T.R.
KAHRAMANMARAŞ SÜTÇÜİMAM UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE

USE OF RAW AND HEAT TREATED ACORNS IN JAPANESE QUAIL DIET

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HAM VE ISITILMIŞ MEŞE PALAMUDUNUNBILDIRCIN RASYONLARINDA KULLANIMI

(DOKTORA TEZİ)

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ÖZET

Bu çalışmanın amacı ham ve otaklavlanmış meşe palamudunun Japon bıldırcın rasyonlarında kullanım imkânlarını araştırmaktır. Ham ve otaklavlanmış meşe palamudu rasyonlara % 0. 10. 20 ve 30 oranlarında katılmıştır. Besleme denemesi 6 hafta sürmüştür. Deneme boyunca Japon bıldırcınları izo-kalorik ve izo-nitrogenik rasyonlarla beslenmişlerdir. Japon bıldırcınların canlı ağırlıkları, canlı ağırlık kazancı ve yem tüketimleri haftalık olarak belirlenmiştir. Deneme sonunda bıldırcınların karkas ağırlıkları, ciğer ağırlıkları, kalp ağırlıkları, taşlık ağırlıkları ve karkas kompozisyonları belirlenmiştir. Altı haftalık denemeden elde edilen verilere bakıldığında, meşe palamudunun rasyona katılması Japon bıldırcınların canlı ağırlıklarını, canlı ağırlık kazancı ve yem tüketimlerini, yem dönüşüm oranını, karkas ağırlığını, ciğer ağırlıklarını, kalp ağırlıklarını ve karkas kompozisyonlarını önemli derecede etkilemiştir. Japon bıldırcınların büyüme performansı, yem tüketimi ve yem dönüşüm oranı meşe palamudun rasyonda kullanım oranına bağlı olarak kötüleşmiştir. Bununla birlikte, büyüme performansı, yem tüketimi ve yem dönüşüm oranında herhangi bir kötüleşme olmadan, meşe palamudu Japon bıldırcınları rasyonuna %10 kadar katılabilir. Bu noktadan sonra meşe palamudunun Japon bıldırcınlarında kullanılması ciddi sorunlar oluşturmaktadır. Diğer yandan, otaklav şeklinde ısı muamelesi meşe palamudunun Japon bıldırcın rasyonlarında kullanımında herhangi bir pozitif etkisi bulunmamıştır. Otaklavlanmış meşe palamudunun kullanıldığı bütün dozlardan elde edilen sonuçlar ham meşe palamudunun kullanım dozlarına benzer bulunmuştur. Bu yüzden otaklavlama şeklinde ısı muamelesi meşe palamudunun kullanımını iyileştirmede etkin yöntem değildir.

Anahtar Kelimeler: Palamut Meşe Bıldırcın Büyüme Performansı Karkas kompozisyonu

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USE OF RAW AND HEAT TREATED ACORNS

IN JAPANESE QUAIL DIET

(PhD. THESIS)

TREFA KAMAL M.AZIZE

ABSTRACT

The aim of this study was to investigate the possibilities of the use of raw and autoclaved acorn into Japanese quails. The raw and autoclaved acorn was included into Japanese quail diets at 0, 10, 20 and 30 of diets. Feeding experiment of Japanese quail last 6weeks. During the experiment, Japanese quail were fed with iso-caloric and iso-nitrogenic diets. The live body weight, body weight gain and feed intake were determined weekly. At the end of experiment, the carcass weight, liver weight, heart weight and chemical composition of carcass of Japanese quails were determined. Based on the for the six week experimental data, the inclusion of acorn into quail diets has significant effect on the live body weight, body weight gain, feed intake, feed conversion ratio, carcass weight, liver weight, heart weight and chemical composition of carcass of Japanese quails. Growth performance, feed intake and feed conversion ratio of Japanese quails impaired with increasing level of acorn inclusion. However acorn can be used into quail diets up to 10% without compromising of growth performance, feed intake and feed conversion ratio. The inclusion rate of acorn after %10 is detrimental for Japanese quails. On the other hand heat treatment by autoclaving has no positive effect on the use of acorn into quail diets. All inclusion rates of autoclaved acorn into diets of quail diets resulted in similar results obtained in inclusion rates of the raw acorn. Therefore autoclaving of acorn to use in quail diet is not effective method to improve the use of acorn in quail diets.

Keyword: Acorn, oak, Quail, growth performance, Carcass composition

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SYMBOLS AND ABBREVIATIONS

A.A : Autoclaved Acorn

R.A : Raw Acorn

H.T : Hydrolysable tannins

C.T : Condensed tannins

FCR :Feed Conversion Ratio

N :Nitrogen Silva

EN :Natural Extract Of Sweet Chestnut

LBWG: Live Body Weight Gain

DM : Digestible Metabolism

ME : Metabolisable Energy

LBW : Live Body Weight

FI : Feed İntake

CP : Crude Protein

DM : Dry matter

EE : Ether extract

CF : Crude fiber

OA :Oak acorn

NE :Net energy

EE :Ether extract

ADF :Acid detergent fiber.

NRC :Nutrient Requirement of Poultry

FA :Fatty Acids

TPC :Total phenolic content

TAC :Tannin content

FLC :Flavonoid content

PAC :Proanthocyanidin content

N.M.R : Nuclear Magnetic Resonance

1. INTRODUCTION

During the last century a remarkable research have been conducted in poultry nutrition (Larbier and Leclercq 1994). These researchers documented that the poultry nutrition science involves providing a balance of nutrients that best meets poultry needs for growth, maintenance and production etc. More over feed intake is an important parameter in poultry production not only because of economic reasons but also it determines both the level of production and economic output. For economic reasons, this supply of nutrients must be relatively cheaper for poultry diets and economic issues must be taken in account when formulation of feed stuff, particularly for energy and protein sources is calculated (Dublecz, 2011). Both local and international trade conditions for raw materials used for poultry feed are the main key-points for the dynamics of the global feed industry. The economical points of accessing the industrial products present a challenge for small-scale production lines in particularly for underdeveloped and developing countries and therefore and traditional poultry production was still based on the availability of local feed resources, with access to markets (Steinfeld et al., 2006).

It is well known that up to 75% of the total cost of animal and particularly poultry production industry is based on total resources cost including vitamins, minerals, feed additives, used to meet the energy and protein requirements of farm animals (Tike, 2010).The energy value of a feed resources used for animal rations could be identified digestible energy, metabolisable energy, etc. although metabolisable energy values are the mostly used to define the dietary energy available to farm animals including poultry. Energy value of any feed ingredient is important since feed intake of the animals are increased when total metabolisable energy value of ration is higher and feed intake is decreased vice versa (Dourado etal.,2009).

However energy it is an expensive feed ingredient in developing countries, it must be imported to cover the energy needs for poultry and livestock. Such difficulty could be partially solved finding a new local feed stuff, you must be in the case of adding any material in the poultry feed it must be by the required standard for poultry diets. Poultry require the presence of at least 38 dietary nutrients in appropriate concentrations because its effect the growth and production of poultry and this is provided by (NRC, 1994).

1.1. Energy Metabolism

As it was stated for all farm animals, energy requirements of poultry could be categorized into two main divisions as i; energy requirements for maintenance of animals and ii; energy needed for products yielded by these animals. The former is in principle defined as that required to maintain basic metabolic duties such as glycaemia, body heath osmotic pressure and some other metabolic pathways which may cause avoidable and unavoidable energy loses via heath, urine and feces. The latter energy required for production is also so important since that energy play as basement role for all animals derived products. Synthetic processes of that energy is not fully efficient process due to various ways of energy loses mainly in heath form associated particularly with biochemical transformations (Peebles et al., 2000; Baiao and Lara, 2005; Latshaw, 2008).

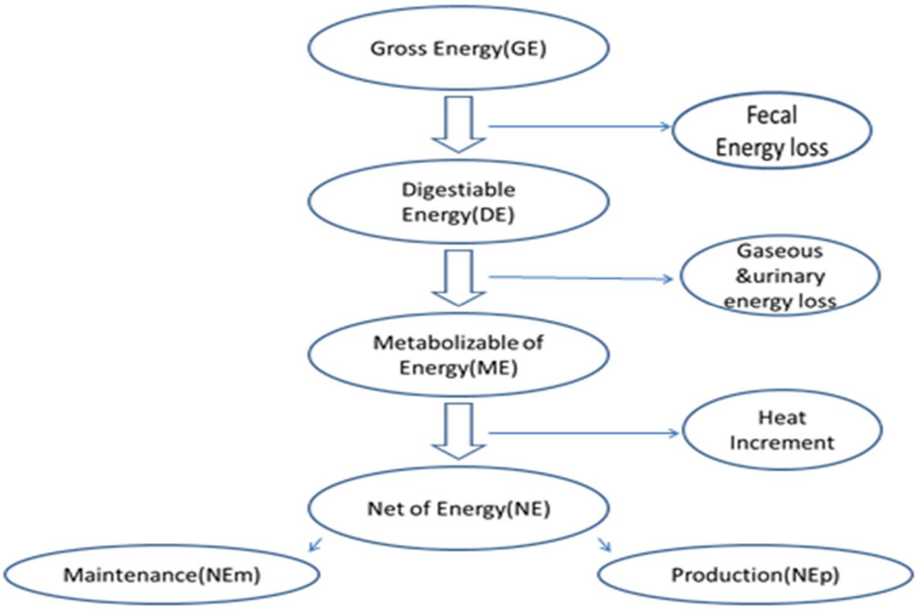

Figure 1.1. Various terms are used to describe energy value of feed resources used in animal nutrition (Jeffri et al., 2010).

Energy is derived from digestion of polymers of feedstuff into their readily consumable and water soluble monomers such as glucosexylose, protein, starch, fat and that energy is normally used for the daily progress of animals such as maintenance, growth lactation, gestation, laying and wool production.

The partition of energy requirements therefore may be illustrated as indicated below (Jeffri et al., 2010).

•Energy for maintenance

• Energy for metabolism

• Energy for adaptive and dietary thermo genesis

• Energy for daily-routine physical activities

• Energy for any type of productions

Under the normal digestive systems, gross energy of diet could not be absorbed totally in the foregut of animals and hence a remarkable amount may pass across the intestinal wall and as a result of this process average of 15% energy of typical diets of domestic birds are lost. Gross energy losses from the intestine includes those of urinary originated unavoidable loses which occurs in the pathway of urinary route. This progress is important when amino acids lead to the production of uric acid. The cumulative intestinal and urinary losses could be reduced from gross energy, giving metabolism energy with using of relatively more fat resources in poultry diets, the amount of feed intake decreased and FCR rates might be improved (Jeffri et al., 2010). A report of Celebi and Utlu (2004) stated that better utilization of unsaturated fats leading to a higher metabolic energy compared to saturated fats and fatty acid profiles have notable effects on the digestibility of dietary fats.

Besides these two main energy identifications, another term “Net Energy” is also widely used terminology which is calculated after reduction of energy loses occurred via fecal, urinary, gases and heath increment. (Dublecz, 2011).

1.2. Main Energy Sources In Poultry Diets

Feed intake is one of the main issues for poultry nutrition and must be considered as main factor when the formulation of poultry rations is conducted. The degree of precision in diet and formulation requires knowledge about the daily nutrient intake level of dietary nutrients regardless of production type either for broiler or laying hens. In the case of poultry production in most commercial situations supplying of feedstuff as ad libitum is now widely applied practice in which the birds are allowed to voluntary feed intake in appetite. However in the same cases actual feed intake could be lesser than potential feed intake which results as negative interaction with environmental, physical or physiological conditions (Forbes, 1995).

Since protein deposition for particularly laying hens is an energy-demanding process, there is association between dietary energy and protein ratio and hence may only proceed if adequate dietary energy is provided. Total intake of dietary energy influences the needs of protein and this reciprocal process induced by one nutrient on the metabolism of the other. Energy levels of the quails and poultry diets are mainly based on financial issues all over the World. However where high energy grains and particularly feed grade fats which could safely be used as feed additives are relatively cheaper, high energy diets can be formulated in an economical way. .

Temperatures and humidity deviations either below or above normal condition are other important factors affecting the feed intake for poultry industry (NRC, 1994; Leeson and Summers. 2001; Gous 2007).Corn is long been used as a traditional energy source not only for beef and dairy industry but it has been used in poultry nutrition as well. Corn and its derivatives are considered as main and energetic ingredient that composes the diets of poultry and therefore it is the productive bottlenecks in the 60 to 70%of diet cost in poultry industry (Morua et al., 2010).

Alternative to corn in poultry and animals feed and Replace the acorn with the corn in poultry diet is not easy work because the alternative materials need to be close to the basic materials in terms of composition and the task point here is to have an inexpensive alternative substance and does not compete with human food and price below, for this reason introduction of alternative feed ingredients for animal and poultry nutrition would have to be economical (Pinna et al., 2009).

Corn and corn derivatives, animal originated fats, plant oils, wheat, wheat derivatives barley and in some extend soybean meal are used as main source for energy in poultry and including quails diets (Dublecz, 2011).Corn is the grain most routinely used in commercial poultry diets because of it shigh potential to obtain dietary energy content and its relatively higher digestibility structure. Because of these facts, demands on cereal corn as main energy source for poultry industry has been increased rapidly particularly during last three decades and this requirement is being increased to approximately 1 billion tones at the year 2030 (FAO, 2003;Steinfeld et al., 2006).

1.3. Characterization Oak Fruit of the Feed Industry

Oak tree is one of the most common plants in the forests and existence of this oak tree forests are located in most part of the world, especially in Mediterranean countries. A remarkable amount of acorns (seed of oak tree) are produced annually all over the World since it is so resistance to drought seasons of the year. These acorns could be exploited as a source of energy in poultry and animals nutrition, besides its consumable features by as food (Correia, and Moital, 2013).

