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Effect of Adding Linseed Oil to The Diet on The Chemical Composition and Some Fatty Acids of Awassi Sheep Meat Chilled and Frozen

ABSTRACT

This study was conducted at the experimental farm, Department of Animal Production , College of Agriculture , University of Tikrit for the period from 7/10/2018 to 15/12/2018.

Sixteen Awassi lambs with an average body weight of 27kg and aged about 6—7-months were used in this investigation. The lambs were randomly assigned into four groups. Each group has 4 lambs the lambs were placed in individual cages (1 x 1.5 m².) and the aim of this study to investigation the effect of supplementing linseed oil on chemical composition and some fatty acids of Awassi chilled and frozen sheep meat,the results showed high significant differences in frozen period in moisture content of meat compared with chilled period it was (70.90 and 66.82)% respectively , and the chilled period conducted high significant differences than the frozen period in fat content (9.39 and 8.15)% respectively. About the effect of linseed oil on fatty acids, frozen period conducted high significant differences in Oleic it was 33.59 % while the frozen period conducted a high significant differences in Linoleic and Arachidonic acids it was (4.88 and 1.19)% respectively.

The interaction between chilled period and treatments, the first and second treatment conducted high significant differences on Oleic acid also first treatment was high in Linoleic Acid percentage. While for the interaction between frozen period and treatments, the fourth treatment was high in Oleic and Linolenic Acid percentage, the first treatment was high in Linoleic Acid percentage it was (5.22)%.

INTRODUCTION

The main purpose of sheep rearing is meat production because it contains nutrients necessary for life, growth and physiological functions, and play very important role in the human nutrition by providing high quality of proteins, essential minerals and trace elements and vitamin B. (Sandro,2012).

In addition of proteins, meat also contains a range of fats, including essential omega-3 polyunsaturated fats. In the recent year there were an interest in the ways to manipulate the fatty acids composition of meat because the meat seen as a major source fatten in diets (saturated fatty acids) which have been implicated in diseases associated with modern life (Omar *et al*.2019).

Many experiments found that feeding vegetable oils or fish oil rich in polyunsaturated fatty acids decrease the content of saturated fatty acids in meat (Czauderna *et al* .2004)

Falx is an oil seed produced in Canada , flax is crushed to produce linseed oil for industrial applications, and the resultant flaxseed meal is used as a supplements in livestock feed but the

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flaxseed composition (similar to most grains) can vary based on variety , environmental factors and method analysis.

Linseed oil is a high content of unsaturated fatty acids, that effect adversely to microorganism growth in the rumen (Jenkins *et al* .1993). The linseed in markets is differ in their fatty acid composition, and that positively effect on the performance of lambs and also on the dietary value of their meat. It is the richest land-base source of omega-3 that has effected some carcass characteristics. The major aim for this research was to identified the effect of addition different levels of linseed oil to dietary sheep on chemical composition and fatty acids in Awassi sheep meat.

MATERIALS AND METHODS

This study was conducted at the experimental farm, Department of Animal Production, College of Agriculture, University of Tikrit for the period from 7/10/2018 to 15/12/2018.

Sixteen Awassi lambs with an average body weight of 27kg and aged about 6—7-months were used in this investigation. The lambs were randomly assigned into four groups. Each group has 4 lambs which were placed in individual cages (1 x 1.5 m^2) Each cage was supplemented with a special feeder for the concentrates and the roughage feed (hay), together with in utensils for drinking water. The mineral salts were placed in front of the lambs during the experiment period.

A keen consideration was also given to lamb's health care to avoid possible diseases as they were prescribed with Bindazole.

Lambs feeding:

The lambs were fed for about a week prior to starting the experiment. The lambs initial body weights were taken after 12 hours fasting. Body weights were measured weekly during the experiment.

The concentrated ration was fed to the lambs on the basis of 2% of their live body weights and was given at morning and evening meals . The hay was supplemented freely. The mineral blocks were placed in front of the animals during the course of the experiment.

Treatment levels:

Group1 lambs were considered as a control group and were given no flaxseed oils. The other groups were given 0.25, 0.50 and 0.85% ml flaxseed oils as a percentage of the concentrate diet, respectively at the morning.

The percentage of flaxseed oil was changed weekly depending on the increase in body weights of lambs until the end of the experiment. Final body weight, daily, total body gain and some other measurement were taken.

Table (1) shows the ingredients of the ration used in the experiment

Feeding Materials	Percentage%
Barley	60
Wheat Bran	35
Corn	3
Premix	1
Salt	1

Total weight gain:

Total weight gain was calculated by subtracting the primary weight of the lamb from the final weight in all groups.

Slaughtering:

At the end of the experiment, lambs were fasted for 12 hours with no water removal , .lambs weighed prior to slaughtering (Slaughter weights).

