An−Najah National University
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Utilization of Fleabane (*Conyza bonariensis*) in Fattening Rations of Awassi Lambs

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Dedication

To who taught me the first words to my mum

For who made me to taste the sweetness of the life and live to my dad

To my brothers and sisters , To my wife

To my sons(Ameer , Tala , Kareem ,and tamar)

To my teachers and friends who occupied my memory

Best wishs to all of them

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إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Utilization of Fleabane (*Conyza bonariensis*) in Fattening Rations of Awassi Lambs

استخدام نبات الرباط *(conyza bonariensis)* في عليقة تسمين خراف العواسي

أقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص ، بإستثناء ما تمت الاشارة إليه حيثما ورد، وأن هذه الرسالة ككل أو أي جزء منها لم يقدم من قبل لنيل أية درجة أو لقب علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى .

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's name:	**اسم الطالب:**
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List of Abbreviations

ADF	Acid Detergent Fiber
ADG	Average Dailey Gain
BWG	Body Weight Gain
AOAC	Association of Official Analytical Chemists
Ca	Calcium
CF	Crude Fiber
CP	Crude Protein
DE	Digestible Energy
DMI	Dry Matter Intake
DMA	Dry Matter Analysis
EBW	Empty Body Weight
FB	Fleabane
FCE	Acid Detergent Fiber
FCR	Average Dailey Gain
FBW	Body Weight Gain
GE	Association of Official Analytical Chemists
GIT	Calcium
GLM	Crude Fiber
IBW	Crude Protein
ME	Digestible Energy
MoA	Dry Matter Intake
NDF	Dry Matter Analysis
NFE	Nitrogen Free Extract
NIS	New Israel Shekel
P	Phosphorus
SBM	Soybean Meal
TDN	Total Digestible Nutrients
TMR	Total Mixed Ration

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Utilization of Fleabane(*Conyza bonariensis*) in Fattening Rations of Awassi Lambs

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Abstract

This experiment was conducted to investigate the effects of feeding fleabane on general performance, carcass cuts and visceral organs of Awassi lambs. Sixteen male lambs were used in the experiment and were divided into 4 groups with four lambs in each in a completely randomized design. Each lamb was considered as a replicate. Animals in group 1 were fed with a commercial fattening ration. Lambs in the other three treatments were fed with fleabane at rates of 5, 10 and 15%, respectively. Fleabane was incorporated to replace similar percentages of barley. Results of the experiment showed that fleabane has significant effect on weight gain of lambs. Starting from week 2, fleabane at all levels increased ($P<0.05$) lambs weight. From week 4 and after lambs fed with 10 and 15% fleabane had the highest ($P<0.05$) gain compared to the gain observed in lambs of the other two experimental groups. Similarly, the average daily gain observed in lambs fed with 10 and 15% fleabane was higher ($P<0.05$) than daily gains of lambs in other treatments. Lambs in all experimental groups had similar feed consumption. Incorporation of fleabane had no negative effects on feed intake even at high levels. Feed conversion ratios were relatively lower to what was expected of such used rations. Feeding fleabane had variable effects on the different carcass cuts. Fleabane at

levels of 10 and 15% caused an increase ($P<0.05$) in leg, rib, shoulder and loin. However, fleabane had no effects on weights of shank, neck and breast. On the other hand, fleabane at the 10%and15% levels increased weights ($P<0.05$) of abdominal fat and the thickness of subcutaneous fat. Fleabane had no effects on the rib eye muscle area and depth. Feeding fleabane especially at the highest two levels caused an increase ($P<0.05$) in the average weights of these organs. Fleabane increased ($P<0.05$) the average weights of forestomach, rumen wet and dry weights, reticulum wet and dry weights, abomasum wet and dry weights, small intestine, large intestine and cecum. However, it has no significant effects on omasum wet and dry tissue weights, esophagus, trachea, total tract, gall bladder, spleen, kidney fat, feet, head and hide average weights.

It is recommended that fleabane can be used in fattening lambs' rations at rates of 10 and 15%, however, more research is needed in this area.

Chapter One

Introduction

Introduction:

The fattening process is very important in local animal production sector. The income from fattening projects operation was estimated to be more than 50% of total income resulted from animal sector (MoA, 2000; Naser, 2009). However, the cost of feed for this process is estimated to be as much as 80% (Abo Omar, 2002). Therefore, any attempts to reduce the high input cost will be of essential importance.

The livestock sector is an important branch of the Palestinian national economy. This sector contributes up to 40% of total Palestinian agricultural income (MoA, 2008). In the West Bank and Gaza Strip, there are two main breeds of sheep: Awassi and Assaf.

In the Mediterranean area, the protein and energy requirements of fast- growing, intensively fattened lambs are usually satisfied by soybean and maize. Both are the major ingredients in the manufactured concentrates which is mainly imported at high costs.

The main problem facing the sector of animal production in the Palestinian National Authority is the limited feed resources (Abo Omar, 1998). Profitability of lamb's production is dependent on reducing input costs and/or increasing production output. Any reduction in feed intake or increase in feed efficiency without compromising growth rate or carcass quality can have a significant positive economic impact on lamb production (Snowder and Van Vleck, 2003). Increasing energy density in diets for lambs and kids showed improvement in feed efficiency and carcass characteristics (Haddad and Husein, 2004; Haddad, 2005).

However, feeding very high grain diets to ruminants could induce acidosis (Owens *et al.*, 1998).

The importance of roughage as a feed resource is decreasing at the expense of cereals and agro-industrial by-products (Abo Omar, 2001; Abo Omar, 2002). Food crops leave a variety of residues (straws) that are utilized for animal feeding. Poor quality roughage comprises the only part of the diet for ruminant animals in most Middle East countries, for a considerable part of the year.

Some Mediterranean Countries are characterized by harsh climate conditions. In these regions, pasture is available only for short periods or is not available at all. Moreover, the use of cereals in animal diets creates a competitive conflict with human nutrition, and the use of soybean is expensive.

Fleabane (*Conyza bonariensis*) is a native summer weed to local rangelands and had been grazed by ruminants since ages. The targeted weed is widely available in local rangelands from northern to southern areas of Palestine. It is characterized by its adaptation to arid conditions and low precipitation. This weed is prevailing in cultivated lands and become as weeds that increase the cost of cultivation for most of farmers. If these weeds are utilized in ruminant diets the problem of being weeds is solved beside the potential savings in feeding costs.

However, no information available about nutritive value and potential use in livestock rations and fattening rations in particular. Utilizing such weeds in ruminant rations may decrease cost of feeding.

The objectives of this study are to investigate the effect of feeding different levels of the *Conyza bonariensis* on performance of Awassi lambs and its effect on visceral organs and carcass cuts.

Chapter Two

Literature Review

2.1 Introduction:

The roughage under focus is fleabane. Its common names are fleabane, hairy horseweed, flax-leaf fleabane, wavy leaf fleabane, rough conyza and belongs to the family Asteraceae (Hanks and Rose, 2001). It is an erect annual; stem rough branching extensively at the base of the plant with tapered leaves cosvered in stiff hairs, 20-75 centimeters in height (Hanks and Rose 2001). It is a widespread weed of cultivated land, garden areas, wasteland and roadsides. It grows from spring to autumn,and most prevalent in summer months. Narrow lanceolate leaves are grey to green in color, measuring 2-6cm in length, coarsely toothed and covered in fine hairs. Upper leaves are smaller and linear (Caroline and Tindale, 1993).

Flowers are numerous on poorly arranged pyramidal panicles (much branched inflorescence). The capitulum (flower head) is greater than 2mm in diameter and looks in fact like a flower bud. Flowers occur at the ends of the branches. Surrounding each flower are involucres (bell-shaped leaf-like) bracts 3-5mm in length, the inside of each bract is white sometimes tinged purple or red. The cypsela (fruit) is a linear shaped seed approximately 1.5mm long, straw colored, covered in hairs with 16-20 noticeably longer at the top that are white or pink. Flowering is in spring-autumn (Kleinschmidt and Johnson 1987). It was reported by Nasir and Ali (1981) that this weed has the ability to act as a natural antioxidant (Hanks and Rose, 2001), which make this herb of certain advantages to animal consuming this weed.

Fleabane is consumed by grazing animals which indicates its palatability by these animals. There is no available information about the usage of fleabane as feed ingredient. However, various nonconventional feeds were used in livestock diets.