Flowers of oak are tassels and are seen fallen in late spring in the North part of the Globe. The nut of oak named as acorn and every acorn has one seed (rarely two or three) and it takes around 6-18 months to mature. Acorns have historically provided food for human being and fodder for animals in cultures across whole Europe, all over the Asia, Northern Africa and North part of USA. Acorns come in many different shapes and sizes, varying from long and conical to short and rounded and black oaks measuring up to 2 inches in length. Indian peoples harvest acorns of most species but preferences for Tanbark and Black Oak acorns were perhaps most widespread. Although people competed for acorns with deer, bears, rodents and birds, it is thought that the average annual production exceeded subsistence demands for example; one researcher suggested that oaks could have supported population densities 50-65 times higher than those estimated at the time of contact in the North Coast (Tejerina et al., 2011). Ranges the productivity of oaks varies, however and the majority of species produce good acorn crop yields only every 2-3 years. Most Indian groups constructed acorn caches or granaries to offset this short coming resulting in the ability to store unshelled acorns for up to 10 or 12 years (Tejerina et al., 2011; Sanchez-Burgos et al., 2013).

The oak trees and shrubs are both native plantations of Northern Hemisphere which are even evergreen species extending from cold latitudes to tropical habitats, where 400 species of oak tree are planted. Oak trees have spirally arranged leaves with a lobed margin in many species. Other oak species have serrated (toothed) leaves or have smooth leaf margins which are also called entire leaves.

True nuts acorns are an excellent source of food for human being since their rich ingredients such as vitamins B. relatively less oil, proteins and complex carbohydrate. They have a therapeutic effect as they are used for controlling blood sugar levels. According to Turkish Standard Institute a limitation of the acorn is its high content of tannic acid which makes it bitter and unpalatable to humans and animal without substantial leaching. In all converting the acorn from an inedible nut high in an oak tree to the soup. Mush, or bread generally consumed by Native people required a lengthy process involving a diverse array of tools.

It is now well known that starchy nut of long-lived trees such as oak, have potential benefits for justifying long-term climate change through carbon accumulation on the atmosphere. Therefore acorns could be used to replace a portion of the grain in animal nutrition (Keddamet al., 2010.Rodriguez-Estevez et al., 2011).

1.4. Usage of Acorn by Humankind

Historically, oak acorns have been used as food and feed stuff for humans and animals respectively particularly in various cultures such as by the people of whole Asia. Northern countries of Africa and USA and in whole Europe. The advent of the twentieth-century saw acorns become marginalized as a feed crop in the USA and vast majority part of the world (Bainbridge, 2006).

Acorn is being used by humankind not only for a part of diet but also for furnishing up to 25% of the food consumed by the prepared classes of some European countries. The person of the EU consumes the oak nuts in the form of bread cake and as type of coffee. The use of acorn in the human diet has been reported since the end of the 19th century in Serbia as well. (Leeet al., 1992).

Oaks (Quercusspp) are widely distributed throughout the Mediterranean region and Jordan .is designated the *Quercusaegilops* as the national tree (Moa, 2003). Making drinks based on heat-treated acorn was especially recommended for children because of the antioxidant feature of some acorn contents.

In some cultures oaks are considered as regional ornament and thought to be sacred trees and therefore they tend to help to ensure that oaks had enough space to thrive. Acorns are a part of food traditions all around the World and each culture has a distinct way of preparing them and some local people of the USA ground acorns and used as flour and in some extend they obtain oil by pressing them (Korus et al., 2015).

Because of their high tannin contents most varieties of acorns must be leached to make them edible although some varieties are delicious and palatable to eat without any treatment (Cantos et al., 2003).On the other hand these acorns could be used as antiviral and antimicrobial agents due to their high content of the tannin. Recent scientific reports have validated several advantageous characteristics of acorns and it seems evident that we are on the brink of drastically increasing the use of this natural resource for various applications such as in human nutrition.

Acorns could be used by humankind as chestnuts gluten free, starchy flour or as cooking oil after obtaining by pressing on acorns which follow the peeling, roasting and/or boiling processes (Deforceet al., 2009).Acorns contains all eight essential amino acids and it is a good source for vitamins A. B and C particularly when it was intact / unprocessed Acorn flour may cause relatively less of a spike in blood-sugar compare to the foodstuff made from corn and wheat because of its low glycaemic index. (Lee et al., 1992).Acorns were typically for their high importance to the rural economy as components of animal feeding and their nutritional value and high phytochemical contents have raised the interest of many researchers looking for undervalued food to be integrated in the human diet in addition, an increase in their consumption can have a positive impact at social and economic levels (Rosenberg 2008).

1.5. The interpretation of acorns

Acorn is the nut of the oaks and Oak tree belongs to the Quercus genus of Fabaceae family. It is considered as acorns alternative corns because good source for energy and they used in animal and poultry feeds because it contains up to 14.4% lipids. The major fatty acids (FA) in acorns were oleic acid which could be included up to 63%.and linoleic acid (16.5-17%). It contains palmitic, stearic acid and linolenic acid as well (12.1-13%).(3-6%) and(1-5%) respectively (Dodd et al.1993). Cholesterol content of acorn was low when compared with other nut (Petrovic et al., 2004). Acorns as source of energy are used for most of animal and poultry and livestock diet and it was antimicrobial effect antioxidant activity

They explained oaks (*Quercus*spp) nut because they are one of the key species in temperate ecosystems in the Northern hemisphere. They not only harbor a large fauna of invertebrates, which feed on their leaves and acorns but they have constituted one of the most sought after sources of calories for vertebrates (e.g. boar. rodents. jays etc.) For humans acorns were also used as an emergency food in war times in societies which had previously abandoned their use, they made bread and cake from acorns and they were also applied in traditional medicine throughout Europe (Mason and Nesbitt 2009; Turner et al., 2011).

It is well documented that there are more than 400 different acorn species all over the globe and their nutritional content varied with the species and environment. In general, acorns appear to be higher in caloric content per unit weight than cereal grains.

Raw acorns are used for diet of Japanese quails because shelled acorns consist of 51–57% starch and crude fat 4–6% (Pinna et al., 2007.Cappai et al., 2010).

Acorn have a great potential to be used as animal and poultry feed. In addition.oak acorns contain about 7-14.4% lipids and 2-8% protein). Dominant fatty acids in oak acorns include oleic acid (66.8%),palmitic acid (18.4%) and linoleic acid (13.5%) (Bouderoua and Selselet-Attou, 2003) and fiber source (Clay. 2004).

The high levels of tannins in acorns give acorns a bitter taste. making it unattractive for consumption some indigenous methods of removing tannins from acorns, or at least decreasing tannin content, tannins at high levels can less metabolic costs since its detoxification characteristics (Chung-MacCoubrey et al. 1997).

Acorns are still used as a food source, acorns have higher amount of calorie because of higher amount of fat and are high in phenolic compounds. Differences in composition due to acorn species have been reported (Bainbridge. 1986; Bettinger et al., 1997).

1.6. Advantages of Planting Oak Trees

Acorns raw and heat treated and shelled acorns must used in limited level because acorns is considered a good source of tannins tannins which is polyphenols compound in plant interfere with an quails ability to metabolize protein and we used raw They suggested that birds may adapt to tannin-containing diets and the digestive system may develop functions to overcome the anti-nutritional effects of tannins and heat treated acorns in our study to know effect both types of acorns Animals may preferentially select acorns that contain fewer tannins Tannin is one of the anti-nutritional factors common in most cereal grains and legume seeds. (Ozkan et al., 2006).

Husbandry practices which support effective immune response in quails are vital. Two perspectives have influenced the focus of research in recent years on this subject:

firstly determining the most appropriate nutrient feeding strategies to optimize the immune response; and secondly the study of the influence of immune response on the growth and nutrient requirements of the bird. The maintenance of immune competence and optimal health status in birds in a range of husbandry situations will remain a priority. Such physiological well-being can be challenged by a number of anti-nutritional factors in feeds oak acorns contain bioactive anti-nutritive factors (Shimada. 2001).

Idea to eat acorns straight off the ground not correct idea because it contains high concentrations of tannic acid, so their taste is bitter and they can be toxic to humans and animal if eaten in large quantities, even the animals that eat acorns raw often find the tannins to be irritating; for this reason, few animals eat acorns exclusively, and some acorn-eaters allow the nuts to soak in water before they consume them On the other hand, raw acorns can be stored for months without spoiling; this dramatically increases their value as a food resource Paleolithic people regularly ate acorns as part of their diet. However, as agriculture developed, the practice of eating acorns declined (Correia, and Moital,2013)

1.7. Nutrition of Japanese Quails

There is considerable research endeavor a lot in quails nutrition science because the feeding is a major factor in controlling profitability and on the way this science we can more precise evaluation of the quality of dietary raw materials which enters in quails nutrition and the poultry science nutrition is a lot a multidisciplinary (Larbier and Leclercq 1994).

It was reported that average feed intakes of Japanese quails varied from 30 to 33g (Albino and Barreto, 2003; Barreto et al., 2007). However Nakahara et al. (2010) observed that average feed intake and feed conversion ratio were 37g 3.86 kg and 0.59-3.86 kg respectively in different genetic groups of meat-type quail.

All poultry needs a complete feeds it must be designed to contain all the protein. Energy, vitamins, minerals and other nutrients necessary for proper for bird growth and egg production and health the feeding other ingredients either mixed with the feed or fed separately upsets the balance of nutrients in the complete feed. Feeding additional grains or supplements is discouraged because the quails have bodies and gain weight quicker than birds grown for flight purposes, diets must contain nutrient levels that meet the dietary needs of the birds being produced meat-type birds fed as flight birds are more expensive to produce and use more feed.

1.8. Establishing Nutrient Requirements Feed Intake Predictability

It was considered the red acorns richest types of acorn and they proved that the red acorns contain three time energy more than white acorns for this in winter depends most of animal and insect wild on red acorns.

As stated from most of the research there is difference between the red group of acorns and white group acorns that the red acorns considered higher in energy and protein, fiber from white acorns although red acorns has all this points but it was not palatable for animals in wild life because the level from tannins was high (Rodríguez Estevez et al., 2010).

The important point of red oak after fall down from oak tree it cannot be damaged for long time it mean that the reds acorns it will be available long time can be food for forest animals and they can found from winter until spring (Makkar et al. 1995).

Most of the research proved that the acorns can be source for energy for animal and avian and human, in most of the place in world especially (Asia, North Africa. Europe and North America) the acorns written from history California's indigenous cultures and the important type of acorns Spanish and North African acorns (Bainbridge 2006).

In the UK and most of the country in world they divided acorns in two kinds; first Spanish acorns, second North African acorns (Boubaker et al., 2007).

Use of oak acorn for animal nutrition is most common in Mediterranean countries. There are 450 species of oak trees word wide but only 13 in Canada. Most of our native species hang out in the most southern parts of the country. The acorns most worth bothering with are considered to be those of the oak tree known variously as holly, holm or ilex oak (*Quercus ilex*varrotundifolia -- aka varballota) which grows all around the Mediterranean. Including particularly north-west Africa. Spain and Portugal (Boudreaux 2003) .

1.9. Treatment of Acorns

Acorns are safe to eat raw but can cause kidney damage if consumed in large quantities over time to avoid this. Tannic acid in acorn as possible needs to be removed by leaching the acorns with water. The process can be lengthy. it is worth the effort. Once the bitter tannins are gone, acorns have a sweet and mild taste. They can be consumed dried or roasted or coated with sugar to make candy. Most often, he said, they are finely ground into meal the best time to harvest acorns is right before they fall from the trees. Once on the ground acorns become susceptible to insect pests such as weevils. Another concern is food safety gather mature acorns but it must refused the acorns nut which infested with insects after that it must make dry by sunny. During this process it will also kill any insect eggs or larvae which might be inside (Clay, 2004).

The activity of acorns it will be more if acorns treated and there is more then way to make less tannins in acorns and removal tannins in acorns for example Native Americans used alkaline ingredients, this is mean that make treated of acorns the hydrolysable tannins were degraded and effect to increase of non-tannin phenolics content and amongst them especially gallic acid, the thermally treated of acorns effect to higher antioxidant activity (Rakica et.al., 2007).

Another way for preparation acorns to use by leaching with water. Besides being unpalatable, in addition to that the raw acorns was not consumed in large quantities over time in it can cause kidney damage. In the past centuries Indians purpose of reducing tannins in acorns by putting acorns in a basket in a clean fast-flowing stream shares that they may have used cactus pouches to hold acorns for leaching for day or two after that they boil after that they dry acorns (Arntfield, 2009).

A research proved the traditional processing techniques including dehulling thermal treatment (ordinary cooking. pressure cooking and roasting) in different solutions like (water, ash, alkali and acid) and fermentation could reduce anti nutritional agents in many acorns the cooking has often considered as means to improve the texture. palatability and nutritive value of cereal due to gelatinization of starch, denaturation of proteins, increased nutrient availability and inactivation of heat labile toxic compounds (Uppal and Bains. 2012). Untreated raw acorns contain high concentrations of tannic acid, so their taste is bitter, condensed tannin and presence of castalag in chestnut which is less toxic and less potent in protein binding compared to tannins (Schiavone et al., 2008).

1.10. Antioxidant activity of Acorns

It was considered that acorns is as natural product which can be used as an inexpensive source of natural antioxidants the antioxidants it can found in food which protect cells from damage. The acorns nut showed the presence of phenolic compounds and showed a certain level of antioxidant activity in the kernels as well as in the hulls of acorns. the scientists reported that the oleic acid and linoleic acid content in acorns arrives 53-65% and 24.2-49.1%in the same time they proved acorns contain bioactive anti-nutritive factors and including tannins (7%) which possess antioxidant activity acorns antioxidants fruit (Rakic et.al., 2007).

The majority of reports that the biological activities of acorns are focused on their strong antioxidant activity and might be related to other biological functions such as anti mutagenity, anti carcinogenicity and antigen effects and reducing risks or symptoms microbial infection and inflammatory diseases. The antioxidant activity was mostly attributed to the presence of high amounts of phenolic compounds in the acorn extracts (Sung et al., 2012;Tooriet al., 2013)

The most studies confirm chloroform and metabolic and aqueous extracts of the internal layer of oak fruit (cotyledons) presented high antioxidant activity it can used as antioxidant activity and different classes of phytochemicals were determined and associated with antimicrobial and antioxidant activities (Dlamini et al., 2009).

Acorns has an antioxidant activity and most of research proved that acorns has antioxidants and usually used to prevent chronic and degenerative diseases with intermediate scan of free radicals (Rodriguez et al., 2007).

