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EFFECT OF DOSAGE OF FOLIC ACID AND COBALT ON LIVE BODY WEIGHT AND BODY DIMENSIONS OF AWASSI SHEEP

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Abstract

This experiment was carried out in the sheep breeding field (private sector) in Babylon province. Twenty of Awassi ewes and their lambs were using in two phases. These animals were homogeneous in live weight and age at the beginning of experiment. The first phase, the ewes was randomly distribution into four treatments, first treatment was (control treatment) and the second treatment, the ewes were daily given 5 mg of folic acid (vitamin B_9) and the third treatment of ewes was treated with (80 μ gm) of cobalt for twice per week and fourth treatment of ewes were given combination of vitamin B_9 and cobalt in the same concentrations mentioned above. The second phase of this study, the lambs were randomly distributed into four treatments, the first treatment (control treatment) and the second treatment, the lambs were given of 0.50 mg of folic acid with two times per week, the third treatment of lambs was dosage of 40 μ gm of cobalt for two times per week. The fourth treatment of lambs was given combination of vitamin B_9 and cobalt. The results of the statistical analysis showed that there were high significant differences ($P \geq 0.01$) in averages of final weight and amounts consumes of dry matter, protein, fat, metabolize energy between first treatment (control) to compared experimental treatments of ewes and lambs. Also showed high significant differences ($P \geq 0.01$) in measurements of various body dimensions of ewes through pregnancy, birth and weaning between folic acid, cobalt and mixture of them treatments when compared for control treatment. As for sucking lambs, the results showed high significant differences ($P \geq 0.01$) in average of initial weight at birth, final weight at weaning and all measurements of body dimensions of lambs at birth and weaning between experimental treatments that were containing folic acid, cobalt and the mixture of them than to control transaction. We conclude from results of this experiment a significant improvement in daily intake of nutrient compounds, which leads to significant positive on growth rates and most different body measurements of ewes and lambs when compared to control group during pregnancy, lactation and weaning which in favor of experimental treatments. The aim of this study is to determine the effect of folic acid and cobalt on growth, amount intake of nutrient compounds and changes in measurements of live body size for sheep and their growing lambs at different periods of their productive life.

Key words: Vitamin B_9, cobalt, pregnant ewes, developing lambs, body measurements.

Introduction

The Sheep are one of the most important sources of food and clothing for people in Iraq and many other countries. They were still to be essential source of meat and milk to meet to purpose of needs of the local market (Al-Jalili *et al.*, 1985, Al-Sayegh and Al-Kass, 2006). Also, provides about 50% of amount of meat consumption to meet demands of domestic consumption of red meat (FAO, 2004). The number of sheep in Iraq were 7,722,000 million (Arab Organization for Agricultural Development, 2008). However, they live on margins of agriculture and pastures, so their productivity and fertility was low. It must be to take care of, and the application of modern methods to increase their rate of production and improve their reproductive properties (Al-Ani *et al.*, 2014) by adding specific nutrients such as folic acid, it is necessary nutrients for growth, reproduction and synthesis of nucleic acids (RNA, DNA), as well as cobalt, was contributed in manufacture of vitamin B_{12} in rumen and have an additional role on regeneration and synthesis of red blood cells. In addition, it is a growth promoter and increases the production of milk and wool, and their decrease leads to nutritional deficiencies diseases (Al-Chalabi and Ezz Aldine 1982, Davis and Nicol, 1988). Folic acid is given to suckling lambs from 2 days until to 18 weeks of age (Dumoulin *et al.*, 1991) to improve their growth and to

