بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

Sudan University of Science Technology

College of Graduate Studies

Effectof Different Dietary Crude Protein Levels on Performance and Reproductiveof Japanese Quails(*Coturnix .Coturnix*)

تأثير مستويات مختلفة من بروتين العليقة علي الأداء الانتاجي والتناسلي لطائر السمان الياباني

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B.Sc.(SUST) 2013

A thesis Submitted in Partialfulfillment of the Requirements for the Degree of Master of Science (M.SC.)

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Desemeber2020

D E D I C A T I O N

To
Those who taught me a word …

To my father …

To my mother …

To my Brothers …

And all my friends…

With great love and gratitude …

Awatif

ACKNOWLEDGEMENTS

I would like firstly to thank Allah for giving me knowledge, Patience and support to complete this task and for all things in my life.Also I would like to thanks my parents

I would like to express the deep gratitude which I feel for the serious and patient supervision provided to me by Professor Intisar Turki.

Special thanks are extended to my friends and colleagues for their support during the study.

Abstract

This study was carried out at the Animal Production Research Centre at Kuku, Khartoum State, Sudan, during (December 2017 -January 2018).This study was conducted todetermineeffectofdifferent dietary crude protein levelson performance، reproductively and dressing percentage of Japanese quailsunder Sudan conditions. One hundred and eighty dayoneoldquail chicks were individually weighted and distributed by using complete randomized design into four groups having 45 birds in each. Each group was further subdivided into three replicates having 15 birds in each. Four different experimental rations of GNC based were included formulated with four levels of protein (22, 24، 26 and 28%) and energy level of (2900Kcal ME\Kg) while control group contains(24% with 2900Kcal ME\Kg) according to the requirements of National Research Council NRC(1994).

Data from this study were subjected to one way ANOVA followed by least significant difference(LSD)to test the differences among the groups.

The Results showed that feed intake (FI) was highly significantly($p<.01$) increase whenthe protein level in the diet decrease، feed conversion ratio (FCR) was significantly($p<.01$)improvedwhen the protein level in the diet increase. The protein efficiency ratio (PER)and energy efficiency ratio (EER) weresignificantly($p<.01$) improvedwhen the protein levels in the diet increase،dressing percentage was significantly($p<.05$) increase when the protein level in the diet increase.

live body weight (BW)and body weight gain (WG) they were no significanteffects of dietary protein levelwhile we observedsignificantly($p<.05$) increased of above mentional parameters when the quail chickswere at early age.

Also The Results showed that age at first egg (AFE) was significantly($p<.01$)improvedwhen the protein level in the diet increase.Therewas no significanteffect of dietary protein levelson mortality،body weight at first egg and weight of first egg.

It could be concluded that dietary level of 28% crude protein in the diet recommended for growth performances of Japanese quail because it has beneficial effect on growth .

ملخص الدراسة

اجريت هذه الدراسة في مركز بحوث الانتاج الحيواني في حلة كوكو ،الخرطوم بحري ،السودان في الفترة (ديسمبر2017-يناير2018) هذه الدراسة اجريت لتحديد اثر التغذية بمستويات مختلفة من البروتين في العليقة علي الاداء الانتاجي ونسبة التصافي لطائر السمان الياباني 180 كتكوت سمان عمر يوم تم وزنها فرديا وتوذيعها باستخدام التصميم كامل العشوائية الي اربعة مجموعات كل مجموعة بها 45 كتكوت قسمت كل مجموعة الي ثلاث مكررات كل مكررة بها 15 كتكوت .كونت اربعة علائق مختلفة تعتمد في اساسها علي امباز الفول السوداني كمصدر للبروتين بمستويات مختلفة من البروتين (22%،26%،28%)وطاقة (2900كيلو كالوري) والمجموعة الضابطة تحتوي علي (24%بروتين وطاقة2900كيلو كالوري) .اظهرت النتائج ان العلفالمستهلك يقل عند مستوي معنوية ($p<.01$)نتيجة لزيادة مستوي البروتين في العليقة، يتحسن معدل التحويل الغذائي عند مستوي معنوية ($p<.01$)نتيجة لزيادة مستويالبروتين في العليقة. كما اظهرت النتائج تحسن معدلاتكفاءة الطاقةو البروتين عند مستوي معنوية ($p<.05$)نتيجة لزيادة مستوي البروتين في العليقة كما ان نسبة التصافي تزيد عند مستوي معنوية ($p<.05$)بزيادة نسبة البروتين في العليقة . لاتوجد فروق معنويةنتيجة لزيادة مستوي البروتين في العليقة علي وزن الجسم الحي والوزن المكتسب بالرغم من ذلك تم تسجيل تحسن في وزن الجسم الحي والوزن المكتسب في عمر مبكر نتيجة لزيادة مستوي البروتين في العليقة .

ايضا اظهرت النتائج تحسنالعمر عند اول بيضةعند مستوي معنوية ($p<.01$)نتيجة لزيادة مستوي البروتين في العليقة. لا يوجد اثر معنويلمستوي البروتين في العليقة علي نسبة النفوق ووزن الجسم عند اول بيضة ووزن اول بيضة.

يمكن استخلاص ان مستوي البروتين(28%)في العليقة يوصي به للنمولانه مفيد للنمو .

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Chapter One
Introduction

World poultry industry depends mainly on chicken production for both meat and eggs. Currently there is increased production in other poultry species either for food production or genetic conservation resources goal (Hassan, 2011).

One way of increasing protein supply is to improve poultry production as well as increase the production of other small livestock species with short generation intervals Among these is the Japanese quail(*El-katchaet al.*,2014).

Feeding cost for poultry is usually considered the most expensive item, especially dietary protein sources. Protein are not alike, they vary according to their origin (animal, vegetable), their amino acid composition (particularly their relative content of essential amino acids), their digestibilityand texture (Siyadati*et al*.,2011).

Japanese quail the smallest farmed avian species, is getting more important for commercial egg and meatproduction. It has marked advantages such as fast growth, early sexual maturity, high rate of egg production, short generation interval and short incubation period. The average age at onset of laying for Japanese quail is6-8 weeks (Sarabmeet*et al*., 2008). and with proper care, quail hens can lay up to 280-300 eggs in their first year. In order to establish a breeding program, it is essential to estimate genetic parameters for improving theproduction traits.