1.11. Secondary Metabolites in Plant

1. Nitrogen containing compounds

2. Terpenoids

3. Phenolics

Phenolic compounds are responsible for physiological, biological and biochemical functions, mainly because of their strong antioxidant activity. but also due to their properties as membrane stabilizers. Polyphenols have the potential to bind positively charged proteins, amino acids or multivalent cations or minerals such as iron, zinc and calcium in poultry diet (Gilani et al., 2005).In same time high level from polyphenols in acorns reduce the bioavailability of essential minerals in perdition reduce their content (Khandelwal et al., 2009).

1.12. Tannins

Tannins are polyphenol compound and were one of the many kinds of secondary compounds found in plants. Molecular weight of tannin is ranging between 500 and 20.000 tannin was soluble in water, with exception of some high molecular weight structures. Tannin has the ability to bind proteins and form insoluble or soluble tannin-protein complexes. Tannins are usually divided into two groups; one of them was hydrolysable tannins (HT) and other was condensed tannins (CT) (Mueller-Harvey. 1999).

Hydrolysable tannins are hydrolysed by weak acids or weak bases to produce carbohydrate and phenolic acids. Hydrolysable tannins can be extracted from different vegetable plants, such as chestnut wood. The condensed tannins (CT) usually have a higher molecular weight than the HT (McLeod. 1974; Mueller-Harvey and McAllan. 1992; Mueller-Harvey. 1999).

Some authors define two additional classes of hydrolysable tannins; taragallo tannins (Gallic acid and quick acid as the core) and caff tannins caffeic acid and quinic acid (Lowry et al., 1996).

1.13. Effects of Tannin on Feed Intake and Animal Performance

Tannins have an effect to inhibit feed intake and physiological performance of animals. In the same time it has an effect for growth. The anti nutritional activities of tannins may involve impaired nutrient utilization, retarded growth, inhibition of enzymatic activity and consequently reduced performance (Grosjean et al., 2000).

The negative effect of tannins on animal is given below

1. Effect to make depress of food intake by absorptive and arrest the blood vessel
2. Tannins in acorns complex with proteins or other dietary components.
3. Effect on digestive enzymes.

4. Complex with endogenous protein, resulting in a drain on the nitrogen supply and on the amino acid supply.

5. Effect on alimentary tract .

6. Hydrolysable tannins or condensed tannins effects to toxic effect in body animals. Kumar and Vaithiyanathan (1990).

Tannins generally have a negative effect when consumed (Leuschner et al., 1995; Ibrahim et al. 1988; Elkin et al. 1990 and Douglas et al. 1993). Tannins negatively affect animal's feed intake, feed digestibility, defense mechanisms and efficiency of production.

Also tannin have toxicity on microorganisms ruminants if it taken in high percentage. These effects vary depending on the content and type of tannin ingested and on the animal's tolerance. And also dependent on digestive tract, feeding behavior, body size and detoxification mechanisms characteristics and monogastric animals it mean type of animal because it has different effect in ruminant and monogastric (Eberhardt and Young 1994; Jelager et al., 1998). However it has been reported that tannin appear more promising in ruminant nutrition (Mueller-Harvey, 2006; Tabacco et al., 2006).

Tannins evaluated *in vitro* antimicrobial activity of this product observed a positive effect on different bacterial strains (Graziani et al., 2006).

Usually condensed tannins not absorbed through the digestive tract. Instead, free tannins and completed forms remain in the rumen, decreasing protein and plant cell wall digestibility (Scalbert, 1991).

The way in which tannins affect animal performance is not exactly clear. Tannins form complexes with proteins and carbohydrates in the feeds and with digestive enzymes. Three mechanisms of tannin toxicity have been identified for microorganisms which are; enzyme inhibition and substrate deprivation for this reason acorns use it must be by limited level for quails diet and (Tesevic et.al.,2005; Midilli et al.,2008)

The interaction tannins in animal stomach with the cellulose enzymes affect the organic matter and fiber digestion, lowering the overall digestibility (Mueller Harvey and McAllan 1992; Scalbert. 1991)

In in vivo studies, protein digestibility is greatly reduced when tannin ferrous feeds are part of the diet; plants high in PAs often have proteins linked tightly to the plant cell wall and lignin (Scalbert, 1991).

The presence of tannins in poultry diet effecting to protein absorption and not let body to benefit to the protein Thus affecting the decreased growth and the animal feeds efficiency it will be reduce resulted in depressed growth rate and reduced feed efficiency (Ibrahim et al., 1988; Elkin et al., 1990; Douglas et al., 1993). It has been shown that as little as 0.5% tannic acid is sufficient to cause growth depression in poultry and 5% tannin can cause 70% mortality (Vohra et al., 1966)

1.14. Structureand Composition of Acorns Starch

The raw acorns starch structure play an important role in a digestibility starch.It can be seen the starch granules by using scanning electron microscopic whereas the starch granules of Downy oak acorns and it showed diameters between 10.2 and 13.8 µm. The specific amylose to amylopectin ratio of acorn starch was 25.8%. 19.5% and 34.0% in the Holm in the same time, respectively 13C Nuclear Magnetic Resonance (NMR) signal analysis displayed a pivotal spectrum for the identification of the amylose peaks in raw acorn starch. as a basis for the amylose to amylopectin ratio determination the chemical composition of acorns rate crude protein 67.6 g. 32.1 g ether extract 32.1 g ether extrac.11.46 MJ metabolisable energy these values correspond with minimum and maximum values published by (Bainbridge, 1986).

It was reported from 18 different species in acorns from the Californian region. Acorn contained 23 - 86 g crude protein 11-313 g ether extract. 327- 897 g soluble carbohydrate and 1-88 g tannins, additionally metabolisable energy concentrations of acorn varied from 11.08 to 24.14 MJ/kg for the 18 acorn species (Cappaiet.al.,2010).

1.15. Poisoning and Toxicity of Acorn

Acorns can be harmful if used without processing the poisoning cases in livestock have involved the consumption of young, especially in spring when the leaves freshly fallen acorns at this time these contain the highest concentrations of condensed and hydrolyzable tannins, they proved that the black and red oak species it has higher concentrations of hydrolysable tannins if compared by another types from acorns (Perez et al., 2011).

Tannins characteristic which complex with protein and don't let the stomach absorb and body benefit it especially in avian if eat more it will be poison and it will be inhibit for many digestive enzymes including proteases, pectinase, amylase and cellulose (Bouderoua et.al.2009).

If eaten acorns in large quantities they can cause sickness and death. raw acorns on his list of poisonous plant that when they are eaten in large quantities over a long period of time results in bloody stools and other symptoms, tannins which are plant polyphenols and interfere with an quails ability to metabolize protein and we used raw and heat treated acorns in our study to know effect both types of acorns Animals may preferentially select acorns that contain fewer tannins, tannins which are plant polyphenols, interfere with an quails ability to metabolize protein and we used raw and heat treated acorns in our study to know effect both types of acorns Animals may preferentially select acorns that contain fewer tannins.

Sam Barringer, Extension veterinarian at West Virginia University Gallo tannin in the acorn is metabolized in the rumen into tannic acid and Gallic acid The tannic acid causes ulceration in the mouth, esophagus and gastrointestinal tract and is especially toxic to the renal tubules or acorns toxicity occurs when too many acorns or buds are ingested and the gallotannin in oak foliage creates gastrointestinal and kidney problems

The first symptom of acorn poisoning is blood-tinged diarrhea, which producers often attribute to worms. Faries says. The Gallo tannins irritate the gastrointestinal tract, so cattle will show abdominal discomfort, appear humpbacked or take short uncomfortable strides while walking in same time if the big mammals not found another source from forage in spring if the chance was just to eat 50% buds or immature leaves that it will be bad chance for them and effect kidneys may also be inflamed. If producers don't catch these signs, he warns, the cattle may progress to fast weight loss, though the calcium and vitamin niacin phosphorus. Total food energy in an acorn also varies by species, but all compare well with other wild foods and with other nuts.

2. LITERATURE REVIEW

2.1. The Use of Acorn in Animal Diets

2.1.1. Acorn for laying hens

Acorn seeds were picked up from species which is famed Iranian oak or Zagrossian oak and grow on Zagros mountain chains of Iran they breeding one hundred sixty raised on deep litter floor until 18 weeks old. In this time the pullet was free in day 10 hours out in lightening and 14 hours pullet was in dark place and they record the result after age 18 the transferred the pullet to the cages and they change the diet in 24 week they take weigh of laying hens after they put in different cage for 36 weeks (Saffarzadeh et al. 1999)

Definitely not any positive result from case found 30% percentage of raw acorns in laying hens diet in the stage egg production and in the stage 24 first phase of egg production until 36 weeks, and all data it show in case use dehulled acorns 30% for laying hens has negative and effects on egg weight, feed intake, mortality, body weight rate, laying hens all be negative but in the same research we can found the effect rate dehulled acorns rate 20% all positive this investigation revealed first time that experimental and any laying hens diets it must Akamovicand Brooker (2005). Containing levels of dehulled acorn not be more then 20% percentage

Additionally it has been proven that acorns have antioxidant effects, acorns samples possess highest antioxidant especially if treated samples by heat or water during thermal treatment hydrolysable tannins were degraded. As the result of this degradation and consequent increase of non-tannin phenolic content, especially gallic acid (Rakica, 2006).

Most of the literature and research proved that the level 10 and 15% of oak acorn in poultry diet and has no adverse effect adverse on body weight gain while 20 and 25% acorn significantly decreased body weight gain (Morua,2010).

Determination of some anti-nutritional factors and metabolisable energy in acorn seeds as know in diets in birds and most of the avian such as chicks, red-headed. Woodpeckers, laying hens, quail and jays. They eat acorns particularly the white oak considered as good source for energy for them and generally white acorns are less bitter than other acorns seed for this point it gave more Delightful for them when they are found (Mahmood et al., 2008; Vilarino et al., 2009).

They proved that the birds which gave high level from acorns it effect to damage from mucosal lining of the digestive tract because of tannins in acorns effect to diets can reduce feed consumption especially in monogastric animals and the level from acorns seed 2.0% in diet effect to increased excretion of proteins essential amino acids and for poultry it decreased the level from egg production. it mean used acorns in level 2.0% it has negative effects but if when it reaches the level 3 to 7% it be more damage and we cannot be controlled and the rate of mortality it will be high.

Existence tannins in laying hen's diet lead to that benefit of energy can be less and significantly affects the digestibility because protein and essential amino acid cannot absorb (Grosjean et al., 2000).

The apparent energy that body can benefit from it be less amount and the process digestibility and benefit from amino acids in broiler chickens it will be minimum for this in broiler chickens should be using the acorns seed most accurate and reduced feed intake and bodyweight (Hughes, 1999; Kumar and Vaithiyanathan1990).

It was confirmed that acorns can be used as a source energy in broiler diet and the quantity and the quality of lipids that stored in chicken tissues is acceptable and growth, carcass characteristics and performance was not affected (Bouderoua and Selsele-Attou, 2003).

Kumar et al. (2007) suggested that in laying hens when the diets food nutrition contain a good levels of shelled acorn seeds it not shown negative effect for death number and body weight but feed efficiency were affected significantly in weeks 24-36 effect and egg production, egg number, egg mass it will affect to be all less all.

Quercus acorns is used a source of food for animals and humans from Iran to Japan because it has best range from most of the mineral benefit for health (Kim and Shin, 1975; Bainbridge, 1991; Tamer and Gulriz, 2005). Inclusion of acorns in high level into chicken diet would be negative effect to pancreatic enzymes (Mansooriand Acamovic., 2007)

Several studies have reported about broiler diets containing acorn especially at days 35 and 49 low in BW and FC were obtained. Acorns negatively affected performance for body weight and food intake (Hur et al., 2006).

Ozkan et al.(2006) suggested that birds may adapt to tannin containing diets they consumed, the digestive system may develop functions to overcome the anti-nutritional effects of tannins.

Using peeled acorns in quail rations, Midilli et al. (2008) reported that up to 20% peeled acorns can be used in the ration of Japanese quails. It has been reported that the eggs obtained from the birds fed with ration containing more than 25% in ration. They have coloration in the skin and the power of hatching has decreased (De Boer and Bickel, 1988). It is reported to cause a decrease in degrees (Bouderoua and Selsele-Attou, 2003).

2.1.2.Acorn for wood pecker

Results revealed that acorns immature and mature acorns are an important component of the diet of woodpecker bird (Koenig. et al. 2008).The estimated proportion of acorns in their diet increased shown that use 19% diet acorns 9- to 12-d-old nestlings but the 42% in 23- to 26 old woodpeckers have significantly different diets. The stored acorns by bird's residency during the winter greatly enhance reproduction the following spring. However, acorns are often high in tannins.

2.1.3. Acorn for small ruminants

Worldwide goats and sheep consume not only the leaves of the acorns seeds they consumes shelled acorns too us source for energy (Sallam et al., 2010).

Acorns could replace 50% of the barley in goat diets 25% in lamb diets without any problem because acorns are a good source of energy for small ruminants (Moujahed et al., 2005 and Al Jassim et al., 1998). In Tunisia, normally they use grain and some forestry products and fruits and acorns especially *Quercuscoccifera* because the energy in acorns high and level good for small ruminants feeding and in same time the price of acorns not expensive if compare other crops and other seeds with (AlJassim et.al.,1998).

There are times of the year when deer appear to be actively grazing. Spring and fall are two times when it is common to see deer on roadsides research studies of non-winter food habits of deer have been conducted the study in deer rumens (stomachs) contained plants different groups (genera) during the year. However, the principal food items were acorns. The order of these principal foods changed with the season but these four tended to dominate year-round. Grasses and sedges led in the spring, alfalfa and corn leaves in the summer and kernel corn and acorns in the fall. Clearly cultivated crops were the main source of forage in farm country other studies in farm country of the Midwest have also found that about half of all food items in deer rumens were of agricultural origin. This should not be a surprise as a high percentage of the home range of farmland deer is composed of agricultural fields. Moreover, agricultural crops are fertilized and grown for food. Deer aren't dumb. But the use of crops by deer for food should also underscore a potential problem. There is a limit to farmer tolerance when it comes to hosting deer a limited number of deer can be charming. But too many deer can be damaging (Keith R. McCaffery 2011).

