EFFECTS OF GROUND RAW CANDLENUT (*Aleurites moluccana (L.)* **Willd.**) KERNEL ON CARCASS YIELD IN QUAIL

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ABSTRACT

The experiment was conducted at the Faculty of Sustainable Agriculture Poultry Housing in Universiti Malaysia Sabah, Sandakan Campus, Sabah to study the effects of ground raw candlenut *(Aleurites Mollucana (L.)* **Willd**) kernel on carcass yield in quails. The objective of the study was to determine the effects of ground raw candlenut kernel at different levels on the carcass yield in quails. The experimental design used for this study was Completely Randomized Design (CRD) by utilizing were 100 quails from the species *Cortunix cortunix japonica* or commonly known as the Japanese quails at the stage known as DOQ (day old quail). For the first 3 weeks, the quails were fed with commercial poultry starter ration before they were introduced to the treatments which were (T1) basal diet, (T2) basal diet + 2.5g/kg ground raw candlenut kernel (0.25%), (T3) basal diet + 5g/kg ground raw candlenut kernel (0.5%) and (T4) basal diet + 10g/kg ground raw candlenut kernel (1%) which have been isonitrogenously formulated to meet or exceed NRC (1994) until they were culled at the age of 6 weeks or 42 days. Based on the study, it was found that different levels of ground raw candlenut had no significant ($p>0.05$) on the Animal Fat Pad (AFP) weight, the carcass weight, the breast weight, the thigh weight, the wing weight and the skin weight of the quails. However, there were significant ($p<0.05$) effects on parameters such as the live weight, the bone weight and the meat weight of the quails. The best performing treatment was Treatment 3 that was able to produce the highest live weight, carcass weight, breast weight, thigh weight, wing weight and meat weight while producing the lightest bone weight among all the treatments used. All the data were analyzed by using Statistical Analysis System (SAS) v 9.4.

KESAN MIL ISIRUNG BUAH KERAS (Aleurites moluccana (L.) willd.) MENTAH TERHADAP PENGHASILAN KARKAS PADA BURUNG PUYUH

ABSTRAK

Satu kajian lapangan telah dijalankan di sistem perumahan poltri Fakulti Pertanian Lestari Universiti Malaysia Sabah, Kampus Sandakan, Sabah bertujuan untuk mengkaji kesan mil isirung buah keras (*Aleurites Mollucana (L.)* **Willd.**) mentah terhadap penghasilan karkas pada burung puyuh. Objektif bagi kajian ini adalah untuk menentukan kesan mil isirung buah keras mentah pada tahap yang berbeza pada penghasilan karkas dalam burung puyuh. Rancangan percubaan yang digunakan untuk kajian ini adalah, (T1) diet basal (DB); (T2) diet basal + 2.5g/kg mil isirung buah keras mentah (0.25%); (T3) diet basal + 5g/kg mil isirung buah keras mentah (0.50%); dan (T4) 10g/kg mil isirung buah keras mentah (1.0%) dalam catuan makanan harian yang telah dirumuskan untuk memenuhi atau melepasi keperluan NRC (1994). Ujikaji ini telah disusun berdasarkan kaedah Rekabentuk Rawak Lengkap menggunakan 100 ekor dari spesies *Cortunix cortunix japonica* pada peringkat anak puyuh yang baru menetas yang diistilahkan sebagai Day Old Quail (DOQ). Burung puyuh tersebut dibekalkan makanan ayam pemula untuk 3 minggu pertama sebelum diperkenalkan kepada makanan rawatan sehingga hari dimana burung puyuh tersebut akan disembelih pada minggu ke-6 kajian ataupun ketika burung puyuh tersebut berumur 42 hari. Berdasarkan kajiann yang telah dijalankan, didapati bahawa buah keras pada tahap yang berbeza tidak mempunyai ($p>0.05$) kesan yang ketara pada penghasilan lemak abdominal, berat karkas, berat dada, berat peha, berat sayap dan juga berat kulit burung puyuh. Walau bagaimanapun, terdapat kesan yang ketara ($p<0.05$) pada berat hidup, berat tulang dan juga berat daging yang dihasilkan oleh burung puyuh. Rawatan yang terbaik telah ditunjukkan oleh T3 kerana ianya mampu menghasilkan berat hidup, berat karkas, berat bahagian dada, berat peha, berat sayap dan juga berat daging tertinggi di samping mampu untuk menghasilkan berat tulang paling rendah berbanding rawatan yang lain. Kesemua data telah dianalisa menggunakan Statistical Analysis System (SAS) v 9.4.