Japanese quails, as other poultry, require certain minimal quantities of amino acids from a biologically available source as part of a large protein nitrogen intake. The

required amounts of these amino acids vary with age, physiological condition and state of health (Ali, 2009).

The Japanese quailsrequireaccordingtoNRC(1994) 24% CP and 2900 kcalME/kg for growth. Quails fed on dietswith 27 and 24% CP at constant level of energy (2800Kcal ME/kg) during starter and grower phases hadmore body weight (BW) at 5 weeks of age compared todiet with 20% CP (Shrivastav and Shukla,1993).Hyankova*et al.,(*1997)also reportedthat Japanese quail fed on diets with 26 and 21% CPhad performed well during 1-21 days and 22-35 days ofage. Higher feed conversion and growth rates wereobtained by feeding 23.23% CP with 12.97 MJ ME/kgduring 0-5 weeks of age (Kaur et al., 2008) .

The objectives of this study are to investigate the effect of different dietary crude protein levels on performance، reproductively and dressing Percentage of Japanese quailsunder Sudan conditions.

Chapter Two

2.Literature Review

2.1 The Japanese Quail:

The Japanese quail belongs to the order Galiformes, family Phasinidae ,genusCoturnix and species japonica. The scientific designation for Japanese quail is Coturnixjaponica, different from the common quail "Coturnixcoturnix" (Thear, 1998; Mizutani, 2003).

The first record of wild Japanese quail appeared in Japan during the eighth century and these species are found in Japan, Korea, Eastern China, Mongolia and Sakhalin as migrating birds. The plumage colourofther wild type is predominately dark cinnamon brown. However, adult female have pale breast feathers that are speckled with dark colour spots. Adult males have uniform dark rusted feathers on the breast and cheek (Mizutani, 2003). These sex differences in plumage colour appear at about the third week of age .

Japanese quail are hardy birds that thrive in small cages and are inexpensive to keep. They are affected by common poultry diseases but are fairly disease resistant. Japanese quails are usually in full egg production by 50 days of age. With proper care, hens should lay 200 eggs in their first year of lay. Life expectancy is only 2 to 2½ years. Quail eggs are a mottled brown colour and are often covered with a light blue, chalky material. Each hen appears to lay eggs with a characteristic shell pattern or colour (Randall, and Bolla.,2008).

The Japanese quail originally domesticated around the 11th century as apet song bird, has since gained value as a food animal. Several features accounted for the utility of this bird. First, it has attained economic importance as an agricultural species producing eggs and meat that are enjoyed for their unique flavour (Kayang*et al.*, 2004).

Quails are blessed with several desirable characters like fast growth, early sexual maturity, high rate of egg production, short generation interval ,requirement of less floor space, short incubation period and less susceptibility to diseases. Generally quails are reared in multi-tier cages both during growing and laying periods. The convenience in handling and conservation of space and energy are major advantages with this system However, quails are also being reared on floor equally well (Padma Kumar*et al*.,2000).

Japanese quail has early sexual maturity - resulting in short generation interval (3-4 generation per year), resistance to diseases and high egg production; rendered it as an excellent laboratory animal (Minvielle, 2001). It has thus been used extensively in many studies (Kayang*et al*., 2004).

2.2Energy requirement:

Rather than a nutrient, energy is a property of energy-yielding nutrients when they are oxidized during metabolism (NRC, 1994).

recommended 24% CP and 2900 kcal ME/kg for growing Japanese quails(NRC1994). Increasing the dietary energy levels from 2,600 to 2,800 ME kcal/kg did not influence weight gain but significantly affected the efficiency of feed consumption and utilization (Bawa, 2010).

Syed *et al.*,(2000) reported optimum performance at 2800 ME kcal/kg. Furthermore,Soares*et al.*,(2003) discovered that 2900 ME kcal/kg diet was efficient for growing and laying Japanese quails.

The main sources of energy are cereal grains which are the main ingredients for most diets. Fat such as animal tallow, lard or vegetable oils are added to the diet if high energy is required (Shrivastav, 2000).

2.3Protein Requirements:

Protein provides the amino acids for tissue growth and egg production. Hence, the requirement for protein is mainly requirement for amino acids. The dietary protein and amino acids requirement of quail is influenced by age, egg production and metabolizable energy content and the ingredients used to formulate the diets.their requirements decrease with age, similar to other animal species (Soares*et al.*, 2003). The type of protein to be fed to quails must be provided from a high quality source. Protein quality is generally based on amino acid composition of the feedstuff and the availability of these amino acids from the feedstuff following digestion in the gut. Amino acids are considered as the building blocks of proteins (Babangida and Ubosi, 2006).

The NRC (1994) recommended protein levels of 24 and 20% for quails in the rearing and production periods, respectively. A lot of researches were conducted varying the recommended levels at different environments.

Whyte *et al*., (2000) suggested a dietary protein level of 18-24% for better performance. In female Japanese quail, Hashiguchi *et al* .,(1998) reportedthat feeding low protein diets lowered body weight at sexual maturity. Also, Annaka,(1994) and Marks,(1993) stated that body weight gain decreased linearly with decreasing dietary protein level in quail diet. Lilburn and Meyer-Miller,(1990) suggested that body fat and protein depositions were increased and decreased, respectively, by decreasing dietary protein level in broiler breeder hen.Kirkpinar and Oguz,(1995) stated that feeding low protein diets increased carcass fat content and decreased carcass protein content in female quail.

Soares*et al* .,(2003) evaluated five dietary crude protein levels (16,18, 20, 22 and 24%) in the rearing period of Japanese quail (Coturnixcoturnix japonica) and he concluded that protein levels had no effects on feed intake and feed conversion ratio. They estimated that CP level requirement for rearing period of Japanese quail is 23.08%.Hyankova*et al*.,(1997) also reported that Japanese quail fed 26 and

21.6% CP had a good performance from 1 to 21 and 22 to 35 d of age, respectively.

Generally the CP content in diets of growing quails ranges from 24 to 27% (Shrivastava and Panda, 1999).Igbasan and Guenter,(1999) concludedthat decreasing the dietary protein during the later part of egg laying cycle significantly improvedegg production and feed utilization with negligible effect on egg weight and egg shell quality.

