 7.15%, respectively. On the other hand, poultry patty added with 50% ground PSC shows the highest concentration of total dietary fibre (TDF) of 4.90 g/100g compared to poultry patty containing 25% of mushroom (3.40 g/100g) and to the control (1.90g/100g). In addition, patty incorporated with 25% PSC had moisture content of 57.91% which is significantly lower than patty formulated with 50% which had moisture of 61.80%. In the sensory evaluation, there were no differences recorded in all sensory attributes of PSC-based patties judged by untrained panelists. In conclusion, the addition of PSC to replace poultry meat can be recommended for the purpose of lowering production cost, enhancing nutritional composition and maintaining the acceptability of poultry patties.

***Keywords*—**oyster mushroom (PSC), poultry patty, nutrient composition, sensory evaluation

I. Introduction

HISTORICALLY, mushrooms have been used for both medicinal and culinary properties in Asian and many parts of the world. There are approximately 5000 different species of mushrooms, of which at least 1220 are reported to be edible [1]. There is significant interest in the use of edible mushrooms extracts as dietary supplements based on the facts that they have a lot of bioactive compounds. Pharmaceutically, bioactive mushroom constituents continue to be the main focus of most scientists, including chemical structures, isolation and efficacy experimentations *in vivo or in vitro*. The lipid fraction was found to contain a compound with antitumor activity, subsequently identified as ergosterol. Other mushroom constituents may inhibit promotion or progression by exerting direct cytotoxicity, against tumor cells, interfering with tumor angiogenesis, or upregulating other nonimmune tumor-suppressive mechanisms [2]. Mushrooms have been associated with many medicinal and pharmacological properties by both eastern and western medicine. They range from lowering blood pressure, reducing cholesterol, strengthening the immune system against diseases including viral ones, improving liver function and combating tumors [3, 4]. Freshly harvested edible mushrooms were reported to contain low fat content in average ranged from 0.38% to 2.28%, indicated low calorific value (kcal) contribution of mushrooms on total daily energy intake [5]. On the other hand, the cultivated edible mushroom normally had high moisture content at more than 80%. Mushrooms are considered to be healthy because they are low in calories, sodium, fat and cholesterol level. Therefore, they form an important constituent of a diet for a population suffering from atherosclerosis [6]. It also contain appreciable amount of dietary fibre and β-glucan, vitamin B groups, D and other useful nutrients. β-Glucans, also a components of soluble or insoluble dietary fibre (SDF, IDF) is present in appreciable amounts in mushrooms and are linked to the ability to lower blood cholesterol levels and glycemic response [7]. β-glucans are also linked with it ability to show significant immonumodulative properties, possess better antioxidant activities and exhibits scavenging capacities against free radicals [8]. Extensive studies have been done in the use of various types of fat replacer and plant dietary fibre in processed meat and poultry products in attempts at increasing dietary fibre and lowering of fat content. The effect of utilization of oat fibre [9,10], cereal and fruit fibres [11] and whey protein [12] on the physical characteristics and sensory properties of low-fat beef patties has been studied previously. Recently, researchers found that dietary grape pomace concentrate and grape antioxidant dietary fibre could be successful in retarding lipid oxidation of chilled and long-term frozen stored of raw and cooked chicken patties [13]. The incorporation of PSC as non-meat ingredient in the present study is intended to enhance the nutritional value, maintaining sensory qualities while reducing formulation cost in PBPs. This intention therefore necessitate that a thorough study to be done to determine nutritional composition, fibre content and sensory properties of poultry patty added with oyster mushroom (*Pleurotus sajor-caju*).

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II. Materials And Methods

A. Poultry patty formulation

Three poultry patty formulations were compared. Each of them contains either 0 (control), 25 and 50% of ground PSC. The percentages of other ingredients are unchanged compared to

the control sample, whereas the percentage of poultry breast decreases with the increase of ground oyster mushroom content. The ground PSC was incorporated into the poultry patties using the formulations described in Table 1. The finished poultry patties were directly stored in a freezer at -18°C while waiting for further analysis. Freshly harvested PSC was supplied by the National Kenaf and Tobacco Board of Malaysia from Bachok district of Kelantan, Malaysia. Fully-grown mushrooms with the pileus cap diameters between 9 to11 cm were used throughout the study. PSC was prepared in the Nutrition Laboratory of the School of Health Sciences, Universiti Sains Malaysia Health Campus. Poultry breast was purchased from local wet market. Other dry materials were purchased from local suppliers

