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The Effect of adding graded levels of treated pigeon pea (*Cajanus Cajan*) seeds meal on broiler chicks' performance

اثر اضافة مستويات متدرجة من بذور اللوبيا العدسية المعالجة على اداء الدجاج اللاحم

A desertion Submitted in Partial Fulfillment of the Requirement for the Degree of BSc (Honour) In Animal Production Science and Technology

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DEDICATION

We dedicate this work to our:

Families

Fathers

Mothers

Brothers

Sisters

And Friends

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We are grateful almost to Allah who gives us the health and patience to complete this work. Our wishes to express special appreciation and gratitude to our supervisor Dr.Elhadi Mater Omer for this suggestions, guidance and good supervision during this study

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ABSTRACT

This study was conducted to evaluate the effect of adding graded levels of treated pigeon pea (Cajanus cajan) seeds meal on broiler performance. Ninety six (Ross308) one day-old broiler chicks were randomly assigned into 4 groups a control group[A] with 0% and treated groups [B],[C],[D] with Cajanus cajan 6%,8% and10%, respectively. Each group replicated three times with 8birds each.The experiment extended for 42 days. Feed intake, weight gain, and feed conversion ratio and body weight were all recorded. The weight of some internal organs [liver, Heart, Gizzard and Internal fat] were recorded after slaughtering. The results showed that there were significant difference ($p \leq 0.05$) in feed intake, weight gain, body weight and feed conversion ratio [FCR].Group C recorded feed intake [2685.8±210.87], weight gain [1363.1±61.10], body weight [1412.9±61.01] and feed conversion ratio [1.96±0.07], followed by group D in feed intake value of [2700.3±124.98], weight gain [1301.00±200.39], body weight [1350.8±200.13] and feed conversion ratio [2.09±0.23].The results showed that there were significant differences ($p \leq 0.01$) in liver weight. Group C recorded the highest value of [37.77±0.96], followed by group D [34.44±3.84]. The results showed that there was significant difference ($p \leq 0.05$) in Heart weight, group C recorded the highest value of [9.44±1.92], followed by group D [9.44±0.96]. The results showed that there were significant difference ($p \leq 0.01$) in Gizzard weight, group D recorded the highest value of [37.77±2.54], followed by group C [37.77±0.96]. The results showed that there were significant difference ($p \leq 0.05$) in Internal lipid weight, group D recorded the highest value of [28.88±5.51], followed by group C [27.22±4.81].

Keywords: Cajanus cajan; Performance; broiler; Anti nutritional factors

مستخلص البحث

اجريت هذه التجربة لتقييم اثر اضافة مستويات متدرجة من بذور اللوبيا العدسية المعالجة (مبللة) والمجروشة على اداء الدجاج اللاحم. تم استخدام ستة وتسعون كتكوت عمر يوم من سلالة (الروس 308) تم توزيع الكتاكيت عشوائياً الى اربعة مجموعات مجموعة ضابطة [أ] لم يضاف لعليقتها اللوبيا والمجموعات الثلاث الاخرى تم اضافتها. المجموعة [ب] عوملت باضافة 6% من بذور اللوبيا العدسية (مبللة) للعليقة والمجموعة [ج] عوملت باضافة8%بذور لوبيا عدسية (مبللة) للعليقة والمجموعة [د] عوملت باضافة 10%بذور لوبيا عدسية (مبللة) للعليقة. كل مجموعة تحتوي على ثلاث مكررات وكل مكرر يحتوي على ثمانية كتاكيت. استمر التجربة لمدة اثنين واربعين يوماً دون خلالها استهلاك العلف والزيادة الوزنية ووزن الجسم ومعدل التحويل الغذائي. تم وزن بعض الاعضاء الداخلية [الكبد،القلب،القانصة،الدهن الداخلي] بعد الذبح . اظهرت نتائج التحليل وجود فروق ذات دلالات احصائية($p\leq0.05$) في العلف المستهلك والزيادة الوزنية ووزن الجسم ومعدل التحويل الغذائي حيث سجلت المجموعة (ج) استهلاك علف بلغ (2685.8±210.87)، واعلى زيادة وزنية (1363.1±61.10)، ووزن الجسم بمتوسط(1412.9±61.01)، ومعدل تحويل غذائي (1.96±0.07). تليها المجموعة (د) باستهلاك علف بلغ (2700.3±124.98)، وزيادة وزنية (1301.3±200.39)، ومتوسط وزن جسم (1350.8±200.13)، ومعدل تحويل غذائي (2.09±0.23).كما اظهرت النتائج وجود فروق ذات دلالات احصائية ($p\leq0.05$) في وزن الكبد حيث سجلت المجموعة (ج)اعلى قيمة(37.77±0.96) تليها المجموعة (د) (34.44±3.84). بينما اظهرت النتائج وجود فروق ذات دلالات احصائية ($p\leq0.05$) في وزن القلب حيث سجلت المجموعة (ج) اعلى قيمة (9.44±1.92)، تليها المجموعة (د) (9.44±0.96). اظهرت النتائج وجود فروق ذات دلالات احصائية ($p\leq0.01$) في وزن القانصة حيث سجلت المجموعة (د) اعلى قيمة (37.77±2.54)، تليها المجموعة (ج) (37.77±0.96) ،كما اظهرت النتائج ايضاً وجود فروقات ذات دلالات احصائية($p\leq 0.05$) في وزن الدهن الداخلي حيث سجلت المجموعة (د) اعلى قيمة (28.88±5.51) تليها المجموعة (ج) (27.22±4.81).

كلمات مفتاحية: اللوبيا العدسية - الاداء - الدجاج اللاحم – عامل مضاد التغذية

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CHAPTER ONE

INTRODUCTION

Worldwide poultry meat and eggs Production has increased consistently year over year and this trend is expected to continue. Most increases in poultry production during the next two decades will occur in developing countries, where economic growth and urbanization are higher, household incomes as well which increase the demand for animal proteins (FAO, 2013).

The objective of Livestock and poultry industry is to provide good quality feed for the humans. Quality feeds are expensive because most of the constituent of feed materials such as soya bean, maize, fish meal and groundnut cake are utilized not only by the animals but by humans and industries as well. Competition for these items of feed (especially protein feeds such as soya bean) will increase the price and hence high cost of production of poultry products. Soya bean is an oil seed legume, high in protein (44-47 crude protein) and forms the major source of plant protein for non-ruminants mainly poultry, constituting 20-30% level of inclusion in their rations (Opara and Okorie, 2015).

In Sudan *C.cajan* is grown in about 70000 fedan yielding About 700 kg/fedan, traditionally it is grown in Northern and Central Sudan as minor crop, and is locally known as (Lubia Addasy) and consumed as boiled dry grain particular during the month of Ramadan (ICRISAT, 1993).It is now used instead of Egyptian beans and eaten with bread at the out skirts of the capital.

Traditionally Pigeon pea is grown in northern and central Sudan as minor crop, around the irrigation canals of the Gezira scheme and in western Sudan as rain fed crop (ICRISAT, 1993). Its seeds are considered non-conventional poultry feed and are available potential protein source and

resource that can avail an option or protein substitute in poultry feeding in many parts of the country (FAO, 2008).

Pigeon pea seeds contain various anti nutritional factors that can have deleterious effects depending on the animal species: hema glutinins, trypsin and chymotrypsin inhibitors, cyanoglucosides, alkaloids,oxalate, hydrogen cyanid, saponins, phytates,urease and tannins (Onwuka, 2006, Iorgyer et al., 2009; Nwoagu et al., 2010, Das et al., 2002).