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LIST OF SYMBOLS, UNITS AND ABBREVIATION

%	Percent
°C	Degree Celsius
AFP	Abdominal Fat Pad
ANOVA	ANALYSIS OF VARIATION
AST	Aspartate aminotransferase
cm	Centimeter
DHA	Decosahexaenoic
EPA	Eicosapentaenoic
g	Gram
Ha	Hectare
Kcal/kg	Kilo Calories per Kilogram
m	Meter
LDL	Low Density Lipoprotein
ME	Metabolisable energy
MJ	Mega Joules
Ω	Omega
pH	Degree of acidity

CHAPTER 1

INTRODUCTION

1.1 Background of Project

The poultry industry has high potential for expanding protein output for human consumption since the consumption of poultry meat and its product is developing globally (Mielnic *et al.*, 2002). The Japanese quail is no exception as it is an additional source of animal protein for human consumption and they are kept for both commercial and scientific purposes. This may be due to the fact that quail meat composition and quality has dietary focal points over other poultry bird (Genchev et *al.*, 2008). The maintenance system of quail is generally easy and quite simple. Similarly, the capital and operating costs of quail rearing are relatively lower if it is compared to other large poultry species. Due to the small labour involved in the rearing of quail, their products have been sold in a more stable value while at the same time the purchasing power is still within reach of the public. Quail is also included in a category of livestock with relatively high productivity. The short life cycle of these birds lead to its fast production, in which at the age of 35-42 days they are starting to produce eggs.

In this manner, the point of this study was to assess ground raw candlenut (*Alleurites moluccana (L.)* **Willd.**) kernel as an alternative supplement to enhance the carcass characteristics yield in Japanese quail. This is because there are very little studies can be found that particularly address the impacts of fusing ground raw candlenut kernel into the feed mixture (*Alleurites moluccana (L.)* **Willd.**) on quail meat carcass yield. The incorporation of different cereal grains in the diet affects the gastrointestinal tract development and the utilization of nutrients in chickens (Baurhoo et *al.*, 2007, Brenes et *al.*, 2008 and Santos et *al.*, 2008). In term of the composition of broiler meat in chickens, there are numerous components that can influence them, including strain, age and sex of the bird, diet formulation, nutrient intake (Husak et *al.*, 2008, Ponte et *al.*, 2008 and Romero et al., 2009). A few recent reports illustrate the effects of formulating the diet and housing systems on the production of meat in chickens (Santos et *al.*, 2008, Jia et *al.*, 2009 and Viveros et *al.*, 2009).

Candlenut (*Aleurites moluccana (L.)* **Willd.**) is a member of the Euphorbiaceae family and it is a medium-sized tree, conspicuous by its shining green takes off up to 20 meters tall which is local to the Indo-Malaya region. The common English dialect name given for this species is "candlenut". Candlenut oil is usually used as a laxative as well as consumed due to its purgatory and irritant properties. It has been broadly utilized in folk medicine for the treatment of ulcers, headache, fevers, diarrhea and hypercholesterolemia (Niazi *et al.*, 2010). *Aleurites moluccana* seeds contain glycerides, linoleic, palmitic, stearic, myristic acid, oil, protein, vitamin B1 while the stem bark contains alkaloids, polyphenols, flavonoids, coumarins, tannins, steroids and triterpenoids (Silva et *al.*, 1997; Samah et *al.*, 2010)