In the Eastern US there are large areas for oak trees So that benefit from them for grazing especially for deer because there is large number from deer in this place If these fields do not exist they must go for far place in search for found food and the deer to put themselves in potential danger by going elsewhere for food that is not quite as tasty, full of fats and starch because the deer need high energy and the acorn are easily digestible, their nutrients are readily absorbed and they are processed and passed through the body quickly

Turkey has approximately 6.5 million hectares with oak field, there are generally three different oak species in this area. These oak trees are classified according to the anatomical structure of the wood, the maturation period of the fruit, the white and red according to the leaf and shell characteristics and the greenness of each season (Yaltırık. 1984).

Oak plant is mainly used in firewood, furniture industry and soil erosion Acorns, especially for wild animals and the livestock are an important source of food (Cyrpet and Burton, 1948). Acorns have been found in ancient archaeological excavations since they were used as food by both humans and animals (Bainbridge, 1986).

In addition to the existing oak areas in the country, Turkey Combating Soil Erosion (TEMA) and the ongoing 10 billion acorns initiated upon the completion of sowing and planting campaigns, this oak (average of 20 kg each oak tree) is about 150-200 million tons of feed acorns to produce It is estimated (Karaca, 1999).

Even if 10% of this amount (about 15 ton20 million tones) of acorns is collected and evaluated as bait .is a fact that will provide. This amount corresponds acorn in question nearly Turkey wheat production.

The crude protein contents of acorns were reported to be between 2.75 and 8.44% in white oak. 3.13 to 6.38% in red oak and between 3.93 and 3.69% in acorns obtained from green oak species (Özcan, 2006). Although the crude protein content of acorn is low, it has been reported to be rich in carbohydrate content. (Sarıçiçek and Kılıç, 2002).

Field studies were carried out on acorns as in many parts of Turkey. Kahramanmaraş and are also found to be around a lot of oak. It was determined that some of the oak trees found here are frequently branched.2-3 meters in length, in the form of green bush. Some of them are 10 meters or more in length and leaves their leaves. A significant amount of acorns are produced each year from these plants. However, some of the acorns produced are evaluated by wild animals and animals grazing in these areas, while most of them are not evaluated at all.

Figure 2.1. Fallen oak fruit (acorn)

Using acorns in ruminant rations Moujahed et al. (2005), in their study, they can be replaced by 50% of the barley instead of barley reported. Boubaker et al. (2007) in his study of goats in the feed sources of scarce autumn and winter feeding rations with acorns reported that the economic benefits of joining. Al Jassim et al. (1998) in his study with Awassi lambs. 25% instead of barley replacement of barley reported that economic benefits. Moujahed et al. (2007) in their study of lamb in case of use of acorns to eliminate the protein deficit in addition to the acorns of soybean meal or urea in the use of lambs reported that the need for protein can be removed.

Acorns can enter into the diet as an effective energy source for small ruminants (Kayouli and Buldgen, 2001; Al Jassim et al., 1998). Recently they proved by research which it can able to alternative a barley us source for energy in ruminant diets and can reduce the need for barley in the diet and the effect of replacing some or all barley with acorns from Kermes oak in concentrate they showed negative results *in vitro* for goat energy dietary supplement (Moujahed et al., 2005).

High level for acorns in livestock diet nutrition it has harmful effect but the case ruminants was different when compared with monogastric so that the effects are less detrimental effects because the ruminants they have chance to digestive concentration of tannins in acorns diet in same time they have chance to decrease tannins concentrations in mouth by secretion salivary which contain protein, this protein in salivary contact and make bind with tannins in acorns that make them inactive (Frutos et al., 2004 Min et al. 2003). The results suggested that acorns it can alternative by barley without any bad effect if it used in rate 50% for small and large ruminant.

2.1.4. Acorn for pig

The high level raw shelled acorns in the diet for pigs lead to increased amounts of feces with specific qualitative peculiarities, directly attributable to acorns. In several Mediterranean countries, acorns are used as the main energy source for extensively reared pigs. In terms of chemical composition, free ranging pigs can directly consume ripe acorns from the ground or combined into mixed diets and the high level raw hulled acorns in the diet for pigs leads to increased amounts feces with specific qualitative peculiarities, directly attributable to acorns, administered to ranged finishers (Nieto et al., 2002).

In some of Mediterranean countries acorns are used for fattening pigs there are too much research about use acorns for pigs nutrition and they alternative barley by acorns and some of research they alternative wheat by acorns and all result positive and they use us source of energy and all they showed that the nutrients acorns may well be more suitable for use in combined diets for fattening pigs rather than in diets for growers (Cappai etal., 2010).

It was shown acorns are used as the source of energy. Pigs can consume acorns or ripe acorns from the ground or combined into mixed diets and practice of feeding shelled acorns ensures stability in quality and hygiene of the seed and prolonged storage time but also an economic advantage (Rodriguez Estevezet al., 2009).

There are a lot of researches about the use of acorns for pig’s nutrition and all proved that the high level raw shelled acorns in the diet for pigs leads to increased amounts of feces(Nieto. et al., 2002).

2.1.5. Acornfor rabbit

They reported that 25% of acorn in the rabbit ration were not affected by fattening parameters such as acorns, live weight gain, feed intake, feed consumption and carcass yield (Baubaker et al. 2007). *Quercus ilex* and *Quercussuber* oak oaks are fed in the pigs' farms on the island of Iberia in Spain, feeding pigs between November and January (Rodriguez-Estevez et al., 2009).

2.2. Future Perspectives for Acorns

Because acorns contain good level of starch products, acorns have diverse beneficial effects, mainly due to the presence of specific functional groups of phyto chemicals which will be adequate for consumers with celiac disease. Likewise, acorn starch might be used as thickening and stabilizing agent, owing to its high paste consistency. In addition, since this polysaccharide is present as resistant starch in a high percentage in same time it can be alternative to other current prebiotic agents such as fructo-oligosaccharides, inulin, isomalto-oligosaccharides, polydextrose and lactulose. Acorn can also be used in other industrial applications such as plastics, textile. pharmaceutical, paper and cosmetic industries. In addition aliphatic alcohols in nut oil can be industrially used as emulsifiers, moisturizers and condensates in food and personal care products.

Considering the number of studies acorns as a natural source of bioactive compounds or as base of new foodstuffs. Acorns and acorn by-products could also replace several other products, usually more expensive and with more negative impact on the environment, namely as an innovative source of oil and flour, as well as a diverse set of different food products prepared with these 2 key ingredients, such as bread, breakfast cereals, pastry products and yogurt components. In general, acorns can be used as a source of dietary energy, starch and fiber, providing an attractive low-cost food. In addition, acorns contain essential fatty acids and high levels of provitamin A and vitamin E (Pinna, 2013).

Global change by highlighting acorns as an added-value resource not only for their nutritional qualitybut because it has beneficial health effects due to their bioactive compounds, particularly helping in the prevention of several diseases (Rakic et al.,2006).

2.3. Objective of Thesis

Dry oak acorn with high starch content was widely used to meet the requirements of livestock animal in the most parts of the world. Small part of fallen acorn is consumed by small ruminant animal such as sheep and goat, although most of fallen acorn are not collected and left in the field for deterioration. It is very important in terms of animal nutrition to make use of acorn obtained from 6.5 million hectares of oak forest in natural flora of Turkey. Recently high demands and cost of animal feedstuffs made it inevitable to make use of feedstuffs like acorn with high energy content. Chemical composition of acorn ranged from species to species. Generally crude protein contents of acorn were low although tannin content is high. Acorn can be used to some extent in ruminant and poultry ration. High tannin and low protein contents are the main factors for inclusion of acorn into diets. Acorn supplemented diets should be supplemented with protein. Therefore the objective of the current study was to investigate the possibilities the use of raw and heated acorns in Japanese quail diets.

3. MATERIALS AND METHODS

3.1. Material

The research was carried out in the quail breeding unit in the Poultry Research and Application Unit of the Faculty of Agriculture. Kahramanmaraş Sütçü İmam University. Faculty of Agriculture, Kahramanmaraş, Turkey.

3.1.1. Trial cages and quail chicks

Trial material for quails was housed in a cluster of 56 m^2 cage system with dimensions of (8x7) meters. There are 2 windows and one ventilation aspirator in the experiment room. The base and the wall of the trial room are covered with tiles. The trial room is presented in Figure 3.1.

Figure3.1. Experimental room

Japanese Quails (*Coturnixcoturnix* japonica) that used in this experiment were obtained from parent stock of Çukurova University in Adana. Animal Science Department. Avian Research Units and in the first two weeks of the study we used the cage in size 50x100x25 cm and every cage it has 5-storey for Quails chick. The chick cage used in the experiment are given in Figure 3.2.

Figure 3.2. Chicken growth cages used in the experiment.

Starting from the third week of the study, quail cages with 50 quail capacity of 50x100x25 cm and 5 stores were used. The fattening cages used in the experiment are given in Figure 3.3 and 3.4.

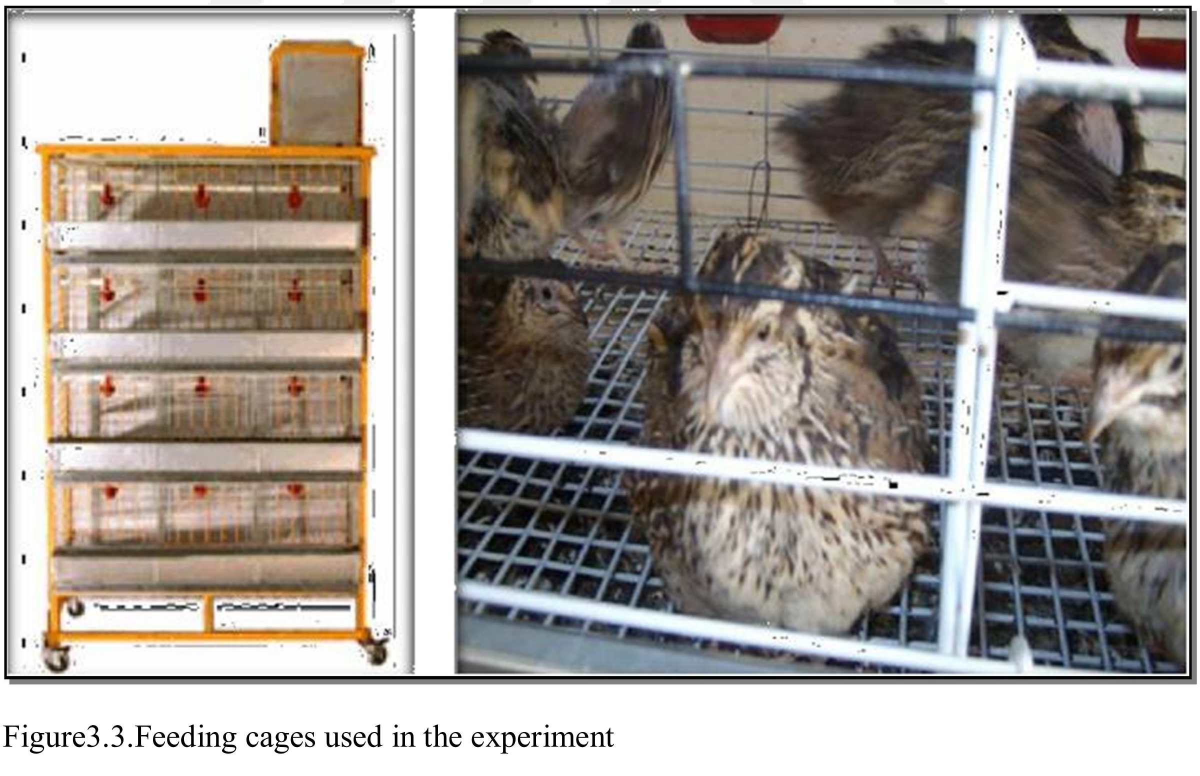

Figure3.3.Feeding cages used in the experiment

Figure3.4.Feeding cages used in the experiment

420 Japanese quail chicks were used in the experiment presented in Figure 3.5.

Figure3.5.One day old Japanese quail chicks

3.1.2. Acorn (*Quercusscoccifera*) and feed ingredients

Mature acorn were collected oak forest in Kahramanmaras (Figure 3.1) maize, soybean meal, oil, $CaCO_3$, DCP, lysine, methionine, salt, vitamin and minerals were obtained from commercial feed company.

Figure 3.6. Picture of oak trees (*Quercuscoccifera*) with acorn

Other feed raw materials used in the experiment; It consists of maize, soybean meal, oil, $CaCO_3$, DCP, lysine, methionine, salt, vitamin and minerals. The two main raw materials used in feed are corn and soy bean meal in Figure 3.7.

Figure 3.7. Corn and soybean meal

3.1.3.Grinding mill of feed raw material

The mill in our project which grinding acorn and other feed raw materials to be used in the trial are milled is given in Figure 3.8 and 3.9.

Figure3.8.The mill used for grinding oak acorn and other feed ingredients

Figure3.9 The mill used for grinding oak acorn and other feed ingredients

3.1.4. Scales

In order to determine the weekly live weights, 0.001g precision scales with 400 g capacity were used. Feed weightings were made with 15 kg capacity and 1 g precision scale. In the laboratory studies, precision balance was used. The scales used in the experiment are given in Figure 3.10.

Figure 3.10. Our experiment scales picture

3.1.5. Cutting equipment

The 55 x 43.5 x 53 cm electric feather wetting boiler was used in the experiment. 14 chopped cutting stands are used for cutting. 10-14 poultry plucking machine was used in the hair removal process. Cutting equipment is presented in Figure 3.11.

