Chapter one

INTRODUCTION

Broilers provide much of the proteins in the human diet and are a ready source of cash for smallholder farmers (Mapiye et al., 2008; Mwale et al., 2008). Despite the importance of broilers to the human diet their production is adversely affected by ever-increasing cost and inadequate supply of feed, particularly the conventional type (Raviundran, et al., 1982). Feed accounts for 70-80 % of the total cost in broiler production (Saina, 2003). Conventional feed ingredients such as broiler protein concentrates used in the formulation of broiler diets are predicted to be in short supply in a few years to come due to high demand (Farrel, 1997). Robinson and Singh (2001) suggested that the major factor that will contribute to this shortage is competition with human requirements and expanding intensive livestock production. In addition, price increase of conventional broiler feed resources occurs when supplies are low (Saina, 2003; Saina et al., 2005). Therefore, research on low-cost and locally available indigenous feed resources are fundamental, particularly those which do not attract competition with human beings and ever expanding intensive livestock production. The high crude protein and essential amino acid levels in water melon seed can be still taken as an advantage at low inclusion levels to cut down the cost of broiler feeds. However, the utilization of such feedstuffs necessitates having a good knowledge of the nutrient composition as well as inclusion levels (Mwale et al., 2008). The major objective of this study was, therefore, to determine the effect of water melon seed meal in broiler performance.

Chapter Two
litrature Review

2.1 Poultry farming:-

Poultry farming means 'raising various types of domestic birds commercially for the purpose of meat, eggs and feather production'. The most common and widely raised poultry birds are chicken. as a source of food (both meat and eggs of chicken). The chickens which are raised.

2.2 Broiler chickens :

(Gallus gallus domesticus), or **broilers**, are a gallinaceous domesticated fowl, bred and raised specifically for meat production.[1] They are a hybrid of the egg-laying chicken, both being a subspecies of the red junglefowl (Gallus gallus). Typical broilers have white feathers and yellowish skin. Most commercial broilers reach slaughter-weight at between five and seven weeks of age, although slower growing breeds reach slaughter-weight at approximately 14 weeks of age. Due to artificial selection for rapid early growth and the husbandry used to sustain this, broilers are susceptible to several welfare concerns, skin and eye lesions, (The breeding stock (broiler-breeders) grow to maturity and beyond but also have welfare issues related to the frustration of a high feeding motivation and beak trimming). Broilers are usually grown as mixed-sex flocks in large sheds under intensive conditions, but some breeds can be grown as free-range flocks. Chickens are one of the domestic animals

2.3 Nutritional Requirements of Poultry:

Poultry convert feed into food products quickly, efficiently, and with relatively low environmental impact compared with other livestock. The high rate of productivity of poultry

results in relatively high nutrient needs. Poultry require the presence of at least 38 dietary nutrients in appropriate concentrations and balance. The nutrient requirement figures published in Nutrient Requirements of Poultry (National Research Council, 1994) are the most recent available and should be viewed as minimal nutrient needs for poultry. They are derived from experimentally determined levels after an extensive review of the published data. Criteria used to determine the requirement for a given nutrient include growth, feed efficiency, egg production, prevention of deficiency symptoms, and quality of poultry product. These requirements assume the nutrients are in a highly bioavailable form, and they do not include a margin of safety. Consequently, adjustments should be made based on bioavailability of nutrients in various feedstuffs. A margin of safety should be added based on the length of time the diet will be stored before feeding, changes in rates of feed intake due to environmental temperature or dietary energy content, genetic strain, husbandry conditions (especially the level of sanitation), and the presence of stressors (such as diseases or mycotoxins).

2.4 Broiler meat production in the world:.

It is common knowledge, that world population has grown by 80 million in 2013 and as of January 1, 2014 has reached 7.2 billion people. It increases annually by about 1.3% (broiler chicken key facts) . Therefore, food production should increase to at least the same pace. First of all it concerns animal protein. If its production would grow less rapidly, then nearly 1 billion people, who currently have problems with full meals or are starving, would increase each year by millions of new .However, to meet the increasing demand for animal protein is a real challenge even for broiler industry. Its performance on the traditional strategy is associated with new farms construction and leads to decreasing the total, the need for which is growing due to the necessity of a substantial increase in the addition,

reserve land resources, suitable for construction of new farms or increasing of arable land area, in the countries of North America and Europe (where it is focused almost 45% of world poultry production) have already been exhausted. Therefore further researchers' efforts should be directed to the development and implementation of new technological solutions able to ensure a significant increase in broiler meat production per unit area of existing capacities, as well as to identify regions of the world, promising to produce the product according to the modern industrial technologies.