Whyte *et al.*,(2000) showed that increased level of crude protein in diet had a significant effect onthe average weight of adult quail birds. This finding agrees with the report ofOkekeandOluyemi,(2003) whey reported faster growth rates and higher reproductive ability in quail fedwith higher levels of protein.

2.4 Vitamin Requirement of Japanese Quails:

Housed quails are entirely dependent on the vitamins that are present in their compounded feed in the correct amount and proportion, for they have no access to the natural supply of thesenutrients, Vitamins are only needed in small amounts and are needed by chickens to grow well,during period of stress caused by disease, shipping or sudden changes in the environment, it is recommended thatvitamins and electrolytes be provided in the drinking water until the stress condition is corrected(Martina, 1996).

The principal vitamin functions and requirement are as follows:

The principal feature of vitamin A is its functions in ensuring adequate growth and as a means of assisting in the bird’s resistance to diseases. Vitamin A is essential for normal vision, eggproduction, and reproduction(Murakami *et al.*, 1993) .NRC

(1994) recommended 1650 IU per kg vitamin A for starting and growing birds and 3300 IU/kg for breeding quails.

Murakami *et al.*, (1993) also reported a deficiency of vitamin E causes a disease of the nervous system in chicks known as “Crazy chick disease” (Encephalomalacia). According to Shim (2004), the fertility and hatchability of quail eggs were severely depressed after the birds were fed a diet containingglucose and soyabean meal, but deficient in vitamin E for 20 weeks,it was found that encephalomalacia or muscular dystrophies were observed in quail fed vitamin E deficient dietsfor 35 weeks.

VitaminBcomplex are well distributed in cereals and grains deficiencies are normally unlikely to occur,the main functions of vitamins B are to assist the quail in achieving its optimum growth (NRC, 1994).

Vitamin D can besynthesized in the skin of birds from precursors when the birds are exposed to the sun However, when birds are kept under intensive condition, some forms of supplementation are essential andthese can be provided by addition of fish-oils to the diet or by a dry synthetic preparation (NRC, 1994).

2.5 Mineral Requirement of Japanese Quails:

Minerals are the inorganic elements remaining when feedstuff is burned. Calcium and phosphorus account for about 75% of the total mineral content of ash. Dozier and Bremwell ,(2002) investigated the effects of dietary concentration of manganese in relation to that of calcium on growing performance of Japanese quails they are reported that 0.8% calcium and 60mg/kg manganese for optimum growth, feed efficiency, tibia weight, bone ash and serum calcium and phosphorus. Meanwhile,Shrivastav and Shukla,(1993) found that fertility was not related to dietary manganese or zinc concentration.

2.6 Water Requirement of Japanese Quails:

Water makes up the basic medium in the body for the transportation of nutrients, metabolic reactions, elimination of waste products, and to aid in maintenance of body temperature Water is not often thought of as a nutrient itself, but it is indeed a very important one.the function of water in the body of animals include; regulation of body temperature, transportation of nutrients and taking part in numerous chemical reactions inthe body. Furthermore, water requirements (volume) of poultry are often crudely estimated by multiplying the amount of feed eaten by two. However, under hot conditions, animals drinksubstantially more water(Smith, 2005).

2.7Grouthperfoemance parameter:

2.7. 1Feed intake:

Omidiwura et al.,(2016) reported that the different dietary protein levels had a significant effect on the total feed intake/bird.AlsoSiyadati*et al.,(*2011) found that Average Feed intake(AFI)had significant difference during starter and finisher periods,the AFI increased at the quails fed with diets containing low crude protein than that diets containing high crude protein in the starter period .*El-Katcha et al.*,(2014)reportedIt can be concluded that feed intake of Japanese quail chicks during growing period increased with lowering protein content and higher calorie/protein ratio. Bregendhal et al.,(2002) reported that increasing dietary crude protein decreased the feed intake. AlsoNahashon et al.,(2005) reported decreased feed intake with increase in dietary crude protein.

2.7.2 Body Weight :

Body weight plays an important role in determining several other economic characteristics in poultry farm(Pesmen and Yanrdimen, 2008). It is an important attribute as it forms the basis for assessing growth, feed efficiency and also inmaking economic and market decisions in poultry farm (Momoh, and Kershima, 2008).Gheisari et al., (2011) indicated that body weight of quail chicks، particularly at early age (14 and 28 days) was significantly influenced by dietary protein level .AlsoAbbasali et al.,(2011) observed that the mean body weight was significantly higher and influenced by increased dietary protein level in the growing phase thus emphasizing the importance of dietary protein and also amino acid concentrations in growing quail diet . Han et al., (1992) observed that growth depression due to low protein diets may be due to low amino acid profile of such diets.Maurice and Gerry, (2005) indicated that, when Japanese quail reared under proper management males weighed about 100 to140 g, while the females were heavier and weighed from 120 to160 g.

2.7.3 Body Weight gain :

Omidiwura et al., (2016) reported that Level of crude protein and metabolizable energy had no significant effect on the body weight gain alsoDowarah et al., (2014) observed that Protein as a variable singly had no significant effect on final body weight (FBW), weight gain during starter and finisher phases .Sharifi*et al.*,(2011) who found that body weight ,daily weight gain and feed conversation ratio were improved for Japanese quail fed medium and high crude protein compared with birds fed low crude protein in diet.

2.7.4Feed conversion ratio:

Mosaad*et al.*, (2009) reported that FCR differed significantly during 0–3 weeks of age due to CP levels also in accordance with saker *et al.*, (2015) who reported that

the final live body weight, body weight gain and feed conversion ratio of the groups fed on dietary levels of (24.2, 26.2 and 28%) crude protein significantly improved when compared with the group fed on dietary levels of 22.17% crude protein.

2.7.5 Protein efficiency ratio:

Omidiwura et al.,(2016) reported Inclusion of varying levels of protein in the diet of Japanese quails had a significant effect on crude protein intake, average daily crude protein intake and protein efficiency ratio of the birds.Mosaad*et al.,*(2009) found that quails under high CP level consumed more protein per unit gain than those on medium or low CP levels during 0–3 and 4–6 weeks of age . Karaalp*et al.,(2009)* reported that PER decreased with higher levels of crude protein in the diet (20-24% CP).

2.7.6 Energy efficiency ratio:

Keur et al., (2008) and Mandal et al.,(1999) found that improved FCR and EER with the increased level of CP or amino acidsin Japanese quails and guinea fowls, respectively during initial growth period. also Shim and Vohra, (1984)reported that the improved EER might be due to the ability of Japanese quails to retain more energy as protein than fat in body tissues in comparison to broiler chickens, which was supported by high essential amino acid level.