Moisturizer broiler Machine   Cutting position   Tweezing

Figure 3.11. Cutting equipment

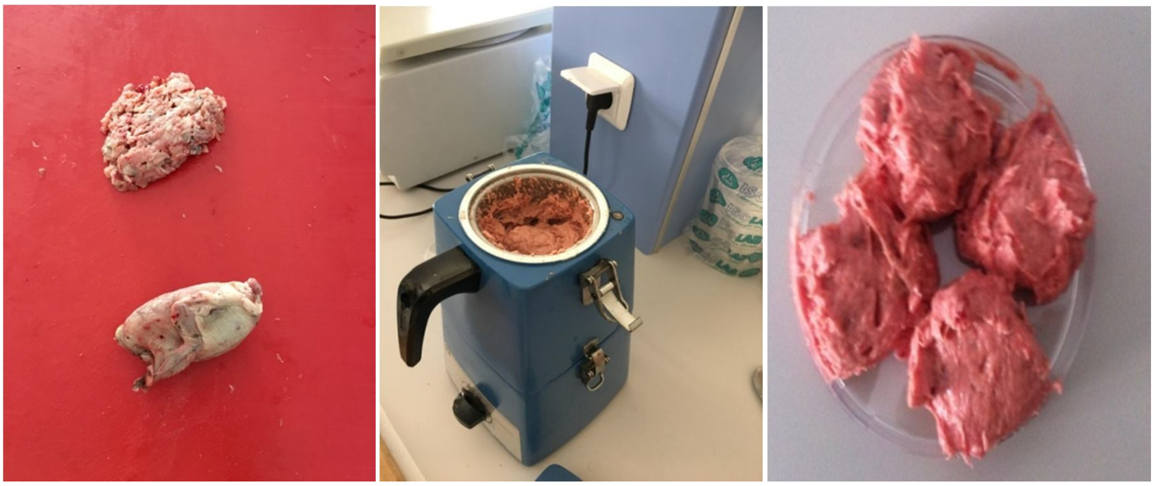

Figure3.12. Carcass and meat analysis

3.2. Methods

3.2.1. Trial pattern and duration

The research was arranged according to the trial plan of coincidence plots. The distribution of the quail chicks to the cages was done by randomly generating random numbers. Each replication of the experiment consists of 7 treatment groups and has 3 replications per treatment, consists of 20 male and female quail chicks. A total of 420 animal materials were tested. Treatment groups Table3.1.

Table3.1.Treatment groups used in the current experiment

		Inclusion Ratio	n	Abbreviated Name
Groups	Control	0%	60	C %0
	Raw Acorn	10%	60	RA10%
		20%	60	RA20%
		30%	60	RA30%
	Autoclaved Acorn	10%	60	AA10%
		20%	60	AA20%
		30%	60	AA30%

The trial period was planned as 6 weeks. During the experiment, inside of the house temperature ranged between 21 and 34^{o}C and humidity was 50-70%. Climate indicators were identified by data loggers. Ventilation is provided by window and aspirator .In the third week of the experiment, gender was differentiated by looking at the cloak and neck and chest feathers and the males and females were separated from each other.

3.2.2. Feed, water and lighting applications

In the first two weeks of the experiment, table chick feeders were placed in the cage and feeding was done. After the second week, trough-type feeding troughs were mounted outside the cage, during the first three weeks of watering, nipple drinkers were introduced with automatic nipple-type chick drinkers. Feed is given to quails and water is given as ad-libitum. 24 hours of illumination was applied to the research cluster with fluorescent lamps with daylight as a light drop of 3.2 watts per square meter.

3.2.3. Preparation of experimental rations

The acorns that have matured on the ground have been grinded in the grinding mill which has 1un2 cm sieves and made ready for use. Grinded acorns were divided into two and half were subjected to heat treatment in autoclaves at 121 ^{o}C for 10 minutes (Büyükçapar and Kamalak. 2007). The purpose of the heating process; to eliminate the anti-nutritional factors found in the acorn to reduce the bitterness and increase the flavor. Approximately 300-350 kg of age acorns was used in this experiment. The acorns used in the experiment were obtained from *Quercuscoccifera* "oak species. The main reason for the selection of this type of oak is that it grows intensively in Kahramanmaras and its surrounding areas and that the acorns they produce have been used so little in animal feeding and have not been evaluated sufficiently.

3.2.4. Preparation of experimental diets

Raw and Autoclaved acorn was included into diets of quails at the seven different ratios (0. 10. 20 and 30 %) and given in Table 3.2. Seven iso-nitrogenic and isocaloric experimental diets were prepared.

Table 3.2. Seven iso-nitrogenic and isocaloric experimental diets used in the current study

	Composition of Experimental Diets						
	C 0%	**RA10%**	**RA20%**	**RA30%**	**RA10%**	**RA20%**	**RA30%**
Maize	570.38	450.02	328.40	206.80	450.02	328.40	206.80
SBM	334.00	347.88	363.00	378.03	347.88	363.00	378.03
Acorn	0.00	100.00	200.00	300.00	100.00	200.00	300.00
Oil	56.00	62.50	69.00	75.55	62.50	69.00	75.55
$CaCo_3$	15.67	14.79	15.33	16.25	14.79	15.33	16.25
DCP	13.49	14.41	13.92	13.04	14.41	13.92	13.04
Lysine	4.17	3.95	3.75	3.57	3.95	3.75	3.57
Vit-Min	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Salt	2.00	2.00	2.10	2.26	2.00	2.10	2.26
Methionine	1.79	1.95	2.00	2.00	1.95	2.00	2.00
Total	1000	1000	1000	1000	1000	1000	1000
CP(%)	20.06	20.02	20.02	20.01	20.02	20.02	20.01
ME(kcal/kg)	3001.5	3001.7	3000.8	3000.1	3001.7	3000.8	3000.1

3.2.5. Chemical analysis of feed ingredients

Feed ingredients of diets such as a corn, soybean and maize grain were analyzed in terms of dry crude protein and ether extracts using the AOAC (1995) methods. Starch contents of feed ingredients of diets were also determined by Colorimetric method described by Dubois et al. (1956).Water soluble contents of feed ingredients of diets were also determined by method described by Nelson (1994).ME contents of maize, soybean meal and acorn were also determined by the formula suggested by (Carpenter and Clegs, 1956).

ME= (kcal/kg) 38x (1 CP + 2.25 EE + 1.1 Starch + 1.05 Sugar) + 53 Carpenter and Clegg (1956).

3.2.6. Determination of live weight and live weight gain

Daily live weights of quail chicks in all groups were weighed individually with 0.01 g precision electronic balance. Then, they were individually weighed and their weekly live weights were determined. Live weight gain per week was calculated by subtracting the weighing one week before the first week and the next week.

3.2.7. Determination of characteristics of feed consumption

All groups were fed every day from the outlet and the weight was determined by weighing the given feed with a 1g precision balance. On a weekly basis, the feed in each group's bowl was weighed and removed from the feed total given to that group during the week. Thus, weekly feed consumption of the groups was determined.

At the end of the experiment, cumulative feed utilization rates of weekly and six weeks of age were determined by using weekly weight gain value and feed consumption values obtained at group level. The weekly and six-week total feed conversion rates were calculated using the following formula below.

Feed Conversion Rate =(Feed Intake (g) /Weight Gain (g)) (Şenköylü, 2001).

3.2.8. Determination of mortality rates

Deaths were recorded daily in all groups during the study. At the end of each week, the total number of quails per week was determined and the number of quails per week was measured by the number of quails in the cage and the mortality rate was calculated.

3.2.9. Cutting and plucking

At the end of the six-week trial, each group and gender of each group and gender were to be collected. The quail of the quail slaughtered in the quail was plucked. After the extraction process, the carcass characteristics were determined.

3.2.10. Determination of liver heart and gizzard weights of trial quails

At the end of the study, a total of 42 quails (3 male and 3 female) from each trial group, liver, heart and gizzards were taken separately and weighed in the sensitive balance.

3.2.11. Determination of carcass characteristics

At the end of the experiment, the hot carcasses of the slaughtered animals were kept in a temperature of +4 ° C for one day and then weighed in the sensitive balance to determine the cold carcass weights.

3.2.12. Test material analysis of quail's meat.

The carcasses of the research quails were kept at +4 C degree in a cold store for one day and then all carcasses were subjected to the mincing process and then homogenized by mixing well in the mixer. Chemical analyzes (% crude protein. crude oil. dry matter and raw ash) were carried out in the samples taken from the homogenous quail meats.

3.2.13. Analysis of dry matter in meat

In order to determine the amount of dry matter in the meat, the test material was weighed in 3 replicates of 5 gram aluminum containers and placed in the oven and kept in the oven for 10 minutes. Then the weighing containers in the oven were taken to the desiccators for cooling.

The samples taken from the desiccators were weighed on the sensitive scale. After weighing with the previous weighing, the weight values were calculated by substituting the weighing values in the formulas given below (AOAC, 1990).

% CM = 100% humidity

% Humidity = ((A-D) - (A2 - D)) / A * 100

DM: Dry matter%

A: the amount of meat, grams

A1: amount of meat + tare of the container, grams

D: tar of the container, grams

A2: dry matter + container tare, grams

Determination of Dry Matter Contents (AOAC, 1990)

3.2.14. Analysis of raw ash in test meat

The porcelain crucibles were left empty for 2 hours in a 550 ^{o}C raw ash furnace and then allowed to cool to room temperature until desiccators was reached. 2 grams of meat (A) was placed into the crucible (D) which was tarred in the sensitive balance (A) and placed in the raw ash furnace and burned at 550 ° C for 8 hours. The muffins taken from the ash oven cooled down to a certain temperature were cooled to room temperature in the desiccators and re-weighed (A2). Previous and subsequent weighing values were obtained by substituting the formula for raw ash content of the meat (AOAC, 1990).

% DM = ((A1 - D) - (A2 - D)) i A x 100

A: the amount of meat, grams

A1: amount of meat + tare of the container, grams

A2: final weighing

D: tar of the container, grams

RA: crude ash%

Ash is an inorganic part of the dry matter, which carbon does not contribute in the composition including minerals and inorganic salts in the dry matter and remain in feed material after placed in the burning oven temperature of 525 ° C for 8 hour. Organic matter is the non-metallic part of the dry matter which carbon contributes in chemical structure. However, it turns to carbon oxides and water vapor by burning at high temperatures of about 525 ^{o}C and completely lost it consists of proteins, fats and carbohydrates.

The crucible containers were burn at 525 ^{o}C and cooled in desiccators then weighted; approximately 1-2g from dried leave samples were weighted in containers and placed in a burning oven then heated to 525 ^{o}C for 8 hours, and then the containers was removed to desiccators and cooled it to room temperature. After than removed the sample from the furnace, cooled in desiccators to a room temperature and reweighed immediately.

The weight of the residual ash was then calculated as:

Percentage Ash =

The organic matter can calculated as follows:

Organic matter %=Dry matter% - Ash% .3.2.5.3. Determination of crude protein content in meat

The crude protein content of the quail meat was analyzed according to the Kjeldahl method. According to this method, the samples of meat were burned with concentrated sulfuric acid (H_2SO_4) to form nitrogen (N) in ammonium sulphate and then to ammonia (distillation). In the final stage, the crude protein value was calculated by multiplying the nitrogen amount measured in the structure of the meat sample by the conversion coefficient. The phases of analysis of the nitrogen content of meats were as follows.

I. Incineration

0.5-1 g meat sample was weighed on a precision scale and placed in Kjeldahl l tubes. Two parallel studies and two blind tests were used in the analysis. 1 catalyst tablet and 15-25 ml H_2SO_4 were added to the incinerator to facilitate the incineration process and to prevent swellings and spills. After the tube is placed in the incinerators30 min was preheated at 200 °C. The combustion process was continued at 400 °C for 45 minutes. The burning process was terminated when the solution was greenish yellow.

II. Distillation

After placing 25 ml of 4% boric acid in the erlenmayer, the necessary chemicals and pure water of the distillation unit were checked. 50 ml of distilled water and 100 ml of NaOH were added to the Kjeldahl tube from wet burning process. The distillation time was set to 3 min and the unit was switched on. Age-incinerated tubes were subjected to individual distillation starting from blind trial. The accumulation of the nitrogen in the Kjeldahl tubes in the deposition in the erlenmeyer was continued until the pink color changed to green erlenmayer were then subjected to titration.

III. Titration

After the distillation, the samples collected in the erlenmayer were taken and titrated slowly with the 0.1 HCL solution in the digital burette until the green color in the distillate was converted to pink color. The amount of 0.1 N HCL used in this assay was replaced by the corresponding formula and the HP contents of the samples were calculated.

% HP = (Amount of HCL Used - HCL Used for Blind) x 0.1 x 1.4 x 6.25 x F x 100

Sample Quantity (M)

F = 1

K: 14.007 (Atomic weight of nitrogen) V: HCl used (ml)

N: Normality of HCl (0.1) fHCL: factor of 0.1 N HCl (1)

CP: Protein conversion factor (6.25) M: The amount of meat weighed.

Crude protein = (HCL_KHCL) *0.1 *1.4 *6.25 /sample.

3.2.15. Determination of crude fat content in meat

After weighing 2 grams (A) of the meat on the sensitive scale placed in the cartridge and the mouth of the cartridge is compressed with cotton so that the sample does not come out. Cartridges and oil flasks were then stored at 95 ^{o}C for 2 hours in a drying cabinet. Materials were taken from the drying cabinet.

The balloons which are cooled in the desiccators and which are tarred in the sensitive scale are placed in the extraction part of the Soxhlet tool (Figure 3.17). To the extraction part of the Soxhlet, the cartridges were put into the balloons with ethyl ether to make a full one half flush after 4 hours; the ether is extracted from the ether with a mixture of oil and ether. The balloons containing oil were kept in the drying cabinet at 95 ^{o}C for 1 hour, taken to the desiccators and cooled and weighed on the sensitive scale by taking the desiccators (C). The previous and next weighing values were put in the formula and the% HY oil contents of the samples were calculated.

Figure 3.13.Soxhlet extraction apparatus

Crude Fat (g \kg DM) = (A –C) /(A1)*100

3.3. Statistical Analysis

The effect of inclusion of raw and heat treated acorn on the growth parameters, feed intakes, feed conversion ratio and the chemical composition of Japanese quails were determined using analysis of variance (ANOVA). The differences among treatments were determined with Tukey multiple range test.

4. RESULT AND DISCUSION

4.1. The Effect of Inclusion on Live Body Weight of Japanese Quails

The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 2 weeks is given in 4.1. The inclusion of acorn into quail diets has no effect on the live body weight of female Japanese quails at two weeks of the experiment whereas the inclusion of acorn into quail diets has significant effect on the live body weight of male Japanese quails at two weeks of the experiment.