Several waste materials and agro-industrial by products were tested locally where research proves its importance as feed ingredients. The following is a brief review of some of the research on these wastes as livestock feeds.

2.2 Utilization of some wastes and agro-industrial by-products in livestock rations

The effects of feeding treated straw, olive cake and tomato pomace with *Pleroutus ostreatus* on the performance of Awassi lambs was inverstigated by Al-Barakeh (2007). Thirty percent of olive cake mixed with 60% cereals straw and 30% tomato pomace mixed with 60% cereals straw inoculated with *pleroutus ostreatus* fungi. The results showed that crude protein and ash contents were increased in the spent substrate, while the organic matter and crude fiber contents were high in untreated straw.

It is indicated that lambs' weaning weight and their daily gain were lower for spent cereals straw and spent cereals straw with olive cake. Total ewes' milk yield was significantly higher for untreated cereal straw and spent cereals straw with tomato pomace than cereal straw and spent cereal straw with olive cake. Also, carcass characteristics were not affected by using spent straw in lambs' diets.

In conclusion, *pleroutus ostreatus* fungi improve nutritive value for harvested spent by-products which can be used for growing mushroom and in sheep feeding as roughages (Al-Barakeh, 2007). However, the production of oyster mushroom on different agricultural wastes.

In this study five agro wastes were used: olive cake, tomato tuff, banana leaves, pine needle and saw dust, in addition to control treatment (wheat straw).

The results showed that in all agro wastes studied; adding 30% of it (replacing wheat straw) gave the best result. Carbohydrates and protein gained the highest percentage in their content and then came the fiber. Protein and minerals' (Na, P and K) content increased as the rate of agro wastes added to the substrate (straw) increased (up to 30%).

The study revealed that mushroom cultivation is an effective method for conversion of agro wastes, at the proper level, into value product high in protein content (Ananbeh, 2003).

In order to investigate the effects of chopped straw with alfalfa hay on Awassi lambs and goats kids, three experiments were conducted to study the effect of replacement alfalfa hay by barley straw in total mixed rations (TMR) for fattening Awassi lambs and Shami kids. Animals allocated randomly to four isocaloric and isonitrogenous total mixed ration treatments which were containing different level of alfalfa hay and barley straw.

Results in the first experiment with lambs showed that the voluntary feed intake and average daily weight were not different at partial replacement of alfalfa hay while it reduced when hay was completely replaced by barley straw. Cold dressing % and rib eye area were not different among different treatments with either partial or complete substitution with straw.

Dry matter and organic matter digestibilities of the total mixed rations used in the four treatments were reduced at total replacement by straw but higher at partial replacement.

The study indicated that barley straw can successfully replace alfalfa hay partially or totally without any adverse effect on intake or gain of fattened lambs and goats or their carcass characteristics (Darswish, 2006).

The effects of feeding sesame hulls on growth performance and nutrient digestibility of black baladi kids was investigated by Gharaybeh (2005).

Black Baladi Kids were used to evaluate the effect of replacing barely and soybean meal with sesame hulls (SH) at 0, 10, and 20 % of the diet on growth performance, digestibility, and carcass characteristics. Kids fed 10% SH registered higher intakes of dry matter (DM), organic matter (OM), and crude protein (CP) compared to control fed kids and tended to be greater than in kids fed SH20 diet. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) intake was the highest for kids fed the SH10 diet when compared to control fed kids and SH20 group. Ether extract (EE) intake was greater in kids fed the SH10 and the SH20 diets when compared to control fed kids. Digestibility of DM, OM, CP, NDF, and ADF were similar among all treatment diets. However, sesame hulls inclusion showed greater EE digestibility. Final body weight, total gain, average daily gain (ADG), and feed conversion ratio were comparable among all dietary groups. Cost of gain was lower in kids fed the SH20 than in kids fed the Cont diet while the SH10 group was intermediate. Dressing percentage, hot and cold carcass weight, non-carcass components, carcass cut weights, and meat quality parameters were not influenced by SH. Total fat percentage in leg was greater in control fed group than in the SH10 group. Results of this study demonstrated the possibility of including sesame hulls up to 10% in finishing diets by Black Baladi kids.

In another study (Al-Kalabani and Harb, 1996) the voluntary feed intake and digestibility coefficient for pregnant and lactating ewes fed different levels of tomato pomace in the ration was investigated. Four experiments were conducted to evaluate tomato pomace (TP) as an agricultural by-product in the feeding of Awassi sheep. The first was carried out to find the digestibility of five rations containing 0,25,50,75 and 100% of TP with alfalfa hay. The results showed that as the level of TP increased in the ration, the digestibility coefficients of organic matter, crude protein, crude fiber and nitrogen free extract decreased significantly (P<0.05) while that of the ether extract increased significantly (P<0.01). The total digestible nutrients (TDN) was not affected among the five rations.

The second experiment aimed at finding the voluntary feed intake of the five rations named above. Results showed that the average voluntary dry matter intake (VDMI) decreased as the TP percent increased in the ration, but the differences were not significant except for the last ration (75%).

In the third experiment, we looked forward to finding the effect of incorporating differences levels of TP in complete rations on the VDMI of the ewes. TP was incorporated at a level of 0, 15 and 30% replacing wheat bran. Differences in voluntary dry matter intake were not significant.

In the fourth experiment, Adult pregnant Awassi ewes were assigned to the same three rations mentioned in experiment three. Concentrate diets were given *ad libitum.* During the last 9 weeks of pregnancy the results showed that the average VDMI was decreased as TP increased in the ration. However, no differences were observed among the three groups in the average live weight gain. During the weaning stage, results showed no differences among the three treatments in their reproductive traits. Likewise, differences in lamb birth weight, weaning weight, and lambs growth rate among the three treatment groups were not significant.

During the last interval (3 months post weaning) the results showed that differences in milk production and content (fat and protein %) among the three treatment groups were not significant.

Results obtained herein suggest that tomato pomace can be used up to 30% of the concentrated diet during pregnancy and lactation of Awassi ewes.

The utilization of dried banana leaves as a roughage source in feeding Awassi sheep was proved to be practical (Darwish and Harb, 1996).

A set of three experiments were conducted to study the nutritive value of dried banana leaves (DBL) as a roughage source for feeding Awassi sheep. The potential amounts of banana residues which can be utilized in Jordan is around 8000 tons dry matter (5700 kg/ha). This material is available in Jordan Valley between March till November. Voluntary feed intake feed intake (VFI) was measured in experiment 1. Awassi lambs were fed the following rations: R1 (Chopped wheat straw and 250 gm of concentrate ration), R2 (dried and chopped dried banana leaves (DBL) and 250 gm concentrate ration), R3 (DBL treated with sodium hydroxide and 250 gm concentrate ration), R4 (DBL treated with urea and 250 gm concentrate ration) and R5 (DBL treated with both NaOH plus urea and 250 gm concentrate ration). No significant differences in the voluntary feed intake (VFI) were found among the five treatments (rations).

The analysis of banana leaves on DM basis was: 6.5, 27.4, 2.17, 51 and 12.9% for crude protein, crude fiber, ether extract, nitrogen free extract and ash, respectively. Van Soest analysis showed that dried banana leaves contained: 66, 46.1, and 11.3% neutral detergent fiber, acid detergent fiber and lignin, respectively. Gross energy and metabolizable energy were 16.4 and 7.4 MJ/kg DM, respectively.

The same animals of experiment 1 and the same rations without the concentrate portion (250 gm concentrate ration) were used in experiment 2 to measure the digestibility and nitrogen balance. No significant differences in digestibility of dry matter and organic matter existed among the five rations. Crude fiber (CF) digestibility of DBL treated with both urea plus NaOH was significantly different from untreated DBL while the nitrogen balance was negative for all treatments with no differences among groups.

In experiment 3, Lactating Awassi ewes were fed a complete ration containing either 20% wheat straw or 20% dried banana leaves to measure milk yield and composition and to determine the effects of this nutrition on the performance of lambs. Average milk yield (during 10 weeks after weaning the lambs) was not different between both groups. Milk composition showed no significant differences between the two groups of ewes. The average growth rate of lambs was also not different between both groups.

The results of this study revealed that the dried banana leaves can substitute wheat straw especially during drought and feed shortage periods and can be used up to 20% in the complete ration for lactating ewes without any negative effects on milk yield, composition, or on the performance of lambs (Darwish and Harb, 1996).

