

## Effect of adding carrots as feed supplementation on reproductive performance in Awassi ewes

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### Abstract

The present study was designed to estimate the effect of carrots supplementation on reproductive performance in ewes. Thirty Awassi ewes. Ewes were randomly divided into three equal groups, distributed as 10 ewes for each group. First group consider as control, second group feed 400 g carrot/animal daily, third group feed 800 g carrot/animal daily. Each group were synchronized with intra vaginal sponges and injected with 400 IU of eCG at the time of sponge withdrawal. Estrus ewes were conceived naturally with rams and pregnant ewes were followed until parturition. The results of current study demonstrated that G3 had high estrus response and fertility rate 90% compared with G2 and control 80 and 70% respectively. Fecundity rate increased significant in G3 200% compared to G2 and 125 and 100% respectively. Ewes in G3 showed the highest multiple lambing rate 66.67% compared with G2 25% and control 0%. Blood progesterone concentration was high increasing at the 18<sup>th</sup> day of estrus in the ewes for G3 and G2 compared with control, also, estrogen level at the day of estrus showed high increasing in G3 compared with G2 and control group. We concluded that carrots fed as a supplementation have essential effect on enhancement of reproductive performance in ewes.

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### Introduction

Sheep are usually seasonal polyestrous animals and usually give birth once a year and have a long postnatal anestrous period, therefore, the increase of attempt must be taken to improve the reproductive efficiency of these animals using simple and cost-effective options (1). Nutrition has an essential role in maintaining reproductive activities in animals (2). Zarazaga *et al.* (3) revealed that the postpartum ovarian rebound in farm animals is affected by nutrition statement. Schillo (4) reported decreased number of ewes showing estrus when the dietary energy is restricted because decreased luteinizing hormone (LH) released from pituitary gland. The productivity of sheep can be increased through the ability to control the fetus's survival at the early pregnancy period, as some research has

shown that fetal death, especially in the first period of pregnancy, can be reduced through good nutrition, especially vitamins (5). Fresh carrot contains many essential nutrients (protein, dietary fiber, sugar, fat and ash) in addition to its considers good source of vitamin B6, vitamin C, beta-carotene, vitamin K and E (6).  $\beta$ -carotene content in orange carrots may reach to about 200-1000 mg/kg (7). Many researchers revealed clear enhancement of reproductive performance in cattle fed with fresh carrots in the diet like decrease in the number of inseminations necessary for successful fertilization, an increase in the calving rate and decrease in the calving interval (6). Therefore the current study was designed to estimate effectiveness carrots as feed supplementation on the reproductive performance in ewes.

## Materials and methods

The current study was conducted in period from October 2018 to April 2019. 30 Awassi ewes were used, aged between 3-4 years with an average weight of  $35 \pm 0.45$  kg, all ewes were housed in semi open barns in animal's house of College of Veterinary Medicine, Tikrit University and fed freely on pasture with 500 gram of concentrated feed once daily. The study ewes were divided into three groups randomly, 10 ewes for each group. Group one (G1) left without carrot added and considered as control group. Group two (G2) feed 400 g carrot/animal daily. Group three (G3) feed 800 g carrot/animal daily.

Estrus synchronization were used for each group by intra vaginal sponges impregnate at 30 mg flugestone acetate (Intervet, Chronogest®, Holland) for 14 days with injection eCG 400 IU (Intervet, Folligon®, Holland) for each ewe at the time of sponge's withdrawal (8).

All ewes were conceived naturally with rams (one ram for each 5 ewes) introduced at the day of sponge withdrawal. Pregnancy diagnosis conducted by measuring progesterone concentration at the 18<sup>th</sup> day after mating and the ewes that showed more than 2 ng/ml or more progesterone considered pregnant. Pregnant ewes were followed until parturition.

### Blood sample collection and hormones measurement

Five ml of blood was gather via the jugular veins for each ewe at the day of estrus and after 18 days of estrus, for measurement of progesterone and estrogen levels.

Blood serum were collected after left the blood sample for about 15 minutes then centrifuged 3000 cycle/minutes for 10minutes and stored at -20°C till analysis (9). Estrogen and progesterone levels were analyzed by the method of Enzyme Linked Immunosorbent Assay (ELISA) by special diagnostic trade kits (Medix Biotechs Inc., CA) (10).