Table 4.1. The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 2 weeks of experiment

		Female +Male (♀♂)		
Control		9.25±0.06^{a}	32.79±1.00^{a}	74.93±3.10^{a}
Raw Acorn	10%	9.30±0.08^{a}	28.05±1.05^{b}	57.16±2.94^{b}
	20%	9.32±0.04^{a}	25.35±1.34^{c}	49.51±2.33b^{c}
	30%	9.31±0.04^{a}	18.53±0.26^{e}	29.93±1.76^{d}
Autoclaved Acorn	10%	9.23±0.02^{a}	29.55±0.49^{b}	67.43±0.92^{a}
	20%	9.26±0.02^{a}	22.46±0.86^{d}	43.58±3.02^{c}
	30%	9.26±0.10^{a}	19.02±0.32^{e}	40.44±5.89^{c}

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 3 weeks is given in 4.2. The inclusion of acorn into quail diets has significant effect on the live body weight of female and male Japanese quails at 3 weeks of the experiment. The live body weight of female ranged from 56.66 to 142.95 g whereas the live body weight of male ranged from 58.15 to 141.87 g.

Table 4.2. The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 3 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		142.95±2.28^{a}	141.87±2.85^{ab}	142.41±1.65^{a}
Raw Acorn	10%	109.48±0.88^{cb}	118.17±9.34^{c}	113.83±4.62^{b}
	20%	86.96±5.07^{e}	92.60±12.30^{d}	89.78±6.08^{c}
	30%	58.02±5.52^{g}	58.15±0.88^{g}	58.09±2.50^{d}
Autoclaved Acorn	10%	111.52±6.80^{c}	117.87±10.47^{c}	114.70±5.76^{b}
	20%	80.22±2.62^{ef}	83.67±3.84^{ef}	81.95±2.22^{c}
	30%	56.66±3.10^{g}	66.57±3.03^{fg}	61.62±7.21^{d}
Average		92.26±6.60^{a}	96.99±6.70^{a}	94.62±4.66

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 4 weeks is given in 4.3. The inclusion of acorn into quail diets has significant effect on the live body weight of female and male Japanese quails at 4 weeks of the experiment. The live body weight of female ranged from 92.23 to 213.63 g whereas the live body weight of male ranged from 95.87 to 196.42 g.

Table 4.3. The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 4 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		213.63±3.15[a]	196.42±7.53[ab]	205.02±5.30[a]
Raw Acorn	10%	181.82±3.34[bc]	175.48±10.70[bc]	178.65±5.21[b]
	20%	142.81±5.26[d]	128.27±18.45[de]	135.54±9.18[c]
	30%	92.23±6.33[f]	95.87±0.38d[f]	94.05±2.95[d]
Autoclaved Acorn	10%	190.40±6.33[abc]	166.66±15.12[c]	178.53±9.05[b]
	20%	140.44±3.73[d]	124.50±6.54[de]	132.47±4.90[c]
	30%	97.94±0.99[f]	112.50±3.95[ef]	105.22±3.73[d]
Average		151.33±9.70[a]	142.81±8.36[b]	147.07±6.36

[abcd..]: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 5 weeks is given in 4.4. The inclusion of acorn into quail diets has significant effect on the live body weight of female and male Japanese quails at 5 weeks of the experiment. The live body weight of female ranged from 129.95 to 277.00 g whereas the live body weight of male ranged from 122.13 to 249.55 g.

Table 4.4. The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 5 week of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		277.00±6.71[a]	249.55±1.30[b]	263.28±6.86[a]
Raw Acorn	10%	244.97±7.66[bc]	231.59±3.88[bc]	238.28±4.87[b]
	20%	195.14±5.18[d]	166.28±19.83[e]	180.71±11.21[c]
	30%	129.95±7.18[g]	122.13±7.95[g]	126.04±5.10[e]
Autoclaved Acorn	10%	246.47±7.46[bc]	229.9±9.37[c]	238.18±6.51[b]
	20%	199.12±6.72[d]	176.19±9.79[de]	187.66±7.38[c]
	30%	138.31±9.31[fg]	158.81±6.40[ef]	148.56±6.82[d]
Average		204.42±11.79[a]	190.64±10.21[b]	197.53±7.78

[abcd..]: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the live body weight of Japanese quails at 6 weeks is given in 4.5. The inclusion of acorn into quail diets has significant effect on the live body weight of female and male Japanese quails at 6 weeks of the experiment. The live body weight of female ranged from 178.7 to 328.99 g whereas the live body weight of male ranged from 175.82 to 279.8 g.

Table 4.5 The effect of raw and autoclaved acorn on the live bodyweight of Japanesequails at 6weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		328.99±4.35^{a}	279.8±3.63^{bcd}	304.4±11.29^{a}
Raw Acorn	10%	292.04±14.43^{bc}	268.77±1.27^{cde}	280.41±8.31^{b}
	20%	250.75±13.70^{ef}	215.79±19.94^{gh}	233.27±13.35^{c}
	30%	178.7±2.10^{i}	175.82±7.11^{i}	177.26±3.38^{e}
Autoclaved Acorn	10%	303.99±6.63^{ab}	269.46±9.15^{cde}	286.73±9.23^{ab}
	20%	260.76±5.83^{de}	230.99±7.16^{fg}	245.88±7.83^{c}
	30%	200.30±4.10^{hi}	220.56±4.48^{gh}	210.43±5.28^{d}
Average		259.36±11.65^{b}	237.31±8.29^{b}	248.34±7.27

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the live body weight of Japanese quails for 6 weeks experimental period is given in 4.5. The inclusion of acorn into quail diets has significant effect on the live body weight of female and male Japanese quails at 6 weeks of the experiment. The live body weight of female ranged from 225.05 to 335.95 g whereas the live body weight of male ranged from 192.13 to 285.52 g.As can seen from Table 4.6, the live bodyweight decreased with increasing level of acorn in the quail diets. The decrease in live body weight is possibly associated with decrease in feed intake of quails. Similar results were obtained with Midilli et al. (2008)

Table 4.6. The effect of raw and autoclaved acorn on the live bodyweight of Japanese quails for 6 weeks experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		335.95±20.51	285.52±12.50	310.74±15.57^{a}
Raw Acorn	10%	339.86±0.97	276.45±11.68	308.16±15.12^{a}
	20%	286.21±15.38	238.17±31.39	262.19±18.97^{b}
	30%	225.05±19.36	192.13±20.09	208.59±14.49^{c}
Autoclaved Acorn	10%	312.06±12.90	297.80±5.11	304.93±6.98^{a}
	20%	288.18±0.41	241.55±10.89	264.87±11.51^{b}
	30%	251.56±29.85	241.43±6.35	246.50±13.83^{b}

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The live body weight of Japanese quails for six week is given in Figure 4.1. As can be seen, the live body weight of Japanese quails was significantly lower than those obtained in groups fed diets including raw and autoclaved acorn.

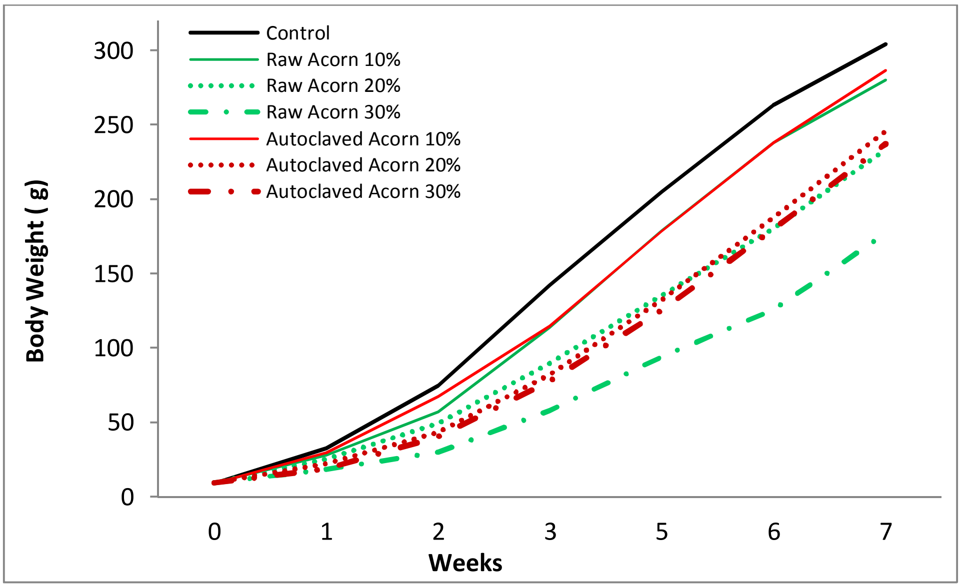

Figure4.1. Weekly live body weight data of this experiment

4.2. The Effect of Inclusion on Body Weight Gain of Japanese Quails

The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 3 week age is given in Table 4.7. The inclusion of acorn into quail diets has significant effect on the body weight gain of female and male Japanese quails at 3 week of the experiment. The body weight gain of female ranged from 9.21 to 23.55 g whereas the body weight gain of male ranged from 11.40 to 42.15 g.

Table 4.7. The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 3 week of experiment

		Female +Male (♀♂)		
Control		23.55±0.96a	42.15±2.29^{a}	68.02±0.89a
Raw Acorn	10%	18.75±0.98^{b}	29.11±1.89^{b}	52.32±3.37^{b}
	20%	16.03±1.35^{c}	24.16±2.27^{b}	37.44±3.63^{bcd}
	30%	9.21±0.31^{e}	11.40±1.80^{c}	28.09±4.09^{d}
Autoclaved Acorn	10%	20.32±0.47^{b}	37.88±0.46^{a}	44.08±7.41^{bc}
	20%	13.20±0.86^{d}	21.12±2.35^{b}	36.64±5.53^{cd}
	30%	9.76±0.38^{e}	21.42±5.76^{b}	31.67±5.55^{cd}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 4 week age is given in Table 4.8. The inclusion of acorn into quail diets has significant effect on the body weight gain of female and male Japanese quails at 4 weeks of the experiment. The body weight gain of female ranged from 34.21 to 72.34 g whereas the body weight gain of male ranged from 37.72 to 57.31 g.

Table 4.8. The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 4 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		70.68±1.41^{abc}	54.54±9.71^{def}	62.61±5.68^{a}
Raw Acorn	10%	72.34±2.74^{ab}	57.31±5.10^{bcde}	64.82±4.24^{a}
	20%	55.86±0.88^{cdef}	35.68±6.16^{g}	45.77±5.30^{bc}
	30%	34.21±1.08^{g}	37.72±0.65^{g}	35.97±0.97^{c}
Autoclaved Acorn	10%	78.88±1.66^{a}	48.79±7.47^{defg}	63.84±7.55^{a}
	20%	60.22±1.52^{bcd}	40.83±10.36^{fg}	50.52±6.38^{b}
	30%	41.28±2.11^{efg}	54.69±1.69^{defg}	43.60±1.59^{bc}
Average		59.07±3.48^{a}	45.83±2.75^{a}	52.45±2.42

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 5 weeks age is given in Table 4.9. The inclusion of acorn into quail diets has significant effect on the body weight gain of female and male Japanese quails at 5 weeks of the experiment. The body weight gain of female ranged from 37.72 to 63.38 g whereas the body weight gain of male ranged from 26.26 to 63.24 g.

Table 4.9. The effect of raw and autoclaved acorn on the body weight gain of Japanese quails of 5 weeks of experiment.

		Female (♀)	Male (♂)	Average (♀♂)
Control		63.38±7.01^{a}	53.13±7.26^{ab}	58.26±5.06^{a}
Raw Acorn	10%	63.15±7.84^{a}	56.11±6.88^{ab}	59.63±4.92^{a}
	20%	52.33±4.99^{ab}	48.01±11.10^{ab}	45.17±3.97^{ab}
	30%	37.72±11.13^{ab}	26.26±8.27^{b}	31.99±6.71^{b}
Autoclaved Acorn	10%	56.07±1.71^{ab}	63.24±23.92^{a}	59.65±10.85^{a}
	20%	58.68±3.02^{a}	51.69±5.27^{ab}	55.19±3.13^{a}
	30%	40.69±10.28^{ab}	46.31±6.53^{ab}	43.34±5.61^{ab}
Average		53.10±3.16	47.82±4.26^{a}	50.46±2.65

$^{abcd..}$: Column mean with same superscript t are not different (p>0.05).

The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 6 weeks age is given in Table 4.10. The inclusion of acorn into quail diets has significant effect on the body weight gain of female and male Japanese quails at 6 weeks of the experiment. The body weight gain of female ranged from 47.08 to 62.00 g whereas the body weight gain of male ranged from 30.25 to 61.75 g.

