بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

The Use of Safflower *(Carthomus tinctorius .L)* Seed and Meal with or without Xylem Enzyme in Broiler Diets

إستخدام بذرة و كسب القرطم مع أو بدون إنزيم الزيلام في علائق الدجاج اللاحم

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M.S.c. (poultry production) Omdurman Islamic University 1997.

A Thesis submitted in fulfillment of the Requirements of the Sudan University of Science and Technology

For the Degree of Doctor of philosophy

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March 2015

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بسم الله الرحمن الرحيم

(وَهُوَ الَّذِي أَنْزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجْنَا بِهِ نَبَاتَ كُلِّ شَيْءٍ
فَأَخْرَجْنَا مِنْهُ خَضِراً نُخْرِجُ مِنْهُ حَبّاً مُتَرَاكِباً وَمِنَ النَّخْلِ مِنْ
طَلْعِهَا قِنْوَانٌ دَانِيَةٌ وَجَنَّاتٍ مِنْ أَعْنَابٍ وَالزَّيْتُونَ وَالرُّمَّانَ
مُشْتَبِهاً وَغَيْرَ مُتَشَابِهٍ انْظُرُوا إِلَى ثَمَرِهِ إِذَا أَثْمَرَ وَيَنْعِهِ إِنَّ فِي
ذَلِكُمْ لآيَاتٍ لِقَوْمٍ يُؤْمِنُونَ) [الأنعام: 99].

صدق الله العظيم

Dedication

This work is dedicated to

The of my farther and my mother

My wife

My son

My daughters

My Brothers   on the department of animal production

Acknowledgement

Thanks to god for giving me strength and patience to fulfill this study

My sincere gratitude and appreciation g to my supervisor, **Dr .Mukhtar Ahmed Mukhtar** associate professor and professor **Kamal abdelbagi Mohammed** for hi s encouragement , eagerness enthusiastic curiosity , commentary discussion valuable advices , ever non ending assistance and patience during the intact on first establishment of this work and up to the end .

I would like t thank the staff of animal department faculty of agriculture sudan university for science and technology

Sincere gratefulness to my family for their enormous support

My thanks extend to Haytham Osman for good help during this experiment and thanks for everyone who helped me to do this study.

Also I am thankful and grateful to **Alaa daffalla** for assistance and help typewriting this study .

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ABSTRACT

Two experiments were carried out to determine the effects of various levels (o , 5 ,10 ,15 and 20 %)of full fat safflower seeds and seeds cake with and without enzyme (xylanase) as source of energy and protein on the performance and carcass characteristics of broiler chicks and their economic impact .

The first Experiment was carried out to evaluate inclusion of various levels (o, 5, 10, 15 and 20 %) of full fat safflower seed (FFSS) with and without enzyme on the performance of broiler chicks. Total of two hundred and ten, seven days –old unsexed broiler chicks were used. Five experimental diets (A, B, C, D and E) containing graded levels of FFSS (0.0, 5.0, 10.0, 15.0, and 20%) were formulated; the same diets were supplemented with xylam 500 enzyme to have ten experimental diets. Each treatment was subdivided into three replicates. The treatments were distributed in a Complete Block Randomize Design (CBRD).

Results showed that FFSS can replace sorghum in the broiler diet as a source of energy without any adverse effects on the performance and carcass yield. The supplemental of commercial enzyme (xylam 500) to diets containing different levels of FFSS improved the broiler chicks performance, results also revealed that it is economical to use FFSS with and without enzyme as a source of energy in a broiler chicks diets .

The second experiment was carried out to determine the effect of various levels (o , 5 ,10 ,15 and 20 %)of safflower seed cake with and without commercial enzyme (xylem 500) containing as source of protein on the performance and carcass characteristics of broiler chicks and their economic impact .

Two hundred and ten, seven day old unsexed broiler chicks were used to evaluate the inclusion of graded levels of safflower cake (0.0, 5, 10, 15, and 20%) with and without enzyme as a source of plant protein. Chicks were randomly distributed to ten treatments with three replicates, each replicate with seven chicks. Five iso caloric, iso nitrogenous diets were formulated, the first five groups were fed on diets containing graded levels of safflower cake (0.0,5,10,15, and 20%)without enzyme , other groups were fed on the same diets but supplemented with enzyme . Experimental parameters covered , body weight , feed intake , body weight gain, feed conversion ratio, rate of mortality , carcass yield and economic appraised. Results showed that undecorticated safflower seed cake can replace the groundnut cake up to 20% without adverse effects on broiler chicks performance. Weight gain of broiler chicks improved with the increase of safflower seed cake levels in the diets, however, chicks fed on 15% and 20% un decorticated safflower seed cake with and without enzyme recorded significant improvement in body weight gain compared to other treatment groups, also all experimental chicks showed significant improvement in feed conversion ratio (FCR) .Supplementation of enzyme increased the feed intake in all experimental groups except group fed on diets containing 5% and 10% safflower cake. Economically chicks fed on safflower seed cake (SFC) supplemented with enzyme (xylem 500) recorded the highest profit.

الملخص

في هذا البحث ثم اجراء تجربتين لدراسة اثر ادخال بذرة القرطم كاملة وامباز (او كسب) بذرة القرطم الغير مقشورة بمستويات مختلفة (0،5،10،15 % ، في علائق الدجاج اللاحم مع او بدون انزيم (الزايلام 500) كمصدر للطاقة والبروتين علي الاداء الانتاجي وخصائص الذبيحة للدجاج اللاحم و اثرها الاقتصادي

التجربة الاولي : اجريت لتقيم اثر إدخال مستويات مختلفة (0'5'10'15'20)من بذرة القرطم كامله مع او بدون اضافة انزيم الزايلام لتقيم الاداء الانتاجي لكتاكيت الدجاج اللاحم, استعمل في التجربة 210 كتكوت لاحم عمر سبعة ايام وتم تكوين العليقه والتى تحتوي علي مستويات مختلفه من بذرة القرطم كاملة (0'5'10'15'20)وتم تركيب عليقه اخري تحتوي نفس مستويات بذرة القرطم مع اضافة انزيم الزيلام (500)ونجده انه تم تكوين العشره علائق للتجربه وكل معامله من هذه المعاملات قسمت عشوائيا الي ثلاثه مكرارت وكل مكرر يحتوي علي 7 كتاكيت وصممت هذه التجربه علي النظام العشوائي الكامل .

واظهرت نتائج هذه التجربه انه يمكن احلال بذرة القرطم كامله بديلا للذره الرفيعه (الفتريته) في علائق الدجاج اللاحم كمصدر للطاقة بدون أي اثر سلبي علي اداء الدجاج اللاحم او خصائص الذبيحة .

ووجد ان اضافة انزيم الزايلام 500 في علائق تحتوي علي مستويات مختلفة من بذرة القرطم ادت الي تحسين ايجابي علي اداء الدجاج اللاحم .

ظهرت النتيجه ان ادخال بذرة القرطم كامله مع او بدون ازيم كمصدر للطاقه ذات قيمه اقتصاديه .

اجريت التجربة الثانيه لتقييم اثر ادخال كسب (امباز) بذرة القرطم الغير مقشورة بمستويات مختلفه (20’15’10’5’0) مع او بدون اضافة انزيم الزابلام 500 كمصدر للبروتين في علائق الدجاج اللاحم وتأثيره علي الاداء الانتاجي وخصائص الذبيحة للدجاج اللاحم وعلي القيمه ألاقتصاديه.

في هذه التجربة تم رعاية 210 كتكوت لاحم غير مفروز عمر 7 ايام لتقيم اثر ادخال كسب(امباز) بذرة القرطم الغير مقشورة بمستويات مختلفه (20’15’10’5’0)مع او بدون اضافة انزيم الزيلام 500 كمصدر للبروتين النباتي وقسمت الكتاكيت عشوائيا الي عشره مجاميع في كل مجموعه ثلاثه مكرارات وكل مكرر 7 كتاكيت .

تم تركيب خمسة علائق تجرييبه متوازنه من ناحية الطاقه والبروتين وكل عليقه تحتوي علي مستويات مختلفه من كسب (امباز) بذرة القرطم الغير مقشور(20’15’10’5’0) وتم تكوين خمسة علائق اخري تحتوي علي نفس المستويات من كسب (امباز) بذرة القرطم الغير مقشور مع اضافة انزيم الزيلام 500 .

وتم اخذ قياسات الاداء الانتاجي (الزياده في الوزن استهلاك العلف ’ معدل التحويل الغذائي ’نسبة النفوق’ وخصائص الذبيحه والقيمه الربحيه) .

اظهرت نتائج هذه التجربه انه يمكن ادخال كسب (امباز) بذرة القرطم الغير مقشور بنسبة 20% في علائق الدجاج اللاحم بدون أي اثر سلبي علي اداء الدجاج اللاحم او خصائص الذبيحه .

كما اظهرت الدراسه ان الزياده في وزن الجسم تتحسن بزياده نسبة ادخال كسب (امباز) بذرة القرطم الغير مقشور في العليقه .ووجد ان الكتاكيت التي تغذيت علي عليقه تحتوي علي نسب 15’ 20% من كسب (امباز) بذرة القرطم الغير مقشور مع او بدون اضافة ازيم الزيلام سجلت تحسنا ملحوظا في زيادة وزن الجسم مقارنه مع المجموعات الاخري.

اظهرت نتائج التجربه و في كل المجموعات تحسنا ملحوظا موجبا في المعدل التحويل الغذائي.

وأضحت النتائج ان اضافة انزيم الزيلام الي علائق الدجاج اللاحم ادي الي زيادة استهلاك العلف في كل مجموعات التجربة ماعدا المجموعات التي غذيت علي عليقه تحتوي علي 5’ و 10 % امباز بذرة القرطم الغير مقشور .كما اظهرت نتائج التقيم الاقتصادي ان الكتاكيت التي غذيت علي علائق تحتوي علي مستويات مختلفه من كسب او امباز بذرة القرطم مع اضافة انزيم الزيلام اعطي قيمه ربحيه اعلي.

Chapter One

Introduction

The poultry industry occupied a leading role among agricultural industries in many parts of the world. Intensive poultry production in Sudan goes back to 1972 as small scale around capital and other big cities. The position of good protein in shortest period of time in form of meat and eggs is the major contributing role of poultry in human nutrition; poultry meat production has shown much growth than other type of meat during the last decades. The potential for growth is obvious in view of the value of this kind of meat in modern day human diets (Daghir, 2008). The rate of increase in chicken meat production has averaged 5.7% per year since 1990 .The hot regions of the world have probably the greatest potential for further growth since the level of consumption is still very law (Daghir, 2008).

Poultry feed cost about 65-70% of total variable cost Smith (1990). The energy and protein sources materials were contributed by 65-70% and 28% in feed mixture respectively. Today the price of poultry diet ingredients mainly, the energy and protein sources continued to increase and this was attributed to decline in production and increasing demand with the rapidly expanding in poultry industry. Consequently there is an interest in searching for alternative sources of poultry feed of plant species (Mukhtar, 2007). Oilseeds are one of the best and common energy sources in poultry nutrition (Dajue and Mudel, 1996). Among the various oilseeds available on the market today, full-fat safflower seeds.

Safflower (Carthmus tinctorusl.), is a member of Composite or Asteraceae, it is an annual herbaceous plant, cultivated mainly for its seed. The seed contains more ether extract, which contributes to high metabolic energy per unit or high energy density of feed. Full-fat Safflower seed contains about 15-19% crude protein, 28-35% ether extract, 15-19% crude fiber, 30-32% acid detergent fiber and 40-45% natural detergent fiber Hill and Knowles, (1968) ; Weiss (1983), Choline , magnesium, lysine, pyriodoxine, biotin, pathothenic acid (Oguz and Oguz (2007).

Safflower oil is rich in linolic acid (75-78%) which plays an important role in reducing blood cholesterol level. Safflower seeds pressed for oil production (GRDC, 2010) so the by-product, Safflower meal, is mostly used as a protein ingredient for animal feeding. The quality of Safflower meal is highly variable as it depends on the amount of hulls and on the extent of oil extraction. Seed and cake of Safflower contain high level of non-starch polysaccharides (NSP) and phytic acid which act as anti nutritional factors.

In recent years, much attention has been focused on improving nutrients unitization of inferior feed ingredients with the aim of reducing feed cost (Pourreza and Classen ,2001) .Results of many experiments mentioned indicated that microbial exogenous enzyme supplementation of poultry diets improved nutritional value of starch, fat digestibility and crude protein Meng, *et al.,* (2005) and phytate unitization .Therefor, the addition of the microbial (xylam 500) enzyme, lead to hydrolysis of phytate, which bind phosphorus protein, amino acid and starch increasing availability of each (Elharthi, 2006).

The objectives of the study are:-

- To study the effect of various levels (0, 5,10 , 15 and 20%) of full fat safflower seed and cake meals with or without enzyme as sources of energy and protein on performance, carcass characteristic and economical traits of broiler chicks.
- To evaluate the use of dietary enzyme (xylem 500) on the performance and meat yield quality of the broiler fed diet containing either full-fat seed or cake of safflower.

To study economical efficiency of various experimental diets.

Chapter Two

Literature Review

2:1 Description of Safflower

Safflower (*Carthamus tinctorills L)* is annual herbaceous, highly branched plant which reaches 0.3-1.5 m in high. It has an extensive root system with a strong fleshy tap roots reaching 2-3 m in depth and thin lateral roots exploring the first 30 cm of the soil Ecoport, (2010); Oyen *et al* (2007), the stem is glabrous greenish white, cylindrical and woody near the base. The leaves are sessile arranged in a rosette from the base 4 – 20 cm long x 1.5 cm broad, glossy dark green, the upper leaves bear many sharp spines. Each stem bears a terminal inflorescence. It is a globular capitulum 1.3 – 3.5 cm in diameter containing dark red during flowering. Each flower produces one fruit. Safflower fruits are achenes usually called "seeds" surrounded by a thick fibrous hull they are smoothing, shiny and angular about 6 – 9 mm long white or brownish and white with grey brown or black strips. They generally contain 33–66% hull and 40–67% kernel (Baumler, et al (2006) Mandel, *et al* (2004) ; Ecoport, (2010), Oyan, *et al* (2007).

A multipurpose crop safflower was originally grown for its flowers that were used in making red and yellow dyes for clothing and food preparation, but it is now primarily grown for its oil which is used for food and industrial purpose

Safflower is a major crop with a world production of about 650/ mt in 2009 (FAO, 2010) . There are linoleic and oleic types of safflower varieties . The oil in linoleic variety contains about 70–80% linoleic acid and is used for edible oil products such as salad oils and soft margarines. The oil of oleic varieties contains about 80% oleic acid and servers as heat-stable cooling oil or as drying or semidrying oil for paints and other surface GRDC, (2010) , Oeke, *et al.,* (1992) other industrial uses include soap and “roghan wax“ for the batik industry Dajue, *et al*., (1996) Pharmaceutical products infant formulas, cosmetics and bio diesel (GRDC, 2010) several safflower seed products can be used as animal feeds, and by product of the oil extraction and the hull Oeke, *et a.,l* (1992). Safflower young leaves may be eaten as vegetable and safflower foliage and stem can be used as green fodder, hay or silage *(*Ecoport, (2010); Oyen *et al*; (2007 *)* it is potentially valuable fodder plant for semi-arid and arid areas Dajue, *et al.,* (1996).

2 : 2 History of Safflower

Safflower (*Carthamus tinctorius L.*) is commonly known as kusum in India and Pakistan and honghua (red flower) in China Chavan , (1961).

Safflower (*Carthamus tinctorius*) has been cultivated since ancient times Breitschneider (1870) it has been known under many names salfram, salflor, khardam), Weiss (1971). Salunke *et al;* (1992) call it the world's oldest crop where as others in evaluation crop plants indicated that olives, dates and sesame may be older.

In many cases over 4000 years ago safflower was grown in Egypt, it is possible that it was grown earlier in the Euphrates region.

Weiss (1971) uncovered a number of Egypt logical references showing that safflower was prized as source of red-yellow and orange dyes for cotton and silk. The dyes were derived from safflower flowers and this use continues to this day.

Safflower is one of the world's oldest oil seed crops that have been commercially for edible oil and natural dye source around the world .However in this century it has become an oil crop used both for food and industrial purposes in many countries Watanabe and Terabe (2000).The safflower flowers produce red and yellow pigment and mainly used as material dye Kulkarni, et al (1997) the flower petal contain about 30% of yellow pigment Rudometova, *et al.,* (2001) and 0.83%red pigment (Nagaraj, *et al.,* 2001, Kulkarni, *et al*. (2001) .

The safflower crop was initially grown to produce dyes for food and fabric and medicinal use, but currently cultivated for edible oil and bird seed. Safflower oil has nutritional values that similar to olive oil. Moreover the high oleic type is very suitable for hypo-cholesterol diets. For frying and in the preparation of frozen food Ekin, (2005).

The safflower is one of the crops with its use in China reported 2200 year ago safflower cultivation remained a back yard crop for personal use and as a result it remained a major and neglected crop with world seed production in 1989 estimated at 908,000 ton (Rouland, (1993).

Safflower oil has been produced commercially for export more than 50 years ago Dajue and Mundel ,(1996) .Crop is also now grown commercially as cut flower, vegetable and medicinal plant.

2 : 3 Botanical Description

Safflower is a member of the compositae (Cynoraae) family which includes several important crop plants such as artichoke (Cynara Scolymus), sunflower (Heliamthus annus), wager seed (Guizolia abyssinica) and Chrysan themum (Chryan themum) Smith, (1985).

The plant is highly branched, herbaceous, thistle like, annual, varying in high from 30 – 150 cm. it has strong, somewhat thickened tap-root, and numerous thin laterals, the stem is stiff , solid and circular in section, thick at the base and tapering with height, smooth and glabrous. The plant has many branches; each terminating in flower and the extent of branching with a variety depends mainly on environment. Abel, (1976) has shown that yield is not correlated to plant high.