According to the UN FAO and the Ministry of Agriculture of the United States information, the sustainable growth of poultry meat production volumes, including broiler meat takes place all over the world for many years. The leader in the production of this product, as is evidenced by the data, is America's North, Central and South parts together. The specific share of USA in the global production of poultry in 2013 was 43.6%. In comparison with 2012, chicken and broiler meat production on this continent has increased by 0.9 million. tons, that has provided its leadership by growth rates. The second place by the volume of chicken meat production (including broiler meat) belongs to Asia. In 2013, this continent has produced 31.6 million tons of chicken meat that was 33.5% of its global volume. In specified rating, Europe during 2000-2014 has the third place, Africa is fourth, Oceania is fifth.

Specified rating of the regions of the world (by volumes of chicken meat production in 2013) is demonstrated more clearly . Herewith it is still about general chicken meat production volumes on the continents of the world excluding the population. However, when determining the volumes of production and consumption of chicken meat in recalculation per one ordinary resident of each continent, their rating is significantly changed. For example, in 2009 for one average resident of America (920 million) it was produced up to 39.9 kg of chicken meat, Asia (4117 million)

– 6.8 kg, Europe (738 million) – 16.4 kg, Africa (999 million) – 4.2 kg, Oceania (36 million) – 27.8 kg. Therefore, in the rating by the volume of chicken meat produced for average residents in 2009, the first place belongs to America (39.9 kg), the second – Oceania (27.6 kg), the third – Europe (16.4 kg), the fourth – Asia (6.8 kg) and the fifth – Africa (4,2 kg). Regarding total volumes, then, as is evidenced by the data in table 1, the proportion share of broiler meat is 87.4-90.3% of the produced chicken meat. World broiler meat production in 2013 was 86.4 million tons. In comparison with 2008 it increased by 13.6 million tons, or by 18.7 %. The pace of this growth is graphically shown In 2009, broiler meat production increased by 1.0 million tons (by 1.4%) against the previous year (2008), in 2010 - by more than 4.5 million tons (by 6.1%) against the previous year (2009). In 2011, broiler meat was produced more by 3.0 million. tons (3.8%), in 2012 – 1.9 million tons (2.3%), in 2013 – 3.2 million tons (3.8%) compared to previous years (2010, 2011 and 2012, respectively). Therefore, the annual variation of broiler meat production growth in the world was within 1.4-6.1 %. This growth was provided by increased number of enterprises of growing chickens for meat. But in 2014, In particular, it is forecasted that it would be produced more than in 2013 just by 0.6 million tons, or by 0.7 %. Whether it is the usual cautious forecast or the signal of the exhaustion of the reserve lands for the construction of new production capacities? In any case, in our opinion, the question of more efficient technologies introduction of growing chickens for increasing broiler meat production volumes for 1 sq. m of the poultry house, reducing costs (feed, energy, labor resources, etc.) per obtained production unit and its recycling, becomes actual year by year.

2.5 Water melon:-

2.5.1 Botanical Description of water melon seeds :

Botanically , water melon is named citrullus lanatus and it

belongs to the family cucurbitaceae water melon is an aggressive vining annual plant adapted to mean temperature greater than 21c ̊among the wild and early cultivated water melons , in addition to the sweet there are bitter types . among the latter there is aform of citrullus lanatus known as ``egusi`` is grown in some regions of Nigeria whose flesh is inedible and only the seeds are used (Rice et al 1987) . Sweet water melon has many local names in middle east countries such as ``Battikh `` in Sudan , `` Hab Hab `` in Saudia Arabia , ``Doulaa`` in morocco and roughee in Iraq . in other contries it also carries different local names as pasteque in france , ``water meloneon `` in Netherlands , ``tarbus kalingada `` in India and ``Sakwa`` in China (Tindal986) .

Water melon in characterized by slender hairy stems growing to 5 m . stems are angular and grooved with 2-3 branched tendrils . the root system is deep extensive and superficial (pierce 1987) . the large leaves have 3-4 pars of lobes which are subdivided and toothed . petiols are 1-10 cm in length . the flowers are 2-4 cm in diameter with 3-5 stamens and hairy ovary . fruits are globular or oblong in shape and are up to 60 cm or more in length and 3.43 – 4.13 kg or more in weigth the rind is smooth , green or cream and may be stripped or mottled . the flesh is red , yellow or white and is often sweet (rice et al. , 1987) .

Water melon fruits include numerous flattened seeds constituting about 1.9 -4.0 % of fresh fruit (kamel et al . 1985). Seeds are contained in the pulp . seeds of different varieties vary in size , thickness , texture of the seed coat and the thickness of the seed edges Basically , there are small , moderate and large sized seeds. The seed coat may be thin , thick or encrusted and the seed edges may be flat or moulded. Also seeds differ in colour , they may be black , brown , red, yellow and rarely white (Oyolu, 1977). Water melon seed length and width may be (0.6- 1.5cm) and (0.5-0.7 cm) respectively.