1.2 Justification

In Malaysia, the consumption of quail meat are not as high contrasted with other countries particularly here in Sabah. The reasons are principally on the grounds that individuals are not all around presented to the nutritious content of quails. Additionally, the availability of quails are quite limited and scarce here in Sabah. For the ground raw candlenut (*Aleurites moluccana (L.)* **Willd.**) kernel, the main reason why it was chosen for this study was due to its content. Roughly 53% of the candlenut content is fat. However, these fat are unsaturated fat that functions not only to reduce levels of Low-density lipoprotein (LDL), but also help to prevent blood clots which are the primary cause of heart attacks and strokes (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Candlenut other essential ingredients are vitamins, folate and phytosterols that can restrain the formation of forming enzyme of cholesterol in the liver, thus inhibiting the formation of cholesterol. There have been just a couple contemplates on the genetic, physical, and management factors that affect the production as well as composition of quail meat (Marks, 1996; Minvielle *et al.*, 2000; el-Dengawy and Nasser, 2001). Nonetheless, there are still no studies that particularly address the influences of ground raw candlenut kernel on quail meat production performance and composition of quail meat could be found. Hopefully, the incorporation of ground raw candlenut in the feed of quails can improve the carcass yield of Japanese quails and at the same time to demonstrate the nutritional value of quail meat to the local market and also to the worldwide market that quail meat can be used as one of the leading source of protein alongside broiler meat, beef, mutton and all other types of meat.

1.3 Objectives

(i) To determine the effects of ground raw candlenut kernel at different levels on the carcass yield in quails.

1.4 Hypothesis

H_o: There are no significant effects of ground raw candlenut kernel at different levels on the carcass yield in quails.

H_a: There are significant effects of ground raw candlenut kernel at different levels on the carcass yield in quails.

CHAPTER 2

LITERATURE REVIEW

2.1 Japanese Quail (*Cortunix cortunix japonica*)

Scientific Classification

Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Galliformes
Family	Phasianidae
Sub-family	Perdicinae
Genus	Cortunix
Species	Cortunix japonica

Source:http://www.birdlife.org/datazone/speciesfactsheet.php?id=195

Japanese quails belong to the Animal Kingdom under the Family Phasianoidea, Order Galliformes and Class Aves. The scientific designation for Japanese quail is Coturnix japonica which is diverse in connection to the regular quail "Coturnix coturnix" (Mizutani, 2003; Hassan *et al.*, 2003). *Cortunix cortunix japonica* is called Japanese quail yet it is additionally known by a couple of different names, for example, the Common quail, Eastern quail, Stubble quail and numerous different names. The accurate nomenclature for Cortunix cortunix japonica is Japanese quail or just cortunix. It ought not to be cortunix quail because in light of the fact that in Latin "cortunix" might be deciphered as quail.

2.1.1 Origin and Distribution

Subspecies of the genus *Cortunix* are native to all continents with the exception of in the North and South America and one of the subspecies *Cortunix cortunix* are migratory birds of Asia, Africa and Europe. It is believed that these birds were initially domesticated around the eleventh century as a pet song bird (Howes, 1964; Crawford, 1990) and has picked up in esteem as a food animal since 1910 (Wakasugi, 1984; Kayang et *al.*, 2004). Japanese quail likewise is the smallest avian species farmed for its meat and egg production (Baumgartner, 1994). It has in this manner been utilized widely as a part in many studies (Kayang et *al.*, 2004). These birds are probably to be well-adapted to the hard conditions and imperviousness to diseases as it has achieve monetary significance as an agricultural species and are appreciated for their unique flavor. (Mamizade N et *al.*, 2013; Kayang et *al.*, 2004).

Quails rearing and consumption additionally began to pick up consideration because of the low upkeep cost connected with its little body measure (80-300 g) combined coupled with its short generation interval, (3-4 generation per year), imperviousness to diseases and high egg production, rendered it an excellent research facility animal (Woodard et al., 1973; Baumgartner, 1994; Yalcin et *al.*, 1995; Oguz and Minvielle, 2001). In the meantime, Japanese quail farming for meat production extended in few nations (Baumgartner, 1994; Yalcin et *al.*, 1995; Minvielle, 1998).

2.1.2 Morphology

A quail can be recognized from different types of poultry by their little size and light body weight. The plumage shade of the wild type is predominately dark cinnamon brown. In any case, adult female have pale breast plumes that are speckled with dark colored spots while the adult males have uniform dark rust-red feathers on the breast and cheek (Mizutani, 2003). From the phylogenetic perspective, the Japanese quail is closely related to the chicken (Stock and Bunch, 1982). An adult male quail weigh around 100 -140g while the females are somewhat heavier, weighing from 120-160g (Bolla and Randall, 2008). For their eggs, the shade of the eggshell of Japanese quail is white, flesh-tint with spots of brown. However, the size, shading pattern and the shape of the eggs fluctuates among the females (Mizutani, 2003).

