PRODUCTION OF LOW FAT BURGER PATTY FROM LOCAL BROILER

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ABSTRACT

The production of low fat chicken burger patty using local broilers were conducted in this study. A total of six chicken burger patty formulations using two by three factorial designs were prepared using ingredients such as salt, onion, garlic, mixed spices, iced water, chicken meat and binder. The binder selected for this study was maltodextrin and was proven to be the best fat replacer among few other choices. The salt, onion, garlic and mixed spices content as the ingredients were all kept constant whereas the chicken meat and maltodextrin percentage were manipulated. Upon completion of the low fat burger patty, proximate and sensory analysis were carried out. Proximate analysis was carried out in order to determine the ash content, moisture content, crude fat content, and crude protein content. The sensory analysis was assessed based on the sensory attribute namely, the color, aroma, tenderness, juiciness, flavor, and overall acceptability of the six different chicken burger patty formulations. Sensory analysis was conducted via 30 semi-trained panelists and each was required to assess the sensory attributes of the chicken burger patty formulations using the hedonic scale method. The proximate analysis result showed the lowest fat chicken burger patty formulation is the fourth chicken burger patty formulation and the sensory analysis exhibited the fifth chicken burger patty to be the most acceptable out of the six chicken burger patty formulations. A continuous research can be conducted in order to determine the physiochemical content of the chicken burger formulations or changing the types of meat used in the burger formulations in order to produce an even better low fat burger patty.

PENGELUARAN BURGER PATTY AYAM BERLEMAK RENDAH DARIPADA AYAM DAGING TEMPATAN

ABSTRAK

Pembangunan patty burger lemak rendah menggunakan ayam daging ayam tempatan telah dikajikan dalam kajian ini. Sebanyak enam ayam burger patty formulasi dengan menggunakan 2x3 reka bentuk faktorial telah disediakan dan bahan-bahan yang digunakan adalah seperti garam, bawang besar, bawang putih, rempah campuran, air ais, daging ayam dan pengikat. Pengikat yang terpilih untuk kajian ini adalah maltodekstrin kerana maltodekstrin telah terbukti sebagai pengganti lemak terbaik di antara beberapa pilihan lain. Kandungan garam, bawang besar, bawang putih dan rempah bercampur telah dijadikan malar manakala kandungan daging ayam dan maltodekstrin akan dimanipulasikan. Setelah burger patty yang berlemak rendah sudah dibuat, analisis proksimat dan pancaindera telah dijalankan. Analisis proksimat dijalankan untuk menentukan kandungan abu, kandungan kelembapan, kandungan lemak mentah, dan kandungan protein mentah. Analisis deria pula telah dinilai berdasarkan warna, bau, kelembutan, keberairan, rasa, dan penerimaan keseluruhan daripada patty enam formulasi yang berbeza ayam burger. Analisis deria telah dijalankan dengan menggunakan 30 ahli panel separa-latih dan setiap panel telah menilai ciri-ciri deria formulasi burger patty ayam menggunakan kaedah skala hedonik. Hasil analisis proksimat menunjukkan formulasi ayam burger patty yang berlemak paling rendah adalah burger patty ayam formulasi keempat dan analisis deria telah mempamerkan burger patty ayam kelima adalah yang paling boleh diterima daripada enam formulasi ayam patty burger. Penyelidikan yang berterusan boleh dijalankan untuk menentukan kandungan fisiokimia formulasi burger patty ayam atau menukarkan jenis daging patty yang digunakan dalam burger formulasi untuk menghasilkan burger patty yang lagi berlemak rendah.

