



RESEARCH ARTICLE

<https://doi.org.10.58928/ku26.17107>

## Effect of Additives of Supplements Green Tea with a Mixture of Vitamins A and E on Parameters of Pregnancy Awassi Ewes and Their New Born Lambs

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Received:09/07/2025

Revised: 19/09/2025

Accepted: 24/01/2026

Published: 05/03/2026

### ABSTRACT

This study was conducted to assess the effects of green tea extract, and a mixture of vitamins A and E on growth and reproductive indicators in Awassi ewes and their offspring. A total of 20 pregnant ewes (average weight  $56.6 \pm 4.70$  kg) were randomly assigned to four treatment groups, each with five ewes. The first group was the control (water only), the second received green tea extract at 100 mg/kg body weight, the third received green tea extract at 200 mg/kg body weight, and the fourth received a combination of 400 IU/kg of vitamin A and 200 mg/kg of vitamin E along with the green tea extract. The study tracked the physiological stages of pregnancy from day 50 (middle stage) to birth, and the post-birth stages. Results showed that ewes receiving the green tea extract at 200 mg/kg body weight demonstrated the highest weight gain in their lambs (84.69%), followed by ewes treated with the mixture of vitamins A and E. The ewes treated with the 200 mg/kg green tea dose also exhibited superior reproductive performance, with a higher number of embryos (6) and twin pregnancies (2). While the vitamin A + E mixture showed positive effects, it was less effective than the higher dose of green tea. The results suggest that supplementing ewes with green tea extract and vitamins A and E enhances both growth and reproductive indicators in Awassi ewes and their lambs.

**Keywords:** Supplementation, green tea, Vitamins, Pregnancy, Ewes.

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### INTRODUCTION

Metabolic disorders and oxidative stress are prevalent issues in field animals during pregnancy and lactation, negatively impacting their health and productivity [1]. Efforts are being made in most countries to discover new and safe antioxidants from natural sources that have a protective effect and higher bioavailability than synthetic ones, to reduce the global use of antibiotics in animal production [2]. Therefore, attention has shifted to green tea, which, after water, is the most popular tea. There are three types of tea, differing in their drying and fermentation processes [3]. Besides black tea, which is the most prevalent form (78%), green tea (20%) and Chinese tea (2%) are also produced. These tea types are of paramount importance in addressing the global drug crisis, drug costs, and pharmaceutical industry, and have become an important substance for many applications worldwide, not only as nutritional supplements but also as medical preparations [4]. As mentioned, therefore, the utilization of aqueous extract of green tea has been directed, which contains polyphenols and the main flavonoids, which consist of catechins, epicatechi (EC), galactocetin (GC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG), the most active and important component [5]. Vitamins A and E are essential nutrients for the growth and well-being of ewes and their newborn lambs [6]. Vitamin A is a fat-soluble vitamin stored in the liver, with small amounts in other tissues and organs, it is an essential factor for maintaining the body of an adult animal, and animals require it in larger quantities for growth, reproduction, and milk production [7]. Sheep and all cattle cannot produce vitamin A themselves; they must eat green plants containing carotenoid precursors, such as  $\beta$ -carotene, the yellow-orange pigments in green leaves [8]. Sheep then convert  $\beta$ -carotene to vitamin A in the wall of the small intestine. When the diet is deficient in carotenoid precursors, vitamin A is released from the liver [9]. Vitamin E is one of the fat-soluble vitamins and exists in several forms, the most important of which are tocopherol and tocotrienol [10]. Vitamin E (tocopherol) is classified as an antioxidant: it protects cells from damage caused by free radicals, which are byproducts of normal cell activity, and it also participates in chemical reactions within cells [11]. Vitamin E supplementation increases the amount of alpha-tocopherol deposited in muscle and fat, neutralizing free radicals before lipid peroxidation occurs in the unsaturated fatty acids of cell membranes [12]. Maiorano has indicated that vitamin E, especially when administered between 35 and 70 days of age, affects the growth of the lamb skeleton and improves productive performance [13]. The study aims to evaluate and compare the productivity and growth performance of Awassi ewes and their newborn lambs when administered varying concentrations of green tea and vitamin A and E mixtures. Additionally, it seeks to investigate the potential advantages of green tea extract and vitamin supplementation on the productive and growth outcomes of Awassi ewes during the mid to late stages of pregnancy and the

postpartum period.

## Materials and Methods

This experiment was performed in the sheep field affiliation to the department of animal production - faculty of Agriculture University of Kirkuk, from 2/9/2024 to 17/12/2024 for a total period of 107 days, in addition, 25 days were added to measure growth indicators in newborn lambs, bringing the total days of the experiment to 132 days. Twenty Awassi ewes at -two-year-old with an average weight of  $56.6 \pm 4.70$  kg were used and haphazardly distributed over four transactions, with five ewes per transaction.