Bread by-product (BBP) has similar composition to barley grain and is much cheaper. Therefore, substituting BBP for barley grain in fattening diets would be of economical importance. Therefore, the objectives of this study were to determine the effect of substituting BBP for barley grain in high concentrate fattening diets for lambs on nutrient intake, and growth performance. Weaned Awassi lambs (21.75 ± 1 kg) were fed fattening diets differing in bread by-product ratio. Bread by-product substitute barley grain by 10, 20, 30 % of the diet DM (LBBP, MBBP and HBBP diets, respectively). At the end of the experiment, 6 lambs from each treatment were slaughtered to have carcass measurements.

Dry matter intake (DMI) in the CON diet decreased by the 10% (LBBP diet). No further reduction in DMI was observed with the higher substitution levels (MBBP and HBBP diets). This reduction in DMI between the CON diet and the LBBP, MBBP and HPPB diets was reflected on organic matter (OM), Crude protein (CP) and neutral detergent fiber (NDF) intakes. Metabolizable energy intake for the CON diet was also reduced. Feeding LBBP, MBBP and HBBP diets reduced daily gain compared to non fed lambs regardless of the BBP level. Therefore, they gained less weight by the end of the experimental period. Feed to gain ratio increased for lambs consuming different levels of BBP compared to lambs consumed no BBP in their diet.

Slaughtering characteristics were not affected by the addition of BBP to the diets. Dressing percentage, full gut weight, empty gut weight and liver weights were all also unaffected by the BBP addition to the diets. However, fat tail weight was increased with the higher levels of the BBP inclusion. The lowest inclusion levels (10% of the diet DM) reduced performance by approximately 24%. Therefore, further research is needed to study the inclusion of lower levels of BBP (Haddad, 2009). Obeidat et al. (2009) investigated the effects of feeding sesame meal on growth performance, nutrient digestibility, and carcass characteristics of Awassi lambs. Agro-industrial by-products, such as sesame meal (SM), can have a major influence on reducing the production cost. Sesame meal is a by-product of the sesame seed industry for oil extraction. In Jordan, a total of 3250 tons of sesame hulls and sesame meal are produced annually Nutrient intake, diet digestibility, N balance, carcass characteristics, and meat quality were evaluated in Awassi lambs fed different levels of sesame meal (SM); 8 and 16% SM. Intakes of dry matter (DM), organic matter (OM), and crude protein (CP) were highest for lambs fed the SM8. Whereas, intake of ether extracts (EE) was greater for SM16 while intake of the metabolizable energy (ME) was greater for SM8. Final weight and average daily gain (ADG) were greater for SM8. All groups had similar feed conversion ratio; nevertheless production cost was lower for lambs fed the SM compared to non fed ones.

Digestibility of DM, OM, CP, and EE and N retention were similar among all treatment diets. Fasting live weight was greater for lambs fed SM8 diet while, the dressing percentage was greater for lambs fed no SM diet. Loin weight was greater in lambs fed SM8 diet and lambs receiving the SM diets had greater total percentage. No differences were observed in carcass and longissimus muscle linear dimensions, fat measurements, and meat quality characteristics among the treatment diets.

It is concluded that sesame meal could replace 8% of soybean meal in the diet without any detrimental effect on lamb growth and meat quality, thus reduces feeding cost.

Sesame hulls were fed to broilers (Farrani *et al*., 2000). Sesame hull (SH), a by-product of sesame cream manufacturing, is rich in methionine, cystine, and calcium and is a moderate source of protein. Sesame meal (SM), as a protein source, has been used to varying degrees in chick, duckling, and broiler and laying hen diets.

Three studies were conducted to determine the effect of dietary levels of SH on the performance of broilers and layers. In Studies 1 and 2, as dietary SH level increased up to 12%, the weight gain (WG) and feed conversion (FC) of 2-wk old broilers were negatively affected to become significant at 12% level only. In Study 3, the 28% SH reduced both body weight (BW) and egg production (EP) and significantly increased the FC.

Feed intake (FI), egg weight (EW), and Haugh unit score (HU) were not affected by SH levels. Yolk color (YC) and shell thickness (ST) were significantly reduced by the 28% SH diet. The results of these studies indicate that SH, as such, is not recommended in broiler starter diets beyond a level of 8%, but may be used up to 14% in layer diets without apparent ill effects. The effects of feeding different levels of sesame oil cake on performance and digestibility of Awassi lambs was investigated (Abo Omar, 2002). This experiment investigated the effect of feeding different levels of sesame oil cake on the intake and digestibility of DM, CP, crude fiber, and crude fat in Awassi fattening lambs. Sesame oil cake was incorporated into lambs' rations at levels of 10 and 20% to replace similar percentages of barley and soybean. The results showed that the high level of sesame oil cake inclusion decreased DM and protein intake, however, it increased crude fiber, and crude fat intake.

Addition of 20% sesame oil cake also increased the digestibility of CP and crude fiber. Sesame oil cake resulted in more daily gain and better feed conversion efficiency compared to control. The results indicated that addition of sesame oil cake to Awassi lambs' rations had some economical advantages in digestibility and performance compared to traditional fattening rations. The higher cost of gain was in lambs fed the commercial fattening feed. Sesame oil cake reduced cost of gain. This was because of the low costs of rations incorporated with sesame oil cake.

To investigate the effect of feeding sesame oil cake on performance, milk and cheese quality of anglo-nubian goats an experiment was conducted (Hjazi and Abo Omar, 2009). Sixteen lactating (20 days-in-milk) Anglo- Nubian goats were used in the experiment that lasted for 60 days. Goats were divided into 4 dietary treatment groups of 4 goats in each and the goats were distributed between the groups in a way they represent age and lactation stage. Goats were housed in pens of suitable size and were managed as any other commercial goat flock. The animals had free access to water. Straw was fed at rate of 1% of live body weight. Four types of dietary treatment were prepared using SOC. The first diet was the control and the other three diets contained: 5, 10, and 15% SOC, respectively. Animals fed twice daily and were milked during the feeding time. Milk yield (MY) was recorded daily and samples were taken for chemical analysis. Cheese was made on a monthly basis and samples were taken for sensory evaluation for flavor and texture.

Incorporation of SOC in goats' diets at levels of 10 and 15% caused an increase ($P<0.05$) in MY compared to control and 5% SOC. Feeding SOC at all levels tested had a positive effect ($P<0.05$) on goats milk fat (MF). However, the highest MF percentage was detected in milk of goats fed with 15% SOC. Sesame Oil Cake had variable effects on milk protein (MP) where the highest MP content was from milk of goats fed with 5%

cake. Both total solids (TS) and solids non fat (SNF) were increased ($P<0.05$) due to feeding different levels of SOC compared to control. Similar trends were observed on cheese composition in regard to fat content where feeding SOC at different levels increased significantly ($P<0.05$) cheese fat content compared to control. Other cheese components such as protein and ash were not affected by SOC feeding. Sensory results showed that flavor of cheese from goats consuming 10 and 15% SOC ($P<0.05$) was better than cheese from the other groups. However, an opposite trend was observed regarding cheese texture. The cheese from goats fed the control diet had ($P<0.05$) a better texture. The results of this study indicate that SOC can be used in goats' diets during lactation season. Similarly using SOC in goats' diets proved to be economically feasible.

In order to find new sources of energy instead of conventional sources as barley grains, yellow grease was used as an energy source in nursing Awassi ewes and their suckling lambs diets (Awawdeh *et al*., 2009). Yellow grease as an alternative energy source for nursing Awassi ewes and their suckling lambs. Awassi ewes nursing single lambs were utilized to study yellow grease by partially replacing barley as an alternative energy source. Ewes with their lambs were individually housed in shaded pens and fed one of three dietary: no added fat (control), 32 g/kg added fat as yellow grease (restaurant fat; YG), or as soybean oil (SO) by partially replacing barley in the control diet. All diets were formulated to be isonitrogenous, isocaloric, and to meet all nutrient requirements for nursing ewes. For ewes, dry matter intake, milk yield, BW change, milk composition, and milk composition yields were all not affected by dietary treatments. Average daily gain (ADG) of lambs was also not affected (by dietary treatments.