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LIST OF SYMBOLS, UNITS AND ABBREVIATIONS

%	Percentage
ml	Mililiters
mm	Milimeters
kg	Kilograms
g	Grams
WHO	World Health Organization
GMO	Genetically Modified Organisms
H_0	Null Hypothesis
H_1	Alternative Hypothesis
MoA	Ministry of Agriculture
RM	Ringgit Malaysia
m	million
kcal	kilocalories
EC	European Council
CMC	Carboxylmethyl cellulose
FAO	Food and Agriculture Organization
AOAC	Association of Official Agricultural Chemists
°C	Degree Celcius
M	Molarity
ANOVA	Analysis of Variance
Wt	weight

LIST OF FORMULA

Where, W_1 = weight (g) of sample before drying

W_2 = weight (g) of sample after drying

Where,

W1 = weight of receiver flask with extracted materials (g)

W2 = weight of receiver flask (g)

m = Initial weight of sample in (g)

Where,

V = volume of 0.05 M sulphuric acid needed to titrate the sample (ml)

B = volume of 0.05 M sulphuric acid needed for the blank test (ml)

M = molarity of sulphuric acid solution

14.01 = atomic weight of Nitrogen

Wt = weight of air dry sample (g)

CP = %N x F

Where,

F = 6.25

CHAPTER 1

INTRODUCTION

1.1   Background

Poultry products have the highest consumption rate among other livestock animal industry. According to The Poultry Site (2014), at the global extend, in 2015, one person consumes an average amount of 10.5 kg globally. An expected increase of consumption to 14 kg is set to happen in 2030. In Malaysia, since poultry meat is the one of the primary sources of protein, hence, the consumption increased from 1.40 million metric tons to 1.43 million metric tons from 2013 to 2014. The per capita consumption is amongst the highest in the world going over 40 kg per year. Hence, it is without a doubt that the broiler industry are advancing and growing with the increase in population and thus, food demand of the world. According to World Poultry (2016), Malaysia is fortunate as we are self-sufficient in the poultry meat production. With reference to Index Mundi (2014), the Malaysian population stands at an estimation of 30 million. As for the poultry sector, production in 2014 was set at 1.49 million tons in 2014 and is expected to increase to about 1.54 million tons in 2016.

According to Lo *et al.* (2008), the incident of obesity is on the rise in recent years mainly due to human diet. Cardiovascular disease, often caused by high consumption of oily, fatty and sodium food is one of the major causes of death. Hence, to improve the health of the human population, various recommendations for better nutritional plan has been introduced by nutritional organizations such as World Health Organization (Simopoulos *et al.,* 1999; WHO, 2003). Such plans include daily intake of fats should be in a range of 15% to 30% of the total diet and calorie intake of no more than 10% is to be from saturated fatty acid. Therefore, these recommendations have resulted in consumers to be aware and reduce intake of food with high saturated fatty acids such as red meat. Other recommendations include the inclusion of high fiber in the diets as

well as fruits, lean meat and fish. However, Norton and Sun (2008) claims that some consumers would not change their dietary plans. Hence, potential to formulate food to suit with the recommended dietary changes is high.

Givens *et al.* (2000), (2006) and Scollan *et al.* (2000) reported that the most commonly used method to lower fats in food products is via the animal's nutrition with implementations of forages and dietary lipids. Nonetheless, effort to produce such low fat meat with good quality through this method is not very effective. Hence, instead of manipulating the animal's nutrition, meat industry came up with advance technological methods to modify the meat products to suit the healthier recommendations.

According to Moghazy (1999), fat contributes greatly to the physiological and sensory components. Fat not only contributes in terms of flavor but also to taste, aroma and mouth senses. Over the years, consumers are getting more and more health conscious, even towards fast food business. Papadina and Bloukas (1999) reported that endless effort have been made in order to improve the quality of the burgers due to consumers demand in healthier fast food. Addition of non-meat products was added to improve the emulsification of the meat in the product. Troy *et al.* (1999) carried out a research on replacing fats in low fat beef burger by using tapioca starch, carrageenan, oat fiber, pectin, and whey protein. In the research, samples were tested on their water holding capacity, cooking yield, shape retention ability, sensory and mechanical structure analysis. The results of the study showed that fat replacers have the ability to enhance cooking characteristics as well as retain high capacity of water in burger patties.

Hence, the development of low fat burger patty has a high potential. With recent health concerns from consumers, it is no doubt that this new formulated burger with enhanced taste and palatability can generate more interest from consumers. The potential ingredients used for formulations are safe and causes no hazardous health effects. The product of this research is expected to contribute to a healthier commercial fast food product.