2.5 Geographical Distribution :

Water melon is grown throughout the tropics and sub tropics in drier areas with an abundance of sun shine and fertil sandy soil, it is rairly drought. In the Sudan it is cultivated every where , extensively in sandy areas in Kordufan and Darfour states. It is also grown in aloamy or caly soils of the Gezira and the white Nile, and in silty soils along the banks of Blue Nile, River Nile and in Elgash and Tokar deltas (Sudan Crops).

2.6 Utilization of Water melon :

In the sudan , water melon is used mainly as dessert and use for eat however , the people of Kordufan and Darfour states depend on water melon in a number of living aspects. They use it as , especially , during the dry season(Oklahoma1987).

Water melon , especilly , the desert type may remain fresh until the start of the next rainy season , thus constituting aperennial source of water. This advantage advocates its use as amain source of water for live stock. By doing so the losses of energy experienced by cattle running after.

Socially , in western Sudan, water melon season is considered as time for committing marriage occasions , since this season correlated especially women , who in addition , acquire beauteous features during this period , as they consume a local pudding named as (Bajbaje).

Bajbajei is made by cooking finely ground raw water melon seeds in boiling milk and served to all members of the family

In Nigeria water melon seeds are used as thickening agent and condiment in soup preparation , it is fried and eaten as snacks , (Nwokolo and Sim , 1987). Traditionally it is fermented to yield a product locally known as Ogiri , which is used as an ingredient in a variety of local foods (Akindele , 1978; Ogundana 1980 ; Giami and Bekebain , 1992).

In cameroon water melon seeds is ground into a paste and added to cassava leaves and cooked into a sauce (Guanfobe et al 1991). Also they are milled with a tuberous sclerotium of the mushroom in preparing a traditional vegetable meat substitute. Decorticated ground water melon seeds are used as a flavour component of gravies (Nwokolo, 1987).

Water melon seeds proteins suggested their usefullness as meat additives and extenders because of their high capacity to bind fat (Gbenle and Onyekachi 1995). The dried parched seeds are chewed and used fish bait in china (Beatti and Doolittle , 1951 and parris 1949).

Water melon seeds could be extracted and its oil is used for cooking , for medicinal purposes or soap making and sometimes for illumination (El-Magoil et al 1979 Bedi etal. 1971 , cited by Mustafa et al 1972). In addition water melon seed oil has an advantage of containing low amount of saturated fatty acids which can benefit patients with cardio vascular diseases (Alkalifa. 1996 and Girgis and said , 1968).

2.7 Proximate Chemical Composition of Water Melon Seed :

2.7.1 Moisture content :

Al khalifa (1996) reported the moisture content of water melon seeds from different places to be 2.61% for an Egyptian water melon seeds 3.14% for an lranian and 3.24% for Chinese water melon seeds .

Yousuf (1992) showed that , the moisture content of a Sudanese water melon seeds especially types obtained from western Sudan is (2.8%), whereas Mustafa et al . (1972) reported (4.94%) for another type obatined from Kordufan in vicinity of Alobied Hayat (1994) found 3.45% moisture content in water melon seeds.

Ogunsua et al (1984) reported the moisture content of two Nigerian – varieties of water melon seeds to be 7.9% and

5.6 % respectively.

The low moisture content in water melon seeds , accompanied with its very high dry matter content may contribute substantially in keeeping quality of the seeds even if it is transported for long distances and stored for considerable periods of time.

2.7.2 Crude protein :

the value of cucurbit seeds including water melon as sources of proteins as well as oils in an animal diets has been reviewed by Bemis et al 1967 and 1975, cited by Sawaya et al (1986).

Mustafa et al (1972) reported that, the crude protein content of whole water melon seeds is 18.96%, whereas Dawson (1985) ; Asil et al (1985) and Rakhimove et al (1995) showed a crude protein content range of whole water melon seeds between13.5% and 16.4%,

Kernel of water melon seeds , as reported by Al Khalifa (1995), contained aboud 40.5% , 24.5% and 39.0% crude protein for an Egyptian, Iranian and Chinese varieties, respectively .

Ogunsua et al (1984). Showed a crude protein range of dehulled water melon seeds from Oyo state in Nigeria between 30.8 and 34.0% Approximately similar results were obtained for the crude protein content in water melon seed kernel by FAO (1988) and Hayat (1994).