However, the cost of feeding 10 ewes for 55 days was US $612, 544, and 601 for the control, YG, and SO group, respectively. Additionally, the cost of producing 1 kg of milk was US $1.84, 1.37, and 1.52 for the control, YG, and SO group, respectively. Under conditions similar to this study, it is economically feasible to partially (206 g/kg) replace barley with YG without adversely affecting the performance of nursing Awassi ewes or their suckling lambs.

In order to improve the nutritional value of some forages, it was treated with some enzymes. The effects of enzymatic treatment were investigated on Awassi lambs (Titi, 2004a).The enzyme was derived from *Trichoderma spp* and has a cellulase/hemicellulase activity. For the digestibility part, Awassi lambs were placed into individual metabolic crates to measure total tract digestibility (4 groups) and fed a total mixed ration of either alfalfa hay or wheat straw as a forage source. Each forage type was fed to two groups and one group of each was supplemented with the fibrolytic enzyme. In the second part; growth performance, sixty Awassi lambs were randomly divided into 4 groups fed the same rations above for a period of 75 days. Results showed that type of forage fed did not affect response to cellulase treatment, but it increased dry matter organic matter, crude fiber, crude protein and neutral detergent fiber digestibility. Average daily gain and body weight of Awassi lambs was improved following enzymatic treatment in both forages compared to controls. At the same time, enzyme supplement resulted in improved feed conversion ratio of fattened Awassi with no effect on feed intake. The level of improvement due to enzyme addition was higher in lambs fed alfalfa hay more than those fed wheat straw. Present findings indicated that fibrolytic enzymes could enhance growth of fattened lambs fed rations of either alfalfa hay or wheat straw and improve their conversion ratios mainly through improving digestibility. Also it indicated that a forage material like wheat straw can be nutritionally improved if supplemented with a fibrolytic enzyme source. The effects of enzymatic treatment on carcass cuts of Awassi lambs was also investigated (Titi, 2004b). Lambs were fattened on a total mixed ration with either alfalfa hay or wheat straw as a forage source in the ration. Each forage ration was either supplemented or not with a commercial fibrolytic enzyme. The enzyme was derived from *Trichoderma spp* with a cellulase/hemicellulase activity and was added to the micro content part of the ration fed in a dry powder form. Following a 75 days fattening, 3 lambs of each group were randomly picked and slaughtered. Live body weight, hot and chilled carcass weights and dressing percentages were recorded and analyzed for any differences. Data for feed and total costs, gross and total income, and the ratio of net income to total cost were processed as parameters of financial analysis.

Enzyme treatment had no effect on carcass weights and dressing percentages of lambs fed both forages. Carcass length, back fat thickness and rib eye area were also not different between treated and untreated groups. However, while total costs were not affected by cellulase treatment, feed costs, gross income, net income and income over cost ratio were better for enzyme fed lambs in both forages. Such results indicated that fibrolytic enzymes had no effect on dressing percentages or carcass characteristics of fattened Awassi lambs but can improve income due to increase gain and reduce feed costs as a result of improved digestibility of the forage source incorporated in the finishing diets.

A series of research was conducted to investigate the effects of feeding olive by-products on productivity and performance of livestock. A feeding trial was conducted for fattening Awassi male lambs using olive pulp (OP) to study the nutritional effect of this by-product and to search for low cost rations. Male lambs were fed five dietary treatments containing varying amounts of OP incorporated instead of barley at a level of 10%, 20%, 30% and 40%, respectively.

Average daily gain was significant only for the second and fifth. This means that adding olive pulp at 10% level improved; whereas, at 40% deteriorated the average daily gain of lambs. Average feed conversion rate was not different among treatments and the feed cost per kg gain was 494, 393, 450, 474 and 549 fils for each of the five treatments respectively. This experiment shows that, under the current feed prices in Jordan, replacing up to 10% of barley with olive pulp proves to be beneficial and economically feasible. Such a treatment improves live weight and feed conversion rates in lambs and reduces feed cost per kg gain. On the other hand, going up to 40% olive pulp in rations for lambs proves to be detrimental in terms of live weight gain, feed conversion, and feed cost (Harb, 1986).

Another experiment was conducted for fattening Awassi lambs using agricultural by-products, to search for low cost rations, and to study the effects of feeding these by-products with or without NaOH treatment. Awassi male lambs were fed five different rations. The first ration included 20% tibin. Tibin was replaced by dry olive pulp in the second ration, and by NaOH (5%) treated olive pulp in the third, fourth and fifth rations. Differences in averages of daily gain for lambs among the first, second, and third groups were not significant. Meanwhile, the fourth and the fifth groups were significantly different from the first three groups. Averages for feed conversion ration were not different with feed cost value was: 437, 335, 419, 384, and 464 fils/kg gain for the first through the fifth groups, respectively.

Results of this experiment show that replacing tibin with dry olive pulp at a ratio of 20% of the ration for fattening Awassi lambs, significantly decreased the feed cost without decreasing the rate of daily gain of lambs. Using dry poultry litter as 20% of the ration to replace part of barley and soybean meal, caused a significant decrease in both feed cost and rate of daily gain. Results also show that treating olive pulp and poultry litter with NaOH (5%) did not improve the nutritive value of these feeds, but increased the feed cost for fattening lambs on these by-products (Harb *et al.*, 1986).An investigation(Abo Omar,2005) was conducted to study the effects of olive pulp on the carcass composition, gastrointestinal tract, and visceral organ mass of broiler chicks. A total of 250 one-day-old chicks were used in this research and were divided into five experimental groups with five replicates in each. Olive pulp was incorporated in four of the experimental groups at rates of 25, 50, 75 and 100 g/kg in both starter and finisher feeds to replace similar amounts of maize. Diets were fed for 35 days. At the end of the experiment, four birds of each group were slaughtered in similar routine followed in regular slaughterhouses. Regression analysis (linear and quadratic) showed that level of olive pulp had no significant effects on visceral organ mass, gastrointestinal tract weight, carcass cuts, carcass composition, and dressing percent. However, chicks consuming 100 g olive pulp/kg had heaviest ($P<0.05$) average live weights. Olive cake feeding effects on layers performance and eggs quality was also investigated (Abo Omar, 2003). Two hundred and forty white Hy-Line layers at sixty two weeks of age were used in the experiment (four treatments, sixty birds in each) that lasted for eight weeks to evaluate olive cake (OC) as a source of nutrients. Yellow corn of the diet was partially replaced by olive cake at levels of 0, 6.5,9.75 or 13% . The results obtained could be summarized as follows: There was a significant ($P<0.05$) decrease in final body weight when olive take was fed at level of 13%. Egg production, egg weight, feed consumption and feed conversion were significantly (P<0.05) decrease when olive cake was used at level of 13%. Olive cake had no significant effect on egg quality measurements. It seems that replacing of olive cake up to 9.75% olive cake in layers diets had the highest relative economic efficiency. Levels of cholesterol decreased significantly (P<0.05) in blood plasma of layers consumed diets including 6.5, 9.75 or 13% olive cake. However, the levels of plasma total protein, albumin, globulin, creatinine, GOT and GPT were insignificantly affected with olive cake inclusion. Therefore, it could be concluded that olive cake can be used in layer diets at levels up to 9.75% on the expense of dietary corn without detrimental effects on their productive performance (Abo Omar, 2003). However, antibiotics had some advantages in improving nutritive value of olive pulp fed to broilers (Abo Omar et al., 2002). A total of 210 twenty-day-old broiler chicks were used in this program to investigate the performance, feed intake, digestibility and visceral organ mass of broiler chicks fed with high level of olive pulp supplemented with two antibiotics: streptomycin and tylosin. The two antibiotics were added to supply 150 mg/kg of the active ingredient. Chicks which consumed the medicated dietshad more (P<0.05) gain compared to chicks which consumed the basal diet. However, streptomycin caused more (P<0.05) gain compared to tylosin. Antibiotics had no effect on feed intake. The chicks that consumed the antibiotics had heavier (P<0.05) weights of edible, inedible organs and small intestine but lower weights of large intestine and cecum. The digestibility of dry matter, crude protein and nitrogen free extract increased (P<0.05) in chicks fed with the medicated diets compared to the chicks fed with the basal diet. It is concluded that antibiotic supplementation had a positive effect on chick's performance and digestibility.