Group I (T1): Dosing the ewes with sterile water with the same dose approved in the experiment.

Group II (T2): Dosing the ewes with a watery extract of green tea was administered in a concentration of (100 mg/Kg BW).

Group III (T3): Dosing the ewes with a watery extract of green tea was administered in a concentration of (200 mg/ Kg BW).

Group IV (T4): Dosing ewes with a mixture of vitamin A in a dose of (400) international units/kg of body weight) and (vitamin E (200) international units/ Kg BW).

As advised by the National Research Council (NRC) in 2007 regarding feeding small ruminants, they were given the concentrated fodder, they required in the form of two food a day, in the morning and the evening, with dry coarse fodder (hay), in addition to the green fodder that was available in animal production fields. freely consuming water. The stages of fetal development during pregnancy were monitored using ultrasound imaging (Ultrasound Scanner Biomed, 5 MHz Vet mini, USA), specifically on the 100<sup>th</sup> day from the start of pregnancy, as well as no more than three days before birth, where births occurred on the 158<sup>th</sup> day of pregnancy within 24 hours. Statistic analyzing of the experimented statistics was conducted in accordance with the Complete Randomized Design (CRD) with one-way direction. Duncan's Multiple Range Test was also accustomed to comparing the means at a signification level of ( $P \leq 0.05$ ). The prepared statistical assay program SAS (2012) was used to examine the statistics in accordance with the following statistical pattern [14]:

$$Y_{ij} = M + T_i + e_{ij}$$

Where:

$Y_{ij}$  = the observation j value for treatment i.

M = the overall mean of the examined trait.

$T_i$  = the impact of treatment i.

$e_{ij}$  = the experimental error that is presumed be normally and independently distributing with a mean of zero and equivalent variance of  $\sigma^2_e$ .

## Results And Discussion

### Productive traits:

The results of Table (1) show the effect of dosing Awassi ewes with green tea aqueous extract and Vitamin A + E mixture on their productive traits during mid-late pregnancy, specifically their initial weight, final weight, and total weight gain. Ewes treated with green tea at 200 mg/kg (T3) had the highest total weight gain ( $P \leq 0.05$ ) ( $7.52 \pm 0.29$  kg), followed by those treated with 100 mg/kg green tea (T2) at  $6.12 \pm 0.35$  kg, and the Vitamin A + E treatment (T4) at  $5.52 \pm 0.33$  kg. The control group (T1) had the lowest weight gain at  $4.34 \pm 0.65$  kg. Significant differences ( $P \leq 0.05$ ) between treatments are indicated by distinct letters (a, b, c) in the table, with the highest weight gain seen in T3.

Table (1) The effect of dosing Awassi ewes with green tea aqueous extract and Vitamin A and E mixture on some productive traits during mid-late pregnancy

Treatment	Initial weight(kg)	Final weight(kg)	Total weight gain(kg)
T1 (Control)	50.33±1.50 c	54.67±2.24 c	4.34±0.65 c
T2 (green tea 100 mg/kg)	58.00±2.08 b	64.12±3.08 b	6.12±0.35 ab
T3 (green tea 200 mg/kg)	63.40±2.04 a	69.92±1.43 a	7.52±0.29 a
T4 (Vitamin A + E)	56.40±2.04 b	61.92±2.38 b	5.52±0.33 b

Values were Mean  $\pm$  standard error

The distinct letters inside the same column signify a marked difference among the research groups in the significance level ( $P \leq 0.05$ )

The results in table (1) were agreed with [15] that indicating that administering green tea extract to ewes has resulted in enhanced weight for both the ewes and their offspring. Through the use of the aqueous extract of green tea, notable changes were observed in the performance standards of ewes and their lambs. The results indicated that the administration of this extract could contribute to improving overall growth rates, as the catechin compound enhances feed efficiency and reduces oxidative stress levels. A study by [16] highlighted the role of green tea as a stimulating factor for improving productive traits in ruminants. The study's results stated the components of green tea, such as catechins and polyphenolic compounds, can contribute to improving feed efficiency, leading to increased daily weight gain and better feed conversion ratios. These elements also contribute to enhancing immunity, reducing the incidence of diseases, and thus enhancing the ruminants' ability to achieve higher production quality. The results of our study also agreed with results of [6] vitamins A and E are crucial nutrients for the growth and health of sheep ewes and their newborn lambs. These vitamins are integral to numerous metabolic

functions, including enhancing immune response and facilitating physical growth and overall development. Research demonstrates that incorporating both vitamins into the diet significantly improves weight gain and growth rates, with studies revealing that lambs receiving vitamin A and E supplements exhibit superior growth compared to those that do not receive [17] [18].