A young Japanese quails are yellowish in appearance with brown stripes and weigh around 6-7g when they are recently incubated, however following a couple of days their growth are rapidly increasing. On the third day, flight feathers starts to show up and at about four weeks of age, it will be completely feathered (Marsh, 1977). The exact separation of quails' gender without utilizing special methods, should be possible at the age of 17–20 days in birds with clear sexual dimorphism in plumage shading and at the age of 30–35 days in hued breeds, lines and strains (Genchev et *al.*, 2008).

2.1.3 Maturity and Life Expectancy

The quails have extraordinary attributes and favorable circumstances over different types of poultry which incorporate early achievement of sexual development, short generation interval, making it conceivable to have many generations in a year (Anon, 1991). A Japanese quail will mature at the period of around 6 weeks and usually will produce eggs by the age of 50 days old. With proper care and sustenance, Japanese quails are able to lay up to 200 eggs in the principal year of laying. A Japanese quail have the life expectancy of 2 to 2.5 years (Bolla and Randall, 2008).

2.1.4 Japanese Quails Nutritional Need

High quality ration for growing or breeding quail may not be accessible economically. Hence to make up for the absence of apportion for quails, good quality, fresh, commercial turkey or bird feeds are suggested. However, this bolster ideally encouraged as crumbles to minimize feed wastage as quails are unable to feed on large pellet not all like chickens and turkey. For the initial 6 weeks, ideally quails ought to be bolstered a diet containing roughly 25% protein, about 12.6 megajoules (MJ) of metabolisable energy (ME) per kilogram, and 1.0% calcium (Bolla and Randall, 2008). If this diet is inaccessible, a chicken starter ration with 20%–22% protein content can be utilized, however the quails will grow slower contrasted to ones that are fed with complete ration (Bolla and Randall, 2008).

The dietary prerequisites for maturing quails are quite the same with the exception of that calcium and phosphorus levels ought to be increased. Then again, laying quails diets ought to contain around 24% protein, 11.7 MJ of metabolisable energy per kilogram, and 2.5%–3.0% calcium (Bolla and Randall, 2008). Laying quails additionally oblige calcium to maintain their egg production.

Quails' feed should be stored in secured compartments with tight fitting top and placed in a clean, dry and cool area to safeguard its freshness. Feeds which are put away for over 8 weeks is subjected to vitamin deterioration and rancidity particularly in high temperature area. In average, an adult Japanese quail will consume between 14-18g of food every day (Bolla and Randall, 2008). In relation to nutrition, it is basic to know obviously and decisively the prerequisites of the animal species as indicated by their production potential. Adequate food and diet formulation will help not only to reach nutritional requirements, but will also help to increase the levels of feed conversion (Rondelli et *al.*, 2003).

2.1.5 Japanese Quail Meat

The quality and composition of meat are affected by various elements to be specific, the genotype of birds (Le Bihan-Dual, 2004; Genchev et *al.*, 2005), feeding mode and butchering age (Genchev et *al.*, 2004). Poultry meat quality is controlled by two critical characteristics; the appearance and meat consistency (Fletcher, 2002). The meat appearance relies on upon the shade of skin and meat, the presence of imperfections and is generally rousing buyer's decision. Meat tenderness is more imperative in the final quality assurance. Poultry meat is portrayed by high pH values that ranged between 6.02-6.41 in most domestic fowl species (Riegel et *al.*, 2003). Quail meat and egg are eminent for their top notch protein, high biological value and low caloric content (Agiang et *al.* 2011). The significant taste and dietary properties of quail meat are critical in determining the development of interest of consumers in this product (Genchev et *al.*, 2008).

2.2 *Aleurites moluccana* (L.) Willd.

Aleurites moluccana (L.) **Willd.** which is referred to as candlenut as its common name is a multipurpose tree which is local to the Indo-Malaysia area. In nation, for example, Indonesia, candlenut has for quite some time been utilized as a part of regular daily existence. The species is highly usable for some reasons. The seeds are normally utilized in cooking and provide material for lighting, subsequently came the origin of the name candlenut (Elevitch and Manner 2006).