Another research was conducted to study the effects of different levels of olive pulp on body weight gain, feed intake and feed conversion efficiency of broiler chicks (Abo Omar, 2004). A total of 160 day-old chicks were used in this research and were divided into five experimental groups with four replicates in each. Olive pulp was incorporated in four of the experimental groups at rates of 2.5, 5, 7.5 and 10% in both starter and finisher feeds to replace similar rates of yellow corn. Chicks were fed these diets during the entire feeding trial which lasted for 35 days. Weight gain of chicks was the same in chicks consuming up to 7.5% of olive pulp. However, weight gain of chicks fed the level of 10% olive pulp had the lowest significant ($p<0.05$) weight gain. Similar trends were observed in chicks for feed intake, and feed conversion efficiency. The research showed that olive pulp could be considered as potential low cost feed for broilers. The digestibility of olive pulp in broilers was investigated (Abo Omar, 2000). The analysis of olive pulp samples showed a content of 10.6% crude protein, 12% crude fat, 26% crude fiber, 24% acid detergent lignin and 33% acid detergent fiber. The dry matter consumption by broilers during the experiment averaged 86.5, 91.1 and 93.4g for the control, 3% and the 6% olive pulp groups, respectively. The higher level of olive pulp fed to broilers caused higher feed intake in the course of the experiment but it was not significant. The broiler dry matter intake increased significantly when olive cake was fed at levels higher than 7.5%. The increase feed intake is associated with an increase of fiber which might have an effect on the rate of passing of feed in the gastrointestinal tract. The average daily protein intake was 16.6, 17.0, and 18.8 g/day for the experimental groups, control, 3%, and 6% respectively. The variation in protein intake tended to be not significant and was similar to the recommended levels (NRC, 1994). The intake of protein increased with increased feed intake.

Broilers receiving the olive pulp had a higher ($p<0.05$) intake of fiber compared to the control chicks. The level of intake was 1.0, 1.9 and 2.1 g/day for the control, 3% and 6% groups, respectively. The increase in fiber intake was associated with incorporation of olive pulp.

The level of fat intake averaged 5.7, 6.2 and 6.3 g/day for the experimental groups control, 3% and 6% olive groups, respectively. The intake of fat increased with the increased level of olive pulp but that increase was not significant. However, the total energy content of experimental rations used in this experiment was nearly the same.

The digestibility of dry matter ranged from 69% to 72% . The broiler chicks consuming 3% olive pulp had the highest dry matter digestibility (72%),' while chicks consuming 6% had 70% dry matter digestibility compared to the dry matter digestibility of the control chicks (69%).

Incorporation of olive pulp at the rate of 3% increased digestibility of dry matter by 4%. The level of fiber in diets consumed might have enhanced the digestibility of dry matter. Fiber showed to be responsible for activation of gastrointestinal tissues and enzyme system thus 'improving the digestibility of dry matter and its components of nutrients.

Olive pulp caused an increase in crude protein digestibility. The chicks, which were not fed olive pulp, had the lowest ($p<0.05$) crude protein digestibility compared to the other treatment groups. The digestibility levels ranged between 73 and 78.6% . Again, the increasing level of fiber associated with the feeding of olive pulp was responsible for the increase in the digestibility of protein. The digestibility of crude fiber was not affected significantly by level of olive pulp in diets. However, the digestibility of crude fiber was higher in diets with highest level of olive pulp. The average digestibility were 29.0, 30.0 and 30% for the control, 3% and 6% olive pulp respectively. The feeding of olive pulp had no effect on crude fat digestibility.

The digestibility of fat slightly increased with the level of olive pulp, from 77.6% for control to 78.3% for 3% olive pulp to 79% for 6% olive pulp. The digestibility of nitrogen free extract (NFE) ranged from 80 to 84%. Rations with 6% olive pulp had the highest NFE digestibility (84%) followed by rations with 3% olive pulp (83%) compared with the control diet, which had 80% NFE digestibility.

Rations incorporated with different types silages made of agro-industrial by-products were used in lambs feeding. In an experiment (Zaza, 2009), a total of 20 Awassi lambs an average body weight of 21.5Kg. were used in this experiment. Lambs were divided into four groups of five lambs each. Lambs in the first group were fed a commercial concentrate feed mixture. Lambs in the second, third and fourth groups were with fed the commercial concentrate feed beside silage with rate of 15, 30 and 45%, respectively. Silage was fed instead of the same amounts of the concentrate feed. Lambs were fed their rations individually for 60 days.

Type of diet had growth performance and variable effects on visceral organs. Lambs fed diet containing 15% silage appeared to heavier (P<0.05) trachea and lowest (P<0.05) weight of kidney compared to lambs in other groups. Also, they had the lowest (PO.05) weights of the omasum wet tissue, omasum and abomasums wet and dry contents. However lambs fed 45% silage diet had the heaviest (p<0.05) weights of the above items. Huge amounts of corrugated cardboard are available in Palestine. A feeding trial was conducted with fattening Awassi lambs using corrugated carton to study the nutritional effect of this by-product and to search for low cost rations. Thirty male lambs were assigned to three dietary treatments. The control diet was composed of 40% barley, 16% soybean meal, 12% wheat bran, 1% limestone, 1% salt, 1% lambs' premix and 29% wheat straw. To each of the experimental rations, carton was incorporated instead of wheat straw at levels of 10 and 20%, respectively. Cardboard was treated with urea prior to use. The lamb feeding trial extended for a period of 40 days. Average initial live weights were 29.6, 29.9 and 29.5 kg for each of the three groups, respectively. Mean daily gains were 210, 200 and 205 g per day for each of the three groups, respectively. Average feed conversion rates were 6.3, 6.7 and 6.8 kg feed per kg gain and the feed costs per kg gain were US$ 0.94, 0.87 and 0.74 for each of the three treatments, respectively. The results of the experiment indicated that the low levels of carton in lambs fattening rations had no disadvantages on performance compared to the control ration used. The experiment showed that, under current feed prices in the Palestinian Authority, replacing up to 20% of wheat straw with carton proves to be beneficial and economically feasible (Abo Omar, 2001).

Two feeding trials were conducted on local goats to investigate the effect of urea on both quantity and quality of milk. In the first trial, two groups of lactating goats were fed similar commercial feed plus 1% urea in the feed of one group. In the second trial, same number of pregnant goats were used to investigate urea feeding on colostrum and milk quality. Urea addition in experiment 1 had no significant effect on total milk production, total milk protein, casein, but significantly (P< 05) increased total solids and milk fat. In the second experiment, urea had similar effects as in the first experiment. Colostrum composition was not affected by urea treatment (Abo Omar et al., 1997). The effect of using citrus wood charcoal in broiler rations on the performance of broilers was investigated (Abu Baker, 2006). A total of

120 broilers of Habbard strain at 22 days of age were used in the experiment and were divided into four groups of 30 birds in each. Each group was divided into five replicates with six chicks per replicate. Birds in the experimental groups were fed citrus wood charcoal at rates of 0, 2, 4 and 8% of the ration DM in replacement of yellow corn. The results showed that inclusion of citrus wood charcoal at rate of 2% had an effect on body weight gain, feed intake and feed conversion efficiency. The results indicated that the effect of citrus charcoal is an age dependent as it had no effect at ages of more than 29 days. However, inclusion of citrus wood charcoal increased birds abdomen fat (Abu Baker, 2006).

Chapter Three

Materials and Methods

3.1. Animal management and experimental design

Experiment was conducted at a private farm. The study area is classified as semi arid at latitude 32’28 N and elevation of 150 m above sea level. Sixteen Awassi male lambs of 20+0.85 kg body weight were randomly taken from a large commercial flock born in the winter of 2009 and assigned randomly to one of four treatment diets (4 lambs/treatment diet). The diets were no FB (CON; n=4), 5%FB (FB5; n=4), 10%FB (FB10; n=4) and 15%FB (FB15; n=4) and used to replace barley grain in the diets (Table 1). All diets were iso-nitrogenous/and iso-caloric, formulated to have 18% CP (DM basis) and to meet lambs’ requirements according to NRC (1990). The experiment lasted for 63 days. Animals were housed individually in shaded pens (1.0m x 1.0m), and fed twice daily (two equal meals at 08:00 and 14:00h). The FB material at early bloom stage was collected from a nearby rangeland, allowed to air dry, chopped by a rotating forage chopper to reduce the size into 2-4 cm in length before mixing to avoid sorting. Diets were sampled upon mixing. A total mixed ration diet was offered *ad libitum* to all animals with free access to clean fresh water for the duration of the study. All refusals were collected, weighed, and recorded before the next day feeding to measure the daily DM intake and other nutrient intakes. Representative samples were taken for later chemical analysis. Animals were given a 7-days adaptation period to the pens before receiving the experimental diets. Lambs were weighed at the beginning of the study and weekly thereafter, before the morning feeding throughout the study. Feed samples were analyzed for DM (80 C in air-forced oven for 24h), OM (600 C in muffle furnace for 6h), and CP (Kjeldahl procedure) according to the procedures of AOAC (1990). Neutral detergent fiber and acid detergent fiber were determined according to Goering an Van Soest (1970).