Mustafa et al (1972) reported that the crude protein content in the seed kernel is 39.1% whereas Asil (1968) reported a renge between 25%and 32% , which came in accord with finding of Akobundu et al (1982). Concerning the crude protein in the hull, mustafa et al (1972) reported only 0.52% whereas Hayat (1994) reported 2.508% Western regional nutrition centre of Africa (1965 – 1966) reported arnge of 19.1 – 25.1 % crude protein in the water melon seed cake ,

whereas Nwokolo and Sim (1987) showel a that the crude protein conten in the pressed melom seed cake is 45.33% with respect to protein content in the defatted melon seed meal the same workers reported 66.2%. moreover , Oyenuga and Fetuga (1975) showed the crude protein content of the defatted meal to be between 69.4% and 77.7% Gbenle and Onyekachi (1995) reported the crude protein content of the defatted flour and protein isolate of water melon seeds to be 62.7% and 75% , respectively. Almost similar results were obtained by Abaelu et al . (1979).

2.7.3 Amino Acids:

Nwokolo and Sim (1987) compared the amino acid composition of water melon seed meal with that of soy bean meal on air dry basis as illustrated in their results indicated that water melon seed meal exceeded soy bean meal in Alanine, Glycine, Methionine, phenylalanine and Glutamic acid . moreover , Water melon seeds are distinctly higher in theronine , serine and arginine but lower in lysine with slightly lower levels of Aspartic acid than in soybean meal. The same workers reported that , the contents of proline, Histidine, isoleucine, leucine and tyrosine are nearly similar to that in soy beans.

Oyenuga andFetuga (1975) compared the amino acid profile of water melon seed meal with that of soy bean meal and that of whole hen`egg they declared that water melon seed meal was higher in tryptophan and aromatic amino acids than either soy bean meal or whole hen`s egg. The total sulphur amino acids (methionine + cystine) and threonine content in water melon seed were similer to that in soy bean meal but lower than in whole han`s egg. In addition water melon seed contents slightly lower Isoleucine, and lower lysine than either soy bean meal or whole hen`s egg. Moreover , total essential amino acid content and chemical score values are lower than those exhibited by soy bean meal or whole hen`s egg.

In their study Abealu et al (1979) indicated that, the Nigerian water melon seed of an Egusi type are adequate in essential amino acids. They found that, these water melon seeds contain 6.1 g leucine, 4.7g phenyl alanine , 3.6g glutamic acid per 16gm.

2.7.4 Ether extract (EE):

EE content of many sudanese varieties of whole ground water melon seeds is in the range of 25.8 to 28.7% (Mustafa et al 1972). In another study , Nwokolo and Sim (1989) reported 49.6% oil content in whole seeds. Moreover , Girgis and Said (1968) reported that the EE content in whole ground water melon seeds of ‘‘Egusi„ and another variety ‘‘Cuban queen „ from florida are 51.0% and 26.5% respectively. Adversely, low content of oil in whole seeds of ‘‘egusi„ water melon variety of 23.1% and 26.6% were reported by kamel et al (1985) and Dighir et al (1986) respectively.

With respect to the oil contents in seed kernel , Ogunsua et al (1984) found that , the oil content of two varieties of dehulled water melon seeds to be 47.7% and 51.1% respectively whereas Oyenuga and fetuga (1975) reported that the oil content of dehulled raw undefatted water melon seed meal is 54.2% and that of the dehulled fried undefatted water melon seed meal is 53.7%. Approximately , similar results were obtained by Asil (1985) and Hayat (1994) which were in the range of 50.36 and 51.4% with regard to oil content of hull , Mustafa (1972) found 0.78% whereas Hayat (1994) reported 2.73%.

The noticeable variation in oil contents may be attributed to varietal differences source of seeds and climatic and growing conditions.

2.7.5 fatty Acid content :

There is general agreement in the literature that water melon seed oil is rich in unsaturates Kamel et al (1985)

stated that the unsaturated fatty acid represent about 76.1% of total oils water melon seeds.

Al Khalifa (1996) reported , that , the linoleic acid is the major fatty acid and represents about 63.7% , 62.0% and 68.7% of total oil in water melon seeds obtained from lran , Egypt and China , respectively. Also the same worker found that the percentages of saturated fatty acids were 19.0% , 21.3% and 18.0% and free fatty acids were 2.15%, 1.16% and 7.5% for an lranian , Egyptian and Chinese water melon seeds respectively.

Mustafa et al (1972) characterized Water melon seed oil by its low free fatty acid content, and he concluded that the oil is an excellent source of linoleic acid and represents about 62% of the total oil in water melon seeds.

Girgis and Said (1968) reported that , the linoleic acid contents of water melon seeds obrained from two differrent places, Ibadan (Nigeria) and (USA) were 55.1% and 70.8% respectively. The same workers found that the oleic acid and the percentage of saturated fatty acids contents were 19.0% , 13.2% and 25.9, 15.7% in the two varieties, respctively. Also the same workers concluded that water melon seed oil could be a good substitute for maize oil in human diets in an attempt to reduce high levels of blood cholesterol.