The samples were analyzed in the Clinical Pathology Lab/ College of Veterinary Medicine/ Tikrit University. Reproductive performance in included estrus response (number of female that viewing estrus to whole treated ewes), pregnancy percentage (number of pregnant females to the whole number of inseminated females), lambing percentage (number of female births to the whole number of inseminate females) (11), multiple birth percentage (number of multiple birth to whole number of females lambing), fecundity percentage (number of birth fetuses to the total number of females) (12).

### Statistics analysis

SAS version 10.0 were used for statistical analysis of the data and the average between percentages in this study were significant compared 0.05 and 0.01 probability by using Chi-square test.

## Results

As shown in table 1 the results of current study demonstrated that the group G3 had high estrus response rate 90% compared with the groups G2 and control 80 and 70% respectively. pregnancy and lambing rate didn't show any significant differences among deferent groups. The Fertility rate in the current study (Table 1) reached 90% in the group fed with 800 mg versus with 80 and 70% in the groups of ewes fed with 400 mg and control respectively. Fecundity rate revealed high significant increases in the group G3 200% compared with the groups of G2 and control 125 and 100% respectively. The results of the current study revealed that ewes which were fed daily with 800 mg of carrots showed the highest multiple lambing rate 66.67% compared with ewes fed daily with 400 mg 25% while the control group didn't show any multiple birth.

Table 1: Carrots effect on the reproductive performance

Parameter	Control	G1	G2	$\chi^2$
Estrous response	70	80	90	**7.250
pregnancy rate	100	100	100	N.S
lambing rate	100	100	100	N.S
fecundity rate	100	125	200	**20.064
fertility rate	70	80	90	**7.250
multiple lambing	0	25	66.6	**9.552

\*\* significant at  $P \leq 0.01$ .

### Progesterone concentration

The results of present study showed significant increasing ( $P \leq 0.01$ ) in blood progesterone concentration at the 18<sup>th</sup> day of estrus in the ewes fed with carrots  $8.46 \pm 0.32$  pg./ml and  $8.54 \pm 0.26$  pg./ml for groups G3 and G2 respectively compared with control group  $7.95 \pm 0.12$  pg/ml as shown in figure 1. Estrogen concentration at the day of estrus in the current study showed high increasing in the ewes which were fed daily with 800 mg of carrots  $54.44 \pm 3$  ng/ml compared with ewes fed 400 mg  $41.61 \pm 0.6$  ng/ml and control group  $29.29 \pm 1.85$  ng/ml (Figure 2).

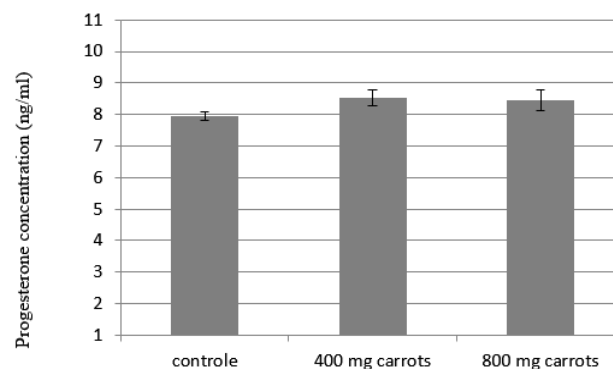


Figure 1: effect of carrots supplementation on progesterone concentration in ewes.

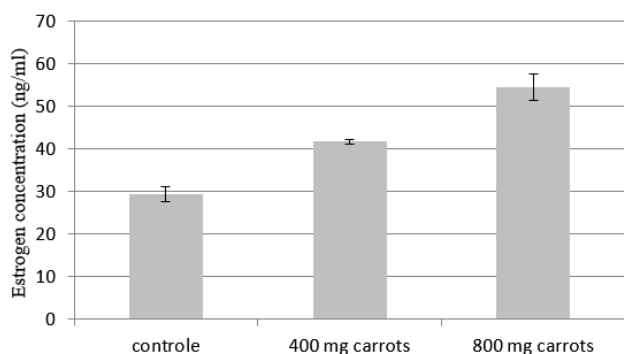


Figure 2: Effect of carrots supplementation on estrogen concentration in ewes.