Table (1): Composition of the TMR fed to fattening lambs, %

Ingredients	**CON**	**FB5**	**FB10**	**FB15**
Barley	42.5	37.5	32.5	27.5
Wheat bran	10	10	10	10
Soybean meal	24	23	22	21
Wheat	10	11	12	13
Wheat straw	10	10	10	10
DCP	1	1	1	1
Limestone	1.5	1.5	1.5	1.5
Salt	.5	.5	.5	.5
Premix*	.5	.5	.5	.5
Fleabane	0	5	10	15
Chemical analysis:				
Dry matter	90	89	89	89
Crude protein	19.0	19.0	19.0	19.0
ADF	10.5	12.0	11.8	13.3
NDF	55.0	52.0	51.9	55.8
Ash	6	6	7	6
Ca	.9	.93	.9	.9
P	.6	.65	.61	.6
ME (kcal/kg)	2800	2780	2890	2788

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

* Premix: 65% shelled corn, 30% SBM, 5% vitamin A and antibiotics.

3.2 Slaughter procedure

The lambs were slaughtered as routinely practiced at the slaughter plant, skinning and eviscerating. The rectum and esophagus were tied off to prevent loss of gastrointestinal tract (GIT) contents before the viscera were removed from the carcass. The liver and gall bladder were removed from the viscera. The heart was removed from the bod immediately adjacent to the base. Lungs, without trachea, were removed and weighed, and the total weight for kidneys was recorded.

The lower gut and abomasum were tied off at the pylorus, the omasal-abomasal juction and the ileocecal junction. The viscera were then placed into a plastic lined offal tray for dissection.

After the total GIT weights were determind, the tract was tied and sectioned into the esophagus, reticulo-rumen, omasum, abomasum, small intestine, cecum and large intestine. The spleen and pancreas were removed first and weighed.

The external fat was removed from each organ of the foregut (rumen**,** omasum, abomasum) and the cecum . The full fat-free organ weight was recorded.The rumen was emptied, scraped as clean as possible without washing and then weighed. The contents were homogenized and a one liter sample taken for dry matter analysis (DMA). A small 2 cm2 sample of ventral sac tissue was removed, placed on a cork piece and frozen. The rumen was washed and weighed. The wet weight of the washed tissue and the oven dry weight of each segment (organ) was determined.

The omasum and abomasum were opened, emptied of their contents and washed. Their tissues were sampled for dry matter analysis (DMA).

The weight of contents was calculated as the difference between the full and washed weights.

The large and small intestines were separated from the alimentary tract leaving some fat.

The fat was removed from the intestines leaving only the tissue which was weighed.

The DM analyses of the samples were conducted following the completion of the slaughter. The tissue samples DM were determined by drying a portion of the tissue sample at 60 C at 20 psi vacuum for 24 h.

Data collected for feed intake, weight gain, carcass and non carcass components were analysed using general linear model (GLM) of SAS (1990). A one way analysis of variance was used to examine the diet effects.

Chapter Four

Results and Discussion

4.1 Chemical composition of fleabane:

The chemical analysis of fleabane is shown in table (2). Results of analysis showed that this type of roughage is of good nutritive value. Values of crude protein and crude fiber fractions make fleabane one of high nutritive value roughage compared to any local cereal roughage. Fleabane has protein level that exceeds that of wheat, barley and sorghum by many folds. The good nutritive value of fleabane makes it practical to substitute part of grains traditionally used in livestock rations.

Table (2): The chemical composition of fleabane, % (DM basis)

Nutrient	Percent
Dry matter	87
Crude protein	20
Crude fat	0.2
Crude fiber	27
ADF	38
NDF	62
NFE	42.4
Ash	10.4

4.2 Weight development and average daily gain

Fleabane has significant effect on weight gain of lambs. Starting from week 2, fleabane at all levels increased ($P<0.05$) lambs weight. This trend remained for additional two weeks of the fattening trial (Table 3). From week 4 and after, lambs fed with 10 and 15% fleabane had the highest ($P<0.05$) gain compared to the gain observed in lambs of the other two experimental groups. Similarly, the average daily gain observed in lambs fed with 10 and 15% fleabane was higher ($P<0.05$) than daily gains of lambs in other treatments (Table 3). Amounts of gain, however, are relatively lower than what was expected from such type of rations used in the experiment. Similar rations in regard to crude protein level and energy values when fed to fattening Awassi lambs gave better daily gain (Abo Omar, 2001; Abo omar, 2002; Zaza, 2008; Irshaid et al, 2004; Zaza, 2008). In contrast, the daily gain observed in this experiment is was similar to other previous reports (Naser, 2009) where similar rations were fed to fattening Assaf lambs. The relatively low gain in Awassi lambs in this experiment can be explained by the short fattening period and in other hand the low rate of gain of the small sized Awassi breed compared to other heavy lamb breeds (Haddad, et al., 2008).

Table (3): Weight development of lambs fed different levels of fleabane, kg

Weeks	CON	FB5	FB10	FB15
Week 1	0.8b	1.5a	1.0b*	1.5a
Week 2	2.5b	3.5a	3.3a	3.8a
Week 3	3.8b	5.3a	5.3a	5.3a
Week 4	5.0b	6.8a	7.5a	7.8a
Week 5	6.5b	7.8b	9.8a	8.5a
Week 6	7.8b	8.5b	11.5a	10.3a
Week 7	9.8b	10.3b	13.3a	13.0a
Week 8	11.8b	11.5b	15.0a	15.3a
Week 9	13.3b	13.0b	16.5a	17.5a

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.3 Feed intake

Lambs in all experimental groups had similar consumption (Table 4). Incorporation of fleabane had no negative effects on feed intake even at high levels. However, lambs fed with the high level of fleabane numerically consumed more feed. This means that fleabane had positive effects on palatability. Type of fiber had no negative effects on feed intake. Normal rate of passage of digesta caused a normal digestion then had no effect on feed intake. The high level of NDF assures the good digestibility and then feed intake.

Feed intake by lambs in all treatments was similar to that in other experiments with fattening Awassi lambs using non-conventional feeds such as wheat staw-grains based diets (Hammad, 2001; Azmuti, 2002); grains-olive cake (Abo Omar and Gavoret, 1995); corrugated cardboard-grains diets (Abo Omar, 2001); sesame oil cake- grains diets (Abo Omar, 2002); citrus pulp silage- grains diets (Zaza, 2008).

Table (4): Feed intake by lambs fed different levels of fleabane, g/day

Weeks	CON	FB5	FB10	FB15
Week 1	1610	1630	1650	1800
Week 2	1650	1630	1650	1800
Week 3	1670	1630	1650	1800
Week 4	1700	1710	1750	1820
Week 5	1700	1800	1750	1840
Week 6	1760	1800	1750	1860
Week 7	1800	1800	1810	1920
Week 8	1800	1800	1830	1960
Week 9	1800	1800	1830	1960

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.4 Feed conversion ratio

Feed conversion ratios are shown in Table (5). These ratios are relatively lower than was expected of such used rations. Low rates of gain observed and high level of intake by all lambs in the different experimental groups can explain these low feed conversion ratios. Some previous research on non-conventional feeds is consistent to this finding (Abo Omar, 2001; Abo Omar, 2002; Hammad, 2001. Zaza, 2008; Irshaid et al 2008; Haddad, 2008; Atti et al., 2008), however, contrasted the higher feed conversion ratios observed by other research (Naser, 2009).