Cajanus cajan contains more trypsin and chymotrypsin inhibitors than soybean seeds, and about as much as chickpeas. The anti nutritional factors of pigeon pea are responsible for the poor protein digestibility of pigeon pea in pigs, and are more detrimental to performance and feed conversion ratio than those of chickpeas, which suggests the presence of other factors than protease inhibitors (Batterham et al., 1990). Heat treatments such as cooking or extrusion reduce the amount of trypsin and chymotrypsin inhibitors and increase pigeon pea digestibility (Onwuka, 2006; Batterham et al., 1993).Pigeon pea seeds contain no appreciable amounts of condensed tannins (Singh, 1988; Dzowela et al., 1995).

All processing methods reduced the levels of total phenols in *C. cajan* to varying extent, soaked seed, and dehull of soaked seed showed lower level of phenols content to 35% and 49%, respectively. Soaking of *C. cajan* seeds reduced trypsin inhibitory effect and improved *in vitro* protein and starch digestibility(Price, et al;1980).The need for animal proteins due to rapid increase in population together with increase demand for unconventional feed stuffs encourage the use of unconventional feed stuffs.

The objective of this work is to study the effect of adding graded levels of treated pigeon pea (Cajanus Cajan) on broiler chick's performance.

CHAPTER TWO

LITERATURE REVIEW

2.1 The poultry:

Poultry is a term used for any kind of domesticated bird, captive-raised for its utility, and traditionally the word has been used to refer to wild fowl (Galliformes) and waterfowl(Anseriformes). Poultry can be defined as domestic fowls including chickens, turkeys, geese, and ducks, raised for the production of meat or eggs and the word is also used for the flesh of these birds used as food (American Heritage, 2009).

2.1.1 Classification of poultry: (Sunil, 2006)

Kingdom: Animalia

Phylum: Chordata

Class: Aves

Sub-class: Neornithes

Order: Galliformes

Family: Phasianidae

Sub family: Phasianinae

Genus: Galles

Species: G.gallus

Subspecies: G.g. domesticus

Scientific Name: Gallus gallus domesticus

2.2 Poultry farming:

Poultry farming is the raising of domesticated birds such as chickens, turkeys ,ducks, and geese, for the purpose of producing meat or eggs for food. Poultry are farmed in great numbers with chickens being the most numerous. More than 50 billion chickens are raised annually as a source of food, for both their meat and their eggs, chickens raised for eggs are usually called layers while chickens raised for meat often called broilers (Naresh, 2014).

2.2.1 Intensive and Alternative poultry farming:

According to the world watch institute, seventy four (74) percent of the worlds poultry meat, and sixty eight (68) percent of eggs are produced in ways that are described as intensive. Poultry farm alternative to intensive poultry farming is free-range farming; however, these methods of husbandry also use large flock sizes in high stocking densities. (Naresh, 2014).

2.3 Poultry nutrition:

Many factors are involved in achieving optimal (growth rate and size harvest productivity) such as breed, gender, nutrition and feed. Balanced rations provides the nutrients that best meet requirements of maintenance and for growth maintenance and repair bodily .This fact applies to all living creatures. The word nutrient refers to abroad category of organic and inorganic compounds as Carbohydrates, Proteins, Mineral …..et (Isbal,2010). The essential nutrients are carbohydrates (the source of energy), protein, fat, vitamins, minerals ,and water. Supplying enough

nutrients to meet the requirements for maximum poultry production can be difficult. (Isbal, 2010). It is not feasible economically to supply just the right amount of food to meet requirements, because some of the nutrient needs must be oversupplied to compensate for the limiting nutrients in the feed: Usually energy and essential amino acid such as lysine and Methionine .The formulation of poultry diets considers the essential nutrients of water, energy, protein, fat, vitamins and minerals in the proper amounts for successful operation. They are provided by animals and vegetable proteins, animal and vegetable fats, macro and micro minerals, vitamins premixes, and cereals (Isbal, 2010).The knowledge concerning the nutritional requirement of the birds function; (egg production or meat production) is the necessary being knowledgeable about nutritional requirement, the poultry producer and manager should consider the availability and hence the cost of appropriate feed stuffs to feed from economical point of. It is also very critical that the nutritionist know the percentage associated with each ingredient .Some feed stuffs may contain anti nutritional factors that limit their usage in poultry diets (Baker J.k., 2000).

2.4 **Pigeon pea (Cajanus cajan):**

Pigeon pea (Cajanus cajan(L.) Huth) is one of the most common tropical and subtropical legumes cultivated for its edible seeds. Pigeon pea is fast growing, hardy, widely adaptable, and drought resistant (Bekele-Tessema, 2007). Because it is drought resistance it can be considered of utmost importance for food security in regions where rain failures are prone to occur (CropTrust, 2014).

2.4.1 Classification: (National Plant Data center)

Domain: Eukaryota

Kingdom: plantae

Phylum: spermataphyta

Subphaylum: Angiopemee

Class: dicotyledonae

Order: fabales

Family: fabaceae

Subfamily: faboideae

Genus: cajanus

Species: Cajanus cajan (L)Millsp.

2.4.2 Morphology:

The fruit of Cajanus cajan is a flat, straight, pubescent, 5-9 cm long x 12-13 mm wide pods. It contains 2-9 seeds that are brown, red or black in color, small and sometimes hard coated (FAO, 2016a; Bekele-Tessema, 2007). An erect, woody, short – lived, per rental shrub, often grown as an annual, which shows considerable variation in form under different environmental and cultural conditions shows can vary in height from 2 to 12 ft(0.6-3.6m) and the spread of the branches normally ranges from less than one- quarter to more than one half of the height of the plant. The root system varies according to the type: tall upright cultivars produce long, vertical, deeply penetrating tap-roots, while spreading, bushy cultivars produce shallower more spreading roots the stems are angular hairy and branched the point on the main stem where branching begins (Daisy, 1979). Pigeon pea show great diversity in their habit growth period, and the color shape and size of the pods and seeds. Some

authorities recognize two separate varieties (i) cajanus cajan var. flavus; (ii) C.cajan ver. bicolor. The former is earlier maturing, semi-dwarf in habit and as yellow flowers and green pods, usually with 2-3 seeds (Daisy, 1979).

2.4.3 Distribution:

The origin of Cajanus cajan is either Northeastern Africa or India (Ecocrop, 2016; Van der Maesen, 1989). The center of origin of the pigeon pea has been the subject of much discussion. Some authorities consider in Indian origin. There is evidence, however, that was cultivated in Egypt before 2000bBC and many authorities consider that it may have originated in the regon between Egypt and East Africa (Daisy, 1979). Its cultivation dates back to at least 3000 years (Mallikarjuna et al., 2011; Van der Maesen, 1989). It is now a pan tropical and subtropical species particularly suited for rainfed agriculture in semi-arid areas thanks to its deep taproot, heat tolerance and fast growing habit (Mallikarjuna et al., 2011). Cajanus cajan can be found in both hemispheres from 30°N to 30°S and from sea level to an altitude of 2000 m (3000 m in Venezuela) (Ecocrop, 2016). It is very heat-tolerant and grows better in places where temperatures range from 20° to 40°C and which are deprived of frost (FAO, 2016a). In Sudan distributed in western Sudan and Algazera, middle Sudan and mean of yield about 750kg/h (Ali, 2007).

