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Productive Impact of Local Awassi Ewes Dosed with and Aqueous Solution of Spirulina Algae with or without Folic Acid in Medium and Late Pregnancy Stages and Indicators of Growth in Newborns.

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ABSTRACT

This experimental study occurred in Iraq, Kirkuk, University of Kirkuk, College of Agriculture, Department of Animal Production, from the 1st of September to the 25th of December 2023. The study targeted the impact of different proportions of spirulina algae and folic acid on the productive traits of Awassi ewes during medium and late pregnancy stages, in addition to the impact of these proportions on the growth indicators of the newborn lambs during the first three weeks after birth. 16 pregnant ewes at 18-22 months old and 56.6 kg average weight were used. The animals were divided randomly into four groups, including four pregnant ewes in the medium pregnancy stage (second trimester). The 1st treatment was the control group which was not dosed at all, the 2nd treatment was orally dosed with 0.625 mg spirulina solution for each ewe, the 3rd treatment was orally dosed with 65 mg folic acid solution for each ewe, and the 4th treatment was orally dosed with 0.625 mg spirulina and 65 mg folic acid solution for each ewe. By using the mentioned proportions, Spirulina group (T2) showed a significant enhancement ($P \leq 0.05$) in ewe's body weight gain, feed intake and growth rate, while the mixed treatment of folic acid and spirulina (T4) showed significant enhancement in feed intake and feed conversion ratio (FCR). On the other hand, dosing the ewes with these proportions did not show any appreciable differences in the traits of embryo number, twin number, pregnancy percentage, mortality percentage and newborns' growth indicators..

***Keywords*:** Ewes, Spirulina, Folic acid, pregnancy, Growth.

INTRODUCTION

Sheep are one of the most important agricultural animals in Iraq, and one of the main sources of meat production, which is increasingly in demand by the population with increasing nutritional awareness of the consumer, [1]. Therefor it is essential to focus on the growth of this industry, [2]. and the population demand for sheep meat is increasing due to consumer nutritional knowledge, [3]. And one of the challenges facing farmers is to ensure efficient integration of natural sources into animal feeds, [4]. The protein amount that is in spirulina algae is found to be more valuable in nutrition and productivity compared to a protein produced from high-protein crops and preserves the amount of freshwater used in traditional crops cultivation [5]. Spirulina contains high amounts of fatty acids, amino acids, antioxidants, and carotenoids, [6]. In addition to that, spirulina has antimicrobial antiviral, and anti-inflammatory properties besides the immune function, [7]. Furthermore, it does not harm the liver, kidneys, or the reproductive system, [8]. Spirulina is nowadays used in livestock systems for multiple purposes, [9]. Some reports have also found that SP increases sheep productivity, [10]. Spirulina algae could also serve as an antioxidant, immune stimulant, and growth promoter in fattening lambs' diets, [11].

These oxidative factors disrupt the delicate balance between the production of free radicals and the body's ability to remove or repair their destructive effects, resulting in harmful damage to various tissues in the body due to the oxidation of fat by free radicals, [12]. It has been determined that oxidative stress plays a significant role in etiology of neurodegenerative illnesses, [13]. Folic acid is vital nutrient for the health and productivity of ewes and an essential nutrient for many essential functions in the body of sheep, it can also help to improve gestation health, increase fertility, increase milk production, and improve wool quality and density. Studies have indicated that ewes always need a sufficient amount of folic acid in their diet to maintain their productivity and health, it can reduce the abortion rate and increases the fertilization rate as well, Folic acid helps to improve milk quality and production, over and above that its importance in the formation of RBC in the bone marrow and the transportation of oxygen throughout the body, [14,15]. Apart from its potential to aid in the prevention of neural tube defects (NTDs) birth defects affecting the fetus's brain and spinal cord [15]. Folic acid supplementation in ruminants has been observed to play a role in increasing the speed of cell division and growth, [16].