2.7.7 Mortality:

Tarasewicz et al.,(2006) found that Mortality during experimental period was at similar level in all groups that were fed with feed mixes containing 21, 19 and 17% CP, respectively also*Annaka et al. ,(1993)* indicated that mortality rate of layer quail increased, when fed diet containing high crude protein the absent of mortality

for quail fed low protein and energy may be due to the decrease of physiological load due to protein and energy digestion

2.8 Sexual maturity:

Sexual maturity was determined as the day of production of cloacal gland foam for males, and the day of laying the first egg for females (Sezer*etal*., 2006).alsoBahie El- Dean *et al*., (2008) reported age at sexual maturity in Japanese quail females (days) were 42.98, 50.05 and 61.89 for early age at sexual maturity group, medium and late groups respectively.

2.9Age at First Egg (AFE):

In breeding research it is very important to estimate the individual birds' age at first egg. Age at first egg can be highly variable because it is affected by feeding and management practices. Early age at first egg can eadvantageous because selection for it could lead to reduced generation interval, but for commercial egg production it will lead to the production of many small eggs which may not find a ready market. However if early age at first egg is accompanied by a corresponding increase in body weight then the egg size will also increase(Daikwo*et al*.,2014).

Bronislawa*et al*., (2008) reported that Female Japanese quails laid eggs at the age of 6 weeks.also El- Full,(2001) and El- Deen*et al*.,(2008) reported higher values of 61.22 and 50.94 days.

2.10Egg production:

Egg production is one of the major performance parameters of laying

birds. Egg production in Japanese quail is influenced by additive geneticeffects and several factors such as: age at sexual maturity, weight of thebird, nutrition, the system of management and the environment. Eggproduction can be reported as whole record performance (by monitoringthe annual production) or part-record performance (short-termproduction). Whole record production can be predicted

from part-recordegg production through the use of mathematical models and projectionsof the egg production curve. If significant positive genetic correlation isfound between part-period egg traits and annual egg traits, early selectioncan be undertaken using the part-period records., average number of eggslaid per quail hen per year was 248 egg (Daikwo*et al.*,2014).

Onyimonyi and Okeke,(2000) reported that the average egg number is about 100 to 200 eggs per bird per year.alsoBronislawa*et al.*,(2008) reported that Female Japanese quails laid eggs at the age of 6 weeks, andduring the entire reproductive period lasting from 10 to 12 months, areable to lay about 300 eggs.Murakam and Riki, (1998) reported that keeping Japanese quail is an economic way for producing egg, becauseof their early sexual maturity (laying egg after 35 days), high eggproduction (250–270 eggs per year), resistance to most of poultry diseaseand great egg production persistency on a high level (approximately 14–18 months). also Minvielle,(2004) reported that Japanese quail maturation happens in about 6 weeks of ageand mature females are usually in full egg production by 50 days of ageWith proper care, hens should lay more than 200 eggs in their first yearof lay ,the average egg weighs about 10–15g which is about 8% offemale body weight,feed conversion for egg production in Japanesequail is better than in laying hens,quail hens need less than 2 kg offeed to produce 1kg of egg, while laying hens need between 1.9 to 2.5kg of feed to make the same amount of egg,japanese quail eggs arenearly identical in taste and nutritional quality to chicken eggs,thereisan expanding market for products such as fresh or pickled quail eggs inAsian, American and some European countries .

Randall and Bolla, (2008)who reported that Japanese quail eggs are amottled brown colour and are often covered with a light blue, chalkymaterial,each hen appears to lay eggs with a characteristic shell patternorcolour,some strains lay only white eggs,the average egg weighsabout10 g, about 8% of the body weight of the

quail hen,youngchicksweigh 6–7 g when hatched and are brownish with yellow stripes. Theshells are very fragile, so handle the eggs with care.

2.11carcass Characteristics:

Dressed carcass as a percentage of live body weight was maximum in quails offered high protein*(*Mosaad*et al.*, 2009). AlsoLaudadio*et al., (*2012) reported that the muscle (breast and drumstick) yields were significantly higher in birds fed the high protein diet compared with those of the medium protein and Low protein diets.Marcu*et al.,(*2011) who found that Higher protein level has positively influenced the participation of the trenched parts in the whole carcass structure (breast, wings, thighs and shanks).

Abdel-Azeem et al. ,(2001) indicated that dietary protein levels had insignificant effect on carcass traits of Japanese quail fed ration containing 20, 22 and 24 % Cp this agree withHamid and Yassin, (2015)were reported that dressing percentage, breast muscles and leg muscles were increased significantly as crude protein level increased in the diet However, *Tuan et al. ,(2010)* reported that varying protein levels in the diet of chickens did hadaffect on the abdominal fat.

Chapter Three

3.Materials and Methods

3:1 Study area:

This study was carried out at the Animal Production ResearchCentre at Kuku, Khartoum State, Sudan, during(Desemeber 2017 -January 2018). Minimum and maximum temperatures outside the poultry unit were 17.5˚C and 26.5˚C respectively.

3:2 Housing and management:

The study was carried out in an open sided house. The dimensions of each cage were 2.5×2.5 m2. The quail house was dry cleaned washed and disinfected before arrival of birds. Feeders and drinkers were routinely cleaned, washed and disinfected at the beginning of the Experiment. Wood shavings were used as litter. Drinkers were daily cleaned and filled with fresh water, birds were offered feed and water *ad libitum* throughout the experimental period. and light was provided for 24 hours. As no information about vaccination program for quails in the Sudan is available, hence no vaccination was done.

3:3Experimental Birds:

180 one day old quail chickswere purchased from the Animal Production Research Centre farm .They were individually weighed and distributed into four groups having 45 birds in each. Each group was further subdivided into three replicates having 15 birds in each.

3:4 Experimental diets:

Four experimental rations on GNC based were formulated (table 1) with four level of protein (22, 24، 26 and 28%) and energy level of (2900Kcal ME\Kg). The control group contained (24%CP with 2900Kcal ME\Kg) according to the requirements of National Research Council NRC(1994).All the groups were

subjected to similar management practices (lighting,feeding and watering) throughout the experiment except the diets offered. Feed and water were supplied*adlibitim* and light provided for 24houres .