In another study Oyenuga and Fetuga (1975) reported , that water melon seed oil is predominately linoleic acid whichrepersents about 52.3% and 57.9%, followed by oleic acid , which ranged between 18.1% in Bara and serwe water melon seed, respectively. In addition the saturated fatty acids were present in lower amounts, particularly, the palmitic acid which approximates to 12.8% and 16.8% and the stearic acid which represents about 11.1% and 13.0% of oil fraction in the seeds of the two varieties respectively.

Gupta and Chakrabarty (1964) reported that , the fatty acid composition in oil of another citrullus species is linoleic

58.81% oleic 20.92% Arachidic 1.7%, stearic 6.52% palmitic 10.4% and linolenic 1.65%.

These investigations are in general agreement, that the family cucurbitaceae is rich in total unsaturates whish amount to 81.9% with linoleic acid present as the major component. Also the studies of Gupta and Chakrabarty (1964) on water melon seeds of different origins indicated clearly that the seed oils of these species showed wide divergence in composition depending upon the location of growth. This concept was also demonstrated by Dhingra and Biswas (1954) cited by Oyenuga et al, (1975) who reffered to the variance of a great extent in oil content and fatty acid proportions of water melon seeds as affected by the place of origin.

Regarding the effect of treatment on the fatty acid in water melon seed oil , Ogunsua and Badifu (1989) Found that roasting decreased the linoleic acid content from 65.03% to 61.40% in total fats , and increased the percentage of oleic from 15.55%, 18.3% steric acid from 9.37% to 9.64% and palmitic acid from 10.06% to 10.66% Apparently processing may insignificantly aggravate the degree of saturation at the expense of unsaturation. These resultis agreed largely with the earlier report of lorusso et al (1982) on heated groundnut oil. The same workers also declared that, roasting of water melon seed kernel don,t alter the fatty acid composition. Processing of water melon seed must be carried out with care.

Iodine value of water melon seed oil as shown by Mustafa et al (1972): Gupta and Chakraparty, (1964); Oyenuga and Fetuga, (1975); Girgis and said , (1968) and Al Khalifa (1964) is in the range of 110.0 to 133.8 confirming the highly unsaturated nature of water melon seed oil.

2.7.6 Carbohydrate Content :

With respect to the carbohydrate content of water melon

seeds, Al Khalifa (1996) reported a range of carbohydrate in water melon seeds from different places between 23.4 and 45.1% conversely the results obtained by Mustafa et al (1972) ; Oyenuga and Fetuga (1975) and Ogunsua et al (1984) did reveal a range of carbonhydrate content of only 3.50%. to 8.38%. these results are approximately comparable to those obtained for an [Egusi]

Water melon seeds which contain between 2.0 and 6.13% (AlKhalifa 1996; Oyolu, 1977 and Sawaya et al 1986). In addition, Mustafa et al (1972) reported the carbohydrate content of the whole seeds to be 8.39% and that of the hull and kernel to be 14.86 % and 1.5% respectively.

2.7.7 Crud fibre content:

kamel et al (1985) reported that, the fibre content of whole water melon seeds on dry matter basis to be 47.7% it was also reported that the fibre content of whole water melon seeds is about 37.7% (Mustafa et al 1972). The same workers declared the fibre content in the kernel to be 41.7% whereas Ogunsua et al (1984); Nwokolo and sim).

2.7.8 The total ash in watermelon seed:

Ash content of watermelon seeds was investigated by several workers,Mustafa et al., (1972); Ogunsua et al.,(1984); Lasztity et al., (1986); Hayat(1994);Shayo et al (1992),and Al khalifa, (1996) and it was found in rangeof 1.85-5.2%.

2.7.9 the effect of using water melon seeds powder in proiler performance:

In a study to determine the effect of weter melon seeds on broiler performance the Results showed an increase in feed intake and body weight for chicks fed on 20% toasted WMSC compared to other tested groups. This experiment revealed that, WMSC can be included in broiler diets up to 20% and who recommended that watermelon seed should not be

included at levels higher than 20%, because these levels brings up the fiber content of the ration to be over 10%, which reduce feed intake. Significant differences ($P<0.05$) observed in protein efficiency ratio between the control and birds receiving 5% and 15% watermelon full fat. However, birds receiving 5% watermelon full fat seed showed a significant reduction in the protein efficiency ratio in their diet. Dressing % was significantly higher ($P<0.05$) in birds receiving the graded levels of (5% 10% and 15%) watermelon full fat compared to the control diet. No differences observed among feeding groups regarding mortality rate.