Table (5): Feed conversion ratio in lambs fed different levels of fleabane*

	CON	FB5	FB10	FB15
Total feed intake	108.4	109.2	109.7	117.2
Total gain	13.3b	13.0b	16.5a	17.5a
FCR	8.1a	8.4a	6.6b	6.7b

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.5 Dressing percentage

The dressing percentages of slaughtered lambs were the same (Table 6). The fleabane level had no influence on gastro intestinal tissues. This contrasts the previous research that indicated that high fiber increased the gastro intestinal tissue mass (Abo Omar et al., 1994). However, dressing percent values were similar to values reported by previous research (Abo Omar, 2001; Abo Omar, 2002; Hammad, 2001. Zaza, 2008; Irshaid et al 2008; Haddad, 2008; Atti et al., 2008).

Table (6): Dressing percentage for Awassi lambs under different fleabane feeding levels

	CON	FB5	FB10	FB15
Dressing %	50.4	50.8	50.1	50.9

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.6 Carcass cuts measurements

Feeding fleabane had variable effects on the different carcass cuts. Fleabane at levels of 10 and 15% caused an increase ($P<0.05$) in leg, rib, shoulder and loin (Table 7). However, fleabane had no effects on weights of shank, neck and breast. On other hand, fleabane at the highest two levels increased weights ($P<0.05$) of abdominal fat and the thickness of subcutaneous fat. Fleabane had no effects on the rib eye muscle area and depth.

Table (7): The carcass cuts measurements as (g/kg empty body weight EBW)

Carcass cuts (g/kg EBW)	CON	FB5	FB10	FB15
Leg	130.4b	133.6b	145.7a	148.9a
Rib	71.1b	80.26b	77.82a	77.80a
Shoulder	39.1b	38.8	41.4a	42.3a
Lion	38.4b	50.2b	49.09a	52.1a
Shank	44.1	43.52	43.4	44.33
Neck	34.2	36.22	36.58	34.99
Breast	36.0	38.5	38.3	48.6
Abdominal fat	26.0b	27.7b	30.2a	31.2a
Thickness of sub cut. Fat (mm)	1.90b	2.2b	3.0a	2.9a
Rib eye muscle area (cm^2)	13.3	13.1	14.0	14.3
Rib eye muscle depth (cm)	5.7	5.8	6.3	6.4

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.7 Edible parts

The organs under investigation were the lungs, liver, heart and kidneys (Table 8). Feeding fleabane especially at the highest two levels caused an increase (P<0.05) in the average weights of these organs. The high metabolic activity of these organs might be the reason of the increase in its mass. Weights of these organs reported here are similar to weights reported by previous research (Abo Omar, 2001; Abo Omar, 2002; Hammad, 2001. Zaza, 2008; Irshaid et al 2008; Haddad, 2008; Atti et al., 2008).

Table (8): The edible parts of carcass for the treatments groups (g/kg EBW)

Organs (g/kgEBW)	CON	FB5	FB10	FB15
Lungs	29.5b	31.2b	34.8a	35.7a
Heart	12.4b	12.0b	14.0a	13.9a
Kidneys	5.5b	5.3b	6.6a	6.7a
Liver	33.8b	35.7b	42.5a	43.3a

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.8 In-edible parts

Fleabane had variable effects on the investigated inedible organs (Table 9). It increased (P<0.05) the average weights of fore stomach, rumen wet and dry weights, reticulum wet and dry weights, abomasum wet and dry weights, small intestine, large intestine and cecum. However, it has no significant effects on omasum wet and dry tissue weights, esophagus, trachea, total tract, gall bladder, spleen, kidney fat, feet, head and hide average weights.

Table (9): Weights of the non-edible parts of carcass for the different treatments groups (g/kg EBW).

Non-edible parts (g/kg EBW)	CON	FB5	FB10	FB15
Hide	282.5	299.5	280.1	260.9
Head	104.6	101.1	100.3	95.3
Feet	48.6	47.2	49.3	47.0
Kidneys fat	7.2	7.2	7.1	6.6
Spleen	3.3	4.0	3.4	4.1
Gallbladder	1.3	1.2	1.1	1.4
Total gastro intestinal tract	305.0	327.6	339.5	360.2
Trachea	2.9	2.7	2.8	2.3
Esophagus	2.1	2.2	2.2	2.1
Four compartment stomach	151.0b	159.2b	177.2a	175.0a
Rumen wet tissue	25.6b	26.8b	31.9a	31.0a
Rumen dry tissue	3.6b	3.1b	5.8a	5.4a
Reticulum wet tissue	4.8b	4.2b	5.6a	5.8a
Reticulum dry tissue	1.0b	1.0b	1.9a	1.8a
Omasum wet tissue	3.7	3.2	3.8	3.4
Omasum dry tissue	0.9	1.0	1.0	1.0
Abomasal wet tissue	8.1b	9.3b	10.8a	11.0a
Abomasal dry tissue	2.0b	2.0b	2.7a	2.8a
Small intestine	5.4b	51.6b	55.6a	54.0a
Large intestine	37.9b	36.1b	41.1a	39.4a
Cecum	14.8b	15.9b	17.9a	18.8a

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

4.9 Economical evaluation

As shown in table (10), the average of saving using the highest two levels of fleabane is about 25 NIS. Assuming that we have around 0.2 million lambs under fattening per year, with similar gain as in this experiment, the total saving could be about 5 million NIS.

Table(10): Economical evaluation, growth characters and performance of Awassi lambs fed different levels of fleabane

	CON	**FB5**	**FB10**	**FB15**
No. of lambs	4	4	4	4
Feedlot period (day)	70	70	70	70
Average daily gain (g/head/day)	211b	206b	262a	278a
Total gain (kg)	13.3b	13.0b	16.5a	17.5a
Average feed intake (kg)	108.4	109.2	109.7	117.2
Feed conversion ratio	8.1	8.4	6.6	6.7
Feed cost (NIS/kg)	1.6	1.5	1.33	1.30
Cost of total gain, NIS	172.4	163.8	144.8	152.4

***means followed with similar letter at the same row are not significantly different at P= 0.05.**

Diets were: (1) no FB (CON; n=4, (2) 5%FB (FB5; n=4), (3) 10%FB (FB10; n=4), (4) 15% FB (FB15; n=4) of the total mixed diet.

Chapter Five

Conclusions and Recommendations

5.1 Conclusions:

It can concluded that fleabane, a wide spread weed in local territories is a potential source of feed and can be used in local ruminant rations without any harm effects. Most of the tested parameters in the lambs fed with fleabane were similar or even better than that in control lambs that fed a commercial fattening ration. Significant improvement in gain and amounts of saving were observed in lambs fed the fleabane diets.

5.2 Recommendations:

It is recommended that fleabane can be used in fattening lambs' rations at rates of 10 and 15%. However, more research is needed to confirm these findings.

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Appendices

Appendix (1): MIOSTURE DETERMINATION

Moisture in feed samples can be determined by drying feed in an oven at 60-65 c until complete depletion of feed moisture.

Procedure:

1. Set crucible dry weight.
2. Weigh about 2 g sample in the pre weighed crucible (**weight A**)
3. Incubate crucible with sample in oven at 60 c for overnight.
4. When dry take to desiccators then take the sample weight **(weight B**).
5. Moisture weight is the difference between **A** and **B**.

Calculations:

Sample weight = weight of crucible with sample before incubation – weigh of dry crucible

Sample dry weight = weigh of crucible with sample after incubation – weight of dry crucible

Moisture weight = A – B

% Moisture = (moisture weight\ sample weight) x 100

% Dry matter (DM) = 100 **-** % moisture

Appendix (2): CRUDE FIBER DETERMINATION

Designated to determine the structural carbohydrates component of feeds. This procedure depends on basic and acidic treatments. These treatments to hydrolyze the soluble fraction of carbohydrates.

Why is it important to measure crude fiber:

1. As indicator of the feed nutritive value.
2. Indicator on feed texture

Factors affect test results:

1. Degree of feed finess
2. Method of heating (boiling).
3. Degree of fat extraction.

Equipment (chemicals):

1. Diluted sulfuric acid (1.25%): 12.5 g of acid (98% conc.) in 1 liter of water.
2. Potassium hydroxide (1.25%): %): 12.5 g of KOH in 1 liter of water.

Procedure:

1. Take crucible weight.
2. Place about 2 g of sample in crucible
3. Fit crucible on the extraction instrument.
4. Add 150 ml of diluted acid.
5. Boil fof 30 minutes then drain acid.
6. Add 150 ml of KOH and boil for 30 minutes.
7. Drain the solution.
8. Dry in oven at 105 c for 2 hours.
9. Take the dry weight.