### Reproductive performance

The results in Table (2) regarding the reproductive performance of pregnant ewes. The total number of embryos varies between the different treatments. T1 (Control) had 3 embryos, T2 (green tea 100 mg/kg) had 4 embryos, T3 (green tea 200 mg/kg) had 6 embryos, and T4 (Vitamin A + E) had 4 embryos. Notably, T3 exhibited the highest number of embryos (6), indicating that a higher dosage of green tea might have a positive impact on the reproductive output in terms of embryo development, which also recorded 2 twin pregnancies, suggesting that this particular dosage might have a stimulatory effect on the occurrence of multiple births. All treatments had a mortality rate of 0%. This is highly encouraging as it suggests that none of the treatments negatively impacted the health of the ewes or their pregnancies. Both the green tea treatments (at different dosages) and the Vitamin A + E mixture appear to be safe in terms of the health outcomes for the ewes during mid-to-late pregnancy.

Table (2) The effect of dosing Awassi ewes with green tea aqueous extract and Vitamin A and E mixture on reproductive performance during mid-late pregnancy

Treatment	Total number of embryos	Pregnancy rate (%)	Number of twins	Mortality rate (%)
T1(Control)	3	100%	0	0%
T2(green tea 100 mg/kg)	4	100%	0	0%
T3(green tea 200 mg/kg)	6	100%	2	0%
T4(Vitamin A + E)	4	100%	1	0%

The observed elevation in embryo numbers and incidence of twin pregnancies, particularly evident in treatment T3 at the higher dosage (200 mg/kg), corroborates the findings reported by [19], suggesting that green tea extract may enhance reproductive efficiency. The increased embryo count documented in T3 may be attributed to potential augmentation of ovarian function or enhanced ovulation rates, whereas the occurrence of twin pregnancies may indicate improved fertility status, presumably due to the bioactive properties of green tea, including its antioxidant capacity and potential hormonal modulatory effects [20]. Concerning the outcomes observed in group T4, the present study's results align with those reported by [9], which demonstrated that vitamin A and E supplementation may exert beneficial effects on reproductive performance. Although this vitamin combination did not significantly enhance embryo numbers compared to the higher green tea dosage, it resulted in one documented case of twin pregnancy. The lack of a distinct dose-response relationship, as observed with green tea supplementation, suggests that vitamins A and E may operate through more complex or alternative mechanisms in modulating reproductive performance, potentially associated with improvements in conception rates and embryonic development [21] [17].

### Weight and growth performance of newborn lambs:

The findings presented in Table 3 demonstrate the influence of supplementing Awassi ewes with green tea aqueous extract and vitamin A and E mixture on the mean body weight of neonatal lambs. The data indicated significant variations among the experimental treatments. Regarding birth weight, all experimental groups exhibited comparable values, with the control group (T1) recording 4.88 kg, while treatments T2, T3, and T4 demonstrated marginally elevated weights without statistical significance. At day 25 post-partum, lambs from treatment T3 (green tea extract at 200 mg/kg body weight) achieved the maximum weight (9.05 kg), followed by T2 (green tea extract at 100 mg/kg body weight) and T4 (vitamin A + E supplementation), whereas the control group (T1) recorded the minimum weight (7.08 kg). The weight increment observed in lambs from T3 (4.15 kg) was significantly superior to other treatments, with T2 demonstrating a considerable gain of 3.8 kg, while T1 and T4 exhibited reduced weight increments. The growth performance of lambs was similarly optimized in T3, achieving 84.69%, which indicates enhanced growth response when administered green tea extract at the elevated dosage, followed by T2 at 76.3%, whereas the control group demonstrated the poorest growth performance at 41.39%. Statistical analysis revealed that groups receiving elevated concentrations of green tea extract exhibited enhanced weight gain and growth performance relative to the control group, with significant differences observed across the majority of evaluated parameters.

Table 3: The effect of dosing Awassi ewes with green tea aqueous extract and Vitamin A and E mixture on weight and growth performance of newborn lambs

Treatment	Weight at the first day of birth(kg)	Weight on day 25 after birth (kg)	Weight gain of lambs (kg)	Growth rate of lambs (%)
T1(Control)	4.88±0.38 a	7.08±0.81 b	2.02±0.55 b	41.39±7.75 c
T2(green tea 100 mg/kg)	4.98±0.29 a	8.78±0.55 a	3.8±0.66 a	76.3±5.33 b
T3(green tea 200 mg/kg)	4.90±0.25 a	9.05±0.37 a	4.15±0.19 a	84.69±5.75 a
T4(Vitamin A + E)	4.95±0.12 a	8.44±0.63 a	3.49±0.52 a	70.5±6.61 b