Materials and methods

In this experiment, 16 pregnant ewes at the age of 18-22 months, with a 56.6 kg weight average and the experiment lasted for 16 weeks from the 1st of September to 25th of December 2023. The animals were split into four groups all of them were fed the same type of concentrated feed and hay twice a day (morning and evening) in addition to green feed of animal production fields with access to mineral salt molds during the research period. The 1st treatment (T1) was the control group, the 2nd treatment (T2) was orally dosed with (0.625) mg spirulina solution each ewe, the 3rd treatment (T3) was orally dosed with (65) mg folic acid solution each ewe, and the 4th treatment (T4) was orally dosed with (0.625) mg spirulina and (65) mg folic acid solution each ewe. In contrast, the spirulina solution was made by mixing 20 mg of spirulina powder with 400 ml deionized water and folic acid solution was made by mixing 80 mg of folic acid with 400 ml deionized water and orally dosed with 50 ml sized syringe each ewe. The experiment period was divided into three stages: the medium period (second trimester of pregnancy), late pregnancy stage (third trimester) and the first three weeks after birth (newborns productivity). SAS (2001) program was used to analyze the experiment data, (CRD) complete randomization design was used for statistical analysis and Duncan's polynomial test [17] to determine the significance of variations based on the mathematical model presented below:

$Yij = \mu + Si + eij$

Yij: viewing value of attributed study.

μ: the overall average.

Si: impact of folic acid and spirulina on the characters under study.

Eij: randomly distributed experimental error.

Results

Ewes weight: Table (1) results demonstrate that no appreciable differences existed in beginning body weight and final body weight between all four treatments. As for the body weight gain, we observe that Spirulina is significantly ($p \leq 0.05$) superior to the alternative treatments and the other treatments did not show significant differences. In the feed consumption trait, we observe the superiority of the second treatment (dosed with spirulina algae solution) and the fourth treatment (dosed with spirulina algae and folic acid) over the other treatments and the differences between the first and third treatments were not statistically significant. While in the characteristic of the food conversion factor, we observe significant differences between the treatments, with the fourth treatment outperforming the other treatments and no significant differences between the first and third treatments.

Newborns weight: The results of Table number (2) indicates that there were no notable variations between all of the treatments in weights at day 0 and day 21, as well as no significant differences between treatments in lamb weight gain and lamb growth rate, meaning that the suckling lamb weights were not affected by the proportions of spirulina and folic acid given to the ewes for this time period. Embryo and twin numbers: The outcome of the table (3) indicate that there were not any notable variations ($P \leq 0.05$) between the different treatments in the traits of number of embryos and number of twins, which means that there was no special effect of spirulina and folic acid whether mixed or separate on the traits of number of embryos and number of twins. pregnancy and mortality rate: The results of Table (4) indicate a 100% pregnancy rate for all treatments with no mortality percentage in all treatments.

Table 1: Effect of adding different levels of spirulina and folic acid on the ewe's body weight characteristics (Mean ± S.E).

Treatments Traits	T1 control	T2 Spirulina	T3 Folic acid	T4 Spirulina + folic acid
Beginning body weight (kg)	57.50±1.85 a	55.75±3.28 a	55.25±2.21 a	58.25±1.38 a
End Body weight (kg)	63.00±2.12 a	62.50±3.07 a	60.00±2.35 a	63.75±1.38 a
Body weight gain (kg)	5.50±0.50 b	6.75±0.25 a	4.75±0.25 b	5.50±0.29 b
Feed Intake (kg)	9.28±0.20 b	15.44±0.74 a	9.10±0.57 b	16.48±1.90 a
FCR	1.73±0.16 b	2.30±0.13 ab	1.95±0.22 b	3.02±0.40 a
Growth rate	9.56±0.75 b	12.30±1.06 a	8.61±0.44 b	9.46±0.58 b

Different letters in the same column shows significant difference between different treatments at significance level ($P \leq 0.05$), values were Mean ± standard error

Table 2: Effect of adding different levels of spirulina and folic acid on the Birth weight (kg) at different periods (Mean ± S.E).

Treatments Traits	T1 control	T2 spirulina	T3 Folic acid	T4 Spirulina + folic acid
Initial weight	4.90±0.29 a	4.78±0.39 a	4.80±0.27 a	4.93±0.13 a
Final weight	9.15±0.83 a	9.35±0.57 a	8.98±0.39 a	10.13±0.69 a
Weight increasing	4.25±0.57 a	4.58±0.68 a	4.18±0.21 a	5.20±0.58 a
Growth rate	85.89±7.77 a	99.32±18.44 a	87.59±5.78 a	105.02±9.63 a

Values were Mean ± standard error.

Table 3: Effect of adding different levels of spirulina and folic acid on the Embryo, and twins' number (Mean ± S.E.).