Table (1):

Ingredients percentages and chemical and calculated

Protein (%) Ingredient	22	24	26	28
Sorghum	48.52	45.5	41.7	39.1
GNC	21.61	28.4	35.7	42.1
Concentrate	5	5	5	5
Wheat Bran	20.8	16.6	13.1	8.7
Limestone	3.05	3.48	3.61	4.31
Lysine	0.33	0.33	0.24	0.16
Methionine	0.24	0.24	0.2	0.18
Nacl	0.35	0.35	0.35	0.35
Antifunaltoxins	0.1	0.1	0.1	0.1
Total	100	100	100	100
Chemical composition				
Metabolizable energy (Kcal/kg)	2900.095	2900.218	2900.761	2900.923
Crude protein (%)	22.158	24.08	26.25	28.02
Ether Extract(%)	4.1	4.8	48	4.8
Crude fibre (%)	6.5	6.7	6.8	6.8
Calcium (%)	1.6	1.8	1.9	2.2
Available phosphorous(%)	0.706	0.704	0.707	0.702
Lysine (%)	1.31	1.39	1.38	1.38
Methionine(%)	0.62	0.64	0.62	0.62

concentrate composition: Crude protein 35%, Crude fat 2.8%, Crude fiber 4.6%, Calcium6.56%, Available phosphorus 5.14%, Lysine 10.00%, Methionine 3.00% and (ME) Metabolizable energy 1904.45kcal/kg.

3:5 Measurements:

3.5.1. Feed intake (FI):

Feed intake was recorded using sensitive electronic balance every day for each group by subtracting quantity of residual feed from quantity of provided feed and then calculated as gram/bird.

3.5.2. Live Body weight (LBW) and body weight gain (BWG):

At the start of thefeeding trail initial live body weight was taken and subsequently one weekly the body weight gain were taken and recorded from each group .

3.5.3. Feed conversion ratio (FCR):

Feed conversion ratio (FCR) was calculated by dividing the amount of the feed intake (g) by body weight gain (g).

3.5.4. Mortality rate:

The rate of mortality was determined by calculating the ratio between the number of the dyingbirds and the initial total number of birds multiplied by 100of each week until week 8.

3.5.5. Protein efficiency ratio (PER):

Was calculated by dividing the amount of the weight gain (g) by protein intake according to (Kamran*et al*, 2008).

3.5.6. Energy efficiency ratio (EER):

Was calculated by dividing the amount of the(weight gain (g)×100) by energy intake according to (Kamran *et al*,2008).

3.5.7. Dressing percentage:

At the end of theexpeirmentalperiod (8weeks) five birds were taken randomly from each group weighed and slaughtered to complete bleeding and weighed to determine Dressing percentage as the follows:

Dressing % = (carcass weight /live body weight)*100

3.6. Statistical analysis:

A completely randomized design was used in the experiment. The data were subjected to analysis by the ANOVA using SPSS software program, (version 16)Gomez and Gomez (1984) .The significant differences among means were determined by least significant differences (LSD) test at 0.05 significant level.

Chapter Four

4. Results

4.1 Performance parameters:

4.1.1 Feed intake :

The mean values of feed intake of Japanese quail are shown in Table (2) .pined showed that there is significant (P<.01) different on feed intake by increasing the levels of dietary protein.

4.1.2Bodyweight:

The mean values of body weight of Japanese quail in table (3).Body weight of quail chicks particularly at early till 6 weeks was significantly a influenced (P<0.05) by dietary protein levelwhileat week (7,8) were observed no significant(P<0.05)affectes.

4.1.3 Body Weight gain :

Table (4)showed the values of body weight gain of Japanese quail duringexperiment.The result showed that body weight gain of Japanese quail at early till 4 weeks was significantly a influenced (P<0.05) by dietary protein levelwhileat week (5,6,7 and week 8) were observed no significantaffectes(P<0.05) . during experimental period there is no significant different(P<0.05) for Body weight gain parameters amangeexperimental groups is recorded in accordance with increased ofdietary protein levels .

4.1.4 Feed conversion ratio:

FCR of Japanese quail are shown in Table (5).

The result showed that FCR of Japanese quail was significantly(P<0.05) affected by dietary protein levels in week(1, 2, 3and 4) but there is no

significantly(P<0.05) affect in week(5,6,7 and 8) . FCR during experiment issignificantdifferent (P<0.01) due to dietary protein levels .

Table(2)Effect of dietary crude protein on feed Intake of Japanese quail(g/bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	19.27±1.09 [a b]	19.61±.75 [a]	17.63±1.28 [b c]	16.5±.47 [c]	*
Week2	56.66±.11[a]	55.98±.30[a]	54.65±.66[b]	53.78±.59[b]	**
Week3	110.45±3.30[a]	91.78±6.97[b]	90.52±.66[b]	77.96±.07[c]	**
Week4	164.79±15.58[a]	152.57±6.[41ab]	142.03±.38[b]c	129.25±.08[c]	**
Week5	180.65±21.63[a]	174.31±11.52[ab]	156.26±.60[bc]	134.58±1.12[c]	**
Week6	180.57±18.04[a]	151.59±29.64[ab]	146.79±.09[b]	126.47±1.17[b]	*
Week7	177.31±2.56[a]	166.59±2.49[b]	151.00±.42[c]	145.15±3.03[d]	**
Week8	151.58±41.93[a]	152.06±.13[a]	112.88±.39[ab]	91.22±.48[b]	*
Overall	1037.41±78.17 [a]	962.51±36.72 [a]	873.43±1.69 [b]	780.12±3.91 [c]	**

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- Number=45

Table(3)Effect of dietary crude protein on Live body weight of Japanese quail(g/bird/week)

Protein% Weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	12.20±.21[b]	13.12±1.37[cb]	15.27±2.14[ac]	16.73±.80[a]	*
Week2	33.50±1.13[c]	34.77±.92[cb]	38.23±1.17[b]	47.01±3.22[a]	**
Week3	50.92±.87[c]	53.58±.42[c]	62.09±.54[b]	69.31±3.53[a]	**
Week4	85.73±.60[b]	93.71±3.83[b]	103.93±2.90[a]	107.13±7.54[a]	**
Week5	127.87±9.13[b]	137.31±2.03[bc]	145.07±3.30[ac]	152.81±9.98[a]	*
Week6	159.65±7.15[b]	167.16±2.33[bc]	175.11±5.35[ac]	186.12±13.04[a]	*
Week7	198.27±15.09	199.07±4.76	203.13±.52	210.86±8.86	NS
Week8	214.41±9.13	211.98±7.96	215.49±.34	222.38±5.79	NS