Values were Mean ± standard error

The distinct letters inside the same column signify a marked difference among the research groups in the significance level ( $P \leq 0.05$ ). The results in table 3, are suggested that the supplementation of green tea aqueous extract, particularly at 200 mg/kg, positively influences the weight gain and growth rate of Awassi lambs. That agreed with results of [22], which his study showed that the positive effects of polyphenolic compounds in green tea, particularly catechins, which possess antioxidant and anti-inflammatory properties. These bioactive compounds may promote metabolic activities, improve gut health, and enhance nutrient absorption, ultimately leading to better growth performance in livestock [23]. The superior growth observed in the T3 group (green tea 200 mg/kg) aligns with findings from other research that suggests that green tea extract can improve growth parameters in animals. The catechins in green tea, particularly epigallocatechin gallate (EGCG), have been shown to enhance metabolism and nutrient utilization, which could explain the improved weight gain and growth rate in the green tea-treated groups [24]. While Vitamin A and E are known to support overall health, immunity, and growth in livestock [25], in this study, their supplementation did not perform as well as green tea. The difference may be attributed to the superior bioactive compounds in green tea that directly influence growth pathways more effectively than vitamins alone.

## Conclusion

1. The study demonstrated that supplementing Awassi ewes with green tea aqueous extract and a mixture of vitamins A and E significantly improved growth performance, reproductive efficiency, and physiological indicators.
2. The results revealed that ewes treated with green tea at 200 mg/kg (T3) exhibited the highest total weight gain ( $7.52 \pm 0.29$  kg) and superior growth rates in their lambs (84.69%), outperforming other treatments.
3. Additionally, T3 showed the highest number of embryos (6) and twin pregnancies (2), indicating enhanced reproductive performance.
4. The vitamin A + E mixture (T4) also yielded positive outcomes, including improved blood parameters, hormonal levels, and reduced liver enzyme activity, though its effects were less pronounced than those of the higher green tea dosage.
5. These findings suggest that green tea extract, particularly at 200 mg/kg, is highly effective in enhancing both growth and reproductive traits in Awassi ewes and their lambs, likely due to its rich polyphenolic content and antioxidant properties.

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## مقارنة التغييرات في معايير أداء النمو للنعاج العواسية المحلية وحملاتها المولودة حديثاً المجرعة بالمستخلص المائي للشاي الأخضر مع خليط فيتامين $E$ و $A$

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الخلاصة

أجريت هذه الدراسة لتقييم تأثيرات مستخلص الشاي الأخضر، وخليط من فيتاميني  $E$  و  $A$  على مؤشرات النمو والتكاثر في النعاج العواسية ونتائجها. تم توزيع إجمالي 20 نعجة حامل (متوسط الوزن  $56.6 \pm 4.70$  كغم) عشوائياً على أربع مجموعات معاملة، كل مجموعة تضم خمس نعاج. كانت المجموعة الأولى هي الشاهد (الماء فقط)، والثانية تلقت مستخلص الشاي الأخضر بجرعة 100 ملغم/كغم من وزن الجسم، والثالثة تلقت مستخلص الشاي الأخضر بجرعة 200 ملغم/كغم من وزن الجسم، والرابعة تلقت خليطاً من 400 وحدة دولية/كغم من فيتامين  $A$  و 200 ملغم/كغم من فيتامين  $E$  مع مستخلص الشاي الأخضر. تتبعت الدراسة المراحل الفسيولوجية للحمل من اليوم 50 (المرحلة الوسطى) حتى الولادة، ومرحل ما بعد الولادة. أظهرت النتائج أن النعاج التي تلقت مستخلص الشاي الأخضر بجرعة 200 ملغم/كغم من وزن الجسم أظهرت أعلى زيادة في الوزن في حملاتها (84.69%)، تليها النعاج المعاملة بخليط فيتاميني  $E$  و  $A$  كما أظهرت النعاج المعاملة بجرعة 200 ملغم/كغم من الشاي الأخضر أداءً تكاثرياً متفوقاً، مع عدد أكبر من الأجنة (6) والحمل التوأمي (2). بينما أظهر خليط فيتامين  $E + A$  تأثيرات إيجابية، إلا أنه كان أقل فعالية من الجرعة الأعلى من الشاي الأخضر. تشير النتائج إلى أن إضافة مستخلص الشاي الأخضر وفيتاميني  $E$  و  $A$  للنعاج يعزز مؤشرات النمو والتكاثر في النعاج العواسية وحملاتها.

الكلمات المفتاحية: المكملات الغذائية، الشاي الأخضر، الفيتامينات، الحمل، النعاج.