Although Pigeon pea keeps growing at temperatures close to 0°C and tall plants can survive light frost. It performs better where annual rainfall is above 625 mm but it is highly tolerant to dry periods and, where the soil is deep and well-structured; it still grows with as low as 250 to 375 mm rainfall. Pigeon pea adapted to a wide range of soils ranging from sands to heavy black clays, with variable pH however, optimum or best

pH range is within 5-7. It has low tolerance of soil salinity, but some cultivars were reported to tolerate high
(6-12 dS/m) salinity (Duke, 1983). Cajanus cajan sensitive to salt spray and water logging. Under shade, it shows reduced growth and bear thin, pale green foliage and few pods (FAO, 2016a).

2.4.4 Uses:

Pigeon peas are used for human and animals. Dry pigeon peas (seeds) are common in Indonesian and Indian cuisines. In India, pigeon peas are soaked, dried, hulled and split to prepare dhal (is a term in the India subcontinent for dried, split pulses). In Indonesia, pigeon peas are fermented with Rhizopus mould then soaked, dehulled and cooked to produce tempeh. Fermentation with Aspergillus oryza yields a sauce similar to soy sauce (Orwa et al., 2009). The pigeon pea is an important protein food in many tropical areas in India it is consumed mainly in from of dhal. In Africa and Indonesia the mature seeds are usually soaked for several hours before being pounded and fried ,or steamed ,and eaten often in the form of a puree .The fresh green seeds are a very popular vegetable, particularly in the Caribbean area, where considerable quantities are processed(Daisy,1979).

Dry peas can be ground and mixed with wheat flour in order to increase the flour protein content. Immature pods may be cooked in curries and other relishes (Orwa et al., 2009). Cajanus cajan has numerous uses in animal feeding. The leaves and pods are valuable and palatable protein-rich fodder. Leaves are sometimes used to replace alfalfa in ruminant's diets where alfalfa cannot be grown. Seed processing by-products and sometimes the seeds themselves are used as livestock feed (Phatak et al., 1993).The seeds can be fed to poultry; and mixtures of pigeon pea with maize grain were successful in animal feed in Hawaii

(Orwa et al., 2009). Plant breeders have created varieties adapted to drier conditions, more resistant to diseases and suited to different production systems and cropping cycles (Valenzuela, 2011). Since the 1990s there has been a great scope for selecting cultivars with not only higher grain yields but also higher forage yields and crude protein (Phatak et al., 1993).

2.4.5 Harvest:

In Sudan seeds are harvested manually where the plant in cut left to dry then seeds harvested. Seeds yield is amounted in Sudan to about ton/hectare (Ali, 2007).

Pod harvest can be done by hand-picking over a long period in gardens and hedge crops. The harvest begins when about 75% of the pods have turned brown. In small farms, the plant is traditionally cut at the base with a sickle. It is possible to use a Combine-harvester if the plants have matured uniformly and the pods are at a uniform level above the ground (CIMMYT, 2011; Van der Maesen, 1989). The cut branches are dried on the field or tied in bundles which are stacked upright in order to dry, and then threshed with wooden flails, by cattle trampling or with a threshing machine (FAO, 2016a; Singh et al., 1992).

Another harvesting method consists in hand-picking pods once, then letting the plant regrow, and hand-picking a second time and sometimes a third time if the quantities of pods make the practice profitable (Singh et al., 1992). If hand-picking is not possible, it is advised to cut the upper parts of the stems bearing the mature pods and let enough foliage so that the plant can regrow (Singh et al., 1992). In Colombia, pigeon peas are cultivated for feed but once for beans and once for forage: during the first year, the peas are used for poultry rations, they are cut at 0.5 m high and,

in the second year, they are cut at 1 m high and cattle are then allowed to browse the forage re growth (FAO, 2016a).

2.5 The Effect of soaked Cajanus Cajan on broiler chick's performance:

In one study conducted to investigate the effect of feeding four levels of soaked *C. cajan* seeds (SCCs) on broilers performance. The diets were formulated to contain four levels of soaked *C. cajan* seeds (0, 50, 100, 150 g/kg). Tannin and trypsin inhibitor levels in seeds were determined as 0.08% and 0.68 mg/g, respectively. 200 unsexed day old broiler chicks were used for six weeks. Birds were distributed randomly into 4 dietary treatments with 5 replicates (10 birds/replicate) in a complete randomized design. Results revealed that, dietary inclusion of different levels of soaked *C. cajan* seeds had no significant effect ($P>0.05$) on feed intake, energy intake, live weight dressing percentage, pancreas and spleen weight, serum cholesterol and protein efficiency ratio. However, inclusion of 100 g/kg dietary soaked *C. cajan* seeds significantly ($P<0.05$) increased overall feed intake, serum total lipids, cholesterol, protein, methionine, lysine intake, and had a better feed conversion ratio (FCR) and cost of production (Babiker, et al; 2006).

In another study the experiment was conducted to assess the effect of feeding different processed pigeon pea seeds on broilers performance. Four isocaloric and iso-nitrogenous diets containing (10%) of soaked pigeon pea seeds, decorticated with added enzyme (multi enzymes with high content of pentosanase), decorticated roasted and control diet were formulated. Parameters measured weekly were feed intake, body weight gain and Feed Conversion Ratio (FCR). Overall body weight, hot carcass weight and dressing percentage were recorded. Results revealed that inclusion of 10% soaked pigeon pea seed, decorticated with added

enzyme (multi enzyme with a high content of pentosanase) and decorticated roasted had no significant ($p>0.05$) effects on feed intake, weight gain, feed conversion ratio, final live body weight, hot carcass weight and dressing percentage. Inclusion of 10% processed pigeon pea seeds resulted in a similar performance of broiler chicks when compared with the control group (Khadiga, et al; 2009).

2.6 The Effect of pigeon pea on broiler chicks' performance:

A study was conducted to evaluate the nutritive value of decorticated pigeon pea *(Cajanus Cajan)* seeds as plant protein source and to substitute the super concentrate for broiler chicks. 160 unsexed broiler chicks (Ross) were used. Five dietary treatments containing 0, 5, 10, 15, and 20% Parameters measured were feed intake, weight gain, feed conversion ratio (FCR), dressing percentage, total serum protein, serum triglycerides and serum cholesterol. Results revealed that dietary inclusion of decorticated *C.cajan* seeds had significantly ($P<0.01$) decreased feed intake, weight gain and total serum protein. Moreover, the treatments had significantly affected ($P<0.05$) the dressing percentage and total serum triglyceride of the birds. However, the dietary treatments had no significant effect ($P>0.05$) on overall feed conversion ratio (FCR) of the chicks and total serum cholesterol (Saeed,et al;2007).

In a study conducted to assess the effects of graded levels of toasted pigeon pea seed meal on the performance of grower pigs compounded using toasted pigeon seed meal. Diet 1 was devoid of toasted seed meal while Diets 2, 3, 4 and 5 had 30%, 40%, 50% and 60% inclusion levels of toasted pigeon pea seed meal (TPSM) respectively. Parameter measured includes live weight, feed intake, weight gain, feed conversion ratio and economics of production. Result showed that all the parameters considered in the study showed no significant difference ($p>0.05$) across all the treatment groups. . The anti nutritional factors (oxalate, phytic acid

and tannins) composition did not show significant difference ($p>0.05$) across the treatment groups (Adama, et al; 2017).