Table 4.10. The effect of raw and autoclaved acorn on the body weight gain of Japanese quails at 6 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		51.99±3.14^{abc}	30.25±4.55^{e}	41.12±5.45^{d}
Raw Acorn	10%	47.08±6.87^{bcd}	37.19±4.24^{de}	42.13±4.23^{cd}
	20%	55.61±8.55^{ab}	49.51±2.12^{abc}	52.56±4.17^{ab}
	30%	48.75±5.41^{abc}	53.69±2.84^{abc}	51.22±2.95^{bc}
Autoclaved Acorn	10%	57.52±1.55^{ab}	39.56±0.74^{cde}	48.54±4.09^{bcd}
	20%	61.64±0.90^{ab}	54.80±4.06^{ab}	58.22±2.41^{ab}
	30%	62.00±5.21^{a}	61.75±3.50^{ab}	61.88±2.81^{a}
Average		54.94±2.05	46.68±2.57	50.81±1.75

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the total body weight gain of Japanese quails for 6 weeks experimental period is given in Table 4.11. The inclusion of acorn into quail diets has significant effect on the body weight gain of female and male Japanese quails for 6 weeks experimental period. The body weight gain of female ranged from 169.39 to 319.75 g whereas the body weight gain of male ranged from 166.50 to 270.55 g. As can seen from Table 4.11, the body weight gain decreased with increasing level of acorn in the quail diets. The decrease in body weight gain is possibly associated with decrease in feed intake of quails. Similar results were obtained with Midilli et al. (2008)

Table 4.11. The effect of raw and autoclaved acorn on the total body weight gain of Japanese quails

		Female (♀)	Male (♂)	Average (♀♂)
Control		319.75±4.30^{a}	270.55±3.57^{bcd}	295.15±11.28^{a}
Raw Acorn	10%	282.74±14.49^{bc}	259.47±1.34^{cde}	271.11±8.33^{b}
	20%	241.43±13.67^{ef}	206.47±19.91^{gh}	223.95±13.33^{c}
	30%	169.39±2.10^{i}	166.50±7.10^{i}	167.95±3.38^{e}
Autoclaved Acorn	10%	294.76±6.63^{ab}	260.23±9.15^{cde}	277.509±23^{ab}
	20%	251.51±5.85^{de}	221.73±7.16^{fg}	236.62±7.84^{c}
	30%	191.04±4.09^{hi}	211.30±4.51^{gh}	201.17±5.29^{d}
Average		250.09±11.66	228.04±8.30^{b}	239.06±7.27

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

4.3. The Effect of Inclusion of Raw and Autoclaved Acorn on the Feed Intake

The effect of raw and autoclaved acorn on the feed intake of Japanese quails at 3 weeks age is given in Table 4.12. The inclusion of acorn into quail diets has significant effect on the feed intake of female and male Japanese quails at 3 weeks of the experiment.

The feed intake of female ranged from 18.43 to 69.87 g whereas the feed intake of male ranged from 40.21 to 79.49 g.

Table 4.12. The effect of raw and autoclaved acorn on the feed intake of Japanese quail at 3 weeks of experiment

		Female + Male(♀♂)		
Control		39.07±2.55^{b}	78.70±3.61^{a}	140.83±5.83^{a}
Raw Acorn	10%	18.43±0.68^{d}	79.49±2.89^{a}	129.87±2.28^{a}
	20%	30.10±1.00^{c}	67.81±3.71^{a}	80.06±4.60^{c}
	30%	69.87±5.13^{a}	40.21±6.72^{b}	72.35±4.75^{c}
Autoclaved Acorn	10%	39.00±0.50^{b}	80.00±0.00^{a}	106.49±8.99^{b}
	20%	27.43±1.56^{c}	48.22±6.59^{b}	100.13±3.95^{b}
	30%	20.07±0.98^{d}	41.24±2.81^{b}	100.27±6.64^{b}

[abcd..]: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the feed intake of Japanese quails at 4 weeks age is given in Table 4.13.

Table 4.13. The effect of raw and autoclaved acorn on the feed intake of Japanese quail at 4 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		160.81±8.25^{abc}	169.68±18.41^{ab}	165.24±9.24^{a}
Raw Acorn	10%	180.86±21.25^{a}	141.04±4.90^{bcd}	160.95±13.20^{a}
	20%	132.31±1.70^{cd}	159.30±19.70^{abc}	145.81±10.70^{ab}
	30%	80.68±9.34^{e}	90.00±8.08^{e}	85.34±5.91^{d}
Autoclaved Acorn	10%	128.70±10.65^{cd}	140.01±8.37^{bcd}	134.36±6.57^{bc}
	20%	110.87±4.3^{de}	116.28±7.62^{de}	113.58±4.10^{c}
	30%	88.37±5.86^{e}	86.67±3.92^{e}	87.52±3.17^{d}
Average		126.09±8.25^{a}	129.00±7.67^{a}	127.54±5.57

[abcd..]: Column mean with same superscript are not different ($p>0.05$).

The inclusion of acorn into quail diets has significant effect on the feed intake of female and male Japanese quails at 4 weeks of the experiment. The feed intake of female ranged from 80.68 to 160.81 g whereas the feed intake of male ranged from 90.00 to 169.68 g.

The effect of raw and autoclaved acorn on the feed intake of Japanese quails at 5 weeks age is given in Table 4.14. The inclusion of acorn into quail diets has significant effect on the feed intake of female and male Japanese quails at 5 weeks of the experiment. The feed intake of female ranged from 142.14 to 219.63 g whereas the feed intake of male ranged from 158.60 to 233.23 g.

Table 4.14. The effect of raw and autoclaved acorn on the feed intake of Japanese quail at 5 week of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		219.63 ± 9.06^{abc}	217.29 ± 10.93^{abc}	218.46 ± 6.37^{a}
Raw Acorn	10%	222.43 ± 4.64^{ab}	204.51 ± 0.25^{abcde}	213.47 ± 4.52^{a}
	20%	178.63 ± 15.31^{bcdef}	160.00 ± 14.93^{def}	169.32 ± 10.43^{b}
	30%	142.14 ± 15.64^{ef}	158.60 ± 25.54^{def}	150.37 ± 13.89^{b}
Autoclaved Acorn	10%	218.92 ± 20.18^{abe}	233.23 ± 29.66^{a}	226.08 ± 16.3^{a}
	20%	191.44 ± 8.82^{abcde}	170.38 ± 12.36^{cdef}	180.91 ± 8.26^{b}
	30%	75.52 ± 5.85^{g}	136.30 ± 12.52^{f}	105.91 ± 14.93^{c}
Average		178.39 ± 11.82	182.90 ± 9.26	180.64 ± 7.42

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on the feed intake of Japanese quails at 6 weeks age is given in Table 4.15. The inclusion of acorn into quail diets has significant effect on the feed intake of female and male Japanese quails at 6 weeks of the experiment. The feed intake of female ranged from 156.93 to 247.68 g whereas the feed intake of male ranged from 158.73 to 228.97 g.

Table 4.15. The effect of raw and autoclaved acorn on the feed intake of Japanese quail at 6 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		226.44 ± 3.03^{ab}	221.29 ± 9.12^{abc}	223.87 ± 4.45^{a}
Raw Acorn	10%	220.22 ± 12.92^{abc}	215.74 ± 8.44^{abc}	217.98 ± 6.98^{a}
	20%	208.72 ± 16.24^{bc}	226.07 ± 6.26^{ab}	217.40 ± 8.70^{a}
	30%	156.93 ± 10.99^{cd}	158.73 ± 15.71^{cd}	157.83 ± 8.58^{b}
Autoclaved Acorn	10%	247.68 ± 43.80^{a}	169.02 ± 35.05^{bc}	208.35 ± 30.64^{a}
	20%	203.44 ± 21.66^{abc}	196.03 ± 19.86^{abc}	199.74 ± 13.25^{a}
	30%	167.17 ± 4.94^{bc}	228.97 ± 11.25^{ab}	198.07 ± 14.87^{a}
Average		204.37 ± 9.34	202.26 ± 8.12	203.32 ± 6.12

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on total feed intake of Japanese quails for 6 weeks of experiment is given in Table 4.16. The inclusion of acorn into quail diets has significant effect on the feed intake of female and male Japanese quails for 6 weeks of experiment. The feed intake of female ranged from 492.65 to 865.48 g whereas the feed intake of male ranged from 538.32 to 866.86 g. As can been from Table 4.16 there is a significant decrease in feed intake of quails fed acorn containing diets. The decrease in feed intake is possible associated with decrease in the palatability of diets containing acorn., It is well known that acorn contains tannin which would complex with nutrients and decreased the availability of nutrients. Tannin in feedstuffs also decreased the palatability. Therefore decrease in the feed intake of quails fed acorn containing diet is inevitable. As mentioned before, the decrease in feed intake of quails fed acorn containing diet was observed in the current experiment. Heat treatment of acorn used in quail diets would not prevent the decrease in feed intake and body weight gain of Japanese quail. Therefore the other way of preventing of decreased feed intake and body weight gain should be applied.

Table 4.16.The effect of raw and autoclaved acorn on the feed consumption of Japanese quail for 6 weeks of experiment.

		Female (♀)	Male (♂)	Average (♀♂)
Control		865.48±23.05[a]	866.86±20.96[a]	866.17±13.93[a]
Raw Acorn	10%	851.30±20.42[a]	805.05±6.11[ab]	828.18±14.07[ab]
	20%	697.64±12.00[cde]	723.34±31.31[bcd]	710.49±16.06[c]
	30%	562.17±37.62[fgh]	538.32±40.20[gh]	550.25±25.20[d]
Autoclaved Acorn	10%	820.80±55.59[ab]	767.75±55.50[abc]	794.28±37.08[b]
	20%	681.53±26.57[cde]	658.47±35.55[def]	670.00±20.51[c]
	30%	492.65±14.31[h]	613.52±15.95[efg]	553.08±28.68[d]
Average		710.22±31.57	710.47±25.90	710.35±20.17

[abcd..]: Column mean with same superscript are not different (p>0.05).

4.4. The Effect of Inclusion of Raw And Autoclaved Acorn on Feed Conversion Ratio

The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 3 weeks age is given in Table 4.17. The inclusion of acorn into quail diets has significant effect on the feed conversion ratio of female and male Japanese quails at 3 weeks of the experiment. The feed conversion ratio of female ranged from 1.66 to 2.09 g whereas the feed intake of male ranged from 1.89 to 3.78 g.

Table4.17. The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 3 weeks experimental period

		Female + Male (♀♂)		
Control		1.66±0.06[b]	1.89±0.19[a]	2.07±0.06[b]
Raw Acorn	10%	1.84±0.09[ab]	2.76±0.25[a]	2.50±0.16[ab]
	20%	1.91±0.20[ab]	2.87±0.36[a]	2.16±0.14[ab]
	30%	2.00±0.11[ab]	3.78±1.08[a]	2.64±0.23[ab]
Autoclaved Acorn	10%	1.92±0.03[ab]	2.11±0.03[a]	2.57±0.54[ab]
	20%	2.09±0.11[a]	2.39±0.57[a]	2.85±0.40[ab]
	30%	2.05±0.07[a]	2.44±0.96[a]	3.42±0.72[a]

[abcd..]: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 4 weeks age is given in Table 4.18. The inclusion of acorn into quail diets has significant effect on the feed conversion ratio of female and male Japanese quails at 4 weeks of the experiment. The feed conversion ratio of female ranged from 1.64 to 2.28 g whereas the feed intake of male ranged from 1.89 to 3.38 g.

Table 4.18. The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 4 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		2.28 ± 0.14^{bc}	3.38 ± 0.88^{b}	2.83 ± 0.47^{ab}
Raw Acorn	10%	2.52 ± 0.38^{bc}	2.50 ± 0.24^{bc}	2.51 ± 0.20^{b}
	20%	2.37 ± 0.06^{bc}	4.59 ± 0.55^{a}	3.48 ± 0.55^{a}
	30%	2.35 ± 0.20^{bc}	2.38 ± 0.20^{bc}	2.37 ± 0.13^{b}
Autoclaved Acorn	10%	1.64 ± 0.17^{c}	2.98 ± 0.37^{bc}	2.31 ± 0.35^{b}
	20%	1.85 ± 0.11^{c}	3.29 ± 0.87^{b}	2.57 ± 0.51^{b}
	30%	2.16 ± 0.21^{bc}	1.89 ± 0.03^{c}	2.02 ± 0.11^{b}
Average		2.17 ± 0.09	3.00 ± 0.25	2.58 ± 0.15

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 5 weeks age is given in Table 4.19. The inclusion of acorn into quail diets has significant effect on the feed conversion ratio of female and male Japanese quails at 5 weeks of the experiment. The feed conversion ratio of female ranged from 2.15 to 3.90 g whereas the feed intake of male ranged from 3.04 to 6.99 g.

Table4.19.The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 5 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		3.52 ± 0.26^{abc}	4.18 ± 0.33^{abc}	3.85 ± 0.24^{ab}
Raw Acorn	10%	3.64 ± 0.51^{abc}	3.77 ± 0.52^{abc}	3.71 ± 0.33^{ab}
	20%	3.43 ± 0.20^{bc}	4.26 ± 0.59^{ab}	3.84 ± 0.33^{ab}
	30%	5.09 ± 2.37^{ab}	6.99 ± 2.07^{a}	6.04 ± 1.47^{a}
Autoclaved Acorn	10%	3.90 ± 0.32^{abc}	5.13 ± 1.99^{ab}	4.52 ± 0.94^{ab}
	20%	3.29 ± 0.25^{bc}	3.32 ± 0.10^{bc}	3.30 ± 0.12^{b}
	30%	2.15 ± 0.54^{c}	3.04 ± 0.40^{bc}	2.59 ± 0.36^{b}
Average		3.57 ± 0.35	4.38 ± 0.46	3.98 ± 0.29

$^{abcd..}$: Column mean with same superscript are not different ($p>0.05$).

The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails at 6 weeks age is given in Table 4.20. The inclusion of acorn into quail diets has significant effect on the feed conversion ratio of female and male Japanese quails at 6 weeks of the experiment. The feed conversion ratio of female ranged from 2.74 to 5.01 g whereas the feed intake of male ranged from 2.97 to 7.63 g.

Table 4.20. The effect of raw and autoclaved acorn on the feed conversation ratio of Japanese quails at 6 weeks of experiment

		Female (♀)	Male (♂)	Average (♀♂)
Control		4.40±0.32^{bcd}	7.63±1.07^{a}	6.01±0.88^{a}
Raw Acorn	10%	5.01±1.16^{bc}	5.92±0.51^{ab}	5.47±0.60^{ab}
	20%	4.05±0.99^{bcd}	4.59±0.31^{bc}	4.32±0.48^{bc}
	30%	3.28±0.30^{cd}	2.97±0.34^{cd}	3.13±0.21^{c}
Autoclaved Acorn	10%	4.30±0.71^{bcd}	4.30±0.93^{bcd}	4.30±0.52^{bc}
	20%	3.30±0.35^{cd}	3.67±0.65^{cd}	3.49±0.34^{c}
	30%	2.74±0.28^{d}	3.71±0.05^{cd}	3.23±0.25^{c}
Average		3.87±0.27	4.68±0.39	4.28±0.24

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

The effect of raw and autoclaved acorn on the feed conversion ratio of Japanese quails for 6 weeks experimental period is given in Table 4.21. The inclusion of acorn into quail diets has significant effect on the feed conversion ratio of female and male Japanese quails for 6 weeks experimental period. The feed conversion ratio of female ranged from 2.70 to 3.32 g whereas the feed intake of male ranged from 2.91 to 3.57 g.