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enhance immunity of the animal's body and it is resistance certain diseases (Mclaren and Frigg, 2001). As well as its role in supporting health, growth, reproduction, maintenance of pregnancy and construction of ovarian epithelial cells of pregnant animal (Al-Zuhairi, 2000), which led to improve reproductive performance and productive (Sirvastava and Sghni, 2000 and Al-Salivani, 2006). Which was stimulated to local farmers to follow good nutrition, health care, genetic improvement and provision of nutrient requirements in order to increase meat production (Saleh and Shams Aldin, 2000) which was reflected in improved national income of sheep farmers (Abu Alulla, 1994). Since so long time the sheep breeders began to assess the state of their physical and health animals in order to determine the appropriate conditions for better investment through assessment external appearance condition of the animal, From here we have found some external body measurements that reflect the state and nature of the body in sheep through the external form, which is related mainly to nutrition, breeding and health care. In practice, the study of body measurements is an accurate indicator of growth and reproductive efficiency of both sexes of sheep (Al-Zaidan 2005 and Hadi 2009). Body measurements are a basic criterion for strain and a good indicator of size and gender (Khan *et al.*, 2006, Al-Hilou *et al.*, 2009). As well as an indicator of the skeletal development and different body tissues in the animal's body. Thus, body measurements can be used to predict weight of the animal's body due to a high correlation coefficient between body weight and other body measurements (Atta and El-Khidir, 2004), especially when there are no scales to measure animal weights in farms and rural locations. The change in proportions of body parts with progress of age is due to differences in growth rates among different breeds of sheep with different production trends in growth and development of bone and muscle tissues and subcutaneous and digestive organs, and that the physical structure of sheep from the biological point of view is the result of the composition of the body. Its internal organs, and physical construction affects the animal's physical appearance, health, functioning and vital functions (Ibrahim, 1998). It was noted that there were changes in proportions parts of the body as the animal progressed in growth the head and legs are large compared to lambs body born. However, as the lambs grow, the animal's body becomes larger and deeper, and the proportions of the main parts filled with muscle such as the cotton area, thighs, shoulders and ribs are increased relative to the minor parts which was few muscle such as the neck, chest, flank and hands, (Jaid and Al-Hilou, 2008). Some studies have indicated (Al-Azzawi *et al.*, 1995, Al-Khuzai, 2000, and Almahdawi *et al.*, 2017) a significant positive correlation coefficient between live weight and different body dimensions of the animal because it is an importance of the synergistic interaction between folic acid and cobalt in stimulating of growth processes and development of animal body measurements during different periods of breeding, it is possible to take advantage of different body measurements to prediction the final weight at the end of the fattening period for sheep (Ravimurugan *et al.*, 2013). because of the importance of synergistic interaction between folic acid and cobalt to stimulate growth processes and the development of animal body measurements during different periods of breeding and fattening to study effects on production performance and body dimensions in order to benefit from the consumption of food compounds, which was reflected positively on growth and body size measurement during birth, pregnancy and weaning, and get healthy lambs, through proper nutrition and health care to prevent anemia and closer cooperation with local breeders in order to achieve self-sufficiency of animal products and improve their income. As well as to enrich our Iraqi libraries with modern scientific sources related to importance of folic acid and cobalt to make positive changes of building and tissue growth of the living body of Iraqi sheep.

Material and Methods

The experiment was carried out on twenty ewes with their suckling lambs in a private sector farm in AL-Fayadhia village in Babylon governorate. The ewes were homogeneous in age and initial weight at the beginning of the experiment which was 36.53 kg. Where the general appearance of ewes was thin body and scarring of mucous membranes and yellow in eyes, and injected with Ivermectin subcutaneous with 0.2 mg/kg of live weight to killed the internal and external parasites. The ewes were provided with rams during the preliminetery period and subsequently the ewes was underwent to pregnant test and to confirm pregnancy. This experiment included two phases, The first phase deals with randomly distribution of ewes to four treatments. The first treatment was called control there was no dosage with folic acid or cobalt while the second group was daily given with 5 mg of folic acid (B_9) and the third group was cobalt with 80µ gm with twice time per a week, and fourth group was mixed with B_9 and cobalt with the same concentrations above. The first phase of the experiment was carried out during pregnancy, birth and lactation until the lambs reached the age of weaning (3 months). The data collected was initial weight at the beginning of experiment and final weight, amount of daily intake of nutrient compounds (dry matter, crude protein, crude fat, crude

fiber and metabolize energy) and body measurements of all ewes according to Al-Hilou, *et al.,* (2009), body dimensions such as chest circumference by using measuring tape which around on chest region of the animal and abdomen circumference was measured by flipping measuring tape around the abdominal region, body height at the front and rear was measured by the same measuring tape vertically from the neck area towards to the ground or from the top of back area at the end of body towards to the ground. The body thickness at the front and rear was measured by using Kalipper, The tail circumference was measured by measuring tape and tail thickness by using Kalipper and body length was measured from the front of chest to the end of body animal by using measuring tape. The lambs were randomly distributed to four equal number per treatments. The first treatment of lambs was considered as control group. While the second treatment of lambs was dosage with folic acid at 0.5 mg for each lamb with twice per week and third treatment was given with cobalt by 40 micrograms per lamb with twice per a week and fourth treatment was combination with B_9 and Co with the same concentrations mentioned above.The lambs which were given folic acid and cobalt after six hours of birth and continued until the lambs reached the age of weaning. The data was collected of lambs includes the weight at birth, final weight at weaning, daily intake of nutrient compounds (dry matter and crude protein, crude fat, crude fiber, metabolize energy). Also, body parameters for all lambs as the same manner of ewes above, according to Al-Hilou *et al.*, (2009), Almahdawi *et al.*, 2017). During the study period, animal groups of ewes and their lambs were fed on concentrate diet which was consisted of 60% barley, 20% wheat bran, 10% alfalfat, 8% wheat straw, 1% salt and 1% limestone. The first meal was served at 8:00 am and the second meal at 4 pm throughout the days of the experiment. In addition, the animal groups went out for daily grazing at a rate of five hours per day. The statistical analysis of the data was performed by using Complete Randomized Design (CRD), according to Al-Rawi and Khalaf Allah (2000) and Al-Zubaidy and Al-Falahy (2016) in order to study the effect of the dosage of folic acid or cobalt and intervention between of them on ewes and their lambs in studied traits. The statistical analysis was carried out by implementing SAS program for (2012). The averages were compared by using the Duncan test (Duncan, 1955) to test the significance differences between the averages of the studied traits.