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: NO significant difference
- Number=45

Table(4)Effect of dietary crude protein on weight gain of Japanese quail

Weight gain (g/bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	6.46±.66[b]	6.86±1.34[cb]	9.15±2.12[ac]	10.27±.70[a]	*
Week2	21.30±1.27[b]	21.64±1.10[b]	22.96±1.37[b]	30.27±2.46[a]	**
Week3	17.42±1.62[b]	18.81±.49[b]	23.86±.80[a]	22.30±1.21[a]	**
Week4	33.80±2.13[b]	39.12±3.45[a]	41.89±.14[a]	40.15±2.46[a]	*
Week5	42.14±8.97	43.60±5.75	41.14±.93	45.68±2.94	NS
Week6	31.79±8.48	29.85±1.17	30.05±2.84	33.31±3.18	NS
Week7	38.61±13.80	31.91±2.46	28.02±5.08	24.73±5.88	NS
Week8	16.14±9.23	12.91±3.25	12.36±.70	11.52±4.58	NS
Overall	207.67±7.24	204.70±7.58	209.42±3.18	218.24±4.49	NS

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: NO significant difference
- Number=45

Table(5)Effect of dietary crude protein on feed conversion ratio of Japanese quail(g feed/g gain/bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	2.85±.31[a]	2.82±.46[a]	2.03±.45[b]	1.84±.18[b]	*
Week2	2.53±.16[a]	2.53±.15[a]	2.44±.15[a]	1.88±.16[b]	**
Week3	6.38±.71[a]	4.88±.35[b]	3.80±.16[c]	3.50±.19[c]	**
Week4	4.73±.46[a]	3.82±.34[b]	3.40±.22[b]	3.46±.50[b]	*
Week5	4.42±1.09	4.06±.68a	3.80±.09	2.96±.21	NS

Week6	6.09±2.30	5.07±.92	4.91±.46	3.82±.39	NS
Week7	6.07±1.30	5.50±.91	5.25±.50	4.95±1.53	NS
Week8	7.92±6.70	8.36±3.47	6.15±.49	4.68±2.88	NS
Overall	4.99±.22[a]	4.70±.19[a]	4.17±.07[b]	3.58±.09[c]	**

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: NO significant difference
- Number=45

4.1.5 Protein efficiency ratio:

The values of PER of Japanese quail stated inTable(6) . PER during experiment is significantdifferent (p<.01) due dietary protein levels .

Table(6)Effect of dietary crude protein on protein efficiency ratio of Japanese quail(bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	1.61±.18[ac]	1.51±.27[bc]	1.96±.42[b]	1.95±.20[a]	NS

Week2	1.80±.11[c]	1.65±.10[b]	1.58±.10[a]	1.91±.16[a]	*
Week3	.72±.08	.86±.06	1.01±.04	1.02±.06	**
Week4	.97±.09	1.10±.10	1.13±.07	1.05±.15	NS
Week5	1.07±.24	1.05±.19	1.01±.02	1.21±09	NS
Week6	.81±.27	.84±17	.79±.07	.94±.10	NS
Week7	.99±.35[a]	.80±.07[ab]	.71±.13[ab]	.61±.14[b]	NS
Week8	.55±.45	.35±.09	.42±.02	.45±.18	NS
Overall	.91±.04[c]	.97±.04[c]	1.09±02[b]	1.27±.03[a]	**

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: NO significant difference
- Number=45

4.1.6 Energy efficiency ratio:

The values of EER of Japanese quail stated inin Table (7).

EER during experiment is significantdifferent (p<.01) due to dietary protein levels .

Table(7)Effect of dietary crude protein on energy efficiency ratio of Japanese quail(bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	12.21±1.35[b]	12.46±2.24[b]	17.55±3.75[a]	18.87±1.89[a]	*

Week2	13.66±0.82[b]	13.66±0.82[b]	14.14±0.88[b]	18.42±1.51[a]	**
Week3	5.45±0.59[c]	7.09±0.53[b]	9.09±0.36[a]	9.87±0.54[a]	**
Week4	7.33±0.70[b]	9.07±0.79[ab]	10.16±0.66[a]	10.09±1.43[a]	*
Week5	8.10±1.85[b]	8.68±1.61[b]	9.08±0.22[b]	11.71±0.84[a]	*
Week6	6.18±2.07[b]	6.97±1.40a[b]	7.06±0.66a[b]	9.09±0.96[a]	NS
Week7	7.50±2.63	6.61±0.60	6.40±1.16	5.86±1.31	NS
Week8	4.18±3.44	2.93±0.73	3.77±0.20	4.36±1.76	NS
Overall	6.92±0.31[c]	7.34±0.29[c]	8.27±0.14[b]	9.65±0.24[a]	**

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: NO significant difference
- Number=45

4.1.7 Age at first egg (AFE) , Body weight at first egg (BWFE)and weight of first egg(WE):

The values of (AFE), (BWFE)and(WE) of Japanese quail are shown in Table(8).The result showed that (AFE) of Japanese quail was significantly(p<.01) affected by dietary protein levels of in the dietwhiletherewere no significantaffect(P<0.05) by dietary protein levels on(BWFE)and(WE) .

Table(8)Effect of dietary crude protein on age at first egg(day),

Body weight at first egg(g) and Weight of first egg (g) of Japanese quail .

parameters	n	22%protein	n	24%protein	n	26%protein	n	28%protein	Si.
AFE(day)	27	50.85 ± 3.58^{a}	21	50.52 ± 3.53^{ab}	21	48.67 ± 3.14^{cb}	20	46.85 ± 2.64^{c}	**
BWFE (g)	27	203.29±13.55	21	197.30±10.20	21	196.50±11.07	20	203.73±11.55	NS
WFE(g)	27	11.77±0.08	21	11.57±0.79	21	11.98±0.22	20	11.87±0.78	N

- Values are expressed as mean± standard deviation. Mean in the same row
- had different letters significantly differ at ($P<0.05$)
- *=significant differences at $P<0.05$
- **=significant differences at $P<0.01$
- NS: NO significant difference
- n=number of birds

4.1.8 Mortality %:

The values of mortality of Japanese quail are shown in Table (9).The result showed that mortality of Japanese quail was no significantly($P<0.05$)affected by dietary protein levels in the diet .