In a study conducted to assess the performance of broiler chicks fed on gradedlevels of decorticated pigeon pea as replacer to sesame cake there were fed(0%,3%,6%,9% and 12%) levels. The study result showed significant ($P\leq 0.05$) improvement in feed intake, feed conversion ratio (FCR) weight gain and final body weight by decortications an increasing rate of inclusion of(Pp) progressively. Incorporation of (Pp) at 12% level followed by 9% gain the best results for all parameters studied 6% incorporation did not show any significant ($P\geq 0.05$) difference from 9 and 12% inclusion rates in indicating best option for incorporation (Alhafiz,et al; 2013).

In a study conducted with 150 nine week-old black Bovan Nera pullets to evaluate the performance of grower pullets fed raw or processed pigeon pea seed meal (PSM) diets from the grower (9week) stage of life comprised pullets fed 20% PSM diets that were iso-energetic and iso-nitrogenous. The seeds were used as raw, boiled for 30minutes, toasted for 30 minutes or soaked in water for 24 hours. Each treatment (raw, boiled, toasted, soaked or control diets) was replicated three times. Parameters measured were feed intake, weight gain, and feed conversion ratio, live weight at point of lay and feed cost. Pullets fed 20% boiled PSM diet had significantly higher ($P<0.05$) daily protein intake and live weight at point of lay. It was concluded that PSM could be a good protein source for grower pullets, which could be incorporated into the diets at 20% of the whole diet without any adverse effect on growth performance (K.U Ameafule,et al;2006).

CHAPTER THREE

MATERIALS AND METHODS

3.1 The Experimental Period:

This study was carried out at the poultry farm, College of Animal Production Science and Technology, (Hillat kuku), Sudan University of Science and Technology. During the period from 17/1/2018 to1/3/2018

3.2 Experimental birds:

Ninety six (96), one day old unsexed broiler chicks (Ross 308) fetched from Mico Company. The chicks were weight by digital balance, and the mean of initial weight was determined .Chicks were kept as one group for one week under the same environmental conditions until the experiment started.

3.3 Housing:

The experiment was conducted in an open side house in gabled 6X3m the long axis of the house extend east, west for efficient ventilation , the sides of house were covered by nylon sheet for incubation period of chicks .The house was divided into 12 experimental section (replicates)of equal size (1x1m).

The pen and equipment were cleaned burned and disinfected three days before the arrival of birds and then fresh wood shaving was spreaded in the floor at depth of 5cm.

3.4 Experimental design:

Study was conducted in completely randomized design (CRD).

3.5 Feeders and drinker:

Each section was provided with one round metal feeder size (5kg) and plastic drinker size (6litters).

3.6 Lightening:

The house had efficient night lamps during night to complete with the day hours the duration of light needed (24houers).

3.7 Experimental treatment and feeding trails:

Chicks were divided into four(4) groups a control (A) and treated groups (B), (C), (D) and each group was replicated three times with 8 chicks per replicate with a total of twenty four birds for treatment. Group (B), (C), (D) were fed with treated (soaked) seeds powder. Group (A) fed with zero Cajanus cajan seed(0%) and group (B) fed with (6%)soaked Cajanus cajan and (C) group fed with(8%) soaked Cajanus cajan and (D) group fed with (10%) soaked Cajanus cajan.

3.7.1 Cajanus cajan soaking and preparation:

The seeds were soaked in fresh water at 37 degree centigrade over night and dried in the shade at good ventilation side and grinded with feed stuffs grinder.

Table (1): chemical analysis of Cajanus Cajan seeds:

Cajanus Cajan	DM%	CP%	FAT%	ASH	CF%	NFE
fresh	91.63	20.13	2.42	3.47	10.50	55.11
Treated(soaked)	79.22	18.40	1.99	2.43	3.98	35.66

M.E: calculate value according to equation of (lodhi et, al; 1974)

3.7.2 Composition and calculated analysis and experimental diets:

Three rations were prepared, a pre- starter (from1to7days) secondly the starter (from7-28day) and thirdly the finisher diets (from 29- 42day). The pre-starter, starter and finisher diets were formulated to be approximately iso-caloric and iso-nitrogenous to meet the nutrient requirements for broiler chicks as out lined by National Research Council (NRC. 1994), Feed and fresh drinking water was provided adlibitum to all birds throughout the experimental periods.

Table (2): composition and calculated Analysis of the diet:

Pre-starter diet:

Ingredients	Percentage%
Sorghum	66
Groundnut cake	26.7
Concentrate	5
Limestone	0.5
Premix	0.4
Di-calcium Phosphate	0.5
Anti toxin	0.1
Salt	0.3
Lysine	0.3
Meth	0.2
Total	100

Calculated analysis of pre-starter diet:

Me/kg	Cp %	Cf %	Ca %	Avp. %	Ly %	Meth%
12.90	22.69	3.69	1.185	0.5149	1.44	0.64

Table (3): starter diet:

Treatment / Ingredient	Control diet	Soaked 6%	Soaked 8%	Soaked 10%
Sorghum	66	63	61.2	61
Groundnut cake	27	24.3	24	22.2
Soaked C.Cajan	0	6	8	10
Concentrate	5	5	5	5
Limestone	0.5	0.4	0.5	0.5
Premix	0.1	0.1	0.1	0.1
Di-calcium Phosphate	0.6	0.5	0.5	0.5
Anti toxin	0.1	0.1	0.1	0.1
Salt	0.3	0.3	0.3	0.3
Lysine	0.3	0.2	0.2	0.2
Meth	0.1	0.1	0.1	0.1
Total	100	100	100	100
Calculated analysis				
Me/kg	12.9356	12.77594	12.6786	12.63476
Cp%	22.828	22.318	22.3116	21.843
C f%	3.713	3.6905	3.7044	3.6548
Ca%	0.9762	0.8836	0.92368	0.9264
Av p. %	0.5338	0.5338	0.54136	0.5449
Ly%	1.4472	1.30112	1.29248	1.26608
Meth%	0.5472	0.5286	0.52404	0.5147

Table (4): finisher diets:

Treatment / Ingredient	Control diet	Soaked 6%	Soaked 8%	Soaked 10%
Sorghum	71.8	65.3	65.9	63.8
Ground nut cake	20	20	17.5	17.3
Soaked C.Cajan	0	6	8	10
Concentrate	5	5	5	5
Limestone	0.5	0.5	0.5	0.5
Premix	0.3	0.3	0.3	0.3
Di-calcium Phosphate	0.6	0.6	0.6	0.6
Anti toxin	0.1	0.1	0.1	0.1
Salt	0.4	0.4	0.3	0.4
Lysine	0.2	0.2	0.2	0.2
Meth	0.1	0.1	0.1	0.1
Oil	1	1.5	1.5	1.7
Total	100	100	100	100
Calculated analysis				
Me/kg	13.3586	13.2196	13.2083	13.16194
Cp%	20.4494	20.6889	20.0117	20.0104
C f%	3.375	3.4513	3.3734	3.3867
Ca%	1.12472	1.10252 .	1.10556	1.10752
Av p. %	0.51454	0.53959	0.54127	0.54904
Ly%	1.26032	1.24472	1.21016	1.20224
Meth%	0.52206	0.51101	0.49953	0.49496

3.7.3 Feeding regime:

Feed was weighed and provided weekly to each group and the refusal was weighed as well.