Results and Discussion

The results of this study included effect of dosage of folic acid and cobalt on the studied traits as follows:

Productive performance of sheep

The results of the statistical analysis of the studied traits was presented in table 1 indicate that there were no significant difference in initial weight of ewes at the beginning of the experiment. This indicates no found of individual differences between the animals groups and they were highly homogenous. The primary weight of ewes was 36.15, 36.55, 36.60 and 36.82 kg for four treatments respectively. The results appeared significant differences ($P \geq 0.05$) on final weight, amounts of consumption of dry matter, crude protein, crude fat, crude fiber and metabolize energy between the first treatment (control treatment) than for the second (folic acid), third (cobalt) and fourth (B_9+Co) treatments of ewes groups at end of the gestation period. The final weight was 47.24, 48.21, 49.23, 50.55 kg, dry matter intake 1.522, 1.605, 1.696, 1.715 kg/day, protein intake 185, 195, 206, 208 gm/kg, fat intake 44, 46, 49, 50 gm/day, fiber intake 188, 198, 210, 212 gm/day and metabolize energy 39.12, 41.25, 43.59 and 44.07 K_{cal}/day for four transactions respectively.

As for the developing lambs, the results appeared in table 2) that there were high significant differences ($P \geq 0.01$)

Table 1 : Effect of folic acid and cobalt on consumptions of nutrient compounds of Awassi ewes.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of ewes :	5	5	5	5
2. Iinitial weight (kg)	36.15 ± 0.25 A	36.55 ± 0.25 A	36.60 ± 0.10 A	36.82 ± 0.12 A
3. Final weight (kg)	47.24 ± 0.59 B	48.21 ± 0.71 AB	49.23 ± 0.61 AB	50.55 ± 0.75 A
4. Dry Matter intake (kg D.M/head)	1.522 ± 0.03 B	1.605 ± 0.04 AB	1.696 ± 0.04 A	1.715 ± 0.04 A
5. Protein intake (gm C.P/head)	185 ± 4.00 B	195 ± 5.00 AB	206 ± 5.00 A	208 ± 5.50 A
6. Fat intake (gm C.Fat/head)	44 ± 1.00 B	46 ± 1.00 AB	49 ± 1.00 A	50 ± 1.00 A
7. Fiber intake (gm C.F/head)	188 ± 4.00 B	198 ± 5.50 AB	210 ± 5.00 A	212 ± 6.00 A
8. Metabolize Energy intake (K_{cal} ME/head)	39.12 ± 0.88 B	441.25 ± 1.12 AB	43.59 ± 1.03 A	44.07 ± 1.21 A

The average of trait which had carried different letters horizontally indicated significant differences at 0.05.

Table 2 : Effect of folic acid and cobalt on consumptions of nutrient compounds of Awassi lambs.

Traits (control)	First treatment (folic acid)	Second treatment (cobalt)	Third treatment (folic acid + cobalt)	Fourth treatment
1. No. of lambs :	5	5	5	5
2. Iinitial weight (kg)	4.27 ± 0.23 B	6.17 ± 0.17 A	6.34 ± 0.16 A	6.48 ± 0.08 A
3. Final weight (kg) (kg D.M/head)	21.58 ± 0.28 C	25.21 ± 0.39 B	25.69 ± 0.19 B	29.00 ± 0.25 A
4. dry matter intake	419 ± 1.00 C	430 ± 3.00 BC	446 ± 6.00 B	466 ± 6.00 A
5. Protein intake (gm C.P/head)	50.91 ± 0.12 C	52.24 ± 0.36 BC	54.19 ± 0.73 B	56.62 ± 0.73 A
6. Fat intake (gm fat/head)	12.06 ± 0.02 C	12.39 ± 0.05 BC	12.39 ± 0.17 B	13.43 ± 0.17 A
7. Fiber intake (gm C.F/head)	51.78 ± 0.12 C	53.15 ± 0.37 BC	55.12 ± 0.74 B	57.60 ± 0.75 A
8. Metabolize Energyintake (Kcal ME/head)	10.76 ± 0.03 C	11.05 ± 0.08 BC	11.46 ± 0.15 B	11.97 ± 0.16 A

The trait which had carried different letters horizontally indicated high significant differences at 0.01.