TABLE I
POULTRY PATTIES FORMULATED WITH DIFFERENT LEVEL OF GROUND PSC

	Mushroom level (%)		
Ingredients (%)	**Control (0)**	**25**	**50**
Poultry breast	54.0	40.5	27.0
Fat	9.0	9.0	9.0
Water	26.0	26.0	26.0
Potato starch	6.0	4.0	2.0
PSC (%)	0.0	13.5	27.0
Isolated soy protein	3.0	3.0	3.0
Salt and seasoning	2.0	2.0	2.0
Total	100	100	100

B.Cooking Procedure

Poultry patties were thawed at 4 °C for 12 h. Poultry 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.

C.Proximate Analyses

Proximate analyses were conducted using AOAC [14] 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) and crude fat content using the semi-continuous extraction (Soxhlet) method [14]. All measurements were carried out in triplicate (n = 3).

D.Sensory Evaluation

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. 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≤0.05 using statistics outlined below.

E.Statistical Analysis

Data obtained were tested for significance using ANOVA and Duncan Multiple Range Test with SAS version 6.12 [15]. All measurements were carried out in triplicate.

III. RESULTS AND DISCUSSION

The nutrient composition of dried PSC is shown in Table 2. The PSC used in this study contained protein concentration of 23.3%. This value is close to the percentage range with those reported previously by [16]. On the other result, fat concentration in oyster mushroom used in the present study is 3.0%. Apart from that, dried oyster mushroom contains 35.6g/100g of TDF with IDF being the highest component (35.4g/100g) while SDF had the lowest value (0.2g/100g). The present result was in agreement with the dietary fibre content of the fruiting body of other mushroom species which ranged from 30-40% dry weight [17].

TABLE II
CHEMICAL COMPOSITIONS OF DRIED PSC

Nutrient Composition	**Concentration (%)**
Moisture (wet basis)	90.2 ± 0.3
Protein	23.3 ± 0.9
Fat	3.0 ± 0.6
Ash	3.2 ± 0.01
Soluble dietary fibre	0.2 (g/100g)
Insoluble dietary fibre	35.4 (g/100g)
Total dietary fibre	35.6 (g/100g)

Among all treatments analyzed, patty formulated with 50% of PSC contained higher moisture content than patties formulated with 25% PSC and control (Table 3). The concentration of protein was decreased proportionally with the level of PSC used in cooked poultry patty. Even though poultry patty formulated with 25% PSC had protein content of 17.46% lower than the control patty which had 18.13% but it was not significant (P> 0.05). Meanwhile, both cooked poultry patties containing 25% and 50% PSC significantly recorded lower concentration of fat at 10.67% and 7.15%, respectively. On the other result, the percentage of ash in all poultry patties range from 2.13 to 2.40%.

TABLE III
NUTRIENT ANALYSES OF COOKED POULTRY PATTY INCORPORATED WITH PSC

PSC	**Concentration (Percent)**			
level (%)	**Protein**	**Fat**	**Ash**	**Moisture**
Control (0)	18.13+0.39[a]	12.92±0.02[a]	2.13±0.09[c]	50.74±0.82[a]
25	17.46+0.47[a]	10.67±0.46[a]	2.40±0.05[a]	57.91±0.19[b]
50	14.16+0.57[b]	7.15±0.02[c]	2.27±0.08[b]	61.80±0.09[c]

[a-c] Mean values within the same column bearing different superscripts differ significantly (P<0.05)

Apparently, the concentration of total dietary fibre (TDF) was increased in line with the level of ground PSC (Table 4). Poultry patty added with 50% ground PSC had the highest concentration of TDF at 4.90 g/100g compared to poultry patty containing 25% PSC (3.40 g/100g) and control (1.90g/100g). Previous study reported that TDF value of the *Pleurotus ostreatus* at 34.5% are close to the values of PSC at 33.1% [8]. In the present study, there was no soluble dietary fibre (SDF) detected all poultry patties. Among samples, poultry patty containing 50% ground PSC had the highest IDF at 4.90 g/100g while poultry containing 0% ground PSC had the lowest value at 1.9 g/100g. All PSC-based patties had β-