1.2   Justification

With the rise of recent concerns on health issues, it is clear that consumers are being more and more cautious on what is placed on their plates. Nowadays, consumers are equipped with knowledge on organic and healthy foods. According to Gagliardi (2015), in recent years, consumers are willing to pay more for healthier food products which includes weight loss supplements. These healthier food includes GMO-free (Genetically Modified Organisms), and no addition of artificial coloring and flavors. In fact, they are more concerned in reading the food label containing high fiber, high protein, whole grains, rich in calcium, high in vitamins, and mineral. According to Nutraceuticals World (2012), over the past few years, consumers purchases food or beverages that are healthier in order to manage their cholesterol level as well as other health concerns. The possible reasons for such drastic change of consumer's perspective can be caused by society, technology, government, and health consciousness of the consumers.

In this present project, the expected outcome is to produce potential low fat chicken burger patties from indigenous broiler chicken. The findings from this project can also affect greatly to the society to produce low fat burger patties from local broilers. The formulation can be further modified and deeper research can be carried out to improve the quality of the patties. In future, the university can even establish its own brand of low fat burger patties and can even widened the scope of animals used to beef, turkey and even goat. The ingredients and materials used for the formulation are safe for consumption. Therefore, conducting a study on developing of low fat chicken patty from local broiler will be consequential to the health conscious community.

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1.3   Objectives

The objectives of this study are:
i.   To investigate the effect of low fat chicken patty of six different patty formulations on proximate data.
ii.   To investigate the sensory attribute acceptability of low fat chicken patty from different patty formulations.

1.4   Hypothesis

Hypothesis for objective is as follow:
i. H_0:   Low fat chicken patty from different formulations using local broilers has no significant effect on proximate results.

      H_1:   Low fat chicken patty from different formulations using local broilers has significant effect on proximate result.

ii. H_0:   Low fat chicken patty from different formulations using local broilers has no significant effect on sensory acceptance.

      H_1:   Low fat chicken patty from different formulations using local broilers has significant effect on sensory acceptance.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to local broiler status in Malaysia

According to Mohd Syauqi *et al* (2015), the current major protein source for the Malaysia's population is the chicken meat or also known as broiler meat. In 2011, the per capita poultry consumption stands at a total of 35.5 kg. Tapsir *et al.* (2011) also stated that in 2010, 53.2% of the total livestock production was taken up by the Malaysia's broiler industry at the value of RM 10.85 billion. The Ministry of Agriculture also reported that in 2011, the broiler industry in Malaysia achieved an astonishing high self-sufficiency level of 128.1% (MOA, 2011). Mohd Syauqi *et al.* (2015) also reported that due to the gradual increase in the broiler production, exportation of the broiler to some counties such as Singapore and a few Middle East counties was possible. Despite the increase in broiler production, the processing industries in Malaysia still depends vastly on the imported broiler meat products such as the breasts and whole legs. Major suppliers of the broiler meat to Malaysia are China, Thailand, Denmark and the Netherlands. Therefore, the broiler industry in Malaysia is developing and advancing at a fast pace. With the advance technologies and infrastructures available in the country, the broiler production is definitely be on the rise to greater heights.

2.1.1 Broiler Production in Malaysia

Since the broiler meat is the major protein source for the Malaysian citizens, then, it is a significant aspect of the food security. According to the MOA (2011), it stated that the National Agriculture Policy (1998-2010) claimed that broiler production became of the key for one the strategies to guarantee the adequate supply of eggs and poultry. Then, MOA (2011) stated that National Agriculture Policy (2011-2020) declared a few strategies to make sure the broiler industry will be able to compete with the other competitors.

Few strategies asserted were encouraging better food farming practice with application of modern technologies as well as advocate the application of natural control agents such as effective microorganisms.

Mohd Syauqi *et al.* (2015) claimed that the broiler production in Malaysia is influenced by a number of huge companies. These companies can be divided into five major categories namely the grandparent stock production, broiler parental stock production, layer parental stock production, commercial broiler production and commercial layer production (Table 2.1).

Table 2.1 Broiler Production in Peninsular Malaysia (2010-2013)

Types of operation	No. of companies	No. of farms	Population (m)
Grand parent	4	4	0.90
Broiler parent	23	79	11.35
Layer parent	5	14	0.31
Commercial broiler	Individual/Contract	+/-2600	118.52
Commercial layer	Individual/Contract	+/-300	47.35

Source: Syauqi *et al.* (2015)

Moreover, Mohd Syauqi *et al.* (2015) also reported that the major breeds used for broiler production in Malaysia are Cobb and Ross where both dominated a total 96.6% of the total broiler population (Table 2.2).