Table 3 : Different body dimensions of ewes at the beginning of experiment.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of ewes :	5	5	5	5
2. Chest circumference (cm)	65.48 ± 0.19 A	65.70 ± 1.09 A	66.70 ± 0.25 A	66.94 ± 0.24 A
3. Abdominal circumference(cm)	60.67± 0.19 A	67.64 ± 0.37 A	67.74 ± 0.20 A	67.86 ± 0.31 A
4. Body height at foreground(cm)	51.48 ±0.21 A	51.54 ± 0.43 A	51.72 ± 0.41 A	51.90 ± 0.41 A
5. Body height at back (cm)	52.18 ±0.59 A	52.42 ± 0.29 A	52.74 ± 0.36 A	53.02 ± 0.52 A
6. Body thickness at foreground (cm)	13.16 ±0.18 A	13.46 ± 0.21 A	13.58 ± 0.21 A	13.70 ± 0.36 A
7. Body thickness at back (cm)	14.46 ±0.22 A	14.68 ± 0.19 A	14.90 ± 0.23 A	14.98 ± 0.25 A
8. Body length (cm)	51.26 ±0.23 A	51.36 ± 0.34 A	51.60 ± 0.27 A	51.94 ± 0.22 A
9. Tail thickness (cm)	2.34±0.06 A	2.40 ± 0.11 A	2.58 ± 0.38 A	2.72 ± 0.28 A
10. Tail circumference (cm)	35.32 ± 0.16 A	35.42 ± 0.25 A	35.50 ± 0.29 A	35.84 ± 0.26 A

The averages of traits whose carried have similar letters horizontally indicates that there were no significant differences under probability level of 0.05 or 0.01.

Table 4 : Effect of folic acid and cobalt on body dimensions of Awassi ewes at final period of gestation.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of ewes	5	5	5	5
2. Chest circumference (cm)	75.52 ± 0.17 D	81.46 ± 0.27 C	83.98 ± 0.19 B	87.84 ± 0.10 A
3. Abdominal circumference (cm)	79.90 ± 0.17 C	85.26 ± 0.31 B	85.56 ± 0.13 B	89.84 ± 0.10 A
4. Body height at foreground (cm)	58.52 ± 0.10 C	67.18 ± 0.21 B	67.38 ± 0.33 B	71.42 ± 0.15 A
5. Body height at back (cm).	61.00 ± 0.18 C	69.22 ± 0.30 B	69.54 ± 0.32 B	73.22 ± 0.11 A
6. Body thickness at foreground (cm)	14.16 ± 0.26 D	18.66 ± 0.18 C	19.92 ± 0.19 B	23.00 ± 0.31 A
7. Body thickness at back (cm)	17.26 ± 0.45 C	20.06 ± 0.45 B	20.08 ± 0.15 B	25.32 ± 0.13 A
8. Body length (cm)	54.22 ± 0.19 D	57.46 ± 0.37 C	58.20 ± 0.10 B	62.02 ± 0.19 A
9. Tail thickness (cm)	2.40 ± 0.14 B	2.58 ± 0.11 B	2.70 ± 0.31 B	4.06 ± 0.09 A
10.Tail circumference (cm)	46.90 ± 0.31 C	56.36 ± 0.48 B	57.02 ± 0.26 B	59.68 ± 0.18 A

The averages of traits whose carried have different letters horizontally indicates that there were high significant differences at 0.01.

on average of live weight at birth between the first treatment (control) than for last three treatments and an other hand, The results showed that there were significant difference between the first than for fourth treatments on final weight at weaning age of lambs. The initial weight of lambs at birth was 4.27, 6.17, 6.34, 6.48 kg and final weight at weaning 21.58, 25.21, 25.69 and 29.00 kg for four treatments respectively. The results showed high significant differences ($P \geq 0.01$) between first treatment compared to the third and fourth treatments in average amount consumptions of dry matter, protein, fat, fiber and metabolize energy of Awassi lambs (table 2). Daily