2.2.1 Taxonomy

Botanical name: *Aleurites moluccana (L.)* **Willd.**
Family: Euphorbiaceae
Subfamily: Crotonoideae
Synonyms: *Aleurites javanica* Gand. , *Camirium moluccanum* (L.) Ktze. , *Croton moluccanus* L., *Jatropha moluccana* L.
Common names: Buah keras, kemili, kemiling, kuikui, Indian walnut, tutui, ragaul

2.2.2 Distribution

Candlenut is generally disseminated crosswise over the greater part of the island in the Indonesian archipelago. Be that as it may, candlenut has not been planted in a large- scale plantation regardless the ease to grow them and widely distributed. The primary cultivation areas of candlenut in Indonesia are in the territory of North Sumatra, Bali and greater part of Kalimantan region. The aggregate development range for candlenut in Indonesia has been accounted for to be around 205 532 ha (Directorate of Perennial Crop Cultivation 2008).

The province with the most astounding number of candlenut tree planted by smallholders are East Nusa Tenggara and North Sumatra, with more than 2 million candlenut trees planted (Indonesian Ministry of Forestry and the National Statistics Agency, 2004).

The tree has likewise been effectively introduced in Antigua and Barbuda, Bahamas, Bangladesh, Barbados, Brazil, Cuba, Dominican Republic, Grenada, Guadeloupe, Haiti, India, Jamaica, Japan, Kenya, Martinique, Montserrat, Netherlands Antilles, Puerto Rico, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Trinidad and Tobago, Uganda, United States of America and Virgin Islands (US) (Elevitch and Manner 2006).

2.2.3 Botany

Aleurites moluccana tree is a medium-sized tree with vast spreading crown and able to reach stature of 20 m and trunk diameter of 0.9 m. However, in an open territory it can grow up to 10-15 m in stature. Commonly, the trunks are slanted and has a sporadic shaper with wide spreading branches. The bark is greyish brown in shading and have a genuinely smooth texture with fine vertical lines. The leaves of *A. moluccana* are very distinctive with wavy edges and 10-20 cm long with 2 glands at the intersection of the leaf base. The upper surface of young leaves is whitish with a shiny sparkle, becoming dull green with age. The underside is rusty stellate-pubescent when young (having a bristly shiny indument) (Elevitch and Manner 2006).

The flowers of *A. moluccana* are both male and female on a similar tree which is otherwise called monoecious. The fruit in the other hand is green to brownish in colour. Each of the fruits as a rule contains 2 or 3 seeds in female fruits while in a male fruits just 1 seed might be found. This seeds are encased in a hard, dark, elliptical rough shell of 2.5-3.5 cm long (Elevitch and Manner 2006).

2.2.4 Seed Collection

The tree achieve flowering and fruiting stage once they are 3-4 years old in which the flowering period normally occur in September and October. Be that as it may, the flowering period differs depending on the countries they are planted in. In some parts of Hawaii, the flowering and fruiting stage can happen almost continuously, and as often as possible, flowers and fruits at all stages of ripeness occur in a tree at the same time (Elevitch and Manner 2006).

The mature fruit can be recognized by its colour change to yellowish-brown and these fruits are harvested by shaking the tree or gathering the one that are on the ground which is generally done amid the pinnacle seed maturation season. At the point when seeds are gathered from the ground, the collection ought to be done frequently (1–2 times a week) amid the pinnacle seed maturation season in order to abstain from losing the seed viability due to soil moisture and microorganisms (Mulawarwan *et al.*, 2003).
During the latter part of the season, immature fruits much of the time fall together with mature fruits. For this situation, care ought to be taken to collect only mature fruits or seeds from the ground (Mulawarwan *et al.*, 2003; Elevitch and Manner, 2006).

2.2.5 Seed Preparation

The extraction of the seeds are done by pressing or by daintily beating which will then proceed by washing and drying of the seeds. For fresh fruits, they are left to decay for a few days in a moist area which makes it less demanding to peel the external husk that encased the hard shell that contain the seed. For every kg of husk removed and shells on, there are around 100-120 seeds available. To enhance the germination rate, bad seeds can be skimmed off in water (Elevitch and Manner 2006).

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