Table 2.2 Market share of individual breeds of broiler parent stock.

Breeds	2010	2011	2012	2013
Cobb	3,370,998	3,806,380	4,176,346	4,594,523
Ross	1,306,322	1,312,480	1,290,105	1,385,345
Arbor acres	180,587	220,770	194,441	333,106
Indian rever	0	0	0	34,855
Total	4,857,907	5,339,630	5,660,892	6,347,829

Source: Syauqi N. *et al.* (2015)

Broiler industry of Malaysia is said to be one of the most competitive industry amongst the other world's top broiler production country (Mohd Syauqi *et al.*, 2015). Syauqi N. also stated that few significant reasons causes Malaysia to be able to compete with the other countries. One of the reasons was the Feed Conversion Ratio of the local broiler is at 1.67 which is comparatively high. Moreover, the annual mortality rate of the broiler was set to be at 4.32%. Apart from that, the average marketing weight of the broiler was estimated at 2.2kg and is usually achieved at day 30 to 33. These points are suffice to place Malaysia to have one of the most competitive broiler industry in Malaysia.

causes an increase in meat proportion and thus, high costs is needed. Besides that, Weiss *et al.* (2010) and Brewer (2012) also reported on other challenges faced throughout the development process which include increase in red color intensity, increase in hardness, reduction of water binding capacity, reduction of sensory quality and as the result, decreases the acceptability of consumers.

As stated by Zlender *et al.* (1995), the protein composition is different in different parts of the broiler. The protein content of the leg muscles ranges from 15.8% to 17.9% whereas the breast muscle with skin ranges from 21.9% to 23.5%. Simeonova (1999) claims that breasts muscle contains more protein content than the high muscles where breasts contains about 22% of proteins and thigh muscle contains 17.20% of protein.

2.3   Burger Patty status in Malaysia

Since the broiler meat became one of the most popular meat source by Malaysian citizens, people started processing the meats into readily available meat products such as burgers (Barbut, 2002). Al-Mrazeeq *et al.* (2008) and Ranken (2000) claimed that in some circumstances, burger can also be known as patties. Chang (2005) and Guerrero-Legarreta and Hui (2010) stated that these process meat products such as burgers received great demand and acceptance into the local market. Majority of the European countries set the burger formulation to be 80% meat and 20-30% fat.

In Malaysia, the Food Act 1983 and Food Regulations 1985, both asserted that the minimum standard of meat content in processing and manufacturing of any meat such as burgers should not be less than 65%. Currently, there are different types of burger brand available in the Malaysian market where they range from different prices and qualities. The quality of these burger varies because of the ingredients used and the different processing method.

2.4   Low Fat Burger Patty

The juiciness and satisfying mouth feel of the burger patty is usually related to the high fat content. Hence, when producing low fat burger patty, in order to maintain the sensory characteristics, binders are used. Binders are also known as fat replacers and as being stated by James (1992), when binders were added to food formulations, meat especially,

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it enhanced the binding properties of water and fats, improved the cooking product, slicing attribute and tastes. Moreover, binders could reduce costs of formulation. James (1992) also stated that there are two types of binders. The first binder is used to hold together separate meat pieces whereas the second type of binder is for the water binding capacity. To produce a low fat meat patty, the second type of binder will be used. Few examples of binders most commonly used are carrageenan, maltodextrin, potato starch, and carboxylmethyl cellulose. Carrageenan is widely used in ground beef patties due to its ability to retain water capacity. Maltodextrin is used for it low costs and easy application. Potato starch is popularly used as thickener, stabilizer, fat replacer, gelling and suspending agent, and fiber source. Carboxylmethyl cellulose (CMC) is used as thickener and stabilizers in products such as ice cream.