3.7.4 Watering*:*

Fresh and clean water was provided the hour round throughout the period.

3.8 Prophylactic measures:

To minimizing transportation handling stress sugar was provided in upon arrival with water to increase glucose to the chicks through drinking the objective of minimizing transportation and handling stresses.

The birds were vaccinated a first dose against infectious bronchitis (I.B) and New castle disease (ND) in the day 8. At the day 14 they were vaccinated against Gamboro disease. The second dose was repeated at the day 21 against New castle disease.

3.9 Data collection:

Weekly feed intake was recorded. Chicks were weighed at arrival and at the end of each week regularly to estimate weekly body weight gain. Total live weight gain was recorded at the end. Data recorded for weight gain and feed intake were used to calculate the weekly feed conversion rate (FCR).

3.10 Carcass preparation:

After six weeks the birds were fasted for 5 hours before being slaughtered. Internal organs (liver, abdominal fats, gizzard, and heart) were weighed and recorded.

3.11 Statistical Analysis:

The data were subjected to analysis of variance (one-way- ANOVA) and the mean were tested for significant by least significant differed (LSD) using the statistical package of social science (SPSS 2007) Computer Program.

CHAPTER FOUR

RESULTS

Table (5): Effect of Cajanus cajan seeds meal on weekly broiler feed intake (g/bird):

Treatment / Week	Control M±SD	Soaked6% M±SD	Soaked8% M±SD	Soaked10% M±SD	sig
1	329.17±18.80	335..00±18.66	301.67±44.02	322.50±16.66	NS
2	416.45±14.91	433.12±36.43	440.41±18.81	450.00±9.07	NS
3	515.00±27.24^{b}	577.08±57.52^{ab}	597.50±34.73^{a}	577.50±0.44^{ab}	*
4	621.67±45.59	657.92±65.60	655.83±51.14	694.58±52.50	NS
5	507.92±53.15	515.83±27.64	578.75±78.19	544.17±88.35	NS

*:Significant different at ($p \leq 0.05$).

NS: no Significant different at ($p>0.05$).

a,b,c mean within the same row followed by different superscripts are significantly($p \leq 0.05$) different.

Fig (1): Effect of Cajanus cajan seeds meal on weekly broiler feed intake (g/bird):

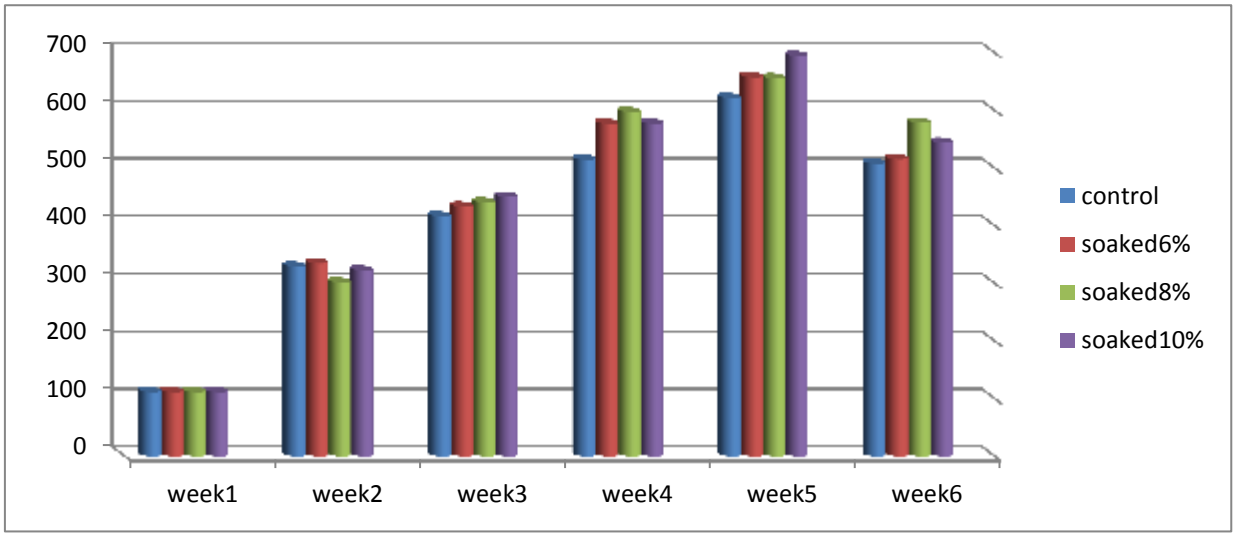


Table (6): Effect of Cajanus cajan seeds meal on weekly broiler weight gain (g/bird):

treatment Week	Control M±SD	Soaked6% M±SD	Soaked8% M±SD	Soaked10% M±SD	sig
1	89.85±8.39	90.83±5.05	111.88±4.96	103.55±23.76	NS
2	162.72±8.25	167.92±10.75	167.53±53.03	186.07±10.35	NS
3	245.63±22.98	246.63±37.01	282.29±2.77	241.25±40.34	NS
4	275.42±20.05^{b}	292.08±48.75^{ab}	342.08±33.17^{ab}	362.08±66.34^{a}	*
5	281.67±52.74^{b}	333.75±33.61^{ab}	370.00±27.64^{a}	355.42±62.07^{ab}	*

*: Significant different at ($p \leq 0.05$).

NS: NO Significant different at ($p > 0.05$).

a,b,c mean within the same row followed by different superscripts are significantly ($p \leq 0.05$ different.

Fig (2): Effect of Cajanus cajan seeds meal on weekly broiler weight gain (g/bird):

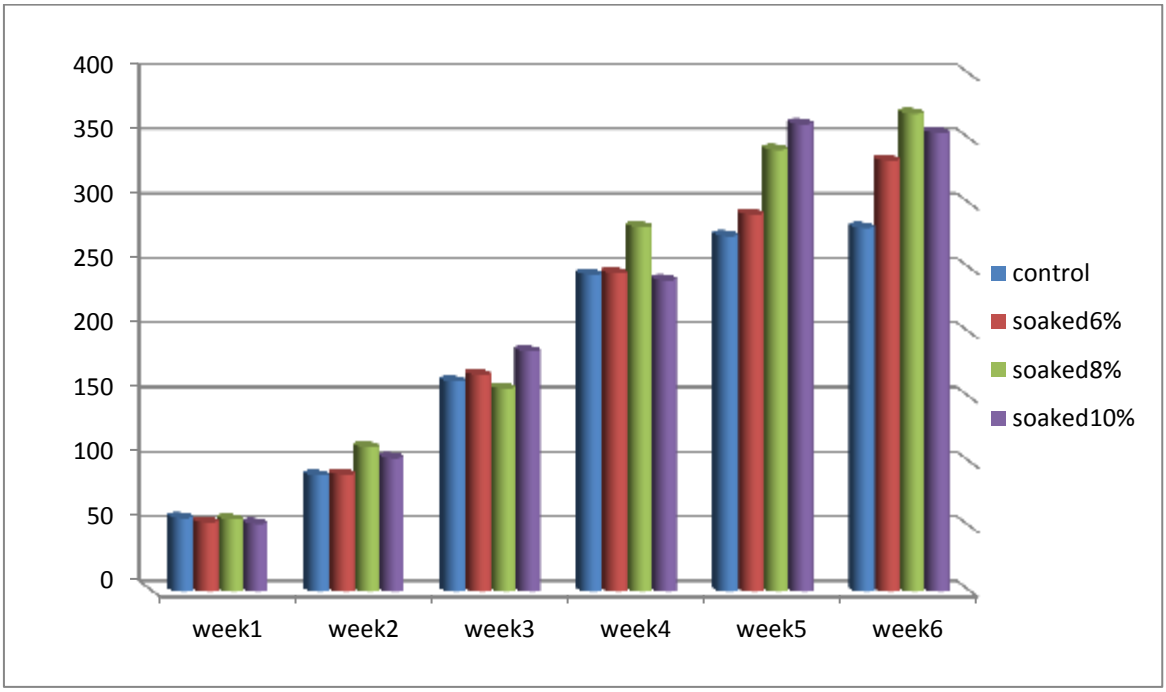


Table (7): Effect of Cajanus cajan seeds meal on weekly broiler feed conversion ratio FCR (g/bird):