The leaves are simple, usually dark green, sessile and glabrous, estipulate deciduous, with short spines, scattered along the margins, width between 2.5 to 5 cm and length from 10 – 15 cm with acuminate (pointed) tips. The midrib projects slightly from tip, most leaves have serrated edge and are lance late in shape hut can be ovate to obviate. Leaves become shorter and stiffer on the upper reaches where the leavers become still shorter ovate to obviate shapes, getting closer and closer together until they crowd on each other around the flower head. The lower leaves on most safflower types are spineless, on the upper leaves the degree spines varies from spineless to horrible. Spines are controlled by multiple genes. The number of spine per leaf varies from zero to 24 and length can be from 1 to 6 mm Classen, (1952)), Ashri ,(1964)Safflower is abroad leaf, annual oil seed crop in the same family as sunflower it is thistle like plant with strong central varying number of branch has tap root system. Each branch usually has one to five flower head and each of these heads contain 15 – 20 seed. The fruit of safflower is an a achenes which is call a safflower seed, the modern types of safflower seed is normally free of Pappas although sometimes it occurs on some seed in the center of the head.

Safflower seed consists of tough, fibrous hull that protects a kernel made up of two cotyledons and one embryo of the hull makes up to 18 – 59% of the seed weight.

The color of safflower seed is generally creamy to white but in the last 30 years a number of variation have occurred as researchers have striven to higher oil contents, by modifying the thick hull. Normal-hull seed ,thin-hull seed , gray-purple; and brown-striped hull seed have combined into a variety of hues. The seed is dicotyledonous, oleaginous and exalbuminous Weiss, (1971).

Florets are classified by color (White, light yellow, yellow-orange, red, purple or others) while the yellow-orange being the most common color. The color of the florets after flowering may vary from the color during flowering. Classen, (1952) found that inherited pair of genes.

Red flowers are the source of two coloring materials, a water-soluble yellow and red pigment the red dye is carthamin. The component that was highly prized in ancient times.

In order to extract the red coloring matter, the yellow dye must first removed. The yellow component (C16H, 2011) has a molecular weight of 558.48. The red component carthamin (43H42027) has molecular weight of 910.81.

The safflower seeds are achenes (fruit) surrounded by thick fibrous hull. They are smooth , shining and angular about 6 – 9 mm long white or brownish and white with grey. Brown or black stripes are generally contain 33–60% hull and 40–67% kernel. Thin hulled varieties have been developed Baumler, *et al* (2006) , Mundel*, et a.l*, (2004) .

2:4 Distribution of safflower

Safflower is very ancient crop which originated in the middle East, Ashri, (1975) compared to the other oil seed crops, it is a worldwide minor crop. According to the FAO data, safflower is grown in large area in India (350,000 ha) Mexico (85,000 ha) Ethiopia (72,000 ha) and U.S.A (54.000 h). Other producer countries in decreasing order Kazakhstan, (36,000 ha) Uzbekistan (13,000 ha) and China (12,000 ha).

However Russian Federation, Pakistan, Spain, Turkey and Israel have relatively minor acreages, in addition Canada, Portugal, Syria Czech Republic, Cyprus, Romania and Italy are known for their safflower research and development (Anonymous, 2004).

Daju and Mundel (1996) reported that the other producing are U.S.A, Mexico, Ethiopia, Argentina, Irag , Iran, China, Kenya, Canada, Spain, Turkey, Italy, Morocco and Russia.

The safflower has been recently imported into Romania and it is cultivated in the southern part of the country. It can be available resource mainly in the droughty area on law fertile soil where they give production comparable to that of sunflower Bilteanu, (1993).

The safflower grown as oil crop has been the subjected of general studies in southern Italy over at least for 30 years. Croleto, (2009). The lack of use of the crop as an oil plant in Mediterranean environment is mainly due to the length of cropping cycle along with law seed yield potential Vonghia, *et al.* , (1990); Cazzato, *et al*., 2011). Recent agronomic research work had strong recommended the adoption of safflower as productive crop under semi-arid rain fed condition due to its environment, nutritional and agronomic benefit Velasco, *et al* ; (2005).

The safflower seed and their products is exported worldwide, the main five producers are India, U.S.A, Mexico, Argentina and Kazakhstan F.A.O, (2011).

Iran is one of the richest germplam of safflower due to its favorable climate and Agricultural condition F.A.O, (2011)

Safflower is an annual crop which can tolerate environmental (drought, salinity stress) Dordas, (2000) . Its minor crop underutilized crop with 615, 214 tons world production during (2008) at present with 225000 ton produced.

India is the largest producer for safflower in world (350,000 ha) followed by Mexico(85,000 ha) Ethiopia (72,000 ha) and U.S.A (54,000 ha) safflower (Carthmus tinctorius L) has become oil crop use both for food and industrial purpose in many other countries Zehra Ekin, (2005). Until this century after cheaper aniline dyes become available, safflower was mainly grown as for north Germany and Alsace in France for dye (Dajue and Mundel (1996).

2:5 The Chemical Composition:

The chemical composition of safflower seed show that the seed contains 20–40% oil, 10–20% protein and 35–45% hull fraction (Rahamat alla *et a.,l* 2001), the seeds of safflower are rich in oil (20 – 40%) with higher levels of unsaturated fatty acid. Nagarj *et al*.,(2001 and Atasie *et al.,* 2009) and protein (15 – 20%) and therefore are of great nutritive value for human and animal consumption. Safflower seed is mainly grown as edible oil for cooking, during extraction of oil its protein solubility is affected by many factor such as PH, temperature, meal solvent ratio etc. (Baudet and Mosses, 1971). Toxic factors are found at some levels in almost all foods for a variety of reasons. However their levels are reduced in modern crops, probably as an outcome of process of domestication (Sarkiyayi and Agor, 2010).

Mature seed of common type constitutes 27–32% oil, 5– 8% moisture, 14–15% protein, 2–7% ash and 32–40% curd fiber .The seed contains 35-50 % oil 15-20 % protein and35-40 %hull fraction .(Rahamatalla, *et al.,* (2001) The standard safflower oil variability for fatty acid composition in seed oil contain about 6–85% palmitic acid, 2–3% stearic acid 16–20% oleic acid and 71 – 75% cinoleic acid Ngaraj*, et al*., (2001) reported that the safflower oil has high linoleic acid content 70% which is a unique trait amongst oil seed crop.

Safflower seed full fat contain about 15–19% crude protein, 28–35% ether extract, 15–19% crude fiber, 30–32% acid detergent fiber (ADF) and 40–45% neutral detergent fiber (NDF) Hill and Knowles 1968; Weis 1983). Determinations analysis of hull-fat safflower seed (on dry matter basis) except dry matter reported by AOA (1995) represented in Table (1).

The whole safflower seeds are normally white cream in appearance and consist of 33–45% tough hull that protects kernel which form 55–65% of the seed weight (Gecgel, *et al*., 2007). Safflower seed from worldwide collection of accession contain 28.3-+4.5% oil and 17.5+–1.8% protein (DM basis) (ligajue , *et al.,* (1993) seed contain high percentage of hull (about 45%) which hampers their use in animal feeding (Hertrampf , *et al.,* 2000).

Gecogel, *et al*., (2007) reported that the whole seed of safflower in normal hull contain nearly 27–32% oil very high quality, 5–8% moisture, 14–15% protein, 2.7–48% crude fiber.

Study of new safflower varieties (Carthomuss tincturing L) variety (PBNS – 12 PB – 40) were analyzed for content of moisture, crude fiber, lipids, proteins, carbohydrate, mineral, energy, toxic compounds (such as gynogenic, glycoside, tannins and oxalates) and nutritive value. In addition detailed studies were conducted on fatty acid, the result of chemical composition showed that the moisture percentage ranged between 6.326–7.396% ,crude fiber 0.488–1.196%, total lipid 25,699–28.989% ,crude protein 15.91–16.14%, total carbohydrate 45.56–48.93%, ash 3.495–3.497%, calcium 0.092–0.122%, phosphorus 0.15–0.41% and energy 490.65–507.701% Kcal/Kg. Lipid analysis revealed that PBNS–40 variety has higher level of unsaturated fatty acids (3.41%) Amino acid analysis revealed 1.599 and 1.665% respectively. The maximum seed proteins of PBNS12 and PBWS- 40 were extracted at PH 12 (9.29 and 9.6 respectively) the toxic factor showed that gynogenic glycoside, tannins and ox ate content ranged between 3.458–3.730 HCN/100g 0.511–0.530%, 0.079–0.085% respectively. Haemagglutinin activity and trypsin inhibition was not found in these varieties. The nutritive values were determined for utilization average ranged between 5.722–5.941%, nitrogen utilization 0.2508–0.2571%, protein efficiency ratio (PER) 1.496–1.509% and feed efficiency ratio (FER) 0.364–0.365% respectively based on the data to nutritive and toxic composition of seed it appears that both hybrids can be good source of nutrient and energy need for animal nutrition with little danger for toxically (Satish ingal and Santosk . Shrivastava, 2001).

2.5 Safflower uses:

2.5.1 The Uses of Safflower seed

Safflower yield 1500kg/seed / ha in rain fed condition and twice that yield under irrigation (Oyen, *et al.,* 2007). Safflower is cultivated mainly for its seed which used on edible oil and as bird feed,. Oil seed are one of the best and common energy sources for poultry nutrition (Dajue and Mundel 1996).

Seeds may also include in pelted product they reduce dust in the hummer mill give products that binds readily as will entirely eaten (Dajue, *et al*., 1996).

For the last fifty years ago the plant has been cultivated for vegetable oil extraction from its seeds .In April 2007 Sembioys Genetic claimed to have genetically modified safflower to create insulin. Several safflower seed products can be used as animal feeds, the seeds by-product of the oil extraction (safflower meal) and the hulls (Oeke, *et al.,* 1992).

Whole safflower seeds are mainly used for pet food either as bird seeds for wild birds, racing pigeon's parrots and other pet seed or for pet mammals such as gerbils, hamsters and chinchillas, safflower seed are normally too expensive to be used on feed ingredient for farm animal (Oelke, *et al*., 1992).

Safflower seeds are often used as bird seed especially for members of the parrot family and pigeons they are a common alternative to sunflower seeds. The bird feed industry prefers to use which hull and normal hull types of safflower seeds than striped types (Emongor, 2010).

In broiler full fat safflower seeds have been tested at level up to 20% in diets where energy and protein were adjusted. Seeds have the advantage of providing more energy than safflower meal. In this study growth performance and carcass traits were not affected and only blood cholesterol was significantly decreased (Malakian, *et al*., 2o11).

Safflower seed is also used quite commonly as an alternative to sunflower in bird feed as squirrels do not like the taste of it (Black Shaw, 1993).

Safflower is a multipurpose oil crop grown mainly as cut flowers, vegetables and for its highly quality of oil. The uses of safflower have been recorded in china approximately 2200 years ago 1(Dajue and Munde, l 996). Traditionally, safflower was grown for its seeds, for coloring and flavorings foods, as medicines and for making red and yellow dyes especially before cheaper aniline dyes become available (Weiss, 1971). In Egypt dyes from safflower was used to color cotton and silk as well as ceremonial ointment used in religious ceremonies and anoint mummies prior to binding safflower and packets and garlands of florets have been found with 400 years – old mummies (Weiss, 1971).

2.5.2 Uses of safflower Hull:

The hull may be in potting mixtures for plant nurseries, to make packing and isolation material and as filler for bricks (Oyen, *et al*., 2007).

As feed staff they are unpalatable reduce gain, and can constitute only small part of the roughage requirement (Gohi, 1982). Hulls contain about 66% crude fiber and 21% lignin (Hertrampf, *et al.,* 2000).

2 :5. 3 Used of Safflower Flower:

Traditionally the crop grown for its seed and used for coloring and flavoring foods in medicine and making red (Carthamin) and yellow dyes, especially before cheaper aniline dyes become available.

Flower used as coloring wildly in food and beverage coloring such as in fruit juice, soda water, fruit powder, wine candy, pastry refreshments tinned food condiment as well as flour soybean and meat production (Pahlavani, *et al*., 2004; Zhaomu and Lijie, 2001).

Heath concerns regarding synthetic food coloring may increase demand for the world in the future natural food dye will continue to be wildly acceptable due to their non allergic and non carcinogenic properties (Rudometova, *et al*., 2001).

The safflower flower dye used in cosmetics always requires strict safety. Safflower flower pigment is very safe for such as hair cream, shampoo, face cream and perfume (Shouchun, *et al*., 1993). The carthamin is also mainly used for making high quality of cosmetics such as lip stick rouge bath soap as well as high quality egg cake (Jingzhong, 1993).

Pahlavani, *et al.,* (2004) reported that the safflower was mainly grown for its flower was used dye sources for coloring food and textiles as well as medicinal purposes.

The safflower flower produces red and yellow pigments and mainly used material of dye (Kulkarni, *et al*., 1997). The petal contains 30% of yellow pigment and 83% red pigment (Nagardj, *et al.,* 2001; Kulkarni, *et al*., 2001).

Safflower yellow and red pigment is a nice and safe natural pigment which can be used as coloring agent for food and cosmetics (Kulkarni, *et al.,* 1997; Zhang, 1997).

Addition of safflower florets to food is wildly spread and ancient tradition, rice, soap, souses, bread and pickles on a yellow to bright orange color from florets (Daju and Mundel, 1996) .

Safflower floret pigment are good replacement for synthetic food colors today red safflower pigment is widely used as food colorant. The main component of red pigment is called carthamis and due to its water solubility (Dajue, 1993), these pigments are also used as natural food additive with a provement of Chinese government (Yunzhau, 1997) and because of these dyes are natural they widely used in food and beverage coloring.

Dried flower are used as natural dyes from plants are getting more now days because of their naturally and fashion trends. The colorful matter in safflower is carthamin which benzoquinone – based (Sem Biosys, 2006). It has a dye of flavonoid type. Hydrophilic fiber like cotton, wool and others can be dyed with safflower because it is a direct dye. Safflower yellow or red pigments are safe for cosmetics coloring such as hair cream, shampoo, face cream, and perfume or body lotions (Shouchun, *et al.,* 1993).

2: 5.4Coloring food and cosmetics:

Safflower yellow and red pigment is a nice and safe natural pigment, which can be used as coloring agent for food and cosmetics (Kulkani, *et al.,* 1997 ;Zhaomu and Lijie 2001) . Addition of safflower florets to foods is a widespread and ancient tradition. Rice, soup, sauces, bread and pickles take on a yellow to bright orange color from the florets (Daju and Mundel, 1996).

The safflower oil contains some essential fatty acids such as linoleic and linoleum acids and lack of these fatty acids for human body caused drought of skin and plump scales (Darmstadt, *et al.,* 2002; Jinzhong, 1993). The linoleic acid can keep cell membranes with soft and strengthen elasticity and vitality. By using safflower oil, it has developed the natural skin toning cream. At present, the safflower oil has been determined as available oil in the cosmetics proportioning dictionary in the cosmetic trades of the United States, Japan etc. (Jinzhong, 1993)

2:5.5 Uses of stem and Leaves of safflower:

The safflower stem and leaves are also good forage for animal, the forage is palatable and its feed valued yields as similar as or better than oats and alfalfa and also safflower can be grazed or stored as hay or silage(Landu, *et al*., 2005; Gohi, 1982 ; Peiretti, 2009 ;

Oyen, *et al*., 2007).

In addition safflower crop also useful to organic manure and serves to a natural fence against trees pass (Nagaraj, 1993) . Young leaves thinning are eaten as a boiled vegetable side dish with currier rice in India, Pakistan and Burma Da jue and Mundel (1996),Nagaraj (1993) . Tea from safflower forage is used to prevent cardiac and cerebral vascular disease in China Dajue and Yunzhou(1993) safflower leaves are eaten as vegetables(Weiss 1983).

2:5.6 Used of oil safflower seed:

Safflower seeds used for oil production may be either solvent or extracted GRDC (2010), these are linoliec and oleic types. According to Safflower varieties , the oil in linoleic varieties contains about 70–80% linoleic acid and used for edible and soft margarines. The oil of oleic varieties contain about 80% oleic acid and serves as heat-stable cooking oil or as drying oil or semidrying oil for paint and for other surface coating (GRDC2010 and Oelke, *et al.,* 1992).

Initially safflower oil was used as source of oil for cooking, making margarine and salad. Safflower oil is thought to be one of the highest quality vegetable oil containing oleic and linoliec acid. High linoleic from 3.1% - 88.8% and high oleic type with approximate range of oleic from 3.9 to 90.6% (Femondez – Martienz, *et al*., 1993).

High oleic acid oil is high appreciated for food non food application because they reduce cholesterol concentration with much greater oxidative stability than oils with higher poly unsaturated oil (Yodice, 1990). Around the world safflower is grown for its edible oil for cooking, salad oil and margarine. In affluent countries the research linking health and diets has increased for demand of oil, which as the highest poly un saturated/ saturated of any oil available. There is considerable health food market for safflower oil especially in America, Italy, Germany (Smith, 1996).

Bergman and Flynn, (2001) reported that high oleic safflower oil has promise to a pollutant reducing diesel fuel additive to reduce smoke and particulate emission it would also reduce acid rain.

Safflower oil contains predominantly a-tocopherals which exhibits the highest vitamin E activity and safflower is spraying on various edible products to prevent losing water and this extend their shelf life (Johnson, *et al*., 1999) . High oleic safflower varieties have become dominant in the international trade science late 1995 these may contain 75–80% oleic acid, this is comparable to olive oil, it's stable when heated, and is used primarily as high quality of frying oil particularly for special snake frying e g. Potato chips, it is also used in production of baby formulas and cosmetics , mono-unsaturated such as oleic safflower oil tend to lower blood level LDL (bad cholesterol) without affecting the (HDL) good cholesterol (Smith, 1996).

Linoleic acid can be used to keep cell membrane soft and strengthen elasticity and vitality by using safflower oil has developed the natural skin cream (Jinzhong , 1993).