glucan value in the range of 0.70-0.77% and significantly (P<0.05) higher than control patty (0.37%). Even though poultry patty containing 50% ground PSC recorded higher value of β-glucan but was not different with poultry patty containing 25% ground PSC. Table V shows the sensory evaluation scores for poultry patties incorporated with PSC. Apparently, the scores of all sensory attributes were in the range between 4.10-4.67 with the patty containing 50% PSC received the highest score as perceived by untrained panellists. The present sensory data also shows that all poultry patties formulated 25 and 50% PSC were not significantly different (P>0.05) compared to control poultry patty for all attributes. Among all PSC-based patty treatments, patties containing 50% PSC had the highest scores for all sensory attributes except for colour and springiness. Poultry patty containing 25% PSC had 4.56 and 4.30 score values of colour and springiness, respectively but was not significant (P>0.05) compared to other treatments. Even though chicken patties formulated with 25% and 50% PSC had higher scores (4.63 and 4.67) for flavor attributes but were not significantly different with that of control.

TABLE IV
SOLUBLE (SDF), INSOLUBLE (IDF) AND TOTAL DIETARY FIBRE (TDF) CONCENTRATIONS (G/100G) OF POULTRY PATTY ADDED WITH DIFFERENT LEVEL OF PSC

	PSC level (g/100g)		
Dietary compounds (%)	**0 (control)**	**25**	**50**
SDF	0.00±0.00[a]	0.00±0.00[a]	0.00±0.00[a]
IDF	1.90±0.08[c]	3.40±0.05[b]	4.90±0.04[a]
TDF	1.90±0.08[c]	3.40±0.05[b]	4.90±0.04[a]
β-glucan	0.37±0.04[b]	0.70±0.03[a]	0.77±0.06[a]

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

Panelists gave the similar score for overall acceptance of the patty prepared with 50% PSC and without PSC (control). On the other parts, the reduction of scores for springiness and juiciness attributes were observed parallel with the level of PSC used in the patty formulations. This lower score could be attributed to the higher moisture content of fresh PSC in poultry or beef protein systems [18]. The dilution effect of nonmeat ingredients in meat protein systems primarily accounted for soft texture [19]. The lower fat content presented in patties with added PSC (Table 4) could also contribute to the lower scores of springiness and juiciness attributes supported by the previous study [20].

TABLE V
SENSORY ATTRIBUTES OF COOKED POULTRY PATTIES AS INFLUENCED BY THE ADDITION OF PSC (N= 60)

Sensory attibute	**PSC Level (%)**		
	0	**25**	**50**
Aroma	4.38±0.52[a]	4.30±0.87[a]	4.52±0.68[a]
Colour	4.63±0.52[a]	4.56±0.64[a]	4.40±0.77[a]
Springiness	4.50±0.53[a]	4.30±0.82[a]	4.12±1.00[a]
Juiciness	4.25±0.89[a]	4.06±1.01[a]	4.10±1.01[a]
Flavour	4.50±0.53[a]	4.63±0.74[a]	4.67±0.69[a]
Overall acceptance	4.63±0.52[a]	4.48±0.85[a]	4.63±0.67[a]

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

To recapitulate, consumers were unable to differentiate aroma, colour, springiness, juiciness, lavour and overall acceptance of poultry patties made from different levels of PSC. This data indicated that consumers accepting the patties prepared with all level of PSC level. These findings are in line to our previous study where the usage of cornsilk dietary fibre did not change the sensory properties and consumer acceptability of cornsilk-based beef patties [21].

IV. CONCLUSIONS

Poultry patty formulated with 25% PSC had protein content of 17.46% lower than the control patty (18.13%) but it was not signifcreasing of fat content significantly. In the sensory evaluation, thereicant. Incorporation of ground PSC in poultry patties resulted in de were no differences recorded in all sensory attributes of PSC-based patties judged by untrained panelists. This novel food item for incorporation in poultry patties could permit a reduction of the formulation cost without affecting sensory descriptors of the product to which the consumer is familiarized. The addition of PSC at 25% to partially replace poultry meat can be recommended for the purpose of lowering production cost and fat content while unchanging the protein content. On the other hand, incorporation of 50% of PSC in poultry patties reduces fat and protein composition but increases moisture content while maintaining the overall acceptability of poultry patties.

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