Chapter Three

MATERIALS AND METHODS

3.1 Experimental site and duration :

This study was carried out at the poultry farm, College of Animal production Science and Technology, Sudan University of Science and Technology (Hillat kuku) , during the period 2017/1/14 to 2017/1/30.

3.2 Experimental Birds:

Atotal of one hundred and twenty (120) one day old unsexed broiler Chicks (Ross) fetched from Arabic company for poultry (ommat). The chicks were weighed 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 sided house in gabled by 8×3 dimensios . The long axis of the house extended east- west facing the wind direction for efficient ventilation ,All sides of the house were covered by nylon sheet during the incubtion period of chicks . The house was divided into 10 experimental sections (replicates) of equal size (1×1 m).

3.4 Feeders and Drinkers :

Each section was provided with one round metal feeder and plastic drinker.

3.5 Dietary Ingredients:

Commercial water melon seeds was obtained from the local markets in Khartoum (Mayo) and Khartoum North (hag yousuf) .

Other ingredients as sorghum , groundnut cake , lime stone , superconcentreate , vitamins , salt , methionine were purchased from "Hillatkuku" market .

Water melon seeds were well cleaned and half the quantity was treated (roasted) , and the other lot wasn't treated and left as it is .

3.6 Experimental Diets :

Five diets were formulated to be isoenergetic (13 MJ ME/Kg)And isonitrogenous (220 g C.P/kg) . According to National Research Council (N.R.C) (1984). Control(A) and four diets were formulated to contain (100g/kg and 150 g / kg)of raw or roasted water melon seeds, respectively . On the basis of inclusion levels and treatment , diets containing water melon seeds were named as follows. Low raw water melon seeds (LRWMS) , adiet which contains 6% raw water melon seeds (B). High raw water melon seeds (HRWMS) adiet whish contains 8% raw water melon seeds(C). Low treated water melon seeds (LTWMS) , adiet whish contains 6% treated water melon seeds(D). High treated water melon seeds (HTWMS) adiet whish contains 8% treated water melon seeds(E).

3.7 composition of calculated and analysed experimental diets :

Three rations were prepared a Pre-starter (from 1 to 7 days) , secondly the Starter (from 7 to 28 days) , and thirdly the Finisher (from 29 to 37 days) . 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 NRC (1994) . Feed and water were supplied adlibitum during the experimental periods.

3.8 **Feeding regime:**

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

3.9 Watering :

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

3.10 lightening :

The house had efficient light. Lampes were lighted during night to complete with the day hours the duration of light needed

3.11 proehylactic measures :

The birds were vaccinated afirst dose against infectious bronchitis (I.B) and new castle disease (ND) in the day 7. At the day 14 they were vaccinated against Gamboro disease. The second dose was repeated at the day 21 and 28 against Gamboro disease and new castle disease respectively.

Multi - vitamin plus antibiotic were provided in water the first seven days , Sugar was added to the water upon arrival and for six hours . and coccidostat was also provided from the day 15 to the day 22

3.12 carcass preparation :

At the end of day 37 the birds were fasted for 10 hours before being slaughtered. Eviscerated carcass weight and internal organs (liver, gizzard , Internal fat, heart) were weighed and recorded.

3.13 Data collection :

Feed weight was recorded on daily basis and birds were weighed weekly to determine body weight, feed intake , and calculate the feed conversion ratio (FCR) during the experimental period started on2017/1/14 and ended on 2017/1/30.

3.14 Statistical Analysis :

The data were subjected to analysis of variance (one – way – ANOVA) and the mean were tested

for significance by least significant (LSD) using statistical package of social science (SPSS).

Table(1): Determined chemical composition of commercial water melon seeds:

Component	Row %	Treated%
Crude protein	19.94	17.84
Crude fat % (E.E)	23.92	25.57
Crude fiber% (C.F)	35.63	40.05
Moisture%	3.61	0.91
Ash %	3.50	2.42
N.F.E%	13.4	13.21
Metabolizable energy(ME) (KCAL/KG)	2612.6691	2627.58365

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

Pre-starter and starter diet :

Ingredients	Percentage
Sorghum	**66%**
Ground nut cake (G.N.C)	**27.35%**
Concentrate	**5%**
Dicalcium Phosphat D.C.P	**0.6%**
Lime stone	**0.7%**
Salt	**0.3%**
Anti fungi	**0.1%**
Total	**100%**

Calculated analysis of pre-starter diet :

Me /kg	Cp%	Cf%	Ca%	Avp.%	Ly%	Meth
12.9	**23.063**	**3.6**	**0.79**	**0.437**	**0.62**	**0.523**