consumption of dry matter was 419, 430, 446,466 gm/day, protein intake 50.91, 52.24, 54.19, 56.62 gm/day, fat intake 12.06,12.39,12.39,13.43 gm/day, fiber intake 51.78, 53.15, 55.12, 57.60 gm/day and metabolize energy was 10.76,11.05,11.46,11.97 K_{cal}/kg for four transactions respectively. Through results of this study are shown in table 1 indicates significant improvement in average of weight gains of sheep with treated by folic acid and cobalt when compared to comparison group. This is due to the fact that vitamin B_9 with cobalt for animals during pregnancy has contributed to cell regeneration and regeneration of all tissues during pregnancy as a result of increased daily consumption and efficiency of utilization of nutrient compounds intake. This means an improvement in performance and growth of the animal and its production (Girard *et al.* 1996, El-Barody, 2002). This results presented in table 2 showed a significant improvement in mean weight of the body lambs at birth and weaning for groups treated with folic acid and cobalt compared to the control group due to the activity and effectiveness of the synergistic role between folic acid and cobalt in construction and development of tissue with growth hormone which leads to increase concentration of immunoglobulin, especially IgG, is the result of antibody synthesis. This is reflected in activation of immunity of newly born body animals and improves its resistance against diseases. Also, it is very important for the life of fetuses during pregnancy (Saadoun *et al.*, 2009). This results was accepted with results of Nasser (2010), Al-Zubaidy and Al-Taey, (2012), Akins (2012), Almahdawi *et al.*, (2017) Who found a significant improvement in rates of weight gains in ewes and their lambs that treated with folic acid compared to the control group.

Body measurements of sheep

The results indicated in table 3 no found significant differences in all body measurements of ewes between four transactions at the beginning of experiment and this indicates to complete homogeneity and disappearance of individual differences in characteristics and body measurements among the animals. The rates of body measurements of chest circumference were 65.48, 65.70,

Table 5 : Effect of folic acid and cobalt on body dimensions of ewes at birth.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of ewes :	5	5	5	5
2. Chest circumference (cm).	66.70 ± 0.22 D	72.16 ± 0.23 C	73.18 ± 0.29 B	75.22 ± 0.16 A
3. Abdominal circumference (cm).	69.32 ± 0.15 D	74.18 ± 0.21 C	75.12 ± 0.29 B	77.62 ± 0.11 A
4. Body height at foreground(cm).	50.52 ± 0.11 C	56.98 ± 0.25 B	57.38 ± 0.20 B	65.88 ± 0.30 A
5. Body height at back (cm).	51.44 ± 0.13 C	57.94 ± 0.27 B	58.18 ± 0.26 B	66.98 ± 0.28 A
6. Body thickness at foreground(cm).	13.17 ± 0.05 C	16.06 ± 0.33 B	16.92 ± 0.31 B	19.30 ± 0.23 A
7. Body thickness at back (cm).	13.36 ± 0.12 D	16.84 ± 0.20 C	18.28 ± 0.53 B	21.84 ± 0.31 A
8. Body length (cm).	49.58 ± 0.26 D	52.12 ± 0.21 C	53.20 ± 0.26 B	61.02 ± 0.25 A
9. Tail thickness (cm).	2.60 ± 0.14 C	3.74 ± 0.34 B	4.10 ± 0.26 B	6.46 ± 0.16 A
10.Tail circumference (cm).	34.82 ± 0.30 C	46.34 ± 0.29 B	46.96 ± 0.28 B	51.52 ± 0.18 A

The averages of traits whose carried have different letters horizontally indicates that there were high significant differences at 0.01.

Table 6 : Effect of folic acid and cobalt on body dimensions of ewes at weaning.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of ewes :	5	5	5	5
2. Chest circumference (cm).	67.38 ± 0.12 D	74.04 ± 0.24 B	74.76 ± 0.21 B	77.44 ± 0.13 A
3. Abdominal circumference(cm)	69.54 ± 0.10 C	77.78 ± 0.30 B	78.00 ± 0.15 B	80.80 ± 0.26 A
4. Body height at foreground(cm).	52.14 ± 0.33 D	63.64 ± 0.12 C	64.44 ± 0.10 B	67.22 ± 0.25 A
5. Body height at back (cm).	53.04 ± 0.25 D	64.70 ± 0.28 C	65.50 ± 0.10 B	68.74 ± 0.18 A
6. Body thickness at foreground (cm).	14.20 ± 0.29 C	16.90 ± 0.22 B	17.52 ± 0.08 B	19.40 ± 0.27 A
7. Body thickness at back(cm).	16.28 ± 0.45 C	18.18 ± 0.24 B	18.88 ± 0.31 B	21.06 ± 0.27 A
8. Body length (cm).	50.28 ± 0.62 C	54.50 ± 0.39 B	54.92 ± 0.18 B	61.78 ± 1.02 A
9. Tail thickness (cm).	2.98 ± 0.19 C	4.68 ± 0.33 B	5.06 ± 0.18 B	6.44 ± 0.30 A
10.Tail circumference (cm).	36.96 ± 0.29 C	48.14 ± 0.27 B	48.54 ± 0.30 B	52.68 ± 0.34 A

The averages of traits whose carried have different letters horizontally indicates that there were high significant differences at 0.01.