10. Ash the sample at 550 c for 3 hours.

11. Take ash weight.

Calculations:

Crude fiber weight = dry weight – ash weight

% crude fiber = (crude fiber weight\ sample weight) x 100

Appendix (3): Van Soest Method of Fiber Analysis (Detergent Method)

Neutral detergent analyses:

Hemicellulose

Cellulose

Lignin

Acid Detergent Analysis (ADF):

Cellulose

Lignin

Acid Detergent Lignin Analysis (ADL):

Lignin

NDF - ADF = Hemicellulose

Neutral Detergent Analysis (NDF):

Acid Detergent Lignin Analysis (ADL): Lignin

ADF - ADL = Cellulose.

DETERMINATION OF NEUTRAL DETERGENT FIBER (NDF)

This to determine the fractions of fiber that can be washed by the neutral solution. The fractions as cellulose, hemicellulose and lignin.

Equipment (chemicals):

1. The neutral detergent solution:
    a. 6.81 g of sodium borate decahydrate: $Na_2B_4O_7 . 10H_2O$
    b. 18.61 g of EDTA: $C_{10}H_{14}N_2Na_2O_8$

c. 30 g of sodium lauryl sulfate: C12H25NaO4S

d. 10 ml of 2-ethoxyethanol: C4H10O2

e. 4.56 g of disodium phosphate: Na2HPO4

f. Dissolve items in a and b in water then items in c and d.

g. Dissolve item in e in water by boiling

h. Mix the two solutions and add water to 1 liter.

i. pH around 7.

2. Anti foaming agent: n- octanole: C8H18O
3. Sodium sulfate anhydrous: Na2SO3.
4. Acetone.

Procedure:

1. Place 1 g of sample in crucible, take weight.
2. Add to sample 100 ml of NDF solution plus .5 g of sodium sulfate.
3. Boil for an hour.
4. Filtrate with hot water then with acetone
5. Dry crucibles in oven at 105 for 8 hours.
6. Ash at 550 c for 2 hours
7. Take weight.

Calculations:

Crude fiber = (crucible weight + dry weight) – crucible weight

NDF % = (crude fiber weight\ sample weight) x 100.

Appendix (4): CRUDE PROTEIN DETERMINATION

Designed to determine the protein content of feed ingredients. Method based on assumption that proteins contain 16% Nitrogen. Nitrogen is determined by Kjeldahl method.

Determination is based on assumptions:

- All nitrogen in the ingredient is in the form of protein.
- All protein in the ingredient contains 16% nitrogen (100/16 = 6.25).

Exceptions: Milk protein contains 15.7% N (6.38)

Wheat protein contains 17.5% N (5.71)

Crude protein contains true protein and non-protein nitrogen

(amino acids, amides, urea, etc.)

Procedure:

1) Weigh .5- to 2-g sample, place in Kjeldahl flask.
2) Add concentrated sulfuric acid and heat for 2 hr.:

$$N \text{ in sample} + H_2SO_4 \text{------>} (NH_4)_2SO_4$$

3) Add concentrated sodium hydroxide to flask and distill off ammonia:

$$(NH_4)_2SO_4 + NaOH \text{---->} NH_3 + Na_2SO_4 + H_2O$$

4) Trap NH_3 in boric acid solution containing an indicator.
5) Titrate with standardized H_2SO_4 to determine N content.
6) Calculate percent crude protein:

$$(N \times 6.25)$$

Crude Protein Calculations

Sample weight __2.0196___gm

Standardized acid to titrate N

in sample (each ml = 2 mg N) ___16.54___ ml

N in sample __________ mg

%N in sample = mg N in sample x 100\ mg sample= __________ %

Percent crude protein = % N X 6.25 **___________%**

Appendix (5): ASH DETERMINATION

Designed to Determine the Mineral (inorganic) Component of Feed Ingredients. Method based on ignition of all organic matter.

Procedure:

1) Weigh 2-g sample into pre-weighed crucible.
2) Ash at 600 C for 2 hr in pre-heated "muffle furnace."
3) Cool in desiccator, weigh.
4) Calculate percent ash.

ASH CALCULATIONS

	Crucible & Sample Wt.	-	Crucible Wt.	=	Sample Wt.
	gm		gm		gm
Before ashing	__11.97__	-	___9.39____	=	___________
After ashing	9.48	-	9.39	=	

% ash = ash weight\ sample weight x 100

% organic matter = 100 - % ash.

Appendix (6): NFE DETERMINATION

Designated to provide an estimate of soluble carbohydrates component (sugars and starches) of feed ingredient.

% NFE = 100 - (% H_2O + % Ether Extract + % Crude Fiber + % Crude Protein + % Ash)

Nitrogen-Free Extract Calculations and Proximate Analysis

Summary

Dry matter _________ %

	% "As fed" Basis	% Dry matter Basis
1. Ether extract (crude fat)	______	______
2. Ash (minerals)	______	______
3. Crude protein (N x 6.25)	______	______
4. Crude fiber	______	______
Total	______	______
Moisture	______	xxxxx
Nitrogen-free extract	______	______
Total	100	100

جامعة النجاح الوطنية
كلية الدراسات العليا

استخدام نبات الرباط ***(conyza bonariensis)*** في عليقة تسمين خراف العواسي

إعداد
مروان إبراهيم محمود عمر

إشراف
أ. د. جمال أبو عمر

قدمت هذه الأطروحة استكمالا لمتطلبات نيل درجة الماجستير في الإنتاج الحيواني بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس , فلسطين.
2010م

استخدام نبات الرباط *(conyza bonariensis)*

في عليقة تسمين خراف العواسي

إعداد

مروان إبراهيم محمود عمر

إشراف

أ.د.جمال أبو عمر

ملخص

أجريت هذه التجربة لمعرفة أثر التغذية بنبات الرباط على أوزان الأحشاء وقطع الذبائح لخراف العواسي .

استخدم في التجربة 16 خروف ذكر من سلالة العواسي, قسمت عشوائيا الى مجموعات , احتوت كل مجموعة على 4 خراف , وقد تم اعتبار كل خروف كمكرر في المجموعات , غذيت الخراف في المجموعة الأولى "الشاهد " على عليقة تجارية عادية, بينما تم إضافة نبات الرباط إلى المجموعات الثانية والثالثة والرابعة بنسبة 15%,10%,5% على التوالي. وقد تمت إضافة نبات الرباط إلى العلائق كبديل عن الشعير.

أظهرت النتائج انه لإضافة نبات الرباط في علائق التسمين تأثير معنوي في نمو الخراف , فمنذ الأسبوع الثاني من عمل التجربة قد اثر نبات الرباط ايجابيا ($p<o.05$) على النمو عند استخدامه بكافة المستويات, إلا انه بعد الأسبوع الرابع كان لمستوى نبات الرباط 10% و 15% التأثير الأعلى على النمو , وبينت النتائج أن استخدام نبات الرباط على مستوى 10% و15% أيضا كان له تأثير ايجابي على معدل الزيادة اليومية في الخراف , مع انه لم يكن لإضافة نبات الرباط في العلائق تأثير على معدل الاستهلاك من العلف , وبينت النتائج أن لنبات الرباط المضاف للعلائق تأثير متفاوت على قطع ذبائح خراف التجربة , فقد تبين أن نبات الرباط على مستوى10% و15% أدى إلى زيادة ($p<0.05$) في معدل أوزان الفخذ والأضلاع والكتف والخاصرة , بينما لم يكن له أي تأثير على معدل أوزان العرقوب والرقبة والصدر . وعلى

الجانب الآخر بينت التجربة أن المستويات العالية من نبات الرباط في العلائق أدت إلى زيادة ($p<0.05$) في وزن دهون الأحشاء ودهون تحت الجلد , بينما لم يكن له أي تأثير على مساحة العضلة العينية وسمكها . هذا وقد أدى إضافة نبات الرباط إلى زيادة معنوية ($p<0.05$) في الوزن الرطب والجاف للمعدة المركبة والكرش والشبكية والمعدة الحقيقية والأمعاء الدقيقة والغليظة والأعور. إلا انه لم يكن له تأثير على أوزان الورقية والمريء والقصبة الهوائية والقناة الهضمية والمرارة والطحال ودهون الكلية والجلد والرأس .

من هنا يمكن التوصية باستخدام نبات الرباط على مستويات 10% و15% في علائق تسمين خراف العواسي إلا أن ذلك بحاجة إلى مزيد من البحث.