Table(9)Effect of dietary crude protein on mortality of Japanese quail (g/bird/week)

Protein% weeks	22%protein	24%protein	26%protein	28%protein	Sig.
Week1	4.44±3.85	6.67±0.00	4.44±7.70	2.22±3.85	NS
Week2	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	NS
Week3	7.94±8.36	0.00±0.00	2.38±4.12	2.38±4.12	*
Week4	5.13±4.44	10.68±5.18	2.38±4.12	4.95±4.29	*
Week5	3.03±5.25	0.00±0.00	2.56±4.44	5.34±4.64	NS
Week6	2.78±4.81	5.56±4.81	5.56±9.62	8.59±8.34	NS
Week7	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	NS
Week8	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	NS

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at ($P<0.05$)
- NS: NO significant difference
- Number=45

4.1.9Dressing percentage:

The values of Dressing % of Japanese quail are shown in Table(10) .

The result showed that dressing% of Japanese quail was significantly (P<0.05)affected by dietaryprotein levels in the diet.While the results reaveld in approximatlynosignificant different(P<0.05)on dressing% between (26 and 28%)quailgroups.

Table(10)Effect of dietary crude protein on carcass traits percentage of Japanese quail Dressing%

Items	22%protein	24%protein	26%protein	28%protein	Sig.
Dressing%	67.71±3.43[b]	68.44±8.13[b]	77.78±0.78[a]	78.44±3.82[a]	*

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- Number=5

4.1.10Effect of dietary crude protein on performance،reproductively and dressing percentage of Japanese quailsduring experimental period:

The values of initialweight (g/bird), finalweight (g/bird),total weight gain(g/bird) , daily weight gain(g/b/d) , total feed intake (g/bird) , daily feed intake(g/b/d) , feed conversion ratio , protein efficiency ratio , energy efficiency ratio , age at first egg (day), body weight at first egg(g), first egg weight (g), mortality % and dressing% of Japanese quail during experimental period are shown in Table (11).

Table(11)Effect of dietary crude protein on performance، reproductively and dressing percentage of Japanese quailsduring experimental period:

parameters	22%protein	24%protein	26%protein	28%protein	Sig.
Initialweight (g/bird)	5.73±.46[b]	6.27±.03[a]	6.12±.03[ab]	6.47±.10[a]	*
Finalweight (g/bird)	214.41±9.13	211.98±7.96	215.49±.34	222.38±5.79	NS
Totalweightgain(g/bird)	207.67±7.24	204.70±7.58	209.42±3.18	218.24±4.49	NS
Dailyweightgain(g/b/d)	3.71±.13	3.66±.14	3.74±.06	3.90±.08	NS
Total feed intake (g/bird)	1037.41±78.17 [a]	962.51±36.72 [a]	873.43±1.69 [b]	780.12±3.91 [c]	**
Dailyfeedintake(g/b/d)	18.53±1.40[a]	17.19±0.66[a]	15.60±0.03[a]	13.93±0.07[a]	**
Feed conversion ratio	4.99±.22[a]	4.70±.19[a]	4.17±.07[b]	3.58±.09[c]	**
protein efficiency ratio	.91±.04[c]	.97±.04[c]	1.09±02[b]	1.27±.03[a]	**
energy efficiency ratio	6.92±0.31[c]	7.34±0.29[c]	8.27±0.14[b]	9.65±0.24[a]	**
Age at first egg (day)	50.85±3.58[a]	50.52±3.53[ab]	48.67±3.14[cb]	46.85±2.64[c]	**
Body weight at first egg(g)	203.29±13.55	197.30±10.20	196.50±11.07	203.73±11.55	NS
First egg weight (g)	11.77±0.08	11.57±0.79	11.98±0.22	11.87±0.78	NS
Mortality %	20.00	20.00	15.56	20.00	NS
Dressing%	67.71±3.43[b]	68.44±8.13[b]	77.78±0.78[a]	78.44±3.82[a]	*

- Values are expressed as mean± standard deviation. Mean in the same row had different letters significantly differ at (P<0.05)
- *=significant differences at P<0.05
- **=significant differences at P<0.01
- NS: no significant difference

Chapter five

Discussion

5.1 Feed intake

The result from this study showed that feed intake by experimental Japanese quails was highly significantly($p<.01$) increased when the dietary protein level was decreased .The results of the present study agreed with Omidiwura et al.,(2016) who found that different dietary protein levels had a significant effect ($P<0.05$) on the total feed intake(g/bird).Similar result was obtained bySiyadati*et al.,(*2011) who found that average feed intake AFIwas significant difference ($P < 0.05$) during starter and finisher periods, the AFI increased when the quails fed with diets containing low crude protein .*El-Katcha et al.* , (2014)reported that feed intake of Japanese quail chicks during growing period increased with lowering protein content and higher calorie/protein ratio. Similar results were stated by Bregendhal et al., (2002) who reported that increasing dietary crude protein will decrease the feed intake. The results of the present study also are in close agreement with those of Nahashon et al.,(2005) who reported that decreased feed intake with increase in dietary crude protein.

5.2 Bodyweight:

Results obtained from this study showed that the Body weight of experimental quail chicks particularly at early till 6 weeks was significantly($P<0.05$)increased when the dietary protein level was increased while at week (7,8) were observed no significant($P<0.05$) affects. The body weight of the groups contained CP (26%, 28%) are(215.49g, 222.38g)in higher than groups contained CP (24%, 22%) of (214.41g, 211.98g),respectively. Thatmay by due to reaching the maturity stage

and the quails finished the growth to motion of his body . The results of the present study wasin line with Gheisari et al. ,(2011) who indicated that body weight of quail chicks particularly at early age (14 and 28 days) was significantly($P< 0.05$) influenced by dietary protein levels . while *El-Katcha et al.* , (2014) stated that these differences in the body weights were not reflected on day 49 of life , being similar in high, medium and low protein groups. Results of the present studyareinpartial agreement of the findings by Abbasali et al. , (2011)who observed that the body weight was significantly($P<0.05$) higher and influenced by increased dietary protein level in the growing phase thus emphasizing the importance of dietary protein and also amino acid concentrations in growing quail diet. Also Han et al., (1992) recorded that growth depression due to low protein diets may be due to low amino acid profile of such diets.