66.70, 66.94 cm, abdominal circumference 60.67, 67.64, 67.74, 67.86 cm, body height at foreground 51.48, 51.54, 51.72, 51.90 cm, body height at back 52.18, 52.42, 52.74, 53.02 cm, the body thickness at foreground 13.16, 13.46, 13.58, 13.70 cm, body thickness at back 14.46, 14.68, 14.90, 14.98 cm, body length 51.26, 51.36, 51.60, 51.94 cm, tail circumference 35.32, 35.42, 35.50, 35.84 cm and tail thickness 2.34, 2.40, 2.58, 2.72 cm respectively of four transactions respectively. During pregnancy period, the results indicated in table 4 high significant differences ($P \geq 0.01$) between four treatments in chest circumference, abdominal circumference, body height at foreground and back, body thickness at foreground and back, body length, tail circumference and thickness of the pregnant ewes between the experimental groups containing folic acid and cobalt or both together compared to the comparison group of pregnant ewes at last pregnancy period. The chest circumference was 75.52, 81.46, 83.98, 87.84 cm, abdominal circumference was 79.90, 85.26, 85.56, 89.84 cm, body height at foreground 58.52, 67.18, 67.38, 71.42 cm, The body height at back 61.00, 69.22, 69.54,73.22 cm, body thickness at foreground 14.16, 18.66, 19.92, 23.00 cm, body thickness at back 17.2, 20.06, 20.08, 25.32 cm, body length 54.22, 57.46, 58.20, 62.02 cm, tail circumference 46.90, 56.36, 57.02, 59.98 cm and tail thickness 2.40, 2.58, 2.70 and 4.06 cm for four transactions respectively (table 4).

During the birth period, the results showed in table 5 that there were high significant differences ($P>0.01$) between four treatments in average of chest circumference, abdominal circumference and body length of Awassi ewes. On the other hand, the results showed high significant differences ($P \geq 0.01$) on mean of other body measures between the first treatment (control) than for last three treatments which containing folic acid, cobalt and combination of them. The average of body measurements of ewes during birth were chest circumference was 66.70, 72.16, 73.18, 75.22 cm, abdominal circumference 69.32, 74.18, 75.12, 77.62 cm, body height at foreground 50.52, 56.98, 57.38, 65.88 cm, body height at back 51.44, 57.94, 58.18, 66.98 cm, body thickness at front 13.17, 16.06, 16.92, 19.30 cm, body thickness at rear 13.36, 16.84, 18.28, 21.84 cm, Body length 49.58, 52.12, 53.20, 61.02 cm, tail circumference 34.82, 46.34, 46.96, 51.52 cm and tail thickness 2.60, 3.74, 4.10, 6.46 cm of four transactions respectively (table 5).The results shown in table 6 high significant differences ($P \geq 0.01$) on mean of all body measurements of ewes between experimental treatments than for control treatment except body height at foreground and back, which was high significant among four transactions. The chest circumference were 67.38, 74.04, 74.76, 77.44 cm, abdominal circumference 69.54, 77.78, 78.00, 80.80 cm, Body height at front 52.14, 63.64, 64.44, 67.22 cm, Body height at rear 53.04, 64.70, 65.50, 68.74 cm, body thickness at front of 14.20, 16.90, 17.52, 19.40 cm, body thickness at rear 16.28, 18.18, 18.88, 21.06 cm and body length 50.28, 54.50, 54.92, 61.78 cm and tail circumference 36.96, 48.14, 48.54, 52.68 cm and tail thickness 2.98, 4.68, 5.06, 6.44 cm for four treatments (table 6).