Food producers and industries use safflower oil. Safflower oil is often considered healthier option than using sunflower oil (Dajue and Mundel 1996).

High linoleic acid safflower oil has an important use in the paint industry. Before 1960's in the USA, the oil was mainly as base for superior quality paints, it is used as drying agent in paints and varnishes because of its non-yellowing characteristic (Bergland, *et al*., 2007).

Safflower oil is heat-stable; therefore it is used as cooking oil to dry such food as French fries, chips and other snack foods. Safflower oil is also used in food coating and infant food formulation. Safflower is also used in salad dressing and for production of margarine (Berg land, *et al*., 2007).

2.5:7 the Use of Safflower in Medicinal

Safflower petals have been shown to have a lot of medicinal and therapeutic values (Hanania, e*t al.,* 2004). Safflower is grown almost exclusively for its flowers, which are used for medicine in China and it is regarded as the most important medicine for invigorating the circulation of blood and reducing stasis and its application has long history. Chinese experts think highly of the future of safflower industry, some curative medicines have been developed, such as safflower injection, safflower powder injection, etc.; health care medicine, such as safflower oral solution, safflower emulsion, safflower tea, safflower cola; health care food, such as safflower capsule, safflower health care oil, health oil, mixed oil, etc. (Zhaomu and Lijie, 2001). Safflower medicine products are mainly developed from dry florets and seed oil in China. The main active ingredient in safflower medicines is water-soluble yellow pigment, but alcohol extracts are also used in some preparations. Many clinical and laboratory studies support the use of safflower medicines (Ligjue , 1993). Up to date, together with other Chinese medical herbs, safflower is widely used in Japan, Korea and other Asian nations and became fashionable all over the world (Kim, *et al*., 2002). In recent years, the dry florets of safflower are mainly used for cure of woman diseases, injures from falls, cardiac and cerebral vascular diseases, high **blood pressure,** diabetes and other illnesses related to blood stasis and microcirculatory disturbances Zhaomu and Lijie, (2001) ,Shouchun, *et al* .,(1993) and Kim*, et al*., (2002) Safflower is also used for health care for middle and old-aged people Zhange. (1997). The Chinese safflower preparation and products spread out of the world and make contribution to the health of mankind Zhaomu and Lijie (2001).Additionally, some Indian pharmaceutical companies have show private interest to utilize safflower petal products (Nagaraj and Srinivas, 2001).

Safflower tea has worth popularization because of its beautiful color and rich nutrients. A pleasant-tasting herbal tea is prepared from safflower blossoms (Dajue and Yunzhuou , 1993). It was developed by Beijing Botanical Garden and became very popular as a new kind of health care beverage. People liked the distinctive taste, color and aroma of the herbal tea and its popularity among the people is gradually increasing due to its therapeutic effects, body invigoration and good health (Nagaraj and Srinivas 2001).The regular users of this herbal health tea have reported its usefulness in curing diseases like hypertension, angina, arthritis, swelling of joints, constipation and menstrual disorders and in reducing cholesterol level. Some experts suggested that safflower should be developed as a health beverage for middle and old ages (Dajue and Yunzhou, 1993). Safflower used as a beverage, will be beneficial to the health of people.

Women in Afghanistan and India use a tea from safflower foliage to prevent abortion and infertility (Weiss, 1983).

In April 2007 it was reported that genetically modified safflower has been bred to create insulin (Sem Biosys ,2006) a pharmaceutical company called sem Biosys genetics is currently using transgenic safflower plant to produce human insulin because the global demand for the hormone has grown.

High oleic safflower oil is low in saturates and higher in monounsaturated than olive oil ,high oleic is beneficial agent in the prevention of coronary artery disease Dajue and Mundle (1996) ,safflower also has dilates arteries reduces hypertension and increase blood flow and hence oxygenation of tissues (Deng 1988 ; Wang and Yili ,1985) .

Safflower used for treatment of cerebral thrombosis with safflower improved and lowered blood pressure in over 90% of patient (Wang and Yili, 1985; Damao, 1987).Safflower decoction has been used successfully for the treatment for male sterility Qin, (1990) and dead sperm excess disease .Treatment with safflower resulted in Pregnancy in 56 of 77 infertile women who had been infertile for 1.5-10 years(Zhou, 1986).

2: -5.8 Use of Safflower cake:

The safflower cake meal is made from the seed that remain after oil extraction. The quality of safflower cake is variable and depends on the amount of hull and the extent of the oil extraction.

The used of high protein safflower meal was reported by (Katzer and Willians, 1947). Safflower meal reported in their lablotary was fed to chicks as the only source of protein with addition of amino acid to determine specific deficiencies. The omission of arginine, methionine and lysine single or glycine and cystine together result in significant decrease.

Kohler, *et al*., (1965) reported due to their high fiber safflower seed un decorticated meal are low value in poultry, however partial or total de hulling associated with appropriate feed formation can enable the use of safflower cake in poultry. The use of decorticated safflower is possible in poultry if energy level is adjusted with special care to lysine and methionine supplementation .Several safflower products can be used as animal feed, the by – product of the oil extraction meal and hull (Oelke, *et al.,* 1992).

The by-product which result after the extraction of edible oil from safflower seed contain about 60% fiber and 18-20% protein if the seed are de hulled before extraction , the resulting safflower meal has 35-50% protein and 10-15% fiber (Dortica, *et al* ., 2009). Safflower was fed as feed ingredient for poultry has been studied for many years for the interest in this protein supplement at this anivesity is recent. Farran,*et al* ., (2008) showed that extrusion of de hulled safflower Kernels resulted in meal 58.4% cp 11.7 ether extract and 2.59% crude fiber on dry matter basis. This meal was found deficient in lysine and methionine but rich in arginine and its apparent and true ME corrected to zero nitrogen balance on dry matter basis was 2565 and 30% Kcal respectively following broiler feeding trial. The authors concluded that the meal they prepared may replace 75% of soybean meal in diets supplement with lysine and methionine.

The quality of safflower seed meal for used in poultry diets is consider poor because the meal is deficient in essential amino acids, lysine and methionine but is an excellent source of phosphorus and good source of zinc and iron Gowda, *et al*., (2004) in general the vitamins content of safflower meal is low. But when compared to soybean meal safflower meal is good source of biotin, riboflavin and niacin relative to soybean (Darroch, 1990).

Even practical decortications improve the feeding value of safflower meal. Decorticated safflower meal is high in protein and low in fiber and suitable ingredient for poultry feed. But removal of hulls make it costly feed ingredient. Decorticated full fat safflower seed can be fed to broiler chickens up to 8% without adverse effect on performance. The level of decorticated full fat safflower seed to be used in old broiler and longer has up to 10% of the diet. When formulating diets from safflower meal it is important to ensure that lysine and methionine requirements of poultry are met.

The De hulled extruded safflower meal can be replace up to 60% of soybean in practical broiler diet without adversely affecting broiler performance (Extension American research, 2013).

Recommended inclusion of safflower meal level lower for young birds 5-8% than older broiler and layer hen 10-15%. Safflower meal does not seem to show toxicity, these levels can be extended in the context of less intensive production, but It is advised not to do so without complementing with other protein and amino acid increase with de hulling and was comparable to that of soybean meal for fully decorticated and extruded safflower meal(Farran, *et al*., 2010).

De hulling safflower meal was also efficient in pullet when lysine and methionine were added (Wylie, *et al*., 1972).

The value of safflower meal depend on, process oil content varies from 1% for solvent extracted to 15% for mechanical extracted ones protein content is about 20-25% in un decorticated meal but that can over 40% in decorticated ones (Dajue *et al* 1996; Gohi 1982).

Crude fiber content is about 30-40% for un decorticated for safflower meal and can be lower than 10% in de hulled meal G R D C (2010) when compared with soybean meal protein quality for monogestric feed is low due to deficiency in lysine and methoionine , iosleucine and low availability of these amino acids (Drroch, 1990).

Safflower meal is a source of high protein for animal but has not been used for human consumption because it is bitter and mildly cathartic. Dexterous glycoside in meal were removed or modification by extracting with either water at ISO-electric point or with method of enzymatic treatment with B-glycosidase.

Safflower meal for un decorticated commercial seed is useful feed for ruminant animal. Its low energy content is a problem in poultry and swine ration.

Partially decorticated meals are valuable for ruminants and also are quite suitable in poultry ration if provision is made for metabolizable calories if other ingredients are supply and addition of lysine and methionine in a proper balanced, ration of safflower meal produces growth rates superior to those from optimally supplemented soybean oil meal (Koher, *et al*., 1965). The quality of safflower meal is highly variable as it depends on the amount of hull and on the extent of oil extraction, the protein content of meal contain two phenolic glucoside, the better flowered matairesinol B-glycoside and purgative 2 by hydroxyarctin B-glycoside they removed by extraction with water methanol, by the addition of B-glycoside Darroch, (1990) or by combination of physical enzymatic treatment ((Jin, *et al.,* 2010).

The un decorticated safflower meal is high in fiber and low in protein. The removal of hull decrease fiber content of (43% CP) from greater than 20% to 14% Because the protein quality of safflower meal is low due to a paucity of lysine, satisfaction of poultry will not result without blending safflower meal with other protein supplements and use of synthetic acid Scott, *et al*., (1982) **,** Ravindran and Blair, (1992) as long as the use of ground nut meal in sulphur amino acids studies athose safflower meal is an excellent protein source and it is deficient in lysine . The product with result after the extraction of edible oil from safflower seed contain about 18-20% protein if the seed were de hulled before oil extraction the resulted safflower meal has 35-50% protein and 10-15% fiber (Dorica, *et al*., 2009).

Several studies were carried out to evaluate the use un extracted whole seed as ingredient poultry diets without negative effects on digestion or on meat quality(Oguz and oguz, 2007 ; Williams and Danils, 1973).

Safflower seed oil is rich in linoleic acid 75-78% which play an important role in reducing blood cholesterol level (Oguz and Oguz , 2007).

A series of shrimp trials shows that safflower meal and particularly high-protein ones can be an economical alternative to soybean meal, fish meals and cereal based ingredients (Galicia – Gonzalez, *et al.,* 2010).

High protein safflower meal can totally replace soybean and up to 66% of the protein in diets, without having adverse effect on growth or feed unitization (Golicia Gonzalez, *et al*., 2008). In diet containing 30% safflower products apparent digestibility's of low protein and high protein safflower meal (48% and 52% respectively) were similar to those reported for others ingredients such as maize grain or cotton seed meal. Apparent protein digestibility.

2:5.9 Uses of the Safflower in Ruminate

2:5.9-1 Uses of Safflower Meal in Dairy Cow:

Post research has shown that safflower meal to be available ingredient to dairy cows with no noticeable effect on flavor or odor of milk produced. It can be good substitute to linseed meal for instance (Smith, 1996). Adding 1 Kg of safflower meal in ration of dairy cows increased milk yield and milk fat and substitution of 1 Kg of concentrate by similar amount of safflower meal gave similar result (Juknevicius, *et al*., 2005).

Un decorticated safflower meal can be used in ruminant ration as protein source in replacement of soy bean, cotton seed meal or linseed meal if used equal protein basis and if adequate energy is supplied Kohter, *et al.,* (1965) when levels of safflower meal are include in ruminant diets lower performance have be observed (Walker, 2006).

Safflower meal is slightly bitter and less palatable than other ingredient (Smith, 1996). However its palatability is variable and may be ready eaten by ruminant when mixed with other feed (Gohi, 1982).

Un decorticated safflower meal has low digestibility in ruminant while it's in vitro digestibility is equal to sunflower meal **..**

2:-5.9-2 Uses of safflower Meal in Beef cattle

Most of the research concerning the use of safflower meal in beef cattle was done in U.S.A before (1960). Expeller meal compared favorable able in weight gain. Linseed meal in steer comparisons with soy bean meal was satisfying only when safflower meal was fed in low amount (Smith, 1996).

In wheat silage ration for steers (285 Kg) inclusion of safflower meal compound feed at 13–35% in diet had not adverse on feed intake and feed palatability result in an average daily gain high that 1.4 Kg/d (Voicu, *et al*., 009). Safflower seeds are less palatable than other common oil seed. Whole seed can be fed to beef cattle without processing. Due to their content high level of safflower seed in diet can result in lower animal performance the maximum indusial rate of safflower seed 1:1 Kg/cow/day (Waker ,2006).

2:5.9 .3 Use Safflowers as Forage for Ruminant

Safflower can be grazed or stored as hay or silage the forage is palatable and its feed value and yields are similar to or better than oats or alfalfa (smith, 1996; Wichman, 1996).

Safflower stubble is highly desired by cattle, sheep and goats (Landaua, *et al*., 2004 Smith, 1996) . It is good for grazing during early stages and shows fast re growth. On Great plains of North

America, the crop remains green after other crop have maturated (Daju and Mundel, 1996). Safflower may be valuable forage provided it is harvested from mid budding to early blooming stage so that it is not too prickly and thus remain highly palatable to live stock (landau, *et al.,* 2005; Gohl 1982). Safflower can be directly grazed by sheep and cattle or can be fed fresh. Safflower is also used as hay especially if it has suffered from frost. Silage should be prepared with safflower at budding stage (Peirtti, 2009; Oyen, *et al*., 2007). Safflower N fertilization many enhance silage quality as safflower N content improves lactic acid bacteria activity in the silage (Wein berg, *et al*., 2007). Safflower DM yield and/or straw yield range from 3.5 to 8 t/ha. (Yau *et a.,*l 2010, Arslan *et al.,* 2008; landau *et al.,* 2004; Wein breg, *et al.,* 2007).

Grazed safflower improve fertility in Canadair ewe (Stanford, *et al.,* 2001) safflower also makes an acceptable live stock forage if cut at or after bloom stage (Bergland, *et al.,* 2007) safflower hay, given ad libittum , has been successfully used as a sole feed for lute-pregnancy dairy cows (Landau, *et al.,* 2004). Safflower silage was substituted for cereal silage in the diet of high-yielding dairy caws (landau, *et al.,* 2005) and dairy sheep without affecting their dairy performance.

Safflower silage has the potential for widespread adoption as feed in many countries since safflower is drought tolerant. Special characteristics such as protein degradability are taken into account to optimize its inclusion in total mixed ration (Landau, *et al.,* 2004).

2-5.9 .4 Using Safflower in Sheep:

In young sheep ration based on low quality grass bay or cereal straw. Supplementation by safflower meal permitted high live weight and increased wool growth than barley supplement in hay. Fed lambs (1.8 Kg body weight) adding 350/g/ day of concentrate mix with 25% safflower meal result in an improvement in feed intake, digestibility feed efficiency and body gain weight (Dessie, *et al.,* 2010).

Tufaeti, *et al.,* (2013) reported that indusion of safflower cake in total mixed ration for growing fatting small ruminant, does not affected their growth performance, meat quality, lipid fatty acid profile. Moreover safflower from practical and economic point of view is present available alternative to conventional in gradients in countries where safflower cultivation is supported by environment.

2 : 10 The use of safflower seed in poultry:

2.10.1 The Using of Safflower in Broiler Diets

(Effect on performance parameters (feed intake, BW and FCR)

A current trend to world formulating high energy diet for broiler chicks makes it necessary. The inclusion of fats and fat oil up to 10% in broiler feed. Fat and oil containing 39-29 M.J /k .cal. gross energy, but are most costly and may contain impurities as an alternative to fat and oil full fat oil seed Ajuyah, *et al.,* (1993) such as soybean seed and used to supplemental oil in broiler diets. However, soybean seed has anti-nutritional factor as trypsin inhibitor which need further processing. This increases the cost of soybean seed.

Several studies were carried out to evaluate the use of un extracted seed as feed ingredient in pigs and poultry diet without negative effect on digestion or meat quality Oguz and Oguz, (2007) and also full fat safflower seed source of magnesium lysine, pyridoxine, biotin, panthotheic acid and chlorine.

Hill and Knowles, (1968) reported that the full fat safflower seed is sources of dietary mono unsaturated fatty acid (MUFA) and inclusion of it in Mona gastric diet can be particularly valuable to increase the degree of unsaturated of intramuscular fat, without negative effect lipid oxidation associated with dietary poly unsaturated fatty acid (PUUFA).

Mahadi, *et al.,* (2010) used various level of full fat safflower seed in diets containing various level of full fat seed 0, 5, 10, 15 and 20% were given to broiler from 21 to 42 days of age to study the effect of different level of full fat safflower seed on performance parameters of broiler chicken, feed intake and feed conversion ratio (FCR) and weight gain were not significantly affected ($P \geq 0.05$) by full fat safflower seed level when compare to the control for whole period. The high and lowest numerically feed Intake observed in 5% of full fat safflower seed and in control. These results are in accordance with those reported by (Raj, *et al.,* 1983).

Oguze and Oguze, (2007) reported that the lowest body weight in 5% of full fat seed and 20% full fat seed of safflower is due to high fiber content of 20% full fat safflower seed diet which could consequently decreased the density of diet. The average body weight gain was not significantly affected by chicken feed 0, 10 and 20% full fat safflower seed.

Mohan, *et al.,* (1984) reported that the average weight gain was not significantly reduced in chicken fed diet containing 23-25% of full fat safflower seed.

Malekian and Hassan, (2011) studied evaluation of the effect of different dietary levels of full fat safflower seed(0, 5, 10, 15 and 20% of diets) on performance, characteristics and blood metabolites on broiler chicken. The inclusion of full fat safflower seed in this experiment diet did not significantly affect weight gain, feed consumption and feed efficiency (FCR).

Oguz and Oguz, (2007) showed that FCR determined during experiment for 4 weeks. The performance was improved in 20% FFSS in broiler chicken diet but Arja, *et al.,* (1998) reported that performance parameters were reduced when full fat safflower was added to diets. While Rodriquez, *et al.,* (1998) reported not significant differences in weight gain, feed intake and utilization among chicken receiving control diet and those fed diets with increasing level of full fat safflower (from 5-25% of diet).