Two Animals were slaughtered from each group and the weights of the hot carcasses were taken. Head, limbs and skin

The external offal parts head, limbs and skin' together with the internal offal parts: spleen, liver, heart, testicles, lungs, trachea and gastrointestinal tract ,filled and empty, kidneys ,kidney fat, intestinal fat, and heart fat were weighed after slaughtering the lambs.

Chemical analysis of meat:

Moisture content:

The method mentioned in AOAC (2005). Moisture calculating through the following equation:
Moisture contents%= pre-dry sample weight – dry sample weight / pre- dry sample weight ×100

Protein content:

The method mentioned in AOAC (2005) the equation is:
Protein content% = sample weight × 6.25 × 0.0014 / 0.5 × 100

Fat content:

Fat content was performed according to the method mentioned in AOAC (2005) as follows:
Fat content % = sample weight before extraction – sample weight after extraction / sample weight before extraction × 100

Ash Rating Determination:

The method mentioned in AOAC (2005) ash ratio was adopted to measure ash rating determination according to the following equation:
Ash content% = ash weight / sample weight ×100

Fatty Acid Determinations:

One gram of meat with one gram of fine quartz sand were thoroughly ground in a thick ceramic dish and homogenized with 5 ml distilled water. After centrifugation for 5 min, 0.5 ml of the supernatant was used for fatty acids extraction by adding 0.5 ml chloroform: methanol (2:1), and mixing 30 sec. Then was followed a centrifugation for 5 min. The supernatant was removed. The extract was dried with a nitrogen flow. Derivatization procedure was applied for esterification with methanol-acetyl chloride (4:1 v/v) for 20 min at 80º C. The method was validated. The validation parameters precision and sensitivity were tested. GC/MS analyses were performed for the determination of fatty acids in different meat samples.

Statistical analysis

Two way classifications with interaction design were performed by factorial experiment (CRD) (SAS, 2001). And compared between means using (Duncan ,1955). Analyze the data using the following linear additive model:

$$y_{ijk} = \mu + P_i + T_j + PT_{ij} + e_{ijk}$$

Where:
Y_{ijk} : the observation of the period and treatment
μ : is the overall mean effect,
P_i : correspond to the main effects of factors period
T_j: correspond to the main effects of factors treatment
PT_{ij} : is the interaction between factors period and treatment.
e_{ijk} : is independent normally distributed random error term with zero mean and variance. σ^2

RESULTS AND DISCUSSIONS

Effect of adding different levels of Linseed oil on the chemical composition of the Awassi lambs' meat.

Table (2) shows that the freezing significantly($P \geq 0.05$) exceeds the cooling in terms of moisture content in the meat 70.90% , while no significant differences were found among the treatments. No significant differences were found in the interaction between cooling with the treatments and freezing with the treatments. These Results were agreed upon by Musella *et al*. (2009) and Gallardo *et al*. (2015). Whereas these Results were not consistent with what was reached by Al-rubeii et *al*. (2012). As for protein content in meat, no significant differences were observed

between cooling and freezing. There were no significant differences among the treatments as well as the interaction between freezing and treatments. As for the overlap between the cooling and the treatments, there was a significant difference (P≥0.05) of the fourth treatment on the second treatment it was 19.85%, while no significant difference of the fourth treatment with the rest of the treatments. There were also no significant differences between the second treatment and the first and third treatments. These results were consistent with the Results of Hrenandez-Calva *et al*. (2011); and Gallar *et al* do *et al.,* (2015), whereas these results were not consistent with what was reached by Al-rubeii *et al* (2012); AL-Khafaji (2016). As for the ratio of meat fat, there was a significant superiority (P≥0.05) of cooling at the expense of freezing it was 9.39% and the first, third and fourth treatments exceeded the second treatment significantly 8.92%, 9.03%, and 9.02% respectively.

Table (2) Effect of added different levels of Linseed Oil on Chemical composition of meat (%).