5.3 Body Weight gain :

Results obtained from this study showed that body weight gain of the experimental Japanese quailsat early age till 4 weeks was significantly($P<0.05$)increased when the dietary protein level was increased while at weeks (5,6,7 and week 8) were observed no significant affect ($P<0.05$) was recorded among experimental groups. Results of the present studyareinpartial agreement with the a findings of*Sharifi et al.*,(2011) who found that the daily weight gain was improved when the Japanese quail has fed medium and high crude protein compared with birds fed low crude protein in diet.

The results of present study also showed that the mean of body weight gain during experimental period has no significant effected by different dietary protein levels . Similar results were stated by Omidiwura et al., (2016) who observed that Level of crude protein and metabolizable energy had no significant effect on the body weight gain. Our results also arein agreement with Dowarah et al., (2014)

whostatedthatprotein as a variable singly had no significant effect(P< 0.05) on body weight gain during starter and finisher period.

5.4 Feed conversion ratio FCR:

The present study showed that FCR of experimental Japanese quail chicks was significantly(p<.01) improvedwhenthe dietary protein levels was increased.That may be due to the quail chicks ability to improve FCR with increasing essential amino acid levels in the diet.The results of the present study are supported with those obtained by Saker *et al.,* (2015) who reported that the feed conversion ratio of the groups fed on dietary levels of (24.2, 26.2 and 28%) crude protein were significantly improved when compared with the group fed on dietary levels of 22.17% crude protein.the present study is are also in accordance with Sharifi*et al.*,(2011) who found that FCR was improved for Japanese quail fed medium and high crude protein compared with birds fed low crude protein in diet .Results of the present studyareinpartial agreement with the findings of Mosaad*et al.*,(2009) who found that FCR differed significantly during 0–3 weeks of age due to CP levels.

5.5 Protein efficiency ratio:

Results obtained from this study showed that PER of experimental quail chicks signed a highly significant (p<.01) improved when the dietary protein levels were increased . The results of the present study agree with Omidiwura et al., (2016) who reported inclusion of varying levels of protein in the diet of Japanese quails had a significant effect(P<.01) on crude protein intake, average daily crude protein intake and protein efficiency ratio of the birds. Similar results were stated byMosaad*et al.*,(2009) who found that quails under high CP level consumed more protein per unit gain than those on medium or low CP levels during 0–3 and 4–6 weeks of age .The result of the

present study disagree with Karaalp*et al.*,(2009)who reported that PER decreased with higher levels of crude protein in the diet 20-24%(CP).

5.6 Energy efficiency ratio:

Results obtained from this study showed that EER of experimental Japanese quail was significantly($p<.01$) improved when the dietary protein levels was increased . This results of the present study agree withKaur et al. ,(2008) and Mandal et al.,(1999) they observed that there is improvement of FCR and EER with the increased level of CP or amino acids in Japanese quails and guinea fowls diets during initial growth period.Similar result was obtained byShim and Vohra, (1984)who reported that the improved EER might be due to the tendency of Japanese quails to retain more energy as protein than fat in body tissues in comparison to broiler chickens which was supported by high essential amino acid level.

5.7 Age at first egg (AFE) , Body weight at first egg (BWFE)and weight of first egg(WE):

The present study showed that age at first egg (AFE) of experimental Japanese quail was significantly($p<.01$)improvedwhen the dietary protein levels were increased . The results of the present studyare in agreement with the findings of Vohra*et al.*,(1971) who found that the quail decrease AFE to increase protein level in diet. TheResults obtained from this study showed that the Body weight at first egg (BWFE)and weight of first egg (WE) is not significantly affected by dietary protein levels in the dietthat may This result disagrees with Ri*et al*., (2005) who found that egg weight and yolk color were significantly affected by different levels of protein.

5.8 Mortality %:

Results obtained from this study showed that the mortality rate of experimental Japanese quail was not significantly (P>0.05)affected by dietary protein levels in the diets .That may be due to the fact that experimental quails had not face any more management problems . The results of the present study agree with *Tarasewicz et al.*,(2006) who found that mortality during experimental period was at similar level in all groups when they were fed with feed mixes containing 21, 19 and 17% CP.The results of the present study disagree with Annaka *et al.* ,*(*1993*)* who reported that mortality rate of layer quail increased, when fed diet containing high crude protein.The absence of mortality for quail fed low protein and energy may be due to the decrease of physiological load due to protein and energy digestion.

5.9Dressing percentage:

The present study showed that dressing% of experimental Japanese quail was significantly (p<.05) increasedwhenthe dietary protein levels was increased . The results of the present study agree with Saker*et al.,* (2015) who revealed that dressing percentage, breast muscles and leg muscles were increased significantly as crude protein level increased in the diet . Similar result was obtained byMosaad*et al.*,(2009) who found that dressed carcass as a percentage of live body weight was maximum in quails offered high protein .Results of the present studyareinpartial agreement of the findings of *Abdel-Azeem et al. , (2001)* who reported that dietary protein levels had significant effect on carcass traits of Japanese quail fed ration containing 20, 22 and 24 % CP.

Chapter six
Conclusions and recommendations

Conclusions:

The results indicated that increased protein level of Japanese quail diet improved feed intake, body weight , feed conversion ratio , Protein efficiency ratio, energy efficiency ratio Age at first egg and Dressing% .

It could be concluded that dietary level of 28% crude protein inthe diet recommended for growth performances of Japanese quail because it has beneficial effect on growth .

Recommendations:

The study recommended that:

- Dietary level of 28% crude protein is recommended for growth performances of Japanese quail because it has beneficial effect on growth .
- More studies need to bedoneonJapanesequailgrowth performance and Reproductivelywith addition of different levels ofprotein in diet.

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List of abbreviations

abbreviations	Title
AFC	Age at first egg
BW	Body weight
BWFE	Body weight at first egg
BWG	Body weight gain
CP	Crude protein
EER	Energy efficiency ratio
FCR	Feed conversion ratio
FI	Feed intake
ME	metabolizable energy
PER	Protein efficiency ratio