Table (3): growers :

Treatment / Ingredient	Control diet (A)	Untreated W.M 6% (B)	Untreated W.M 8% (C)	treated W.M 6% (D)	Treated W.M B.A 8% (E)
Sorghum	66%	60%	58%	63.1%	57.4%
G.N.C	27.35%	26.1%	25.8%	21.2%	26.4%
Super Concentrate	5%	5%	5%	5%	5%
Untreated W.M	0%	6%	8%	0%	0%
Processes W.M	0%	0%	0%	6%	8%
D.C.P	0.6%	0.7%	0.7%	0.7%	0.7%
Lime stone	0.7%	0.7%	0.7%	1%	0.7%
Salt	0.3%	0.3%	0.3%	0.3%	0.3%
Anti fungial	0.1%	0.1%	0.1%	0.1%	0.1%
Oil	0%	0.9%	1.2%	2.2	1.2%
Lysine	0.3%	0.2%	0.2%	0.2%	0.2%
Total	100%	100%	100%	100%	100%

Chemical Analysis:

Me	12.9376	13.00618	13.02904	13.41556	13.01812
Cp	22.928	22.9214	22.9192	21.0027	22.9414
Cf	3.588	5.5137	6.1556	5.5183	6.5356
Ca	0.7942	0.81454	0.81332	0.92292	0.81392
Avp	0.4388	0.4523	0.4508	0.43853	0.45242
Lyc	0.9222	0.79484	0.78572	0.93172	0.79292
Meth	0.5422	0.5275	0.5226	0.50827	0.52458

Table (4): Finisher diet :

Treatment / Ingredient	Control diet (A)	Untreated W.M 6% (B)	untreated W.M 8% (C)	Treated W.M 6% (D)	treated W.M B.A 8% (E)
Sorghum	69.2	63.4	61.5	63.1	60.9
G.N.C	21.8	20.9	20.6	21.2	21.2
Concentrate	5	5	5	5	5
Untreated W.M		6	8		
Processed W.M				6	8
D.C.P	0.3	0.7	0.7	0.7	0.7
Lime stone	0.7	1	1	1	1
Salt	0.3	0.3	0.3	0.3	0.3
Anti fungial	0.1	0.1	0.1	0.1	0.1
Oil	1.5	0.4	0.4	0.4	0.4
Lysine	0.4	2.2	2.4	2.2	2.4
Total	100	100	100	100	100

Chemical analyses:-

Chapter four

Results

4.1 The results in table (5) showed no significant differences ($p>0.05$) in feed intake between the groups.

4.2 Results in table (6) recorded siginificant differences ($p\leq0.05$) in weight gain between the treated groups , untreated groups and control groupe in week 5 and 6 group (E) record the high value and group (B) record the lowest one.

4.3 Results in table (7) recorded siginificant differences ($p\leq0.01$) , ($p\leq0.05$) in weekly body weight between the treated groups , untreated groups and control groupe in week 5 and 6 group (E) record the high value and group (B) record the lowest one.

4.4 Results in table (8) recorded siginificant differences ($p\leq0.05$) in weekly broiler feed conversion between the treated groups , untreated groups and control groupe in week 5 and 6 group (E) record the high value and group (B) record the lowest one

Table (5): Effect of water melon seeds on weekly broiler feed intake (g/bird) :

Treatment / Week	Control diet A	Untreated W.M 6% B	Untreated W.M 8% C	Processed W.M 6% D	Processed W.M 8% E	Sig
4	596.8±65.05	540.5±35.35	492.75±5.02	509.1±81.95	1119.6±79.7	NS
5	586.2±601.6	1018.2±66.9	965.05±42.07	939±7.35	1054.5±140	NS
6	658.9±80.04	631.3±22.76	564.3±15.69	576.5±0.77	589.3±67.24	NS

NS: NO significant difference (p>0.05)

Table (6): Effect of water melon seeds on weekly broiler weight gain (g/bird) :

Treatment / Week	Control diet A	Untreated W.M 6% B	Untreated W.M 8% C	Processed W.M 6% D	Processed W.M 8% E	Sig
4	487.5±58.68	533.8±38.18	524.6 ±7.07	547.8±34.78	533±12.72	NS
5	324.4±33.09^{b}	259.2±53.38^{b}	337.5±7.21^{b}	338.4±38.86^{b}	501.4±120.49^{a}	*
6	185.5±19.09^{b}	148.25±30.75^{b}	188±11.31^{b}	193.75±22.55^{ab}	286.5±68.887^{a}	*

***: significant difference at (p<_0.05)**

NS: NO significant difference (p> 0.05)

a,b,c : mean within the same raw followed by difference superscripts are significantly