Treatment Week	Control M±SD	Soaked6% M±SD	Soaked8% M±SD	Soaked10% M±SD	sig
1	3.69±0.22[b]	3.25±0.70[b]	2.71±0.52[a]	3.23±0.77[ab]	*
2	2.55±0.04	2.58±0.44	2.19±0.14	2.41±0.11	NS
3	2.09±0.09	2.39±0.59	2.11±0.10	2.43±0.40	NS
4	2.25±0.06	2.31±0.63	1.92±0.13	1.94±0.29	NS
5	1.81±0.18[a]	1.54±0.08[b]	1.55±0.10[b]	1.52±0.02[b]	*

*: Significant different at ($p \leq 0.05$).

NS: NO Significant different at ($p > 0.05$).

a,b,c mean within the same row followed by different superscripts are significantly($p \leq 0.05$) different.

Fig (3): Effect of Cajanus cajan seeds meal on weekly broiler feed conversion ratio FCR (g/bird):

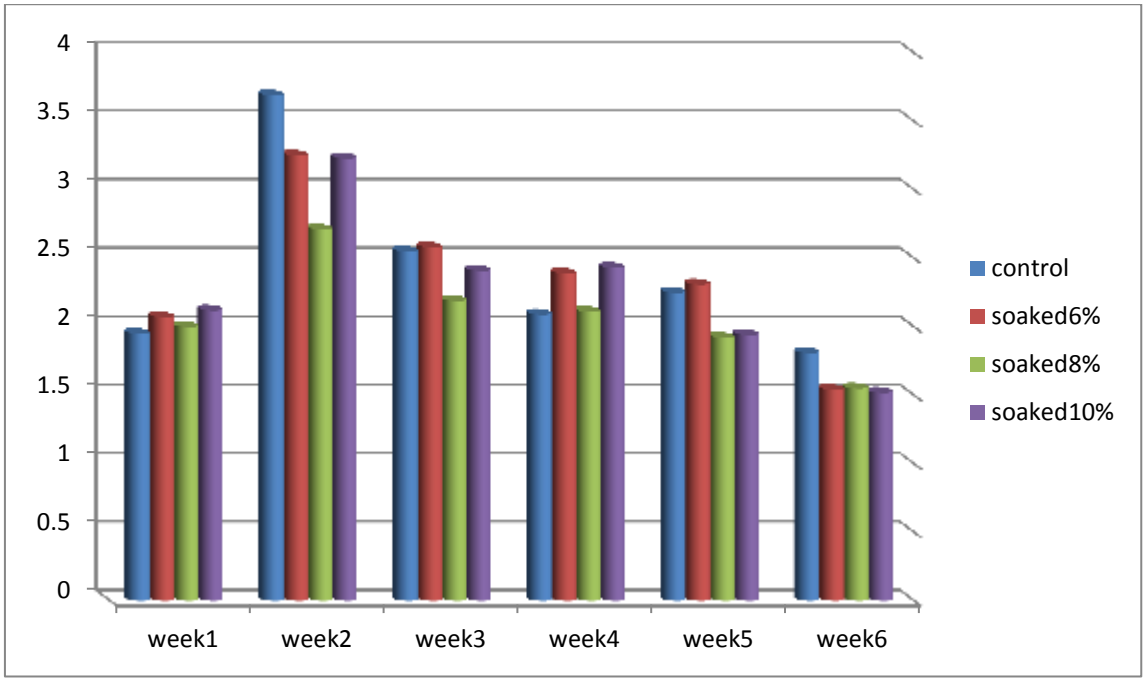


Table (8): Effect of Cajanus cajan seeds meal on weekly broiler live body weight (g/bird):

treatment Week	Control M+sd	Soaked6% M+sd	Soaked8% M+sd	Soaked10% M+sd	sig
1	107.0±2.82	103.7±2.50	105.8±3.55	102.5±1.25	NS
2	196.6±6.29^{ab}	194.5±3.14^{b}	217.7±5.91^{a}	206.0±22.51^{ab}	*
3	359.3±14.53^{b}	362.5±10.84^{b}	418.5±10.63^{a}	392.0±32.82^{ab}	**
4	605.0±35.72^{b}	609.1±45.09^{b}	700.8±12.26^{a}	633.3±73.16^{ab}	*
5	880.4±53.39	901.2±92.56	1042.9±34.73	995.42±.139.50	NS
6	1162.1±106.11^{b}	1235.0±124.73^{ab}	1412.9±61.01^{a}	1350.8±200.13^{ab}	*

**: Significant different at ($p \leq 0.01$).

*: Significant different at ($p \leq 0.05$).

NS: no Significant different at ($p > 0.05$).

a,b,c mean within the same row followed by different superscripts are significantly($p \leq 0.05$) different.

Fig (4):Effect of Cajanus cajan seeds meal on weekly broiler live body weight (g/bird):

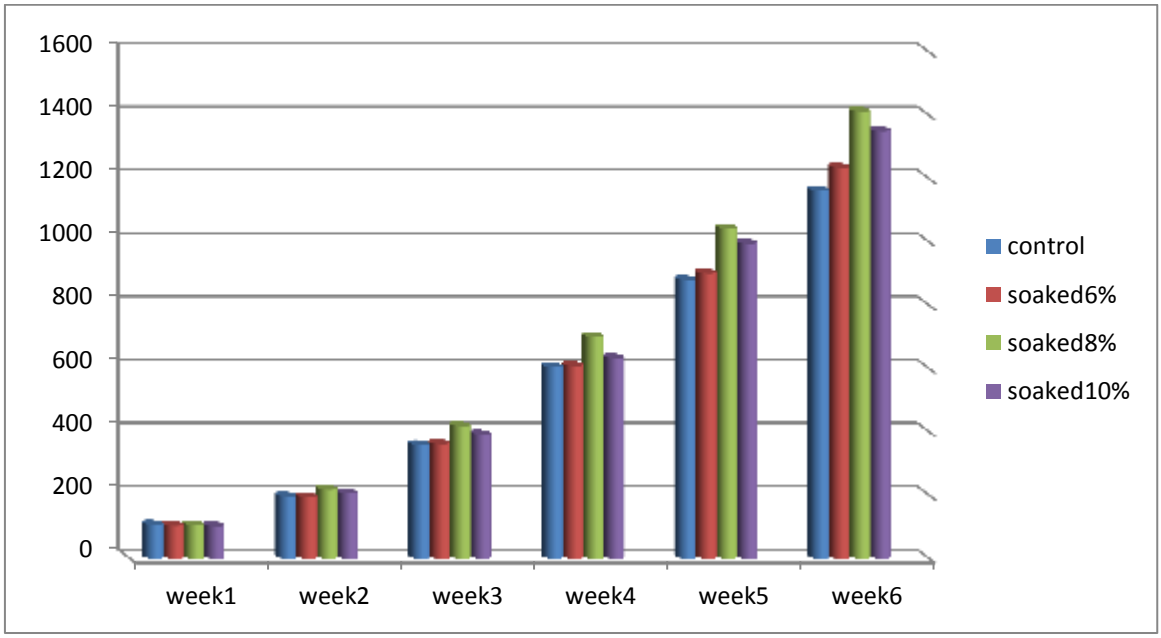


Table (9): The Effect of Cajanus cajan on broiler overall performance:

Treatment / Parameters	Control M±SD	Cajanus cajan rate			sig
		Soaked6%	Soaked8%	Soaked10%	
Feed intake(g)	2501.9±155.49	2588.9±72.31	2685.8±210.87	2700.3±124.98	NS
Weight gain(g/bird)	1112.1±106.12^{b}	1175.8±114.88^{ab}	1363.1±61.10^{a}	1301.00±200.39^{ab}	*
Feed conversation ratio(g feed/g weight)	2.25±0.07	2.24±0.37	1.96±0.07	2.09±0.23	NS
Final live bodyweight (g)	1162.1±106.11^{b}	1235.0±124.73^{ab}	1412.9±61.01^{a}	1350.8±200.13^{ab}	*

*: Significant different at ($p \leq 0.05$).

NS: NO Significant different at ($p > 0.05$).

a,b,c mean within the same row followed by different superscripts are significantly($p \leq 0.05$) different.

Fig (5): Effect of Cajanus cajan on broiler overall performance:

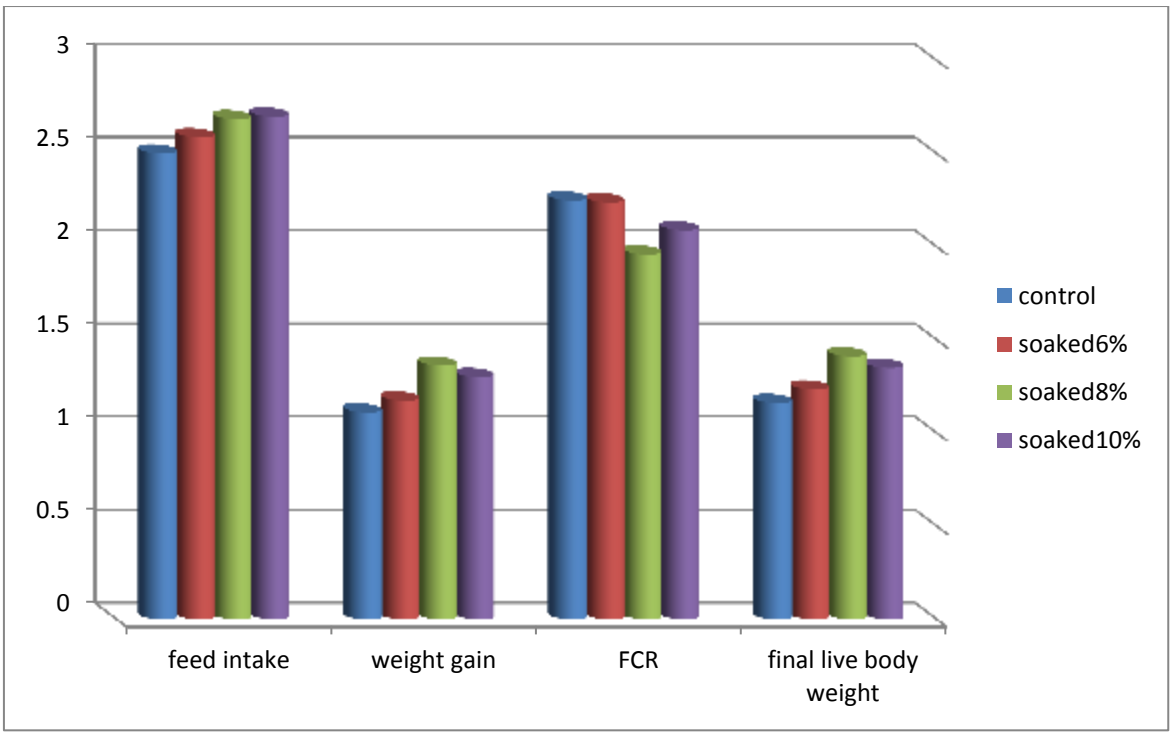


Table (10): The Effect of Cajanus cajan on broiler internal organs weight:

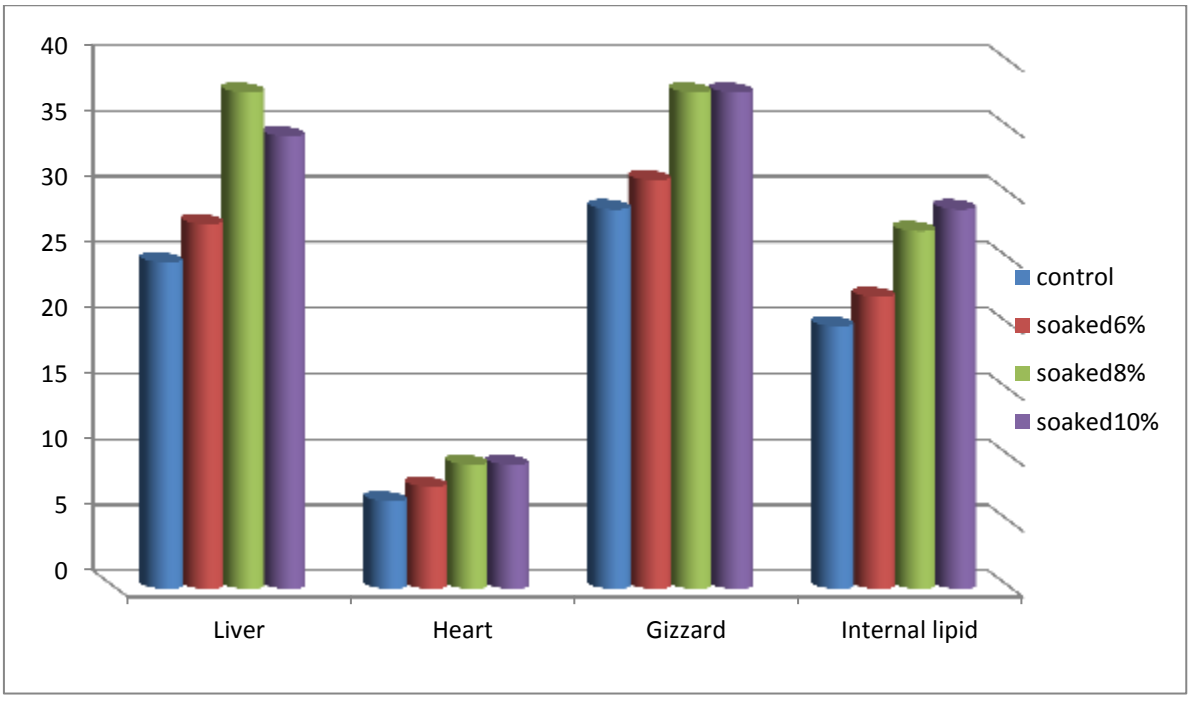
treatment / parameters	Control M±SD	Cajanus cajan rate			sig
		Soaked8%	Soaked6%	Soaked8%	
Liver weight(g)	24.85±5.95^{b}	27.77±2.54^{b}	37.77±0.96^{a}	34.44±3.84^{a}	**
Heart weight(g)	6.66±0.00^{b}	7.77±0.96^{ab}	9.44±1.92^{a}	9.44±0.96^{a}	*
Gizzard weight(g)	28.88±0.96^{b}	31.10±3.85^{b}	37.77±0.96^{a}	37.77±2.54^{a}	**
Internal lipid weight(g)	19.99±7.26^{b}	22.21±0.96^{ab}	27.22±4.81^{ab}	28.88±5.51^{a}	*