Daghir, *et al.,* (1980) observed that feeding 15-25% full fat safflower seed to broiler depressed both body weight gain and feed intake.

Elang Oven, *et al.,* (2000) showed that live weight gain, feed intake nutrient and carcass characteristics of quail did show significant difference when full fat safflower (FFSS) increased in diets.

Selvaraj, *et al.,* (2004) used various levels of (FFSS) (0,5, 10, 15and 20%) reported that weight gain feed consumption were not affected by (FFSS) inclusion.

In Broiler, full fat safflower seed have been tested at level up to 20% in diet where energy and protein were adjusted. Seeds have the advantage of providing more energy than safflower meal in this study growth performance and carcass traits did not affect , only blood cholesterol but significantly decreased its level (Malakian, *et al.,* 2011).

Malakian, (2010) reported that the safflower seed was proven to be a good source of ME in broiler diets. The experiment indicated that substitution of safflower seed of corn, soybean meal up to20% did not had effect on performance of broiler chickens.

The safflower protein is also known to be deficit in lysine (Rehman and Malik, 1986). However the combination of safflower with soybean meal recorded better.

2:10.2 Physiological effect on broiler fed diet containing full fat safflower seed:

Malakian, (2010) reported that the relative weight of the breast yield, thighs, gastrointestinal tract, liver, Gizzard and abdominal fat pad were not affected by dietary levels of full fat safflower seed (FFSS).However relative weight of liver was not significantly decreased in bird fed diet containing full fat safflower seed diet. Similarly**,** ChevaIsarkul and Tang Taweeipat, (1991) reported that the liver percentage decreased by adding (FFSS) to diet.

In current experiment, the lower abdominal fat pat and the large breast muscle showed the level of (FFSS) were increased, but these effects were not significant (Sanz, *et al.,* 1999).The reduction in abdominal fat pad for the broiler fed (FFSS) diet presumably affects a lower total fat content and may demonstrate the importance of fatty acid in modulating body fat in addition to the lower fat pad in chicken consuming FFSS which was associated with increase lipid oxidation (Newman, *et al.,* 2002).

Malekiain and Hassan, (2011) studied the effect of different dietary levels of full fat safflower seed (0, 5, 10, 15 and 20%) on broiler performance characteristics and blood metabolites of broiler chickens.The inclusion of full fat safflower seed in this experimental diet did not significantly affects .Breast yield, thighs, empty gastrointestinal tract, liver, gizzard and abdominal fat pad percentages to live weight were not affected by dietary treatment.

Growth performance can be similar to control treatment (generally soybean meal maize grain diets) if the diets were supplemented with appropriated level limiting amino acid for example up to 2% hulled safflower could maintain growth performance in broiler when lysine was added while un supplemented diet almost halved performance (Mohan, *et al.,* 1984).

However the 30% inclusion rate of safflower led to lower performance even with lysine supplementation. Some early mentioned problem of beak pasting at very high level of safflower meal RomanaRao, *et al.,* (1971), but these inclusion rate was decrease any way.

Some studies even reported that it is possible to maintain broiler performance with decorticated meal using I so –energetic diet but requires expensive energy sources to supplement the diet such as high level of fat more than 10% in this experiment (Thomas, *et al.,* 1983). Elangovan, *et al.,* (2000) showed that the life weight gain, fed intake nutrient retention and carcass characteristics of quail did not show significant difference when safflower cake meal increased in diet.

The use of ground nut cake as sole source of protein or combination with safflower cake was not efficient to support broiler growth while the soy bean meal resulted in excellent growth. Safflower cake can be used along with soybean meal to the extent of 10% (Gaik wad, *et al.*, 2008).

2.10-2 Effect of safflower seed used in layer diet:

Study by Hosseini, *et al.*, (2008) found that the effect of inclusion of different levels, (0, 4, 7 and 10%) of safflower seed on layer hens 26 weeks old white leghorn in layer commercial diet in an experiment over 12 weeks in order to study, the effect of feeding safflower on hen performance egg production, egg weight mass, feed intake and feed conversion ratio and egg quality parameters (Haugh unit) score of yolk color index. Yolk index, egg shape, shell weight shell thickness and density. Result showed that hen performance and egg quality parameters were not significantly ($P \geq 0.05$) different among treatments except in specific gravity observed in 10% less (1.806) and the highest weight was in 4% less (140) treatment. However, the lowest haugh unit and shell thickness observed in 10% but the different among treatments were not statistically significant. The mean yolk cholesterol content, blood cholesterol and anity body titter against ND and IBD were not significantly ($P \geq 0.05$) different among treatments, but the lower yolk and blood cholesterol observed in 10% seed level of safflower seed.

Up to 10% safflower seed were listed by Hosseini , *et al.,* (2008) in layer diet. There was trend for slightly decreased performance although this effect was not significant. In similar trial inclusion of safflower seed in the diet induced changes in yolk fatty acids composition and particularly an increase in linoleic acid (Hossieni-, *et al.,* 2008 b).

2.11.1 Effect of Linoleic Acid in Monogastric:

The major effect of conjugated linoleic acid (CLA) on animal performance is reducing fat accumulation and promoting muscle growth. Park , *et al.,* (1997) reported that (CLA) repartitioned body fat to lean and improved feed efficiency in rats. In study with mice, Delcony, *et al.,* (1999) found that (CLA) feeding increased a rapid and marked decrease in fat accumulation and increase in protein deposition. Park, *et al.,* (1999) observed that a 0.5% CLA diet significantly reduced body fat, increased whole body protein, water and ash in rats. Dugan, *et al.,* (1997) reported that pigs fed (CLA) reduced feed intake by 5.2%, improved feed conversion efficiencies by 5.9%, decreased subcutaneous fat accumulation by 6.8% and gains 2.3% more lean than pigs fed sunflower oil, however Scimeca, (1998) reported that feeding diet supplemented with 1.5% CLA for 36 wk had no effect on feed consumption and body weight rats**.** Stangl, (2000) reported that feeding diet influence growth and body partitioning in rat with 70 Kg live weight in pigs**.** Mueller, *et al.,* (2000) showed that supplementation of (CLA) in Iso-energy diets with a strongly positive energy balance has no marked effect on total lipid metabolism, but as lightly enhanced deposition of protein is evident. (CLA) supplementation at 3.0-3.4 g/d had no significant effect on body composition, body weight and body mass index (BMI) in humans**.**

2 : 11 -2 The uses of Poly Unsaturated Acid :

The control of lipid deposition in broiler aim at efficient lean meat poultry production is of current interest (Fisher, 1984 and Hermier, 1997). It has been previously reported that broiler fed I so-energetic diet rich in poly unsaturated fatty acids showed lower abdominal fat deposition compared with those containing saturated fat Barroeta(1989), Sanz, *et al.,* (1999 b) **,** this concept of particular interest for the rearing of the female broilers because the amount of abdominal fat at slaughter age may represent more than 3% of the live weight Sanz, *et al.,* (1999 b) , any reduction in amount of abdominal fat is considered to be positive by both producers and consumers because it is lost during carcass cut-cup, it contributes little to meat quality and there is an increasing consumers resistance to eating fatty acid foods Fisher, (1984), Hermier, (1997). However the use of unsaturated fat sources to reduce lipid accumulation could negatively affect carcass quality characteristics due to the excessively low melting point of the deposited fat (Hrdinka, *et al.,* 1996).

Several reports suggested the possibility of increasing fatty acid saturation in broiler chicken tissue by introducing a saturated fat into the diet during the late growing period (Scaile, *et al.,* 1994 ; Hrdinka, *et al.,* 1996; Zollitgch, *et al.,* (1997).

The use of an un saturated fat source during the first stages of growth and the substitution of started for few days before slaughter may after the advantage of lower abdominal fat deposition and an acceptable fat fluidity compared with the used of saturated fat source during the whole growing and finishing period (Sanz, *et al.,* 2000).

2 : 12. - Supplementary of Enzymes in Poultry Diet:

2 : 12 .1 Uses of Enzymes:

The application of exogenous enzyme in poultry nutrition has been driven by accruing benefits in terms of improved dietary nutrient utilization and growth performance. Researchers have clearly demonstrated that the supplementing poultry diet with appropriate enzyme activities increases energy and N retention in chickens (Bed ford and Classen, 1992 ; Bed ford, 1995 ; Ghazi, *et al.,* 2003). Furthermore, it has been shown that the use of combination of enzyme activities act synergistically thus providing better responses than single activities used individually (Bedford, 1995 ; Meng, *et al.,* 2005). In study of Adeola and Bed ford, (2004) found that xylanase supplementation to high viscosity wheat improved energy, fat and starch digestibities in wheat Peking ducks.

In the study of Hong, *et al.,* (2002 a) supplementing an enzyme cocktail containing protease, amylase and xylanase to starter and grower duck diet improved growth performance and utilization of N and Amino Acid but not that of energy, results of these studies and of other Ghazi, *et al.,* (2003) clearly demonstrated that response to supplemental enzyme depend on several factors, invaliding type and amount of enzyme activities used and diet composition.

2 : 13 Non Starch Polysaccharide (NSP):

Approximately two billion tons of cereals grain and 140 million tons of legumes and oil seed are produced throughout the world each year, which yield an estimated 230 million tons of fibrous material of variety of by product. The fiber component of the grain consists of cell wall structure. In legume (NSP) also play role as an energy storage material. The role of (NSP) in animal's diets has attracted much attention in recent years due to the fact that (a) the (NSP) elicit unit nutritive effect (b) the utilization of (NSP) as feed material in monogastric animal is very poor. These two factors are of significant concern because the world's population is on increase whereas its food production is static more efficient utilization of potentially utilizable nutrient for food production is therefore paramount importance to the sustainability of Agriculture in future (Choct, 1997 and Nutrex, 2000).

Poly saccharine are polymers of mono char aide's joined through glycoside linkages and are defined and classified glycoside linkages and are defined and classified

2 : 13. 1 Definition and Classification of NSP.

Polysaccharides are polymers of polysaccharides joined through glycosid1e linkages and are defined and classified In term of the following structural consideration (a) identify of monosaccharide present (b) monosaccharide ring from (6 membered pyranose or 5 member far inose; (c) position of glycoside linkage; (d) configuration of glycoside linkage; (e) sequence of monosaccharide's in the chain and (f) present of non-carbohydrate substituent's monosaccharide's commonly present in cereal cell wall are (a) hexoses D-glucose, D-galactose D-mannose; (b) pentose L-arabinose, D-xylose and (c) acidic sugar; D-glucuronic acid and it's 4-0-methyl ether (Choct, 1997).

The term N.S.P covers large variety of polysaccharide molecules including beta -glucanase (starch). The classification of NSP was based originally on methodology used for extraction and isolation of the polysaccharides.

The residue remaining after a series of alkaline extraction of this residue solubilised by alkali was cellulose and the fraction of this residue solubilised by alkali was called hemicelluloses. The word hemicelluloses were adopted because early researchers mistakenly regarded these poly saccharides as the precursors of cellulose. This is now known to be incorrect but the term is still commonly used. Some workers used terms hemicelluloses and pent sans interchangeably because the pentose containing polysaccharides make up the bulk of hemicelluloses (Neukom, *et al.,* 1967 and Neukom, 1976).

Classification by different in solubility lacks precision with respect to both chemical structures and biological function for example, the term crude fiber (CF) refers to the remnants of the plant material after extraction with acid and alkali and includes variable protein of insoluble (NSP) neutral detergent fiber (NDF) refers to the insoluble protein of the NSP plus lignin and acid detergent fiber (ADF) refers to apportion of insoluble (NSP) comprised largely but not exclusively of cellulose and lignin.The nutritional relevance of values obtained using these methods in monogastric nutrition therefore are questionable. The complexity in the structure and confusion in the nomenclature have made it almost impossible to draw a clear cut classification of NSP. However NSP fall into three main groups as namely cellulose, non-cellulosic polymers and peptic polysaccharides (Bailey, 1973 and Choct, 1997).

The NSP in cereal grain are composed predominantly of arabinoxy lanase (Pen Sons) Beta-glucanase and cellulose. Only small amount of peptic poly saccharides are found in stem and leaves of cereals. Corn sorghum contains very low levels of N.S.P, whereas wheat, ray and triticale contain substantial amount of both soluble and insoluble NSP. The NSP content is high in the bran fractions (35.3% and 21.8% in wheat bran and rich barley respectively. Arabinoxylans are a abundantly present in wheat and triticale (8.1 and 10.8%) but also other cereal as barley, ray and corn (7.9, 8.9 and 5.2%) moreover barely is also rich in beta-glucans 4-3% (Choct, 1997).

As mentioned before it can be concluded that in wheat, triticale, ray and wide range of Products arabinoxylans are responsible of the anti-nutritional effect in these cereal grains in barley and oats these effects by both beta-glucans and arabinoxylans. It is very important to focus on the structure of arabinoxylanse and beta-glucans and on their impact on the nutritional value of cereals. In order to get abetter arabinoxylanse understanding of use xylanase and beta-glucanase.

2 ;13.2TheAnti-nutritiveEffect of Soluble Arabinoxylans

1.13.2.1 Increase the Viscosity:

The best effect of high content of soluble arabinoxylans in the rations for monogastric animal is increased viscosity of the intestinal content. This increase is caused by enormous water binding capacity of the arabinoxylans. They are capable of binding ten times their own weight in water (Nutrex, 2000).

The viscosity of arabinoxylanse depends in their solubility and molecular weight, solubility of carbinoxylans, in turn, depends on chemical structure of the carbinoxylanse and their association with the rest of the wall components. The physical effect of viscosity on the nutrients digestibility and absorption appears to be similar regardless of the arabinoxylans sources (Choct, 1997).

Generally high gust viscosity decreases the rate of diffusion substrates and digestive enzymes and hinders their effective interaction at mucosal surface(Edwards, *et al.,* 1988 and Ikegami , *et al.,* 1990). Soluble arabinoxylanse interact with the glycocalyx of the intestinal brush broiler and chicken. The rate limiting a stirred water layer of the mucosa, absorption through the intestinal wall(Jonson and Gee, 1981) the fact that the viscous property of arabinoxylans is the major factor in the anti-nutritive effect of arabixnolans in monogastric diets is supported by the wide spread age of enzymes in monogastric diets. The enzymes cleave the large molecules of arabinoxylans into smaller polymers. There by reducing the thickness of the gut content and increasing the nutritive value of the feed (Bedford, *et al.,* 1991 and Choct, (1997).

2 :13.2.2 Modification of Gut Physiology:

The soluble arabinoxlans can not only act as a physical barrier to nutrient digestion and absorption by increasing gut viscosity but also change gut function by modifying endogenous secretion of water, proteins electrolytes and lipids, Johnson and Gee, (1981); Angkanaporn, *et al.,* (1994). Prolonged consumption of soluble arabinoxylans is associated with significant adaptive gut is characterized by enlargement of the digestive organs and increase secretion of digestives.

Accompanied by a decrease of nutrient digestion. The ability of certain arabinoxylans to hind bile salt lipids and cholesterol is also well documented (Vahouny, *et al.,* 1980). This properly at arabinoxylans may influence lipid metabolism in the intestine. Furthermore, viscous carbinoxylans can enhance bile acid secretion and subsequent resulted in significant loss of those acids in the feces (Ide, *et al.,* 1989; Ikegami, *et al.,* 1990**).** This in turn can result is increase hepatic synthesis of bile acid from cholesterol to re-establish the composite pool of these metabolites in enter hepatic circulation. The continued “drain” of bile acid and lipids by sequestration and increased elimination as fecal acidic and neutral sterols, may ultimately influence the absorption of lipids and cholesterol in the intestine. Those effects could lead to major changes in the digestive and absorptive dynamic of the gut with consequent poor overall efficiency in nutrient assimilation by animal (Choct, 1997).

2:14 Anti-nutritive Effective of Soluble Arabinoxylans:

Insoluble arabinoxylans can affect gut transit time motivate and may also hinder of ability of endogenous enzymes to gain access to their respective substrates Choct , (2001) in soluble arabinoxylans do not cause viscosity but these cell well components can encapsulate capsulate nutrients inside intact cell walls. Correspondingly, the finer grind or particle size. The more of these capsulated nutrients may already be released. Another way of addressing intact cell wall is too added on NSP as such as xylanase to the feed. With the intention of this enzyme acting to open intact cell wall via its action on the arabinoxylans, thus allowing endogenous enzymes access to previously hidden (Janet, 2009 and Nutrex, 2000).

2 : 15 Anti-nutritional Effect of B-glucans:

Low concentration of beta -glucans will bind water through direct interaction with water molecules. However, when the concentration of beta -glucans increases, they will also start to interact with each other, resulting in a network (gel). There for federation high in B-glucans will result in high viscous intestinal content. The negative effects of high intestinal viscosity have already been pointed out during the discussion on arabinoxylans. Shorter transit time higher microbial activity in the testiness decreased digestion and utilization of the nutrient sticky dropping (Rajesh, *et al.,* 2006).

2 : 16 Dietary Enzymes:

The commercial applications of enzymes feed additives have history less than 20 years. During this period, the feed enzymes industry came into existence and had gone through several phases of development. The first phase was to use enzyme to enhance nutrient digestibility focusing primarily on polysaccharides(NSP) such as arabinoxylans and B-glucans from broiler diet based on viscous grain like wheat, rye, barley or triticale during early 1990's the scope of enzyme application expands to consider nutrients other than (NSP) and benefits other than digestibility enhancement. Phytase is prime example where not only was it used to increase the utilization of phytase phosphorous but also to alleviate environmental burdens by reducing phosphorus extraction in excreta. The industry than started advocate enzyme addition to poultry diets based on non-viscous cereal grains.