(p< 0.05) difference

Table (7): Effect of water melon seeds on weekly broiler body weight (g/bird) :

Treatment / Week	Control diet A	Untreated W.M 6% B	Untreated W.M 8% C	Processed W.M 6% D	Processed W.M 8% E	Sig
4	998.2±112.85	1019±9.89	1063.6±8.48	1077±58.54	1119.6±79.7	NS
5	1322.5±79.9^{bc}	1278.2±63.28^{c}	1401.1±15.69^{bc}	1415.8±19.02^{b}	1621±40.72^{a}	*
6	1508±60.81^{b}	1399.5±3.53^{bc}	1594±9.79^{b}	1609.5±3.53^{b}	1907.5±109.6^{a}	*

****: significant difference at (p<_0.01)**

***: significant difference at (p<_0.05)**

NS: NO significant difference (p> 0.05)

a,b,c : mean within the same raw followed by difference superscripts are significantly

(p< 0.05) difference

Table (8): Effect of water melon seeds on weekly broiler feed conversion Ratio (FCR) :

Treatment / Week	Control diet A	Untreated W.M 6% B	Untreated W.M 8% C	Processed W.M 6% D	Processed W.M 8% E	Non
4	1.16±0.01	1.01±0.00	0.48±0.63	0.92±0.09	1.07±0.028	NS
5	3.38±0.66^{ab}	4.09±0.40^{a}	2.85±0.06^{bc}	2.78±0.30^{bc}	2.12±0.23^{c}	*
6	3.70±0.63^{b}	4.33±0.74^{a}	3.00±0.09^{bc}	2.99±0.33^{bc}	2.08±0.26^{c}	*

***: significant difference at (p<_0.05)**

NS: NO significant difference (p> 0.05)

a,b,c : mean within the same raw followed by difference superscripts are significantly

(p< 0.05) difference

Table (9): Effect of water melon seeds of (carcass, Liver, Gizzard , Heart and Internal fat):-

Treatment / Measurements	Liver	Gizzard	Heart	Internal fat	carcass
Control(A)	40±6.32	31.6±4.08	10.8±2.04^{a}	15.83±5.84^{b}	1067.5±152.47
(B)6%	37.5±4.18	30±5.47	9.16±2.04^{ab}	21.16±5.16^{b}	1056.7±149.55
(C)8%	38.3±9.30	33.3±6.05	7.5±2.73^{b}	25.83±10.68^{b}	1111.7±203.46
(D)6%	40±12.64	37.5±2.73	11.66±2.58^{a}	23.33±7.52^{b}	1225.8±217.47
(E)8%	42.5±2.73	34.16±5.84	10±0.00^{ab}	31.66±11.25^{a}	1238.3±88.81
Sig	NS	NS	*	*	NS

*** : significant difference at ($p \leq 0.05$)**

NS: NO significant difference ($P \geq 0.05$)

a,b,c : mean within the same raw followed by difference superscripts are significantly

($p < 0.05$) different

Chapter five

Discussion

The results of present study in table (5) showed that there is significant difference ($p \leq 0.05$) in feed intake. Group (E) which fed 8% treated (Roasted) watermelon seed meal (D), (C).(B) and (A) respectively. This results is similar to those of (Shazali et al (2012)) which reported that birds fed watermelon seed recorded higher feed intake compered to control group.

The results in table (6) showed that there is significant difference in weight gain and feed conversion ratio between experimental groups. Group (E) which fed 8% roasted watermelon seed recorded higher weight gain and better (FCR) followed by group (D), (C), (B) and (A) respectively, this results is in line with those of ((Shazali et al (2012)) who reported that treated group recorded higher weight gain and better (FCR). This might be due to heat treatment which improve protein digestibility.

The results in table (5) showed there is no significant difference in feed intake between tested groups. And that is against those of (Shazali et al (2012)) which showed significant difference in feed intake at between groups fed graded levels of watermelon seeds powder and control group.

The result showed that there is significant difference ($p \leq 0.05$) in heart and internal lipid weight. Group (A) and (D) recorded high value of heart weight, and group (E) recorded higher internal lipid weight compared with other tested groups, that might be due to high fiber content in watermelon seed.

The results showed there was no significant difference in liver, gizzard, carcass weight and mortality rate between experimental groups.

Chapter six

6. Conclusion and recommendations

6.1 conclusion:

The present study concluded that watermelon seed meal can be used in broiler diet up to 8% without any negative effect on their performance, and heat treatment (toasting) improve broiler productive performance (body weight, weight gain and feed conversion ratio (FCR).

6.2 recommendations:

1. More studies should be done on the use of watermelon seeds on broiler performance.

2. The use of unconventional feed stuff as broiler feed stuff to reduce feeding cost.

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