**: Significant different at ($p \leq 0.01$).

*: Significant different at ($p \leq 0.05$).

a,b,c mean within the same row followed by different superscripts are significantly($p \leq 0.05$) different

Fig (6): Effect of Cajanus cajan on broiler internal organs weight:



CHAPTER FIVE

DISCUSSION

5.1.1 Chemical composition:

Table (1) showed the Chemical composition of fresh Cajanus cajan seeds meal. It consist of 91.63%DM, 2.42%Crude Fat, 20.13%Crude Protein and 10.50%Crude Fiber, 3.47% Ash, 55.11% Nitrogen Free Extract .

The soaked Cajanus cajan consist of 79.22%DM ,1.99% Crude Fat,18.40% Crude protein,3.98% Crude Fiber, 2.43%Ash and 35.66% Nitrogen Free Extract.

5.1.2 Feed intake:

Table (5) Showed the results of feed intake, there were significant difference found ($p \leq 0.05$) between control and treated groups in weekly feed intake. Group(C) recorded highest value (597.50±34.73) in week 4, followed by group (D) (577.50±0.44) and (B) (577.08±57.52). These findings agreed with those of (Alhafiz, et al; 2013, Saeed, etal; 2007). Who reported that the birds fed with Pigeon pea recorded the highest value in feed intake.

5.1.3 weight gain:

Table (6) showed the results of weight gain there were significant difference ($p \leq 0.05$) in weekly weight gain between control and treated groups. Group (D) recorded the highest value (362.08±66.34) in week5, followed by group (C) (342.08±33.17) and group (B) (292.08±48.75). Group (C) recorded the highest value (370.00±27.64) in week6, followed by group (D) (355.42±62.07) and group (B) (333.75±33.61) These

findings agreed with those of (Alhafiz, et al; 2013, Saeed, et al; 2007). Who reported that the birds fed with Pigeon pea recorded the highest value in weight gain.

5.1.4 Feed conversion ratio (FCR):

Table (7) showed the results of FCRthere were significant difference ($p \leq 0.05$) in feed conversion ratio (FCR) between Control and treated groups. Group (C) recorded the best (FCR) (2.71±0.52) during the second week, followed by group (D) (3.23±0.77) and group (B) (3.25±0.70). Group (D) recorded the best (FCR)(1.52±0.02) in week six, followed by group (B) (1.54±0.08) and group(C)and (1.55±0.10) these findings are in line with those of (Alhafiz, et al; 2013),who reported that the birds fed with Pigeon pea recorded high FCR value.

5.1.5 Live body weight gain:

Table (8) showed the results of live weight gain there were significant difference ($p \leq 0.05$) between Control and treated groups in live body weight. Group (C) recorded the highest value (217.7±5.91) in week two, followed by group (D) (206.00±22.51) and group (A) (196.6±6.29). The live body weight showed that there were highly significant difference ($p \leq 0.01$) group(C) recorded the highest value (418.5±10.63) in week three followed by group (D) (392.00±32.82) and (B) (362.5±10.84) .Group (C) recorded the highest value (700.8±12.26) in week four followed by group (D)(633.3±73.16) and (B)(609.1±45.09). Groups (C) recorded the highest value (1412.9±61.01) in week six followed by group (D) (1350.8±200.13) and (B)(1235.00±124.73). These findings agreed with those of (Alhafiz, et al; 2013, Saeed, et al; 2007and K.U Ameafule, et al; 2006), who reported that the birds fed with Pigeon pea recorded the high value in weight gain.

5.1.6 Overall performances:

Table (9) showed that there were no significant difference ($p>0.05$) in overall feed intake. Although group (D) recorded highest value (2700.3±124.98) followed by group(C) (2685.8±210.87) and (B) (2588.9±72.31). These findings agreed with those of (Khadiga,et al;2009,Adama,etal;2017). In overall weight gain results showed that there were significant difference ($p\leq0.05$) between control and treated groups. Highest value recorded by group (C) (1363.1±61.10) followed by group (D) (1301.00±200.39) and (B) (1175.8±114.88). These findings agreed with those of (Alhafiz, et al; 2013, Saeed, et al; 2007and K.U Ameafule, et al; 2006). Who reported that the birds fed with Pigeon pea recorded the high value.

Overall feed conversion ratio showed that there were no significant differences($p> 0.05$) between groups .Although groups (C) recorded best feed conversion ratio (FCR)(1.96±0.07) followed by group (D) (2.09±0.23) and (B)(2.24±0.37). These findings agreed with those of (Saeed,et al;2007, Adama,etal;2017). Overall final live body weight results showed that were significant difference ($p\leq0.05$) between control and treated groups. Group (C) recorded the highest value (1412.9±61.01) followed by group (D) (1350.8±200.13) and (B) (1235.00±124.37). These findings agreed with those of (Alhafiz, et al; 2013).

The differences in performance between control group and other treated groups refer to the nutritional value of Pigeon pea (Cajanus cajan).

5.1.7 Internal organs weight:

Table (10) showed that there were significant differences between all internal organs [Liver, Heart, Gizzard, Internal lipid]. The liver showed

highly significant difference ($p \leq 0.01$) between control and treated groups. Group(C) recorded the highest liver weight (37.77±0.96) followed by group (D) (34.44±3.84).and (B) (27.77±2.54). The heart weight showed that there were significant difference ($p \leq 0.05$) between control and treated groups .Group(C) recorded the highest (9.44±1.92) value followed by group (D) (9.44±0.96) and (B) (7.77±0.96). The gizzard weight results showed that there were highly significant differences ($p \leq 0.01$). Group (D) recorded the highest weight (37.77±2.54) followed by group(C) (37.77±0.96) and (B) (31.10±3.85). The Group (D) recorded highest internal lipid weight (28.88±5.51) followed by group(C) (27.22±4.81) and (B) (22.21±0.96).

The difference between the internal organs is due to the difference found between final body weights of birds in different groups.

CONCLUSION AND RECOMMENDATIONS

5.2.1 Conclusion:

1. The results from this study concluded that using Pigeon pea (Cajanus cajan) seeds meal as un conventional protein source on broiler diet showed positive effect on broiler performance.
2. Percentage of 8% and 10% showed good performance in feed intake, weight gain, body weight and feed conversion ratio compared with the birds fed 6% and control ration.
3. The treatment of Cajanus cajan by soaking in water in found to reduce the anti nutritional factors.

5.2.2 Recommendations:

- Further studies with inclusion of high percentage of Pigeon pea (Cajanus cajan) should be taken to evaluate the performance.
- Cajanus cajan can be used to replacer protein source partially in poultry feed.

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