The next phase is the application of enzymes to non-cereal grain components of the diet. These vegetable protein sources are often high in none polysaccharides (NPS) which are poorly characterized in regard to their molecule structures significant progress has been made on characterization of (NPS) in soybean but industry has not able to produce commercially viable products that consistently improved to digestibility of vegetable protein (Choct, 2004). Most of enzymes were drive from fungal source, but today the degree of bacterially drive enzyme has increased especially with new phytase product. In the past five years the market enzymes has changed significantly with phytase now leading followed by xylanase and cellulose (Glucanase) trailing in a distant third place. Other enzyme classes such amylases, proteases and mannoses are making up only a small proportion of total feed enzymes that are positioned at targeting vegetable protein sources (such as alpha galactosidases) their use to data is still small and limited (Wyatt, *et al.,* 1997).

The enzyme industry today is constantly searching for new area of application. Some recent data demonstrate the role of glycanaseas an alternative to feed antibiotics. It is possible to produce enzyme tailored for (a) the generation of specific low molecular weight of carbohydrates in vivo, which in turn produce of specific health outcomes in birds (b) de activation of anti-nutrient other (NSP) and phytate and (c) digression of non-conventional feed resources to yield metabolism energy (Choct, 2004).The development of enzyme technology needs to go hand in hand with better characterization of substrate structures, gut micro-flora and immune system.

2 : 17 The role of starch and non-starch polysaccharide enzyme in poultry nutrition:

The use of enzyme can be categorized into five areas, firstly by removal of ant-nutritional factors. Secondly by increasing the digestibility existing nutrients, thirdly by making a certain nutrient more available for absorption in intestine, fourthly supplementing host endogenous enzyme for example at young age. Fifthly effect of micro-flora in the gastro intestinal tract. Oslukosi, *et al.,* (2007 and Classen and Richard, 1999).

There are many factors affecting the determination of the appropriate type of enzyme which need a diet, including the type and amount of cereal with variety, climate, soils, etc.

Nature of anti-nutritive factor present (soluble or insoluble) from diet (mash or pelted), type of animal (poultry tend to be more responsive to enzyme treatment than pigs) the age of the animal (young animals tend to respond better to enzyme than older animals) and physical and chemical properties of enzyme used (Mathouthi *et al.* , 2002; Jaroni *et al* ., 1999; Choct, 1997 and Sreenivaiah, 2006).

In view of the above, it is obvious that nutritional value of cereals that contain a high level of viscous was soluble (NSP) can usually be improved to a re makeable degree by the addition of the appropriate enzyme to the diet. In general, barley and oat have high content of soluble beta-glucans and there for respond to beta-glucan. Where wheat and rye tend to have higher content of arabinoxylans and there for respond to xylanase and possibly other associated enzymes (amylase and protease) (Sreenivasiah , 2006 , Choct , 1997 and Choct ; 2004). However this choice is sometimes not as easy as it sounds. For example corn which contain 69%starch, is likely to be combined with α-amylase. On other hand, corn contains 5.1% insoluble rabinoxylans. The arabinoxylanas in the cell wall enclosed starch and other nutrients the present of xylanase in feed with set free these captured nutrients. Exogenous α-amylase makes sure that this extra starch is digested in small intestines so combined used of xylanase and α-amylase with increase the digestibility of corn based diets. The same remark can be made for barley. Classically barley combined with Beta - glucanse. However, there are also high levels of arabinoxylans, which make room for a combined use of B-glucanase and xylanase (Soliman, *et al.,* 1996; Cafe, 2002 and Nutrex, 2000).

2 : 18 Supplement of Enzyme:

Barhour, *et al.,* (2006) found the supplementation of an enzyme mixture continuing B-glucanase was found to improve the AME of different found that it increased abdominal fat yield. They concluded that levels up to 25% of barley could be incorporated in diets up to market age without affecting broiler performances.

2 : 18 .1. Xylanase Enzyme:

Xylanolytic enzymes cover several kinds of activities Nutrex (2000) Endo- 1,4, B-xylanase cuts the xylems polymers into a number of shorter chain these Endo-activities in a quick reduction of viscosity and can efficiency liberate the enclosed nutrients. Therefore it is crucial enzyme activity in eliminating the anti-nutritional properties of arabinoxylans.

Exo-xylanase is only active at the end of an arabinoxylans chain. This exo-activity has a minor effect on viscosity. Moreover according to same researchers the production of important quantities of xylose monomers can negatively influence zoo technical performances (Choct, *et al.,* 1995).

Xylanase enzyme deconstructs plant structural by breaking down hemicelluloses a major component of the plant cell wall. Plant cell wall is necessary to prevent dehydration and maintain physical integrity, they also act as a physical barrier or pathogens use xylanase to digest or attack plant. Many micro-organisms produce xylanase but mammals don't have the same herbivorous, inset and crusting crustaceans also produce xylanase. The xylanase enzyme Endo-1,4 Beta-xylanase or xy N 1 1 , E (32.18) from trichoderma SPP, has a PL of 9.0 and is produced by fermentation xylanase consist of 190 amino acids and has a molecular weight of 21 KD . Xylanase belong to the glucanase enzyme family and are characterized by their ability to break down various xylanase to produce short –chain xylo-oligosaccharides.

Xylanase ready crystallizes in ammonium sulphate and sodium potassium phosphate across ph 3.5 to 9.0 xylanase can be also crystallized with other salts polymers and organic solvents. Xylanase solubility in phosphate ph 9.0 decreases in the temperature range of 0-10 degree Celsius but remains constant in range of 10 through 37 degree Celsius. Xylanase has been extracted from many different fungi and bacteria. It is commonly used in animal feed, paper production and food production.

Improving animal feed adding xylanase stimulates growth rate by improving digestibility, which also improves the quality of animal litter. Xylanase thins out the gut contents and allows increased nutrient absorption and increase diffusion of pancreatic enzymes in the digest. It also changes hemi-cellouse sugars so those nutrients for merely trapped within the cell walls are released. Mathlouthi, *et al*;(2002) studies that xylanase and Beta - glucanases supplementation improve conjugated bile acid fraction in intestestinal contents and increase villas size of small intestine wall in broiler chicken fed a rye-based diet. The addition of xylanase and Beta - glucanase to rye based diet improved weight gain, feed intake, feed efficiency and decreases water intake. The digestibility of nutrients and apparent metabolize energy were also increased ($P \leq 0.05$). Xylanase increase villas size and the villas weight-to-crypt- depth ratio as well as the concentration of conjugated bile acid ($P \leq 0.05$) in small intestine content.

Exogenous enzymes improved nutrient digestibility and broiler chicken performance, probably by improving the absorption capacity of the small intestine through increased villas surface and intestinal concentration of conjugated bile acid.

2 : 18 . 2 Effect of xylanase enzyme on broiler chicken performance, metabolizable energy, digestibility and carcass composition:

Numerous researchers (White, *et al.,* 1983 and Friesen, *et al*; 1992) found that addition of NSP degrading enzymes improved significantly protein and energy of wheat, rye, and oat feed the broiler diets. Response to ability to hydrolysis arabinoxylans and Beta-glucans the major component of non polysaccharides present in cereal grains. This include an efficient reduction in viscosity of the gut content, liberation of entrapped nutrient, thereby allowing more nutrient available for digestion in intestinal tract of broiler chickens (Castanon, *et al.,* 1997).

Smuli Kowska and Miecz Kowska, (2000) showed that 62% of increase of AME values was due to better fat digestibility when broiler are fed wheat based diet activities. Adeola and Bedford, (2004) found that addition of xylanase improved AME more in high viscosity than low-viscosity wheat when fed to Duck.

(Cowieson, 2005; Juapere, *et al*; 2005 and Choct 2004) found that xylanase and Beta-glucanase improved the nutritive value of wheat and barley based diet for broiler by reducing the anti nutritive effect of NSP in these cereals.

Pourreza , *et al.,* (2007) evaluated the effect levels 100,200,400 and 800 g/Kg of supplemental enzyme (xylanase) on dry matter protein are energy digestibility of basal diet containing 65% triticale for broiler. The results showed a significant improvement of protein and energy digestibility due to the supplemental enzyme. The highest digestibility was observed with 200 g/Kg enzyme. Enzyme has no significant effect on dry matter digestibility.

Hajati, (2010) reported that enzyme supplementation significantly improved relative growth energy efficiency and protein efficiency from 11-28 days of age. Adding enzyme significantly decreased body weight gain, feed intake and improved feed to gain ratio decrease by enzyme supplementation from 1-44 days ($P \leq 0.05$) enzyme addition significantly increase carcass, thigh and drumsticks percentages at 44 days of age.

Atteh , (2001) showed that the use of bacterial xylanase enzyme, is possible to replace 5% maize with wheat milling by product without detrimental effect on broiler performance. Café, (2002) found that addition of 0.1% of commercial dietary enzyme (Avizyme) to nutritionally complete broiler diet based on corn and soybean meal significantly improved the body weight of male broiler at 16,36 and 42 days while the feed conversion was not improved by addition of enzyme and in fact was significantly worse at 16 and 42 days of age. Also found that birds fed diet with enzyme had significantly lower mortality rate at 16-42 days of age is compared to bird fed un-supplemented diets. The same author also noted birds with enzyme has significantly higher dressing % with no apparent effect on yield of depend breast, leg quarters wings.

Adeola and Bedford, (2004) compared the efficiency of xylanase addition to high viscosity and low viscosity wheat diets and reported that the xylanase improved the performance of broiler to greater extents in high viscosity and low viscosity wheat, thus showing the relation between the potential of feed stuff to cause a viscosity and beneficial effect may result from enzyme as Rajesh, *et al ;(*2006) evaluated the inclusion of safflower meal in broiler diets by replacing meal at 0,33,66,100% level with and without commercial enzyme mixture. The results showed that the enzymes supplementation apparently improved the body weight gain and feed conversion ratio, while the feed intake was decreased in the bird fed the enzyme supplemented diet on based of the economic trials. The inclusion of sunflower meal with 33% and 60% soybean replacement with enzymes decreased the cost of production significantly by 18% and 5.7% respectively.

Makkawi, (2009) examined the effect of addition dietary xylanase 500 (xylanase and Amylase) to sorghum based diet on the performance and carcass characteristics of broiler. The result indicated that the body weight, feed intake, feed efficiency, mortality rate, percentage of (dressing, liver, heart and gizzard) commercial cuts (thigh, drumstick and breast) meat of commercial cats. Meat chemical composition aspects (moisture, fat, protein and ash) and subject meat attributes of broiler chicks were not affected significantly by the addition of xylanase commercial.

Bin Baraik, (2010) studied the effect of two levels of dietary xylanase (500,750) supplementation to broiler diets containing wheat bran on performance and carcass characteristics of broiler the result showed that the body weight, feed intake, feed efficiency, mortality rate, percentage of (dressing liver, heart and gizzard) commercial cuts , meat chemical composition aspects (moisture, fat and ash) and subject meat attributes of broiler chicks were not affected significantly by the addition of xylem commercial.

Munassar, (2011) studies the nutritional value of three levels of prosopis pods as protein source and energy supplemented sesame cake with and without xylanase enzyme on performance and meat characteristics, found improvement in performance and meat characteristics in diets contained xylanase enzyme.

Mariam, (2013) reported that all the level of microbial xylem and phytase enzyme added either individually or combination to diets containing 15% prosopis pod improved the performance of broiler different phases of growth similar to that option by the negative group and also reported the addition of xylanase and phytase enzyme individually or in combination has no significant effect on carcass characteristics and internal organs of broiler chicks, supplementation of diet containing 15% prospins pods diets with xylanase or phytase individually or in combination result in economical benefit .

Chapter Three

Materials and Methods

Two experiments were carried out at experimental farm of Department of Animal Production, in Shambat Khartoum North, Collage of Agricultural Studies, Sudan University of Science and Technology, during period from 25/05/2012 to 26/06/2012.

Experimental I:

3 : 1 Effect of full –fat safflower seed with and without enzyme as source of energy:

The safflower seed and safflower seed cake of are provided from experimental farm of the Department of Agronomy, in Shambat Khartoum, College of Agricultural Studies, Sudan University of Science and Technology.

3 :1:1 Experimental Chicks

Total of two hundred and ten, seven days old unsexed broiler chicks (cob 500) were purchased from a commercial company, ANAM Company, Omdurman– Sudan.

All chicks were weighed with an average weight of 41/g day old chick. The chicks were adopted to premises and fed over 7 days before starting with prestart. After 7 days the chicks were weighed and distributed to ten experimental groups each group was further divided into three replicates each with 7 chicks.

Chicks were vaccinated against Newcastle disease at 8 days and repeated after two weeks and vaccinated against Gambaro disease at 13 days of age and were repeated after a week . Soluble multivitamin compound and antibiotic were given to the chicks before vaccination and after vaccination in order to safe guard them against stress.

3 : 1: 2 The Housing

The experimental house in which the chicks were kept was semi closed with east – west direction. The housing dimensions were 25 m. length, 8.8 m. width and 3.05 m height.

The roof ceiling was made of trapezoid corrugated aluminum sheet and was insulated of (100mm) glass wool with thermal conductivity of (0.04 w/m^2) .

The walls of the house on the northern and southern sides were built from red blocks raised high to the level of 0.69 m. the house was equipped with adjustable side wall curtains to control the flow of air into the house. The top and bottom of the curtain opening was equipped with a curtain rod to minimized draft when fully closed, the floor was concrete.

Mechanical venations system was used in the house to generate on one direction air flow to provide the required levels of uniformity of air distribution over wide range of climatic condition. Two exhaust fan (fan diameter 1.29 with air 44500 m^2 / h).The house have two exhaust fan, Positioned in the middle of the western side wall were to maintain negative pressure inside the house as a result of negative pressure outside air flows into the house through inlet opening with cellulose pad besides maintaining the desired temperature and ventilations inside also an outlet on the roof was required to exit surplus heat, gases, moisture and supply fresh air.

Cooling system was evaporative cooling panel comportment, the cooling pad banks dimensions were (4 m. long * 1.4 m. length * 0.15 width) and that of air inlet valve was 0.45 m. the cooling pad was situated of the at two sides, north and south direction at the rear of the poultry house.

Cooling pad was made of specially impregnated cellulose paper of wait ability, arranged in self supporting structure that guaranteed long life without sagging or deterioration.

The other integral components provided with each pad cooling bank were pump, polyester, water tank capacity (1000 liters). For storage of water which was continuously supplied from main tap water under control of flouter which was put in the tank also there was one horse power electrical motor for pumping water from the tank to the top of pad cooling banks.

The piping system for supply and return of water, the cooling and humidification of outside air is obtain by evaporation of very fine water particles.

Due to negative pressure maintained by the exhaust fans air flow through the pad and then through special air inlet to the house. Special geometry of the pads enables the air to pass through small opening or flutes in turbulent state .thus creating ideal condition for maximum evaporation and consequently maximum cooling to take place as a result of the layer contact area between water and air (excess water is returned to the bank where it is pumped to the top edge of the pad for r-circulation. The temperature inside the house was maintained at 27-30 c throughout the experimental period.

Experiments 20 pens (1.5 * 1 m.) were prepared using wire mesh portioned and then were cleaned washed and disinfected by formalin and white phenol solution.

Before start the experiment allayer of wood shave (5cm) thick was laid on the floor as litter material. Each pen was provided by (5 kg) rounded feeder and (2.5 lit.) baby drinker which were adjusted to the progressive growth of chicks.The light program was 24 hours light from 1-3 days and 23 hours day for the rest period

3 : :1: 3 Experimental Diets:-

According to the approximate analysis of safflower seed table (1) ten experimental diets were formulated containing full fat-safflower seed (FFSS) at (0,5,10,15 and 20%) to be ISO-Nitrogenous 22% and ISO caloric 3100K/cal/Kg with and without a commercial enzyme xylanase , (xylem 500) , 50 gm/100 Kg. to meet the requirement of broiler chicks according to WRC (1994).

Experimental diets were formulated as follow:-

Diet 1 was negative control (without FFSS and enzyme).

Diet 2 was positive control, diets 3,4,5 and 6 formulated to contain graded level (5,10,15 and 20% of FFSS respectively, diets 7,8,9 and 10 were similar diets to 3,4,5 and 6 but they were supplemented with 50 g/Kg xylem 500 enzyme respectively. The composition calculated and determined analysis of the experiment diets was present in Table (1).

3 :1: 4 Microbial Xylam 500 Enzyme:

Microbiological xylem 500 used in this experiment which was composed of Endo-1.4-B- xylanse 126 u/g and amylase 800 u/g, it was produced by Nutrex Company for feed enzyme Production Acherstemhoek 5,22275 Lille Belgium.

3 : 1: 5 Parameters:

The experiment continued for 24 days and the birds were fed ad libitum chicks of each replicate were weighed weekly intervals, feed intake was recorded at weighing, feed conversion rate (F.C.R) and body weight gain were calculated weekly, mortality was recorded daily although out the experimental period.

3 : 1: 6 Data Collected:

- Performance of broiler (body weight gain feed intake and feed conversion ratio).

- Carcass characteristics (selected commercial cuts, gastro intestinal tract, liver, Gizzard and abdominal fat pad.

- Sensory evaluation (Flavors, Color, Tenderness and Juiciness.

- Economic Evaluation.

3 : 1: 7 Slaughter and Carcass preparation:

At the end of the experiment (42 days) the birds were fasted over night except from water, the birds were weighed and 3 birds were randomly selected from each group, then were weighed individually and slaughtered, after bleeding the slaughtered birds were scatted in hot water and feathers were plucked manually, then washed, the skull, feet and shanks were removed at the hook joint and eviscerated for carcass characteristics , hot carcass, heart, head, Gizzard, abdominal fat and liver without gall bladder were measures.

The carcass were divided into two halves each half was divided into commercial cuts (drum stick, high and breast) they were washed and deboned, meat of each was stored at refrigerate for analysis and panel taste.

3 :1: 8 Panel Taste:

Pieces of meat were slightly seasoned wrapped individually in aluminum tot and toasted at 190° c for 70 minutes. Ten well trained taste panelists were used to score, color, flavor, tenderness and juiciness of the meat. Carcass and et al (1978) on scalr 1-8 (Appendix the sample served was provided with water to rinse their mouth after each sample.