Table 4.21. The effect of raw and autoclaved acorn on the feed conversation ratio of Japanese quails for 6 weeks experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		2.70±0.05^{bc}	3.21±0.12^{ab}	2.96±0.13^{ab}
Raw Acorn	10%	3. 02±0.15^{abc}	3.10±0.02^{abc}	3.06±0.07^{ab}
	20%	2.91±0.22^{bc}	3.57±0.39^{a}	3.24±0.25^{a}
	30%	3.32±0.24^{ab}	3.23±0.20^{ab}	3.28±0.14^{a}
Autoclaved Acorn	10%	2.78±0.13^{bc}	2.97±0.32^{abc}	2.88±0.16^{ab}
	20%	2.71±0.12^{bc}	2.97±0.17^{abc}	2.84±0.11^{ab}
	30%	2.58±0.07^{c}	2.91±0.13^{bc}	2.75±0.10^{b}
Average		2.86±0.07	3.14±0.09	3.00±0.06

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

It has been calculated that differences between quail groups according to food conversion ratio were found to be statistically insignificant (p>0.05) for the third, fourth, fifth and sixth weeks, while it was found significant for other week (p<0.05) .The best food conversion ratio was observed from first group which is control group. However, the worse food consumption was observed from fourth group and 7 groups which are received the highest amount of raw acorns and heat treat acorns in their diets. These result obtained in the current study was identical with Midilli et al.,(2008) which gave dietary inclusion of 50, 100, 150 and 200 g/kg acorn and stated that used acorns energy source had no deleterious effect on body weight gain,feed intake and feed conversion ratio of Japanese quail .

4.5. The Effect of Raw And Autoclaved Acorn on The Mortality Rate of Japanese Quails

The effect of raw and autoclaved acorn on the mortality rate of Japanese quails for 6 weeks experimental period is given in Table 22. The mortality rate of Japanese quails increased with increasing level of acorn into diet. This result is in agreement with findings of Cerit (1997),İpek et al. (2003),and Sarıca(1998). Similar effect has been also reported for broiler growth (Ibrahim et al., 1988,Nyachoti et al., 1996.Trevino et al., 1992; Vilarino et al., 2009; Mahmood et al., 2008).

Table 4.22. The effect of raw and autoclaved acorn on the mortality rate of Japanese quails for 6 weeks experimental period

Female+ Male (♀♂)								
Weeks		Week1	Week2	Week3	Week4	Week5	Week6	Total
Control		1.666	1.666	-	3.333	-	-	6.665
Raw Acorn	10	-		6.666	-	1.666	1.666	9.998
	20	-	1.666	-	-	3.333	3.333	8.332
	30	-	6.666	1.666	-	3.333	-	11.665
Autoclaved Acorn	10	-	1.666	1.666	1.666	8.333	-	13.331
	20	-	-	1.666	1.666	-	-	3.332
	30	3.333	3.333	5.000	-	1.666	5.000	18.332

4.6. The Effect of Raw And Autoclaved Acorn on The Carcass Weight of Japanese Quails

The carcass weights of quails are presented in Table 4.23. In both raw and heated acorn added diets. 30% acorn addition caused lower carcass weights (149 and 180 g; $p<0.01$). The highest carcass weights were observed in 10% of both raw and heated acorn diets. Again, 10 percentages of increments resulted linear reductions in carcass weights and may be reflected by lower feed intakes (Rezaei and Semnaninejad, 2016).

Table4.23.The effect of raw and autoclaved acorn on the carcass weight of Japanese quails for 6 week experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		254.23±5.45	226.77±15.81	240.50±9.68^{a}
Raw Acorn	10%	236.97±10.15	214.98±14.34	225.97±9.27^{ab}
	20%	215.56±14.23	185.67±26.43	200.61±15.00^{bc}
	30%	163.47±14.95	134.90±15.71	149.19±11.61^{d}
Autoclaved Acorn	10%	228.03±3.78	226.30±8.00	227.16±3.98^{ab}
	20%	207.61±4.50	193.16±10.03	200.39±5.88^{bc}
	30%	178.71±18.55	182.23±1.90	180.47±8.37^{c}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

Based on the data presented here in. heat treatment of acorn did not do anything for eliminating the anti-nutritious substances of the acorn. Digestive tract of the birds may not be capable of the clear out these substances therefore; acorn supplementation in the diets of quails may be in limited amounts (not more than 10 or 20%).

4.7. The Effect of Raw And Autoclaved Acorn on The Liver Weight of Japanese Quails

Liver weights were not different between 10 and 20% acorn added diets neither with raw nor heat treatments averaging 7.5 g (refer to Table 4.24). However, 30% both raw and heated acorn addition resulted lower liver weights in quails, averaging 5 g (P<0.01). Besides lower live body weights and carcass weights, similar trend in liver weights can be explained by toxic effects of acorn at this level (30%). This result should be extended further whether or not acorn substitution may cause liver damage in birds (Varmaghani et al.,2006;RezaeiandSemnaninejad, 2016).

Table 4.24.The effect of raw and autoclaved acorn on the liver weight of Japanese quails for 6 week experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		9.48±1.24	6.64±0.89	8.06±0.93^{a}
Raw Acorn	10%	8.85±0.40	5.68±0.95	7.27±0.85^{ab}
	20%	8.91±0.87	5.35±0.67	7.13±0.93^{ab}
	30%	5.38±0.65	4.61±0.22	5.00±0.35^{c}
Autoclaved Acorn	10%	6.92±0.36	5.49±0.34	6.2±10.39^{bc}
	20%	9.11±0.52	7.57±0.76	8.34±0.54^{a}
	30%	5.65±0.74	4.83±0.69	5.24±0.49^{c}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

4.8. The Effect of Raw And Autoclaved Acorn on The Heart Weight of Japanese Quails

A linear heart weight reduction with increasing acorn addition from 10 to 30% in the diets may also be considered for cardio-vascular imbalances in the birds (Table 4.25). This could be somehow serious for health issues of birds. Therefore, acorn anti-nutritious substances may need to be investigated before feeding to poultry animals (Varmaghani et al.,2006; Rezaei and Semnaninejad, 2016).

Table4.25.The effect of raw and autoclaved acorn on the heart weight of Japanese quails for 6 week experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		3.86±0.24	3.28±0.40	3.57±0.24^{a}
Raw Acorn	10%	2.94±0.09	2.82±0.20	2.88±0.10^{b}
	20%	2.25±0.07	2.36±0.46	2.30±0.21^{c}
	30%	2.16±0.31	1.89±0.23	2.03±0.18^{c}
Autoclaved Acorn	10%	2.83±0.01	3.03±0.20	2.93±0.10^{b}
	20%	2.52±0.25	2.50±0.23	2.51±0.15^{bc}
	30%	2.02±0.22	2.58±0.20	2.30±0.18^{c}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

4.9. The Effect of Raw And Autoclaved Acorn on The Gizzard Weight of Japanese Quails

Table4.26.The effect of raw and autoclaved acorn on the gizzard weight of Japanese quails for 6 week experimental period

		Female (♀)	Male (♂)	Average (♀♂)
Control		5.43±0.61	6.36±0.06	5.90±0.35^{a}
Raw Acorn	10%	5.91±0.36	5.31±0.54	5.61±0.32^{ab}
	20%	6.55±0.88	5.42±0.58	5.99±0.53^{a}
	30%	5.66±0.29	4.93±0.56	5.30±0.32^{ab}
Autoclaved Acorn	10%	5.11±0.47	5.46±0.61	5.29±0.35^{ab}
	20%	5.51±0.21	5.63±0.37	5.57±0.19^{ab}
	30%	4.68±0.22	4.72±0.28	4.70±0.16^{b}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

4.10. The Effect of Raw And Autoclaved Acorn on The Dry Matter Content of Carcass of Japanese Quails

Dry matter contents of the raw acorn containing diets were not statistically different but numerically lower as acorn addition was increase from 10 to 30% (38. 35 and 33%). However, heat treatment increased DM contents of the all acorn added diets by 2% (41. 37, and 35%). The average dry mater in autoclaves acorns %10 was more then control if we compared and dry mater was between (33 and 41), and our results it came same with Rezaei and Semnaninejad, 2016 reported that feeding broilers diets containing 100 and 200 g/kg OA significantly reduced their performance, impaired the ileal digestibility of nutrients (dry matter (DM) and crude protein (CP)) and had deleterious effects on intestinal morphology In another study, dietary inclusion of 150 g/kg OA.

Table4.27.The effect of raw and autoclaved acorn on the dry matter content of carcass of Japanese quails

		Female (♀)	Male (♂)	Average (♀♂)
Control		40.95±0.86	38.76±0.44	39.86±0.65^{ab}
Raw Acorn	10%	39.11±2.58	37.81±0.65	38.46±1.22^{abc}
	20%	34.27±1.22	34.97±1.77	34.62±0.97^{c}
	30%	33.30±1.75	33.57±0.58	33.43±0.83^{c}
Autoclaved Acorn	10%	41.37±1.83	40.63±4.17	41.00±2.04^{a}
	20%	37.01±2.74	36.96±4.33	36.98±2.29^{abc}
	30%	33.90±2.89	36.76±1.30	35.33±1.56^{bc}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

4.11. The Effect of Raw And Autoclaved Acorn on The Crude Protein Content of Carcass of Japanese Quails

Crude protein contents of the treatment diets compared to control diet did not change with acorn addition. However, every 10% of acorn addition increased CP contents of the diets by1%. Heat treatment reduced the CPs of diets by 1% and this could be explained by the loss of soluble nitrogen fractions of the acorn (Mansooriand Acamovic,2007; Bouderoua and Selselet-Attou. 2003).

Table4.28.The effect of raw and autoclaved acorn on the crude protein content of carcass of Japanese quails

		Female (♀)	Male (♂)	Average (♀♂)
Control		15.75±0.37	15.19±1.14	15.47±0.55^{c}
Raw Acorn	10%	16.37±1.38	17.32±0.35	16.85±0.67^{bc}
	20%	17.59±0.28	17.47±0.87	17.53±0.41^{ab}
	30%	19.26±0.59	18.48±0.50	18.87±0.39^{a}
Autoclaved Acorn	10%	15.89±0.59	15.95±0.94	15.92±0.50^{c}
	20%	15.51±0.67	15.99±0.62	15.75±0.42^{c}
	30%	18.39±0.49	16.98±0.32	17.69±0.41^{ab}

[abcd.,]: Column mean with same superscript are not different (p>0.0

4.12. The Effect of Raw And Autoclaved Acorn on The Crude Fat Content of Carcass of Japanese Quails

Although crude fat contents of the diets were numerically decreased as acorn was added to the diets, no statistical difference was observed in raw acorn added diets. However, heat treated acorn added diets contained statistically higher crude fat contents in both 10 and 20% additions compared to their raw counterparts (17.6 and 18.0%; P<0.01). This could be related to the effect of heat treatment on insoluble oil fractions of acorn in those treatments (diets 5 and 6). Insoluble oil fractions in raw acorn may be dissolved with heat increment (Bouderoua et.al. 2009).

Table 4.29.The effect of raw and autoclaved acorn on the crude fat content of carcass of Japanese quails

		Female (♀)	Male (♂)	Average (♀♂)
Control		11.20±1.10	14.91±2.85	13.05±1.60^{ab}
Raw Acorn	10%	12.14±1.36	11.48±2.58	11.81±1.31^{b}
	20%	16.17±1.69	8.73±2.55	12.45±2.15^{ab}
	30%	8.25±1.28	10.84±2.46	9.54±1.37^{b}
Autoclaved Acorn	10%	15.21±2.34	19.89±5.97	17.55±3.05^{a}
	20%	25.86±3.62	10.14±1.26	18.00±3.91^{a}
	30%	7.38±1.35	14.21±0.96	10.79±1.70^{b}

[abcd.,]: Column mean with same superscript are not different (p>0.05).

4.13. The Effect of Raw And Autoclaved Acorn on The Crude Ash Content of Carcass of Japanese Quail

The crude ash contents of raw and autoclave acorn ranged (2.50 to3.33 %) The crude ash contents of the all diets were not different in both female and male quails, averaging 2.8%.

Table4.30.The effect of raw and autoclaved acorn on the crude ash content of carcass of Japanese quail

		Female (♀)	Male (♂)	Average (♀♂)
Control		3.55±0.86	2.50±0.31	3.03±0.47^{a}
Raw Acorn	10%	2.98±0.21	2.58±0.14	2.78±0.14^{a}
	20%	2.41±0.61	2.85±0.37	2.63±0.33^{a}
	30%	2.07±0.34	2.59±0.51	2.33±0.30^{a}
Autoclaved Acorn	10%	2.93±0.14	2.65±0.53	2.79±0.25^{a}
	20%	2.64±0.47	3.16±0.24	2.90±0.26^{a}
	30%	3.49±0.77	2.37±0.39	2.93±0.46^{a}

$^{abcd..}$: Column mean with same superscript are not different (p>0.05).

5. CONCLUSIONS

Based on the for the six week experimental data, the inclusion of acorn into quail diets has significant effect on the live body weight, body weight gain, feed intake, feed conversion ratio, carcass weight, liver weight, heart weight and chemical composition of carcass of Japanese quails. Growth performance, feed intake and feed conversion ratio of Japanese quails impaired with increasing level of acorn inclusion. However acorn can be used into quail diets up to 10% without compromising of growth performance, feed intake and feed conversion ratio. The inclusion rate of acorn after %10 is detrimental for Japanese quails. On the other hand heat treatment by autoclaving has no positive effect on the use of acorn into quail diets. All inclusion rates of autoclaved acorn into diets of quail diets resulted in similar results obtained in inclusion rates of the raw acorn. Therefore autoclaving of acorn to use in quail diet is not effective method to improve the use of acorn in quail diets.

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Education

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1991 _1994 : Studied at Zhinhight School

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Additional Training

2002_2003 : Had successful and satisfactorily completed a short Course of computer for Microsoft office word and Excel

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1999_2012 : Worked in government office in poultry department at the Same time I worked in FAO food and agriculture Organization

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Language

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