As a result of significant improvement and positive changes on appearance of ewes and their response to transactions (folic acid and cobalt) during pregnancy, this was positively reflected in growth and external measurements of their lambs. The results showed in table 7 high significance differences ($P \geq 0.01$) on all body measurements among of all different treatments of lambs at birth. The results of the body measurements of lambs were shown in following lines (table 7), Chest circumference was 25.46, 36.76, 39.10, 44.96 cm, abdominal circumference 35.44, 38.76, 40.18, 55.30 cm, body height at forward 32.46, 36.82, 39.04, 42.24 cm, body height at rear 35.58, 39.72, 41.08, 45.68 cm, body thickness at foreground 6.46, 12.54, 14.96, 17.44 cm, body thickness of the rear 8.38, 14.60, 16.88, 19.72 cm, body length 28.46, 35.70, 37.54, 40.98 cm, tail circumference 16.84, 22.90, 24.42, 33.76 cm, and tail thickness 2.04, 3.72, 4.80, and 6.92 cm of four transactions respectively. The results appeared in table 8 high significant differences ($P>0.01$) between the first treatment (control) than for second, third and fourth treatments on body measurements of lambs at weaning age. The chest circumference was 50.44, 61,60, 64.44, 68.38 cm, abdominal circumference 59.46, 65.84, 70.56, 74.68 cm, body height at front 48.22, 56.04, 58.06, 60.44 cm, body height at back 50.32, 58.64, 59.72, 64.70 cm, body thickness at foreground, 12.16,16.96, 17.68, 18.52 cm, body thickness at rear 12.38, 16.94, 16.82, 19.68 cm, body length 32.86, 45.82, 46.90, 49.14 cm, tail circumference 21.92, 33.20, 34.12, 41.62 cm and tail thickness 3.40, 5.96, 6.54, 7.62 cm of four transactions respectively (table 8). The results shown in table 7 a positive and significant improvement in response of pregnant ewes when they were treated with vitamin B_9 and cobalt or both of them at the last three treatments compared to the first treatment (control) on all values of live weight of ewes during the last stages of pregnancy due to two reasons, the first reason may be to significant improvement and to increase in live weight as a result of the daily utilization efficiency to increase amount consumed of dry matter, protein and metabolize energy by groups of pregnant ewes which were given vitamin B_9 and cobalt during pregnancy period (Hanrahan and

Table 7 : Effect of folic acid and cobalt on body dimensions of suckling lambs at birth.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of lambs.	5	5	5	5
2. Chest circumference (cm).	25.46 ± 0.12 D	36.76 ± 0.15 C	39.10 ± 0.26 B	44.96 ± 0.16 A
3. Abdominal circumference(cm).	35.44 ± 0.08 C	38.76 ± 0.26 BC	40.18 ± 0.25 B	55.30 ± 0.11 A
4. Body height at foreground(cm).	32.46 ± 0.10 D	36.82 ± 0.26 C	39.04 ± 0.21 B	42.24 ± 0.30 A
5. Body height at back (cm).	35.58 ± 0.09 D	39.72 ± 0.29 C	41.08 ± 0.17 B	45.68 ± 0.11 A
6. Body thickness at foreground(cm).	6.46 ± 0.12 D	12.54 ± 0.59 C	14.96 ± 0.29 B	17.44 ± 0.46 A
7. Body thickness at back (cm).	8.38 ± 0.11 D	14.60 ± 0.58 C	16.88 ± 0.52 B	19.72 ± 0.54 A
8. Body length (cm).	28.46 ± 0.09 D	35.70 ± 0.22 C	37.54 ± 0.66 B	40.98 ± 0.21 A
9. Tail thickness (cm).	2.04 ± 0.25 D	3.72 ± 0.18 C	4.80 ± 0.11 B	6.92 ± 0.24 A
10.Tail circumference (cm).	16.84 ± 0.34 D	22.90 ± 0.31 C	24.42 ± 0.34 B	33.76 ± 0.34 A

The averages of traits whose carried have different letters horizontally indicates that there were high significant differences at 0.01.

Table 8 : Effect of folic acid and cobalt on body dimensions of suckling lambs at weaning.

Traits	First treatment (control)	Second treatment (folic acid)	Third treatment (cobalt)	Fourth treatment (folic acid + cobalt)
1. No. of lambs :	5	5	5	5
2. Chest circumference (cm).	50.44 ± 0.09 D	61.60 ± 0.19 C	64.44 ± 0.52 B	68.38 ± 0.11 A
3. Abdominal circumference(cm).	59.46 ± 0.12 C	65.84 ± 0.30 C	70.56 ± 0.38 B	74.68 ± 0.22 A
4. Body height at foreground(cm).	48.22 ± 0.82 D	56.04 ± 0.27 C	58.06 ± 0.24 B	60.44 ± 0.13 A
5. Body height at back (cm).	50.32 ± 0.13 D	58.64 ± 0.28 C	59.72 ± 0.13 B	64.70 ± 0.15 A
6. Body thicknessat foreground (cm).	12.16 ± 0.26 C	16.96 ± 0.26 B	16.68 ± 0.21 B	18.52 ± 0.31 A
7. Body thickness at back (cm).	12.38 ± 0.08 D	16.94 ± 0.22 C	17.82 ± 0.15 B	19.68 ± 0.23 A
8. Body length (cm).	32.86 ± 0.26 C	45.82 ± 0.20 B	46.90 ± 0.12 A	49.14 ± 0.12 A
9. Tail thickness (cm).	3.40 ± 0.16 C	5.96 ± 0.13 B	6.54 ± 0.09 B	7.62 ± 0.24 A
10.Tail circumference (cm).	21.92 ± 0.29 D	33.20 ± 0.25 C	34.12 ± 0.14 B	41.62 ± 0.29 A

The averages of traits whose carried have different letters horizontally indicates that there were high significant differences at 0.01.