3 :1:9 Calculations:

The commercial cuts were expressed as percentage of hot carcass, non carcass components (heart, head, legs, Gizzard and liver) abdominal fat were expressed as percentage of live body weight, meat of each cut was expressed as percentage of the weight of their cuts.

3 : 1:10 Statistical Analyses:

The data obtained were subjected to analysis of variance following complete randomizes block design and comparison of means determined by Duncan's range test (Duncan, 1955).

Component	Values
Dry Water	94.00
Crude protein	17.90
Ether Extract	32.8
Ash	2.00
Available Phosphorus	0.84
Calcium	0.34
Lysine	2.30
Methionine	0.65
Metabolizable Energy ME/Kg	14.42

Table (1): Table of analysis of safflower seed on dry matter basis, except dry matter reported by AOAC (1995):

	0%	5%	10%	15%	20%
Dura(Feterita)	65.7	63.0	57.0	51.6	45.1
G.N. Cake	13	12	12.0	11.0	11.14
Sesame Cake	13	13.6	12.9	13.7	14.0
Safflower Seed	-	5.0	10.0	15.0	20.0
Concentrate*	5.0	5.0	5.0	5.0	5.0
Oyster shells	1.0	0.53	0.5	0.4	0.27
Salt	0.25	0.25	0.25	0.25	0.25
Vitamins** (.)	0.2	0.2	0.2	0.2	0.2
Lysine	0.08	0.1	0.05	0.06	0.04
Methionine	0.17	0.1	0.05	0.06	0.04
Veg.oil	2.2	0.22	0.1	2.75	4.0
Wheat Bean	-	-	2.0	-	-
Total	100	100	100	100	100

Table (2) Calculated and determine composition of dietary Experimental Diets in Experiment I

	0%	5%	10 %	15%	20%
ME./Kcal*	3106.87	3100.4	3100.4	3100.6	3100.4
CP%	22	22.0	22	21.77	21.91
Lysine	1.2	1.2	1.2	1.2	1.2
Methionine	0.52	0.52	0.51	0.51	0.51
Ca	1.0	1.0	1.0	1.01	1.0
P	0.62	0.65	0.61	0.67	0.69
CF	4.22	4.64	5.26	6.02	6.75
EE	4.38	5.69	6.92	8.44	9.83
Ash	4.52	4.39	4.24	4.39	4.42

Determine composition

Experiment (2)

3 :2 Effect of safflower cake meal with and without enzyme as source of plant protein.

3 : 2 :1 Experimental Diets:

According to result of approximate analysis of un decorticated safflower cake (Table 3) ten experiment diets, were formulated containing safflower cake meal (mechanical method processed) at levels (0, 5, 10, 15 and 20%) with and without enzyme (xylem 500) 50g/Kg. The experimental diets were formulated to be ISO-nitrogenous 22% and ISO-carloric 3100 Kcal/Kg to meet the nutritional requirements of broiler chicks as recommended by WRC (1994) diet (A) without enzyme and safflower cake considered as control diet (table 4)

	Safflower Seed	Safflower Meal	Safflower Cake
Moisture %	4.04	4.00	0.12
CP%	18.64	32.3	31.0
Fat %	29.12	1.3	1.5
Crude Fiber %	17.0	14.0	27.0
Ash %	2.98	2.93	4.38
ether extract %	28.22	45.47	30.5

Table (3) Chemical analysis of safflower seed, meal and cake

Source Animal Nutrition service Center Mariotea Building 3rd floor Mariotea, Sakkara rood , Alharm Giza Egypt (8 /2001)

	0%	5%	10%	15%	20%
Dura(Fetareita)	65.70	63.0	57.0	51.6	45.1
G.N. Cake	13	12	12.0	11.0	11.14
Sesame Cake	13	13.6	12.9	13.7	14.0
Safflower cake	-	5.0	10	15.0	20.0
Concentrate*	5.0	5.0	5.0	5.0	5.0
Oyster	1.0	0.53	0.5	0.4	0.27
Salt	0.25	0.25	0.25	0.25	0.25
Vitamin**	0.2	0.2	0.2	0.2	0.2
Lysine	0.08	0.1	0.05	0.06	0.04
Methionine	0.17	0.1	-	0.04	-
Vegetable oil	2.2	0.22	0.1	2.75	4.0
Wheat Bean	-	-	2.0	-	-

Table (4) Calculated and determine composition of dietary Experimental (II) Diets

	0%	5%	10%	15%	20%
ME./Kcal*	3106.87	3100.4	3100.4	3100.6	3100.3
CP%	22	22	22	21.77	21.91
Lysine	1.2	1.2	1.2	1.2	1.2
Methionine	0.52	0.52	0.51	0.51	0.51
Ca	1.0	1	1	1.01	1.0
Available P	0.62	0.65	0.61	0.67	0.69
CF	4.22	4.64	5.26	6.02	6.75
EE	4.38	5.69	6.92	8.44	9.83
Ash	4.52	4.39	4.24	4.39	4.42

Calculated Composition

3 :2 :2 Experimental Chicks:

Total of 210, one day old (Cobb 500) commercial unsexed broiler chicks were obtained, transported, housed with facilities adapted and experimentally allocated to 10 treatment groups, each group with 3 replicates, each with 7 chicks. The same planned in experiment one, preventive health program were the same in the first experiment.

3 : 2 :3 Housing:

Program was similar to house mentioned in experiment one.

3 : 2: 4 Data Collected:

Performance data programs were similar to those mentioned in the experiment one.

3 : 2:5 Slaughter procedure and carcass data:

Programs were similar to those mentioned in previous experiment.

3 : 2 : 6 Panel Lest:

Programs were similar to those mentioned in previous experiment.

3 : 2 :7 Calculations:

Were similar to those mentioned in previous experiment.

3 : 2: 8 Statistical Analyses:

Programs were similar to those mentioned in experiment o

Chapter Four

Results

4. Experiment (1):

4.1 Effect of feeding broiler chicks on diets containing graded levels of safflower seed with and without enzyme.

The results of broiler chicks fed on diets containing graded levels of safflower seed with and without enzyme illustrated in Table (5) results showed no significant ($p > 0.05$) difference between positive and negative control in body weight gain , chicks fed on diets supplemented with 5% and 10 % (SFS) recorded significant low ($p > 0.05$) values in body weight compared to all experimental groups . However, groups fed on 10 % SFS without enzyme recorded numerically the lowest weight gain value .Although broiler chicks fed on diets containing different levels of FFSS with enzyme significantly ($p < 0.05$) improved in body weight gain .

Results revealed that chicks fed on diet containing 5% without enzyme recorded the lowest value in feed intake compared to other groups, although enzyme supplementation increased feed intake for all levels of FFSS.

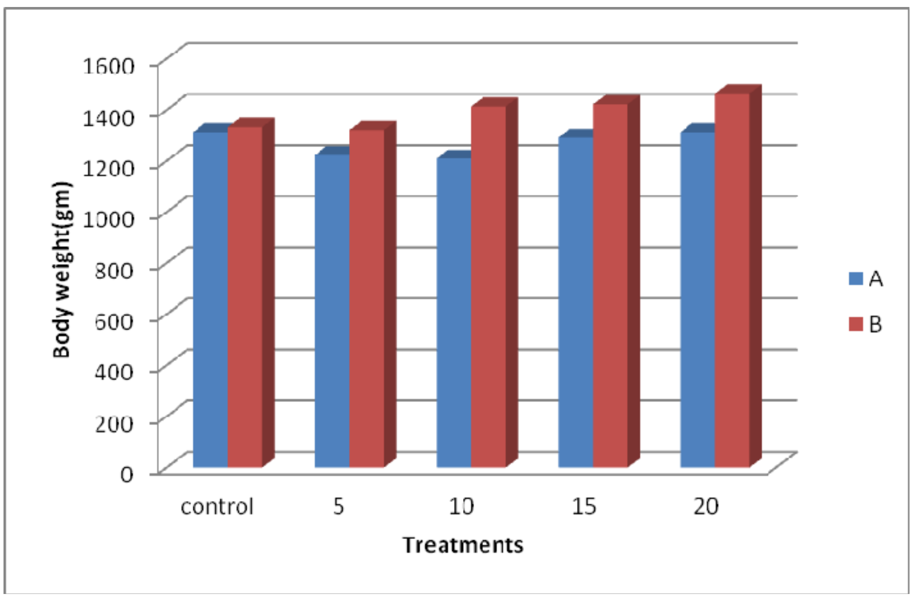
Result also showed that chicks fed on diet containing 10 % FFSS. supplemented with enzyme recorded significantly ($p < 0.05$) the best feed conversion ratio (FCR)compared to both negative and positive controls , while chicks fed on diets containing 5 % and 15 % FFSS with and without enzyme and 20 % with enzyme recorded similar values of (FCR) although both control groups and 20 % without enzyme recorded significantly ($p > 0.05$)the lowest values.

Treatment/ Parameter	Enzyme	% safflower seed					CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Body weight gain (gm)	**Without**	1313.00[c]	1223.00[d]	1209.00[d]	1291.00[c]	1313.33[c]	2.66%	61.87[**]	20.82
	With	1333.00[c]	1322.00[c]	1414.00[b]	1422.00[b]	1465.00[b]			
Feed intake (gm)	**Without**	2921.00[ab]	2563.00[b]	2688.00[ab]	2788.00[ab]	2896.00[ab]	6.91%	336.9[*]	113.4
	With	3034.00[a]	2843.00[ab]	2749.00[ab]	2968.00[a]	2960.00[a]			
Feed conversion ratio	**Without**	2.23[a]	2.09[ab]	2.22[a]	2.16[ab]	2.21[a]	6.72%	0.2426	0.08165
	With	2.28[a]	2.15[ab]	1.94[b]	2.09[ab]	2.02[ab]			
Mortality rate	**Without**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	With	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.32

Table (5): Body weight gain, feed intake and feed conversion ratio

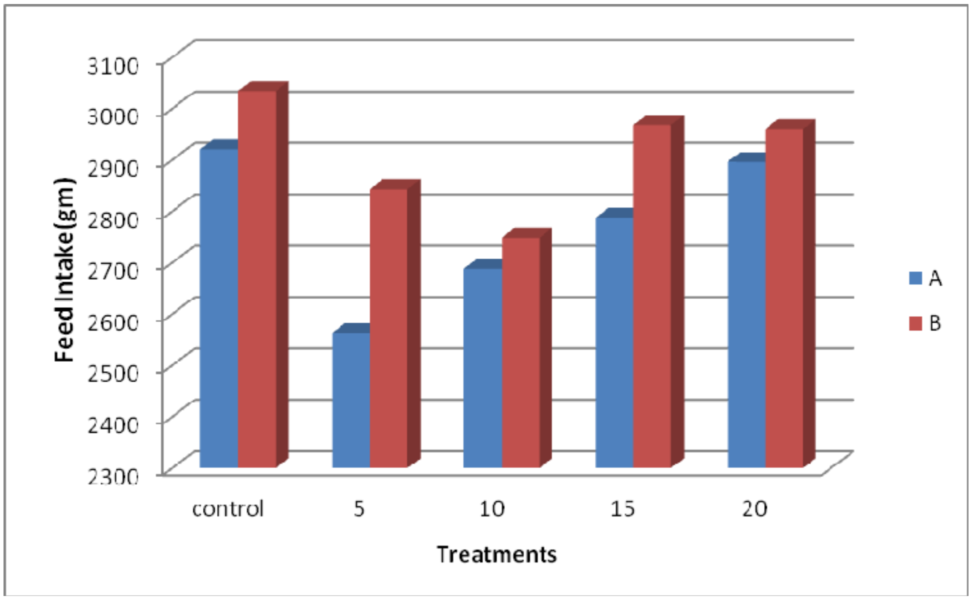
4 : 1 : 1 Results for the commercial cuts :

The results showed that chicks fed 10% of FFSS with enzyme showed significantly ($p < 0.05$) (Table 6) the heaviest weight for breast while those on other experimental groups recorded similar values for the breast value .The same trend was shown by breast meat and bone ratios, the treatment did not affect significantly ($p > 0.05$) on thigh and drum stick weights and their meat and bone ratios Table (7-8).



- With enzyme
- Without enzyme

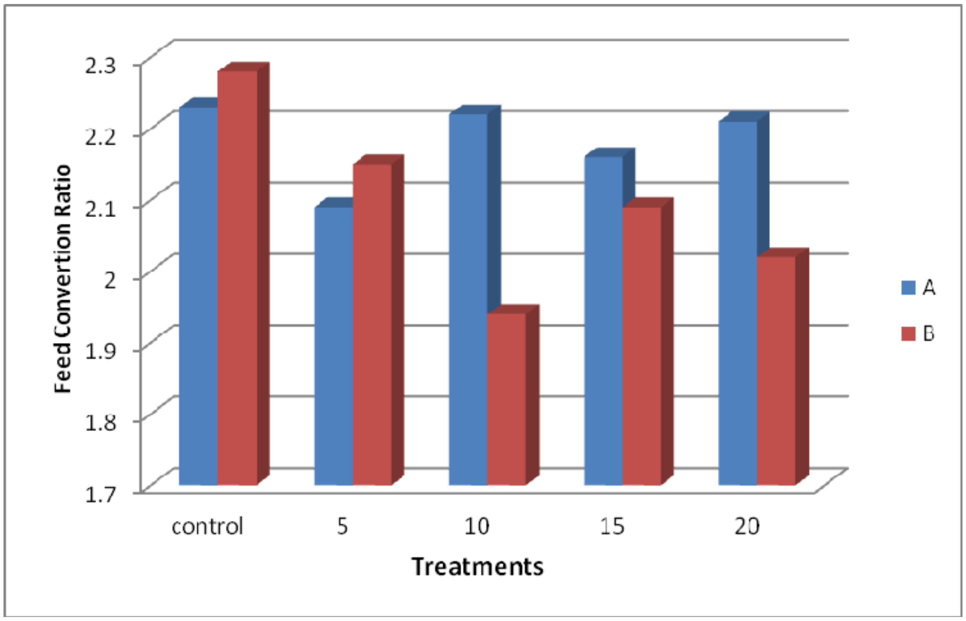
Fig.1:Effect of feeding broiler chicks on diets containing graded levels of safflower seed with and without enzyme on body weight



■ **With enzyme**

■ **Without enzyme**

Fig.2:Effect of feeding broiler chicks on diets containing graded levels of safflower seed with and without enzyme on feed intake



■ **With enzyme**

■ **Without enzyme**

Fig.3: Effect of feeding broiler chicks on diets containing graded levels of safflower seed with and without enzyme on feed conversion ratio

Treatment/ Parameter	Enzyme		% safflower seed				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Breast	**With**	19.10^{ab}	16.58^{a}	21.51^{a}	17.19^{ab}	16.86^{ab}	15.60%	4.714^{*}	1.587
	Without	17.93^{ab}	19.56^{ab}	16.79^{ab}	16.17^{ab}	16.48^{ab}			
Thigh	**With**	3.82^{a}	4.41^{a}	4.28^{a}	4.46^{a}	4.18^{a}	13.25%	1.682^{ns}	0.5663
	Without	7.12^{a}	8.29^{a}	7.63^{a}	7.61^{a}	7.16^{a}			
Drumstick	**With**	9.68^{ab}	9.06^{ab}	9.51^{ab}	9.53^{ab}	9.58^{ab}	14.49%	2.369^{*}	0.7975
	Without	9.20^{ab}	9.48^{a}	8.86^{b}	8.35^{b}	10.06^{ab}			
Wing	**With**	4.60^{a}	4.37^{a}	4.32^{a}	4.62^{a}	4.91^{a}	13.97%	1.459^{ns}	04909
	Without	5.99^{ab}	8.14^{ab}	5.56^{ab}	5.51^{ab}	5.87^{ab}			

Table (6): Breast, thigh, drumstick and wing weights of experiment 1:

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

Treatment/ Parameter	Enzyme		% safflower seed				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Breast meat	**With**	82.43^{a}	78.44^{ab}	78.69^{a}	82.68^{ab}	82.24^{ab}	7.72%	10.83*	3.644
	Without	82.96^{a}	75.49^{a}	79.77^{ab}	84.37^{ab}	79.43^{ab}			
Breast bone	**With**	15.35^{ab}	21.56^{ab}	17.31^{ab}	17.32^{ab}	17.76^{ab}	34.11%	10.72*	3.609
	Without	16.59^{ab}	20.51^{a}	20.23^{ab}	18.63^{ab}	20.57^{ab}			
Thigh meat	**With**	78.96^{a}	75.62^{a}	80.59^{a}	78.47^{a}	76.78^{a}	7.67%	$10.14^{.n.s}$	3.414
	Without	78.91^{a}	75.98^{a}	71.20^{a}	77.83^{a}	76.25^{a}			
Thigh bone	**With**	21.62^{a}	24.38^{a}	19.41^{a}	21.53^{a}	23.22^{a}	25.75%	10.16^{ns}	3.419
	Without	21.09^{a}	24.02^{a}	28.80^{a}	22.17^{a}	23.75^{a}			

Table (7): Breast meat, bone and Thigh meat and bone of experiment 1:

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

Treatment/ Parameter	Enzyme		% safflower seed				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Drum stick meat	**With**	81.25^{a}	81.31^{ab}	81.95^{ab}	86.10^{ab}	84.40^{ab}	8.29%	12.15^{*}	4.089
	Without	81.47^{a}	84.95^{ab}	87.75^{ab}	85.86^{ab}	86.973^{ab}			
Drumstick bone	**With**	12.28^{ab}	11.69^{ab}	12.05^{ab}	13.90^{ab}	15.60^{ab}	25.24 %	5.897*	1.985
	Without	11.99^{ab}	15.05^{ab}	12.25^{ab}	14.14^{ab}	13.03^{ab}			

Table (8): Drumstick meat and bone of EXP. 1:
Means having different superscripts within a row are significantly different (P≥0.05).