		Moisture	Protein	Fat	Ash
storage	Cooling(1)	66.82±1.01 b	17.70±1.21 a	9.39±0.15 a	2.09±0.21 a
	Frozen(2)	70.90±0.38 a	17.35±0.19 a	8.15±0.17 b	1.81±0.25 a
Treatments	T1	69.50±0.54 a	18.17±0.31 a	8.92±0.27 a	1.88±0.30 a
	T2	69.14±2.14 a	15.62±2.24 a	8.10±0.26 b	2.19±0.37 a
	T3	68.88±0.67 a	18.08±0.48 a	9.03±0.34 a	2.13±0.34 a
	T4	69.91±1.20 a	18.23±0.63 a	9.02±0.31 a	1.50±0.28 a
Interaction	11	68.68±0.75 ab	18.30±0.65 ab	9.58±0.14 a	2.25±0.14 ab
	12	68.98±3.79 b	13.66±4.55 b	8.67±0.17 b	2.13±0.66 ab
	13	67.63±0.82 cb	19.00±0.56 ab	9.68±0.31 a	1.63±0.47 ab
	14	67.00±0.91 cb	19.85±0.19 a	9.62±0.31 a	2.13±0.31 ab
	21	70.33±0.58 ab	18.04±0.10 ab	8.27±0.18 bc	1.50±0.54 ab
	22	70.31±0.59 ab	17.58±0.25 ab	7.54±0.27 c	2.25±0.43 ab
	23	70.13±0.60 ab	17.15±0.46 ab	8.37±0.38 bc	2.63±0.38 a
	24	72.83±0.50 a	16.63±0.25 ab	8.42±0.35 b	0.88±0.13 b

- The different letters within the same column indicate significant differences at the level (P≥0.05).

As for the interaction between cooling and the treatments, the first, third and fourth treatments exceeded the second treatment significantly 9.58%, 9.68%, 9.62% respectively. In case of the overlap between freezing and treatments, the fourth treatment significantly it was 8.42% exceeded the second treatment while there were not any significant differences with the rest of the treatments. There were no significant differences between the second treatment with the first and third treatments. These results were consistent with the Results of Noci *et al.* (2011); AL-Khafaji (2016). However, these results were not consistent with what was reached by Zahir (2012), Le *et al*. (2018). As for the proportion of ash in the meat there were no significant differences between cooling and freezing among the experimental treatments. No significant differences were observed between cooling and the treatments. In the case of the overlap between the freezing and the treatments, the third treatment significantly exceeded the fourth treatment it was 2.63, while no significant differences of the third treatment observed with the rest of the treatments. There were no significant differences among the fourth treatment with the first and second treatments and these results were consistent with the Results of Prado *et al.* (2008); And Musella *et al.* (2009). Whereas these results were not consistent with what was reached by Al-Rubeii *et al*. (2012); and Gallardo *et al*., (2015).

Effect of adding different levels of Linseed oil on the ratio of fatty acids in the Awassi lamb meat.%

Table (3) shows that the effect of adding flax seed oil on the ratio of fatty acids was as follows: The results showed that freezing was superior (P≥0.05) to cooling with regard to the fatty acid (Arachidonic acid) it was 1.19% . There were no significant differences among the treatments. No significant differences were observed in the case of overlapping between cooling with treatments and freezing with treatments. As for the proportion of fatty acid (Lenolenic acid), there was no significant difference between cooling and freezing. As for the treatments, the fourth treatment significantly exceeded the rest of the treatments. For the interaction between the cooling and the treatments, the fourth treatment significantly exceeded (P≥0.05) the first and second treatment it was 1.88%, with the absence of significant differences with the third treatment. As for the overlap between the freezing with the treatments, the results showed that the fourth treatment significantly exceeded (P≥0.05) the first and second treatment it was 2.39, while no significant difference was observed with the third treatment. As for the fatty acid (linoleic acid), there was a significant difference (P≥0.05) of freezing on cooling it was 4.88 and the results of the treatments showed that the first treatment was significantly higher (P≥0.05) than all experimental treatments was 4.77%, and the second and fourth treatments significantly exceeded the third treatment was 4.46%, 4.57% respectively. As for the case of the overlap between cooling and treatments, the results showed a significant superiority (P≥0.05) of the first treatment on the second and third it was 4.32% and the superiority of the second treatment on the third treatment it was 4.01%. The fourth treatment significantly also exceeded the third treatment it was 4.12%, while there were no significant differences between the first and second treatments with the fourth treatments. As for the overlap between freezing and treatment, the first treatment exceeded the second and third treatments significantly (P≥0.05) it was 5.22% and the second and fourth treatments significantly (P≥0.05) exceeded the third treatment it was 4.90% , 5.03%. As for the fatty acid (Oleic acid), cooling was significantly higher (P≥0.05) than freezing it was 33.59%.

Table (3) Effect of adding different levels of Linseed Oil on Fatty acids of meat (%)