Treatments Traits	T1 control	T2 spirulina	T3 Folic acid	T4 Spirulina + folic acid
Embryo Number	1.00±0.00 a	1.00±0.00 a	1.25±0.00 a	1.00±0.00 a
Twins Number	0.00±0.00 a	0.00±0.00 a	0.25±0.25 a	0.00±0.00 a

Values were Mean ± standard error.

Table 4: Effect of adding different levels of spirulina and folic acid on the percentage of pregnancy and mortality.

Treatments Traits	T1 control	T2 spirulina	T3 Folic acid	T4 Spirulina + folic acid
Pregnancy	100%	100%	100%	100%
Mortality	0%	0%	0%	0%

Discussion

Spirulina's ability to improve the physiological state of the ewe's body is thought to be the reason for the appearance of substantial variations in growth performance across treatments, improving the metabolism of fats and sugars and regulating the level of reproductive hormones such as progesterone, which has a role in stimulating appetite and increasing feed consumption, thus increasing body weight in the presence of estrogen during pregnancy, [18]. In addition to the high nutritional value of spirulina powder, it contains a high percentage of protein, minerals, vitamins, unsaturated fatty acids, and essential amino acids that are easily digestible and thus promote growth as a result of fulfilling the body's needs for nutrients important for growth, [19]. Spirulina algae can also promote growth by enhancing the synthesis and activation of intestinal digestive enzymes, thus maximizing the use of nutrients, [20]. As for folic acid, DNA synthesis, cell growth, division, and development are all significantly impacted by it and these processes are essential for the growth and development of tissues, thus helping in the overall growth process of the body [21]. The mortality rate is related to the high number of proteins and energy available in the nutrition of pregnant ewes, especially in the last eight weeks. The higher the weight of the fetuses or the weight of the born lambs, the lower the mortality rate, because low-weight fetuses or births have a higher mortality rate, [22].

Conclusion

The treatments that were dosed with an aqueous solution of spirulina algae alone and in combination with folic acid showed a significant improvement, according to the data provided.

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الأثر الإنتاجي للنعاج العواسية المحلية المُجرَعة بالمحلول المائي لطحلب السبيرولينا مع أو بدون حمض الفوليك في مراحل الحمل المتوسطة والمتأخرة ومؤشرات النمو في المواليد.

تريزا سركون عمانوئيل سفرى[1] سرمد عبدالرزاق عبود السعدي[1]

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الخلاصة

أجريت هذه الدراسة في العراق، كركوك، جامعة كركوك، كلية الزراعة، قسم الإنتاج الحيواني للفترة 2023/9/1 – 2023/12/25. هدفت الدراسة تأثير النسب المختلفة من طحالب السبيرولينا وحمض الفوليك على بعض الصفات الإنتاجية للنعاج العواسي خلال مراحل الحمل المتوسطة والمتأخرة بالإضافة الى تأثير هذه النسب على مؤشرات نمو المواليد. تم استخدام 16 نعجة حامل بعمر 18–22 شهر وبمتوسط وزن 56،5 كلغم. تم تقسيم الحيوانات عشوائيًا إلى أربع مجموعات، ضمت كل مجموعة أربع نعاج حوامل. حيث كانت المعاملة الاولى هي مجموعة السيطرة، والمعاملة الثانية كانت بجرعة 0،625 مل من محلول السبيرولينا لكل نعجة، والمعاملة الثالثة كانت بجرعة 65 مل محلول حمض الفوليك لكل نعجة، والمعاملة الرابعة كانت بجرعة 0،625 مل محلول السبيرولينا و65 مل محلول حمض الفوليك لكل نعجة. باستخدام نسب التجريع المذكورة، أظهرت نتائج المجموعة الثانية (*T2*) تحسناً ملحوظاً (أ≥0،05) في صفات زيادة وزن جسم النعاج ومعدل تناول العلف ومعدل النمو، بينما أظهرت نتائج المعاملة الرابعة (*T4*) لحمض الفوليك والسبيرولينا تحسناً ملحوظاً في كمية العلف المتناول ونسبة التحويل الغذائي (*FCR*). من ناحية أخرى، لم تُظهر النسب المستخدمة في تجريع النعاج اية فروقات معنوية (أ≥0،05) ملحوظة في صفات عدد الأجنة وعدد التوائم ونسبة الحمل ونسبة الهلاكات ومؤشرات نمو المواليد.

الكلمات المفتاحية : نعاج، السبيرولينا، حمض الفوليك، الحمل، نمو.