4 : 1 : 2 Percentages of giblets (liver, heart, gizzard and abdominal fat:

Results in Table (10) showed no significant ($p > 0.05$) difference for giblets (liver , heart , gizzard and abdominal fat) values,chicks fed on both negative and positive control recorded significantly ($p > 0.05$) low value for liver but other tested groups recorded similar values ,also the same trend was recorded for heart values .

Chicks fed on both control groups, 5%, 15% and 20%SFS with enzyme recorded significantly the lowest (P> 0-05) values for gizzard value, however, other experimental groups recorded the same values although the supplementation of diets containing FFSS with enzyme decreased the weight of gizzard but not significant (P>0-05) in (table 10).

Result showed that broiler chicks fed on diets containing FFSS without enzyme recorded significantly ($P>0.05$) the heaviest abdominal pad fat compared to other tested groups while, those fed on control diet, 15% and 20%SFS supplemented with enzyme recorded significantly (P>0-05) the lowest value for abdominal pad fat.

Treatment/ Parameter	Enzyme		% safflower seed				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Dressing %	**Without**	63.83^{ab}	63.88^{ab}	65.19^{ab}	63.65^{ab}	65.78^{ab}	2.62%	2.912^{*}	0.98
	With	64.72^{ab}	63.58^{b}	66.49^{ab}	64.31^{a}	64.55^{ab}			
Legs %	**Without**	3.82^{a}	4.41^{a}	4.28^{a}	4.46^{a}	4.18^{a}	12.54%	0.9349^{ns}	0.3146
	With	4.55^{a}	4.47^{a}	4.79^{a}	4.17^{a}	4.29^{a}			
Lung%	**Without**	0.59^{c}	0.78^{ab}	0.78^{b}	0.68^{ab}	0.71^{ab}	11.13%	0.1329^{*}	0.04472
	With	0.63^{c}	0.69^{ab}	0.68^{ab}	0.69^{ab}	0.69^{ab}			
Neck%	**Without**	4.60^{a}	4.37^{a}	4.32^{a}	4.62^{a}	4.91^{a}	9.00%	0.6819^{ns}	0.2295
	With	4.40^{a}	4.44^{a}	4.52^{a}	4.51^{a}	4.45^{a}			

Table (9): Dressing, legs, lung and neck percentages for experiment 1:

Means having different superscripts within a row are significantly different (P≥0.05).

Treatment/ Parameter	Enzyme		% safflower seed				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Liver %	**Without**	2.52^{a}	2.21^{a}	2.33^{a}	2.09^{a}	1.96^{a}	12.69%	0.3836^{*}	0.1291
	With	0.20^{b}	2.30^{a}	2.32^{a}	2.12^{a}	1.89^{a}			
Heart %	**Without**	0.36^{cd}	0.58^{ab}	0.57^{ab}	0.55^{ab}	0.51^{ab}	20.54%	0.1627^{*}	0.05477
	With	0.39^{bcd}	0.56^{ab}	0.56^{b}	0.36^{cd}	0.54^{ab}			
Gizzard %	**Without**	1.66^{bc}	2.18^{b}	2.11^{ab}	2.26^{ab}	2.31^{a}	13.70%	0.4666^{*}	0.1571
	With	1.76^{ab}	2.12^{ab}	2.11^{ab}	1.82^{bc}	1.77^{bc}			
Abdominal %	**Without**	1.33^{c}	1.46^{b}	1.47^{ab}	1.78^{b}	1.89^{ab}	28.4%	0.6622^{**}	0.2229
	With	0.93^{c}	1.32^{a}	1.30^{b}	0.78^{c}	0.82^{c}			

Table (10): Liver, heart, gizzard and abdominal percentages for experiment 1:

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

4 :1 : 3 Mortality rate Exp. 1:-

The mortality rate for Exp1 shown in Table (11) the result showed no significant different all through the experimental period in mortality rate of experimental chicks fed on FFSS.Results showed no mortality although the experimental period.

Treatment	Control	5%	10%	15%	20%
With	0%	0%	0%	0%	0.32%
Without	0%	0%	0%	0%	0%

Table (11) Mortality rate Exp . No : 1

4 : 1: 4 sensory Evaluation.

The effect of treatment on subjective meat attributes is shown in Table (12) the average subjective meat quality score (Color, tenderness, juiciness and flavor) were not significant in all treatment groups and score given for all attributes were above moderate acceptability.

Treatment	Juiciness	Tenderness	Flavor	Color
Control	6.2	5.3	5.9	5.0
5 % S.F.S	5.1	5.7	5.9	5.8
10 % S.F.S	6.3	5.6	6.2	5.4
15 % S.F.S	6.4	6.2	5.7	5.2
20 % S.F.S	6.0	6.1	6.1	5.5

Table (12) Sensory Evaluation Exp. 1 (Supplementation of Safflower seed)

4 :1: 5 Economic appraisal Exp. 1.

Appraisal of total cost, revenues and profit of broiler chicks fed on different level safflower seed diets supplemented with microbial xylam shown in Table (12) chicks purchased, management and feed costs values were the major input considered. The total selling values of meat was the total revenues .profitability ratio /Kg. meat is higher in 10 %safflower seeds with enzyme compare to control and other groups treatments (1.013) and (1.409) , and the result shows there is increases in profitability with supplemented enzymes groups compare to non enzymes diets .

Item	Control		5% S.F.S		10% S.F.S		15% S.F.S		20% S.F.S	
	With	without	with	without	with	without	with	without	with	without
Cost:										
Chicks	2.85	2.85	2.855	2.850	2.85	2.850	2.850	2.850	2.850	2.850
Feed	7.567	7.6	7.106	6.782	6.124	6.674	8.390	8.251	8.711	8.599
Electricity, management	3.000	3.000	3.000	3000	3.000	3.000	3.000	3000	3000	3.000
Total cost	13.430	13.45	12.956	12.632	11.974	12.524	14.240	14.101	14.561	14.449
Revenues										
Average weight carcass	1.333	1.313	1.322	1.223	1.414	1.209	1.422	1.291	1.465	1.313
Price Kg. of bird	16	16	16	16	16	16	16	16	16	16
Total Revenues	21328	21.008	21.152	19.568	22.624	19.344	22.752	14.101	14.561	14.449
Profits:										
Total Revenues	21.108	21.008	21.152	19.568	22.624	19.344	22.752	20.656	23.440	21.008
Total Cost	13.45	13.45	12.956	12.632	11.974	12.524	14.240	14.101	14.561	14.449
Profit / chick	7.897	7.558	8.196	6.936	11.951	6.820	8.240	6.555	8.879	6.559
Profitability Ratio										

Table: (13) The Economic Appraisal for experiment 1:

. **Experiment (2):**

4 : 2 Response of broiler chicks fed dietary safflower cake with and without enzyme:

4 ; 2 : 1 Performance:

The result of feeding broiler chicks on different levels of safflower cake (SFC) with and without enzyme presented in Table (13)

Group of chicks fed on both control diets, 5% safflower with and without enzyme and group fed on 10% SFC with and without enzyme showed no significant ($P>0.05$) differences in body weights (B.W).chicks fed on diet containing 10% (SFC) without enzyme recorded significantly ($P>0.05$) the lowest value for (B.W) while group fed 15% SFC with enzyme and 20% SFC with enzyme showed significantly ($P<0.05$) the heaviest weight gain compared to other experimental group .

The addition of SFC in broiler diets gradually with and without enzyme significantly ($P<0.05$) increase in body weight gain of the chick.

The similar results were obtained for feed intake. (FI) results recorded no significant ($P>0.5$) difference in feed conversion ratio (SFC) between both control groups, chicks group fed on diet containing 5%F.S.C without enzyme recorded significantly ($P<0.05$) the best value of SFC followed by chicks fed on 10% SFC without enzyme and 20% SFC without enzyme while chicks fed control group with enzyme showed significantly ($P>0.05$) the lowest of SFC the mortality percentage showed no significant ($P>05$) deferent among the experimental group.

4 : 2 : 2 Mortality rate Exp. 2:-

The mortality rate for Exp. No.2 shown in Table No. (14) The result showed no significant different all through the experimental period.

Treatment	Control	5%	10%	15%	20%
With	0%	0%	0%	0%	0.32%
Without	0%	0%	0%	0%	0%

Table (14) Mortality rate Exp. 2

Treatment/ Parameter	Enzyme		% safflower cake				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Body weight gain (gm)	With	1333.00^{b}	1336.00^{b}	1360.00^{b}	1515.00^{c}	1539.00^{c}	3.00%	71.49^{**}	24.06
	Without	1313.00^{b}	1307.00^{b}	1266.00^{a}	1416.00^{c}	$1486c00^{c}$			
Feed intake (gm)	With	$3034..00^{a}$	2742.00^{b}	2870.00^{b}	3042.00^{ab}	3142.00^{a}	4.55%	223.2^{*}	75.11
	Without	2921.00^{ab}	2440.00^{c}	2418.00^{c}	3027.00^{ab}	$2959..00^{ab}$			
Feed conversion ratio	With	2.28^{a}	2.05^{b}	2.11^{ab}	2.00^{a}	1.53^{ab}	5.63%	0.1956^{*}	0.06583
	Without	$.2.23^{ab}$	1.87^{c}	1.91^{c}	2.14^{b}	$1..29^{c}$			
Mortality rate	with	0.0	0.0	0.0	0.32	0.32			
	without	0.0	0.0	0.0	0.0	0,0			

Table (15): Body weight gain, feed intake and feed conversion ratio of exp.2:

Means having different superscripts within a row are significantly different (P≥0.05).

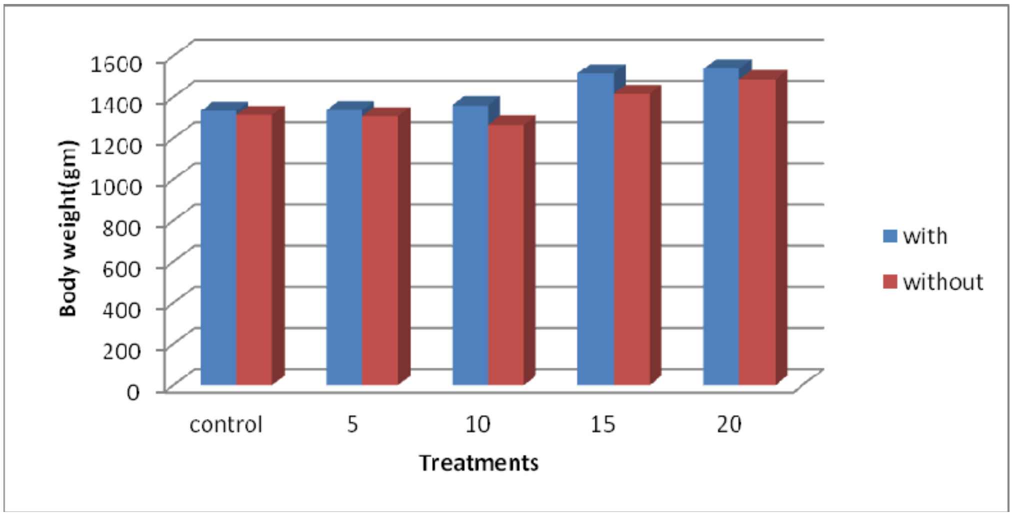


Fig.4:Effect of feeding broiler chicks on diets containing graded levels of safflower cake with and without enzyme on body weight

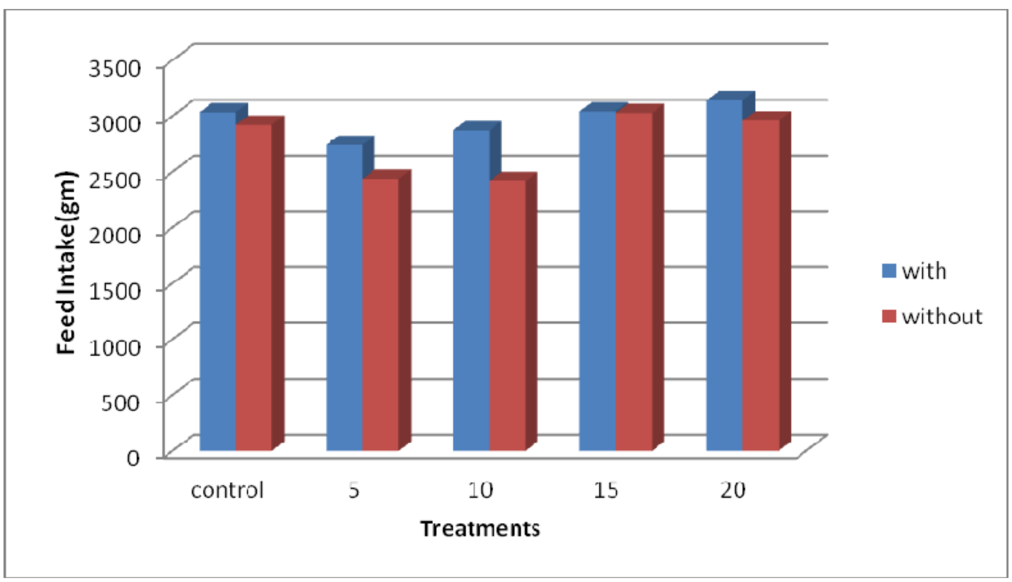


Fig.5:Effect of feeding broiler chicks on diets containing graded levels of safflower cake with and without enzyme on feed intake

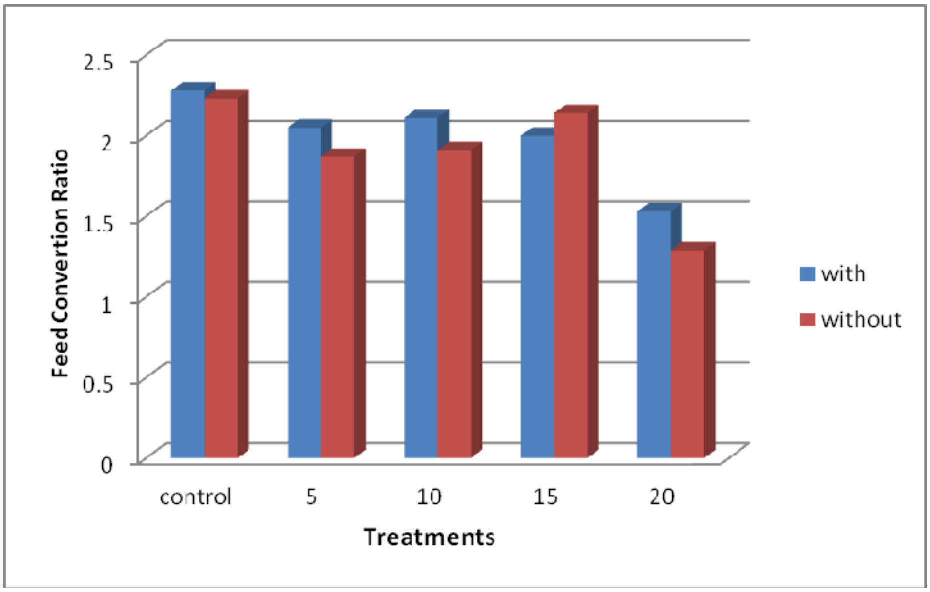


Fig.6:Effect of feeding broiler chicks on diets containing graded levels of safflower cake with and without enzyme on feed conversion ratio

4 : 2 : 3 Dressing and carcass measurement

Result concerning dressing ,legs ,lungs and neck percentages were presented in Table (14) results showed no significant ($P>0.05$) difference between all treatment groups in the previous parameters except that chicks group fed on 20% SFC with enzyme recorded significantly ($P<0.05$) high percentage in dressing compared to other tested groups.

4 : 2 : 4 Non carcass components (liver, heart, gizzard and abdominal fat):

Result of non carcass components (liver, heart, gizzard and abdominal fat) percentage values were illustrated in Table (15) the result showed no significant ($p >0.05$)in liver percentage value between both control groups , although they recorded significantly ($p > 0.05$) lower percentage values compared to other tested groups while there was a significant difference between groups fed on diet containing SFC with and without enzyme in liver percentages .Similar results were obtained for heart. for gizzard chicks fed on control groups without enzyme recorded significantly ($p > 0.05$) the lowest percentage value compared to other tests groups , although there was no significant difference between all treated groups in the percentage of abdominal fat .

4 : 2 : 5 Commercial cuts and their meat and bone ratios:

Results obtained for commercial cuts (Breast, thigh, drum sticks, and their meat /bone ratio) were presented in Table (16, 17 and 18). Results showed no significant ($p > 0.05$) difference between all treatment groups in all parameters

Treatment/ Parameter	Enzyme		% safflower cake				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Dressing	**With**	64.72^{a}	66.27^{a}	64.91^{a}	65.74^{ab}	71.97^{b} b	6.30%	7.124*	2.398
	Without	66.83^{ab}	64.60^{a}	65.09^{a}	65.85^{a}	66.44^{a}			
Legs	**With**	4.55^{a}	4.25^{a}	4.98^{a}	4.24^{a}	4.41^{a}	15.78%	1.209^{ns}	0407
	Without	3.82^{a}	4.57^{a}	4.49^{a}	4.04^{a}	4.29^{a}			
Lung	**With**	063^{a}	0.70^{a}	0.73^{a}	0.74^{a}	0.60^{a}	19.39%	0.2365*	0.07958
	Without	0.60^{a}	0.83^{a}	060^{a}	071^{a}	0.70^{a}			
Neck	**With**	4.60^{a}	4.37^{a}	4.32^{a}	4.62^{a}	4.91^{a}	8.16%	0.349^{ns}	0.2137
	Without	3.60^{a}	4.54^{a}	4.33^{a}	4.59^{a}	456^{a}			

Table (16): Dressing, legs, lung and neck as a percentages for experiment 2:

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

Treatment/ Parameter	Enzyme		% safflower cake				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Liver %	With	0.20[b]	2.14[a]	2.09[a]	2.14[a]	2.43[a]	15.83%	0.5287*	0.178
	Without	014[b]	2.12[a]	2.19[a]	1.85[a]	1.98[a]			
Heart%	With	0.49[a]	0.52[b]	0.57[b]	0.55[b]	.0.56b	17.49%	0.435*	0.0483
	Without	0.48a	0.58[b]	0.56[b]	0.55[b]	0.54[b]			
Gizzard %	With	1.89[b]	1.80[a]	1.82[a]	1.97[a]	1.97[a]	15.69%	0.5001*	0.1683
	Without	1.46[a]	1.86[a]	1.85[a]	1.72a	1.89[a]			
Abdominal %	With	1.39[a]	152[a]	1.29[a]	1.30[a]	1.37[a]	24.53%	0.5817*	0.1958
	Without	1.33[a]	1.42[a]	1.53[a]	1.40[a]	1.35[a]			

Table (17): Liver, heart, gizzard and abdominal as apercentages of live body weight:

Means having different superscripts within a row are significantly different (P≥0.05).