		Oleic acid	Lenoleic acid	Lenolenic acid	Arachidonic acid
Storage	cooling (1)	33.59±0.59 a	3.92±0.11 b	1.38±0.11 a	0.30±0.00 b
	Frozen (2)	23.81±0.39 b	4.88±0.09 a	1.62±0.18 a	1.19±0.01 a
Treatment	T1	29.05±2.37 a	4.77±0.17 a	1.16±0.10 b	0.74±0.17 a
	T2	29.52±2.09 a	4.46±0.18 b	1.12±0.13 b	0.72±0.16 a
	T3	27.69±2.17 b	3.81±0.23 c	1.60±0.21 b	0.75±0.17 a
	T4	28.55±0.96 ab	4.57±0.18 b	2.13±0.19 a	o.76±0.17 a
Interaction	11	35.28±0.42 a	4.32±0.03 c	1.11±0.15 c	0.29±0.01 b
	12	35.00±0.60 a	4.01±0.08 d	1.08±0.20 c	0.29±0.01 b
	13	33.13±1.46 b	3.23±0.09 e	1.46±0.24 cb	0.30±0.02 b
	14	30.98±0.57 c	4.12±0.05 cd	1.88±0.14 ab	0.31±0.01 b
	21	22.82±0.26 e	5.22±0.02 a	1.21±0.14 cb	1.19±0.03 a
	22	24.04±0.09 e	4.90±0.14 b	1.16±0.19 cb	1.15±0.02 a
	23	22.25±0.18 e	4.38±0.10 c	1.73±0.36 cab	1.20±0.02 a
	24	26.13±0.15 d	5.03±0.11 ab	2.39±0.32 a	1.20±0.02 a

- The different letters within the same column indicate significant differences at the level (P≥0.05).

The results of the experimental treatments showed that the first and second treatment significantly exceeded the third treatment. The fourth treatment showed no significant differences with all the experimental treatments. As for the overlap between cooling and treatment, the first and second treatments significantly exceeded (P≥0.05) the third and fourth, them was 35.28% , 35.00% and the third treatment also significantly exceeded the fourth it was 33.13% while no significant differences were found in the first and second treatment. In the case of overlapping between freezing

and treatment, the fourth treatment was superior (P≥0.05) to all treatments it was 26.13%, with no significant differences among the first, second and third treatments. These Results were agreed upon by Zeweil *et al*. (2016); Nguyen *et al*. (2017). However, these Results were not consistent with those reached by Maddok *et al.* (2006); And Mapiye *et al.* (2013).

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تأثير اضافة زيت الكتان الى العليقة في التركيب الكيميائي وبعض الاحماض الدهنية للحوم اغنام العواسي المبردة والمجمدة

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قسم الانتاج الحيواني – كلية الزراعة– جامعة تكريت

المستخلص

اجريت هذه الدراسة في حقل الأغنام التابع لقسم الإنتاج الحيواني / كلية الزراعة – جامعة تكريت للفترة الواقعة من 2018/10/7 ولغاية 2018/12/15. استخدم في التجربة 16 حملاً عواسياً متوسط اوزانها 27 كغم وتراوحت أعمارها بين 6ـ 7 شهور، وزعت الحيوانات عشوائياً بعد اخذ اوزانها الابتدائية ثم قسمت الى اربع مجاميع، تضمنت كل مجموعة أربعة حملان ، واستخدم في هذه التجربة نظام التغذية والتربية الفردية (الاقفاص). تم ترقيم الحملان ووضعت في الاقفاص الفردية مساحة كل قفص(1× 1.5) م^2 في حظائر نصف مكشوفة. وكان الهدف من الدراسة بيان تأثير اضافة زيت بذور الكتان على التركيب الكيميائي وبعض الاحماض الدهنية في لحوم الاغنام العواسية المبردة والمجمدة .

أظهرت النتائج تفوق معاملة التجميد على التبريد في نسبة الرطوبة اذ بلغت (70.90 و 66.82)%على التوالي وتفوقت معاملة التبريد على التجميد في نسبة الدهن حيث بلغت (9.39 و 8.15)% على التوالي . أما بالنسبة لتأثير اضافة زيت بذور الكتان الى العلائق على نسب الاحماض الدهنية اثناء فترات الخزن فقد تفوقت معاملة التبريد على التجميد في نسبة حامض الاوليك 33.59 % ،بينما تفوقت معاملة التجميد على التبريد في نسبة حامضي اللينوليك والاراكيدونيك حيث سجلت (4.88 و 1.19)% على التوالي ، اما في المعاملات فقد تفوقت المعاملة الاولى والثانية على بقية المعاملات في نسبة حامض الاوليك ومعاملة السيطرة في نسبة حامض اللينوليك والمعاملة الرابعة لحامض اللينولنيك. اما التداخلات بين التبريد والمعاملات فقد تفوقت المعاملة الاولى والثانية في نسبة حامض الاوليك ومعاملة السيطرة في نسبة حامض اللينوليك على باقي المعاملات وفيما يخص التداخل بين التجميد والمعاملات فقد تفوقت المعاملة الرابعة في نسبة حامض الاوليك واللينولينيك ، ومعاملة السيطرة على باقي المعاملات في نسبة حامض اللينوليك فقد سجلت 5.22%

الكلمات المفتاحية: زيت الكتان ، الاغنام العواسية ، الاحماض الدهنية.