## Discussion

The positive effect of carrots on increasing estrus response rate in this study may come from the fact that carrots are one of the richest sources of carotene historically used in cattle feed (13), its contain 200-1000 mg/kg of  $\beta$ -carotene ( $\beta$ C) (7). This result was agreed with many studies that recorded positive effect of  $\beta$ -carotene on the estrus response and improved ovulation rate in cattle and goats (14), also agreed with Salem *et al.* (15) who concluded from their study that the injection of  $\beta$ -carotene may enhance the estrous cyclicity in Frafra ewes. Low  $\beta$ C concentrations in blood serum have been shown to affect the reproductive performance of animals due to delayed ovulation and low estrus in intensity (16). Hemken and Bremel (17) reported that  $\beta$ C deficiency correlated with weak or silent estrus. Lopez-Flores *et al.* (18) observed enhancement of ovarian function combined with increases in antral follicle population and ovulation rate in does supplemented with  $\beta$ -carotene, and these ovarian activity was conducted with changes in the LH-release pattern. Carrot didn't show significant effect on pregnancy and lambing rate among deferent groups in the present study. Same results were reported by Wang *et al.* (19) when they used  $\beta$ C supplementation in cattle, and with Gore (5); Gore and Lehloenya (20) in goats. Conversely the result was disagreeing with Hashem *et al.* (21) who found highest lambing percentage in ewes that feed orally with vitamin A compared with control, also disagree with Trojancanec *et al.* (22) who decided that the vitamin A and  $\beta$ C supplementation in cows had positive effect on the pregnancy rate. These differences may due to the difference in animal species and the dose used in these studies. The present study showed the effectiveness carrot as supplementation in increasing fertility rate, these result may come from the effect of vitamin A and B-carotene which is present in high concentrations in carrots (23). AY *et al.* (24) concluded that fertility rate can be improved when serum  $\beta$ C concentrations remain high after  $\beta$ C injections and when the  $\beta$ C concentration are low in blood resulting in decreased

reproductive performance (25). Same results were recorded by Gore and Lehloenya (20) who found positively influences for  $\beta$ C on fertility in goats and with De Ondarza *et al.* (14) who reported improved fertility rate following  $\beta$ -carotene supplementation in cows. Akar and Gazioglu (26) reported relationship between low fertility and the deficiency of vitamin A and  $\beta$ carotene in cows suffered from repeat breeder. These results may come from the effect of beta carotene for supporting an increases of FSH which lead to increase follicular growth process and increases LH-release pattern which lead to increase ovulation rate (27).

High increasing fecundity rate in the group G3 in the present study may come from the carrots are consider one of the richest sources of carotene (13), Carrot root is one of the most important food sources rich in vitamins, carotenoids and fiber, as it contains a high percentage of antioxidants and minerals (28). Lopez-Flores *et al.* (18) demonstrate that  $\beta$ -carotene supplementation improved follicular development, ovulation rate and progesterone production. Hashem *et al.* (21) found clear increasing of fecundity rate in ewes received vitamin A compared to control ewes, and concluded that this effectiveness may be linked to effect of vitamin A on increased embryo survival through improving progesterone production at early stage of gestation (21). Noakes *et al.* (16) approved that the diets deficient in this micronutrient had been shown to affect the reproductive performance of animals due to decreased P4 output and increased embryonic mortality.

The present study demonstrates that the group of ewes feeding daily with 800 mg of carrots has high multiple lambing rate, these result may come from the effect of high concentration of B -carotene which has attributed to boost its antioxidant activity and thus enhancement the environment of uterus for implantation and development of embryo (24) which may have led to improve multiple birth rate. Coffey and Britt (29) demonstrated that high concentration of vitamin A could be necessary at the sensitive stage of fetal growth to promote survival of embryo and the intramuscular administration of B-carotene could be required to elevate vitamin A level and/or the uterine condition to induce positive effects on embryo survive. Noakes *et al.* (16) reported that feed deficient in B-carotene had been shown to affect the reproductive performance of animals due to increased embryonic mortality. Kumar *et al.* (30) concluded that the B-carotene influence the ovarian steroidogenesis, uterine environment and development of early embryo and fetal. These positive effects of beta carotene supplement could be related to increased survival of embryo by enhancing production of progesterone during early gestation (21), improving blastocyst development and supporting the maturation and function of the uterus, oviducts and placenta (31).