According to Turhan *et al.* (2007) and Ali *et al.* (2011), an alternative of producing a low fat burger patty was by adding vegetables as this can improve the functional properties and lower product costs while maintains the nutritional and sensory characteristics of the products. The use of potato flakes as fat replacer was done by Ali *et al.* (2011) and the results was very enlightening. The increase in the use of potato flakes lowers the cholesterol content of the burger patties. Besides that, the cooking yield and water retention ability also increase. As an overall, the acceptability of this potato flake formulated burger patty was high. Bastos *et al.* (2014) suggested a few other examples of vegetable as fat replacer are oatmeal flour, green banana pulp flour and green banana pulp.

Proximate analysis is done in order to determine the moisture, fat, protein and mineral content. Essary (2006) stated that the moisture, fat and protein found in broiler were 72.2%, 14.4% and 13.4% respectively. As for the mineral content, Essary (2006) also reported a decreasing order of amount of minerals found in broiler were potassium, sodium, calcium, chlorine, magnesium, iron, zinc, copper, rubidium, aluminum and bromine.

2.5 Sensory components

Sensory components are attributes that will be accessed and evaluated. Examples of sensory components are color, hardness, springiness, chewiness, flavor, odor, oiliness, juiciness, saltiness, sweetness, sourness, bitterness, spiciness, and overall acceptability.

Ibrahim *et al.* (2011) performed and evaluated on low-fat chicken burger production using a few sensory attributes namely color, chewing, taste, appearance, texture and overall acceptability. However, Prestes *et al.* (2014), used the sensory attributes of hardness, cohesiveness, adhesiveness, elasticity and chewiness. Other than that, Miranda *et al.* (2009) conducted the research with the sensory attributes of odor, taste, texture, juiciness and overall acceptability.

2.5.1 Sensory panel

Sensory evaluation is an essential process in accessing the quality of the meat products. According to Warriss (2010), usually, live panel of human subjects are invited to taste the meat product. There are three types of human panel methods namely trained panels, semi-trained panels and consumer panels. The trained panels consist of a number of eight to ten trained and filtered professionally for their tasting sensitivity. The testing is to be proceeded under controlled environment such as lighting and ventilation as well as well separated from the other panels so as to not affect their individual judgements. Then, the semi-trained panelists. The semi-trained panelists are people who are familiar with the qualities of different food (Warriss, 2010). After a few test runs and instructions, the semi-trained panelists will be able to differentiate and access the food. The usual size of semi-trained panelists are 25 to 30 person. Other than that, the consumer panel differs greatly than that of the trained panel method. The consumer panel requires large number of individuals, usually up to a hundred subjects. There are less need to place these consumers in a controlled environment or separated. A common tests where consumer panel method is used is the hall test where the food product is presented to the consumers at a public area.

Sensory panelists also possess advantages and disadvantages. Advantages of using the sensory panelists are rapid testing compared to non-sensory method, able to provide a clear perception on the tastes on behalf of all consumers, usage of more than

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one senses when tasting makes the process more flexible and some panelists can be very sensitive when tasting the food. In contrast, the disadvantages posed are the panelists can be fatigued due to the long process of testing, panelists might be biased, the whole process of training and recruiting the panelists is time consuming, and some panelists might have trouble describing or quantifying their perceptions.

CHAPTER 3

METHODOLOGY

3.1   Location and Duration of Study

This experiment took place in the Food Processing and Final Year laboratory of Faculty of Sustainable Agriculture, University Sabah Malaysia. The duration of this experiment was conducted for three months commencing in September of 2016 until November 2016.

3.2   Burger Patty Formulation

For this particular final year project, 2 by 3 factorial design was used. Six formulations of low fat burger patties were required in patty production using easily available materials such as fat replacer, chicken, salt, onion, garlic, mixed spices and iced water. Formulations of the low fat burger patties were made using different amount of chicken meat (92.5% and 90%) as being reported by Ibrahim *et al.* (2011) as well as different amount of maltodextrin namely 0.25%, 0.50% and 0.75%.

The reasons for using maltodextrin as binders in the low fat burger formulations was because of the low costing and easy application (Berry, 1991). Berry (1991) also claimed that maltodextrin was often used as binders up to 3.5% in post-production meat products too. Ibrahim (2011) also reported that maltodextrin had the highest sensory evaluation compared to other fat replacers.

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