Treatment/ Parameter	**Enzyme**		**% safflower cake**				**CV%**	**$Lsd_{0.05}$**	**SE±**
		Control	**5**	**10**	**15**	**20**			
Breast %	**With**	18.25^{a}	17.39^{a}	17.81^{a}	17.35^{a}	17.92^{a}	6.45%	1.931^{*}	0.6499
	Without	17.93^{a}	18.78^{a}	17.68^{a}	17.35^{a}	17.64^{a}			
Thigh %	**With**	6.99^{a}	6.50^{a}	7.55^{a}	6.94^{a}	6.69^{a}	10.17%	1.207^{ns}	0.4062
	Without	7.12^{a}	7.25^{a}	6.93^{a}	7.10^{a}	6.77^{a}			
Drumstick%	**With**	8.68^{a}	8.61^{a}	8.63^{a}	8.50^{a}	8.19^{a}	7.70%	1.142^{*}	0.3843
	Without	8.70^{a}	8.69^{a}	8.56^{a}	8.56^{a}	8.54^{a}			
Wing %	**With**	6.14^{a}	5.82^{a}	5.90^{a}	5.99^{a}	5.81^{a}	937%	0.9487^{ns}	0.3194
	Without	5.99^{a}	5.87^{a}	5.91^{a}	5.87^{a}	6.11^{a}			

Table (18): Breast, thigh, drumstick and wing as a percentages of hot carcass weight:

Means having different superscripts within a row are significantly different (P≥0.05).

:

Treatment/ Parameter	Enzyme		% safflower cake				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Breast meat	**With**	85.96^{a}	82.46^{a}	81.67^{a}	82.77^{a}	84.76^{a}	5.35%	7.544^{*}	2.539
	Without	84.82^{a}	83.82a	81.54^{a}	78.54^{a}	77.20^{a}			
Breast bone	**With**	15.35^{a}	17.54^{a}	18.33^{a}	17.23	15.24^{a}	24.73%	7.528^{ns}	2.534
	Without	15.04^{a}	16.18^{a}	18.46^{a}	21.26^{a}	22.80^{a}			
Thigh meat	**With**	$78..96^{a}$	78.40^{a}	77.14^{a}	77.30^{a}	75.87^{a}	2.40%	3.163^{*}	1.064
	Without	78.91^{a}	78.36^{a}	77.18^{a}	76.50^{a}	76.30^{a}			
Thigh bone	**With**	22.62^{a}	22.60^{a}	23.86^{a}	22.70^{a}	23.95^{a}	8.10%	3.198^{ns}	1.076
	Without	22.09^{a}	22.64^{a}	22.82^{a}	23.50^{a}	23.70^{a}			

Table (19): Breast meat, bone and Thigh meat and bone as a percentages of their cut

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

Treatment/ Parameter	Enzyme		% safflower cake				CV%	$Lsd_{0.05}$	SE±
		Control	5	10	15	20			
Drumstick meat	**With**	83.25[a]	83.48[a]	83.56[a]	83.00[a]	8328[a]	2.80%	4.08*	1.373
	Without	83.47[a]	84.90[a]	82.99[a]	83.29[a]	83.90[a]			
Drumstick bone	**With**	14.28[a]	14.69[a]	14.05[a]	16.90[a]	16.00[a]	16.12%	4.236[ns]	1.426
	Without	15.19[a]	15.10[a]	14.01[a]	17.71[a]	17.10[a]			

Table (20): Drumstick meat and bone as a percentage of its cut:

Means having different superscripts within a row are significantly different ($P \geq 0.05$).

4: 2 : 6 Sensory Evaluation:

The average subjective meat quality scores (Color, tenderness, flavor and juiciness) were not significantly among all treatment groups. Scores given for all parameters are above moderate acceptability as shown in Table (19) .

4 : 2 : 7 Economic appraisal for chicks fed on diets containing different levels of SFC:

A appraisal of the total costs, revenues, and profit of broiler chicks fed on different level of safflower cake supplemented with microbial xylem is shown in Table (20).

Chicks purchase, management and feed cost .Values of meat is the total revenues , profitability ratio / Kg. meat . The result show that profitability is higher at level 20 % safflower cake with supplemented enzyme compare to control (1.000 ,1.267) and also the result shows that profitability increase with supplemented enzyme compare to non enzyme diets .

Treatment	Juiciness	Tenderness	Flavor	Color
Control	6.2	5.3	5.9	5.0
5 % SFC	6.3	5.8	6.1	6.2
10% SFC	6.0	6.3	5.5	5.7
15% SFC	5.4	5.2	5.9	5.7
20% SFC	7.0	6.2	6.4	5.7

Table (21) sensory evaluation (supplementation of safflower cake)

Item	Control		5% S.F.C		10% S.F.C		15% S.F.C		20% S.F.C	
	With	without	with	Without	with	without	with	without	With	Without
Cost:										
Chicks	2.850	2.850	2.850	2.850	2.850	2.850	2.850	2.850	2.850	2.850
Feed	8.419	6.682	6.533	5.966	6.520	5.612	7.851	7.907	7.306	8.233
Electricity, management	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3000	3000
Total cost	14.269	12.532	12.383	11.816	12.370	11.462	13.701	13.757	13.156	14083
Revenues2										
Average weight carcass	1.333	1.313	1.336	1.307	1.360	1.366	1.515	1.416	1.515	1.486
Price Kg. of bird	16	16	16	16	16	16	16	16	16	16
Total Revenues	21.328	21008	21.376	20.912	21.760	20.256	24.240	22.6.56	24.240	23.776
Profits:										
Total Revenues	21.328	21.008	21.376	20.912	21.760	20.256	24.240	22.656	24.240	23.776
Total Cost	14.269	12.532	12.383	11.884	12.370	11.462	13.701	13757	13.156	14.083
Profit / chick	7.060	8.468	8.993	9.038	9.390	8.794	10.534	8.899	11.084	9.693
Profitability Ratio										

Table (22) **Economic appraisal for chicks fed on diets containing different levels of SFC**

Chapter Five

Discussion, Conclusion and Recommendations

5.1 Discussion:

a Fats and oils are rich sources of energy, but they are more costly on a weight basis and may contain impurities (Blair and Potter,1988).As alternative to fats and oils ,full fat oils seeds (Mukhtar,2011) such as Rosella seeds are used to replace supplement oils and fats in broiler diets. However, Rosella seed has ant nutritional factors which need further processing .So full fat safflower seed is available on the market and contains more ether extract ,and high ether extract content contributes to a high metabolic energy.

Safflower seed is a productive crop under semi arid or rain –fed condition ,safflower seed contain 33 – 60 % hull and 40 -67 % kernel and due to their very high fiber content , safflower seeds un decorticated safflower meal are of low value in poultry .Kohler *et al.,* (1965) However ,the use of decorticated safflower is possible in poultry if energy level is adjusted with a special care to lysine methionine supplementation . Hill and Knowles (1968) reported that the full fat safflower seed is sources of dietary mono unsaturated fatty acid (MUFA) and inclusion of it in monogastric diet can be particularly valuable to increase the degree of unsaturated of intramuscular fat, without negative effect lipid oxidation associated with dietary poly unsaturated fatty acid (PUUFA).

Body weight gain of broiler chicks in the first experiment, fed on graded levels of safflower seed without enzyme revealed fluctuation in body weight gain values, however groups fed on 15 % and 20 % safflower seed recorded significantly similar values and to those fed on 5 % safflower seed with enzyme. Chicks fed on 10 %, 15 % and 20 % safflower seed with enzyme recorded significantly the heaviest values.

Results showed no significant difference between chicks groups fed graded levels of dietary safflower seeds with or without enzyme except group fed on 5 %without enzyme which showed significantly the lowest feed intake compared to positive control, 15 % and 20 % with enzyme.

Feed conversion ratio improved but not significantly with the increase of safflower seed level and also with the enzyme supplementation.

These results were in line with that recorded by Malakian *et al* (2011 who found that growth performance and carcass trial of broiler chicks were not affected significantly when fed on safflower seeds up to 20 % in diets where energy and protein were adjusted . Also Hossini (2008) who found no significant effect on the performance of laying hen fed different levels of full fat safflower, Oguz and Oguz (2007), Mahadi *et al.,* (2010), Rodriquez *et al.* (1998) and Malekiani and Hassan (2011) when they include full fat safflower up to 20% in broiler diets. Also (Tuzuki *et al.,* (2003) found that sunflower seed inclusion up to 5.6% in laying hens diets had no effect on daily feed intake ,yolk color or Haugh unit scope Results were disagree with the findings of Daghir *et al*.,(1989) who observed that feeding 15-25% full fat safflower seed to broiler depressed both body weight and feed intake and Rodriquez et al., (1998)who reported not significant differences in weight gain ,feed intake and utilization among chicken receiving control diet and those fed diets with increasing level of full fat safflower (from 5-25% of diet).Results were also in contrast to Aria *et al*. (1998), and Mohan et al., (1984) who reported that average body weight gain was significantly reduced in chicken fed diets contained different levels of safflower meal.

The significant improvement of broiler chicks fed on experimental diets supplemented with xylanase enzyme might be to the fact that the exogenous enzyme improved dietary nutrient utilization and digestibility of energy, fat and protein. The result was in agreement with Park (1997), Delcony *et al.* (1999). Gnazi *et al* (2003), Adeola and Bedford (2004), and Munassr (2011).

Result was also in contrast to Makkawi (2009) who found no effect on broiler chick's performance fed diet based on sorghum supplemented with xylanase enzyme and Bin baraik (2010) fed diet containing wheat bran supplemented with xylanase enzyme.

Results obtained showed that relative weights of breast yield, thigh, drumstick, subjective meat attributes, leg. Lung, neck, liver, heart and gizzard were not affected significantly (P>0.05) by dietary full fat safflower seed inclusion levels. These results were in agreement with con the findings of Malakine (2010), Malakian and Hassan (2011). In contrary Chevalsarkul and Tong Taweeipat (1991) reported decreased in liver percentage by addition of full fat safflower seed in broiler diet. However the supplementation of experimental diets with commercial xylem 500 enzyme improved yield of drumstick, relative weights of heart, gizzard. Results were in agreement with findings of Munassr (2011). Also Makkawi (2009) reported no significant affect due to enzyme supplementation. This result agree with Mariam 2013

Several studies reported that feeding poly unsaturated fatty acids to broiler chickens resulted in reduced abdominal and total carcass fat as compared to that in broiler fed saturated fatty acid sources (Sanz *et al*., 2000). Full fat safflower is rich in linoleic acid (75-78%) which plays an important role in reducing fat accumulation and promoting muscle growth. This effect is in accordance with the results obtained by Park *et al.* (1997), Delcony *et al*. (1999) and Halmiski *et* *al.,* (1991). Also the reduction of fat pad in chicks fed diets containing full fat safflower seed was associated with an increasing full fat safflower seed which was associated with an increase in lipid oxidation (Sanz *et al*. 2000).

In the second experiment, the nutritive value of safflower seed cake is depending on the method of oil extraction. The quality of safflower cake is variable and depends on the amount of hull and the extent of the oil extraction. This meal was found deficient in lysine and methionine but rich in arginine and its apparent and true ME corrected to zero nitrogen balance on dry matter basis was 2565 and 30% Kcal respectively Farran *et al*, (2006), but it is an excellent source of phosphorus and good source of zinc and iron Gowda *et al* (2004) in general the vitamins content of safflower meal is low and it contained phenolic glacoside which are reported to be associated with bitterness and cathartic activity also the high level of fiber contributes to a reduction in the energy digestibility of diets . However, limited research is available regarding the effects of dietary safflower cake on broiler chick's performance.

Body weight gain of chicks fed on graded levels of safflower cake improved with increase of safflower seed cake in diets supplemented with enzyme, however group fed on 15 % and 20 % safflower cake with and without enzyme recorded significant improvement in body weight gain compared to other tested groups .Chicks fed on 10 % safflower seed cake without enzyme recorded significantly the lowest body weight gain.

Feed consumptions for Chicks fed on diet containing 5 % and 10 % safflower seed cake with and without enzyme consumed significantly low compared to other groups .However, enzyme supplementation increased the feed intake.

Feed conversion ratio (FCR) for Chicks fed on diets containing safflower cake (SFC) with or without enzyme significantly improved compared to both control groups. Chicks fed on diets containing 20 % safflower cake with or without enzyme showed significantly the best values. Feed to gain ratio was significantly improved in chicks in safflower seed cake groups .These results are in line with other studies reporting that FCR is associated with higher weight gain .

These negligible results might be due to high fiber content and deficient in essential amino acids and low content of vitamins in SFC. These results were in line with finding of Quguz and Oguz (2007). Results obtained for dressing percentages, Legs. Lung, neck, non carcass components (liver, heart, gizzard) abdominal fat and commercial cuts and their meat/bone ratio were not affected significantly neither by the level of SFC nor by enzyme supplementation. The result was in line with the finding of Sarica et al (2005)and Arabi (2006) who reported that these parameters did not affected by enzyme supplementation .

The results of the study showed that meat yield and the average of subjective meat quality scores (color, flavor, juiciness and tenderness) were not affected by dietary treatment at different levels, all being at moderate values. These results were in line with the findings of Mukhtar *et al.,* (2013a).

The apparent health of the experimental chicks was good throughout the experimental period and in all treatments. Environmental temperature during the experimental period fell within thermo neutral zone, no mortality was recorded. This might be due to good sanitation or that supplementation of safflower seed and cake did not affect on mortality rate. The result was in a agreement with findings of (Oguz and Oguz, 2007), who reported that the pharmacological properties of safflower seed have been explored to identify a role in cardiovascular health. Also in line with the finding of Makkawi (2009),Bin Baraik (2010) and Mariam (2013) who reported lower mortality with the diets supplemented with enzyme compared to diets un supplemented .

The results of economical evaluations of the experimental diets showed that the supplementation of SFS and SFC to broiler diets improved the performance of chicks and resulted economical benefits. Profitability ratio (1.409) for 10% SFS supplemented with enzyme was the highest although all chicks fed on different levels recorded high ratio of profits compared to control group these results were in agreement with findings of Mukhtar *et al.,* (2013b).For SFC group fed on diet containing 20% SFC with enzyme recorded the highest value for the tested groups (1.267), also result indicate that the profitability ratio increased with the enzyme supplementation compared to non enzyme. The result was in line with the findings of Mukhtar, and Abdal-Rahim (2012), who reported that enzyme supplementation to diets containing Roselle seeds, and Idris (1984) who reported economic value of the inclusion of Roselle seeds cake in broiler ration.

5.2 Conclusion and Recommendations :

5: 2 : 1 Conclusion:-

1 - Inclusion of full fat safflower seed in broiler diets at different levels (0 , 5 , 10 , 15 , and 20%) had no negative effect on broiler performance (body weight , feed intake , feed conversation ratio and mortality rate .).

2- The performance was increased in descending order as the level of safflower cake increased in broiler diets .

3 – Addition of commercial enzyme (xylem 500) to diets containing different levels of safflower seeds or un decorticated safflower seed cake (0 , 5 10 , 15 and 20 %) improved the performance of broiler .

4 – Using either full safflower seed or cake with or without enzyme in the diets made no changes in carcass yield and meat quality.

5 – The result of economical evaluations of experimental diets showed the full safflower seeds or safflower seed cake to broiler result in economical benefits value.

5 : 2 : 2 RECOMMENDATION : -

5.2.2 .1 Practical Implication: -

1 - Full fat safflower seed or un decorticated safflower cake is recommended to replace the sorgum grains or ground nut cake in broiler diets up to 20 % without any adverse effects.

2 – Commercial enzyme (xylem 500) is recommended in the diets containing different levels (0, 5, 10, 15 and 20 %) of full safflower seeds or un decorticated safflower seed cake to improve the performance of broilers.

3 - Increasing the cultivation area of safflower crop to be available for poultry feeding.

5.2.2 .2 Suggestion for future research: -

1 – Based on the finding of present study, it may be worthwhile to investigate further; whether or not higher levels of full safflower seeds or un decorticated safflower cake above level 20 % in broiler diets could give beneficial effect.

2 – Further experiment are needed to test the synergistic effect of different exogenous enzyme on anti – nutritional agent in either safflower seeds or its cake.

3 – Further, safflower seeds or its cakes with or without enzyme supplementation can be evaluated as well in lying hen diets testing its effect on egg yield and quality.

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Appendixes

Safflower flower used for dye

Safflower Seeds

Safflower Plant

Safflower flower used for Medicine

Safflower Oil

Tablets used from safflower flower

Safflower plant growing in department of Agronomy, College of Agricultural Studies

Tea made Safflower leaves

Resaved the day old chicks

Semi closed house used in experiment

Cooling bad

Exhaust Fan

Cooling system

Tank used for storing water for cooling system

Replicates used in experiment

Brooding Experiment Chicks

Wood shaving used in Brooding

مع تحياتي ابنتك المفضله

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