The increasing in progesterone concentration in the groups of animals feeding with carrots was agreed with Hashem *et al.* (21) who found significant increases of

progesterone at the luteal phase of estrus cycle after vitamin A supplemented orally in Rahmani ewes, also a significant increases of progesterone level after used B-carotene supplementation in goats (20,32). Also same result was reported by Trojancanec *et al.* (22) who found significantly higher plasma progesterone concentration during the luteal phase in cows fed B-carotene compared to un supplemented cows.

These results may due to the effect of B-carotene on the proses of steroidogenesis (5), its play important role in the synthesis of progesterone (33).  $\beta$ -carotene has also been implicated in the luteal cells function for the synthesis of progesterone in goats (32). Arikan and Rodway (33) reported that beta-carotene increases progesterone excretions by stimulate pituitary gland to secreted luteinizing hormone, while feed deficient in B carotene had been shown to affect the reproductive performance of animals due to decreased P4 synthesis (16). The result of increasing concentration of estrogen in the ewes fed daily with 800 mg of carrots was agreed with Hashem *et al.* (21) in Rahmani ewes, Arellano-Rodriguez *et al.* (32) in goats, Trojancanec *et al.* (22) in cows. These increasing of estrogen concentration could be occur because the enhanced efficiency of estrogen synthesis by the follicles or due to the increased number of the ovulatory follicles (21).

This results are agreeing with Haliloglu *et al.* (34) who revealed clear relationship between plasma estrogen concentrations and vitamin A throughout the follicular phase.  $\beta$ -carotene has a specific role in reproduction and is involved in the formation of estradiol-17 b in tertiary follicles (30). These explained was improved by Trojancanec *et al.* (22) who found significant increase of pre-ovulatory follicle size in cows supplemented with B-carotene compared to control group.

## Conclusion

Carrots fed as a supplementation have essential effect on enhancement of reproductive performance in ewes.

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## Conflict of interest

The author declares that there is no conflict of interest.

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## تأثير إضافة الجذر كإضافات علفية على الكفاءة التناسلية في النعاج العواسية

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### الخلاصة

صممت الدراسة الحالية لمعرفة تأثير إضافة الجذر كإضافات علفية على الكفاءة التناسلية في النعاج. استخدمت ثلاثين نعجة عواسية. وزعت النعاج عشوائياً إلى ثلاثة مجاميع متساوية بواقع عشرة نعاج لكل مجموعة. المجموعة الأولى اعتبرت مجموعة سيطرة، المجموعة الثانية أعطيت ٤٠٠ غرام جزر/حيوان يومياً، أما المجموعة الثالثة فقد أعطيت ٨٠٠ غرام جزر/حيوان يوماً. تم توحيد الشبق لكل المجاميع باستعمال الإسفنجات المهبلية وحقنت بجرعة ٤٠٠ وحدة دولية من محفز القند الخيلي عند وقت رفع الإسفنجات. لقحت النعاج الشبقة طبيعياً باستعمال الكباش وتم متابعة النعاج الحوامل لحين الولادة. أظهرت نتائج الدراسة الحالية أن المجموعة الثالثة أظهرت أعلى نسبة استجابة للشبق ونسبة خصوبة وصلت إلى ٩٠% مقارنة مع المجموعة الثانية ومجموعة السيطرة ٨٠ و ٧٠% على التوالي، كما ازدادت نسبة الإخصاب في المجموعة الثالثة بواقع ٢٠٠% مقارنة مع المجموعة الثانية والسيطرة ١٢٥ و ١٠٠% على التوالي، أظهرت نعاج المجموعة الثالثة أعلى نسبة ولادات متعددة بنسبة ٦٦,٦٧% مقارنة مع المجموعة الثانية ٢٥% ومجموعة السيطرة ٠,٠%، كما ارتفع مستوى البروجستيرون في الدم عند اليوم الثامن عشر من دورة الشبق في المجموعة الثالثة والثانية مقارنة مع السيطرة، كذلك أظهر مستوى الأستروجين في يوم الشبق ارتفاعاً كبيراً في المجموعة الثالثة مقارنة مع المجموعة الثانية ومجموعة السيطرة. نستنتج من هذه الدراسة أن تغذية الجذر كإضافات علفية له تأثيراً واضحاً على تحسين الكفاءة التناسلية في النعاج.