Table 9 : Correlation coefficients between live body weight and different body dimensions of ewes and lambs.

Traits	Correlation Coefficients	
	Ewes	lambs
1. No. of animals :	20	20
2. body weight × body weight.	1.000	1.000
3. body weight × Chest circumference.	0.981 **	0.979 **
4. body weight × Abdominal circumference.	0.982 **	0.982 **
5. body weight × Body height at foreground.	0.978 **	0.993 **
6. body weight × Body height at back.	0.983 **	0.958 **
7. body weight × Body thickness at foreground.	0.865 **	0.990 **
8. body weight ×Body thickness at back.	0.972 **	0.977 **
9. body weight × Body length.	0.403 NS	0.946 **

NS: Non Significant differences. * significant differences at 0.05. ** high significant differences at 0.01.

Owen,1989) which in turn resulted to an increase in body weights and was reflected in improving reproductive efficiency and productivity in sheep females (Harb, 1994, Al-Azzawi *et al.*,2012) as resulted in secretion of gonadotropic hormones, which was increased ovarian activity through the growth and development of the follicle grafts and sacs and developing vesicles and formation of the yellow body during pregnancy (Hafez and Hafez 2000, Al-Azzawi *et al.,* 2012, Duplessis *et al.*, 2014). The second reason is due to a positive correlation between

live weight of animal and all other body measurements. The values of correlation coefficients between body weight and body measurements of pregnant ewes were (0.982,0.982, 0.978, 0.983, 0.865, 0.972, 0.403, 0.966 and 0.909) of the chest circumference, abdominal circumference, body height at foreground, body height at back, body thickness at foreground, body thickness at rear, body length, tail circumference and tail thickness respectively. The results of this study indicated that there were high significant differences ($P \geq 0.01$) on all body measures of the folic acid and cobalt in the last three treatments compared to the control group. This is due to age progress of lambs and physiological development of the digestive system which thus improving efficiency of the feed conversion of lambs due to the dosage of folic acid and cobalt and their role in activating digestion, absorption and nutrient metabolism, which leads to a high increase living weight and thus increase consumption of dry matter to provide the necessary protein for maintenance and growth (Potter *et al.*, 1971) and consequent large size and increase of physical measurements so as to completion of the construction of their bodies and the formation of muscle and fat deposition and thus increasing of final weight of animal (Rutter, 1973). This is one hand, and on the other hand, the presence of positive and significant correlations ($P \geq 0.01$) between the body weight and the body measurements were mentioned in table 9. The values of correlation coefficients between body weight and body measurements of developing lambs were (0.979, 0.982, 0.993, 0.958, 0.990, 0.977, 0.946, 0.988, 0.50) of the chest circumference, abdominal circumference, body height at foreground, body height at back, body thickness at foreground, body thickness at rear, body length,tail circumference and tail thickness respectively (Afolayan *et al.*, 2006, Al-Hilou *et al.*, 2009, Ravimurugan *et al.*, 2013, and Almahdawi *et al.*, 2017). This results are consistent with reported by Al-Essawi and the Al-Wazir (2011), who found significant increases in measurements of chest circumference, hip circumference, body length and body height in front and back between the last three groups of lambs compared the first group (control), When they were using food additive such as dietary probiotics by 0.02% in the second group and nigella sativa at 2% in the third group and combination of dietary probiotics at 0.02% + 2% nigella sativa in the fourth group than compared to control group in the fattening rations of males Awassi lambs for 60 days period. The results were identical to result of AL-Shimari (2015), who found significant superiority in measurements of chest circumference, hip circumference, body length, body height at foreground and back between experimental groups of lambs that given licorice extract at concentrations of 300, 400 gm/kg of body weight when compared to control group. This results were consistent with results of Almahdawi *et al.,* (2017) who found significant improvement in most of body measurements of Awassi lambs which were given folic acid in the second group and vitamin B_{12} in the third group and combination of (folic acid + vitamin B_{12}) in fourth group when compared to first group (control group).

We conclude from results of this study that there were a significant improvement in rates of live weight and body measurements of ewes and lamb as result of increasing rates of daily consumption of dry matter and utilization efficiency of nutrient compounds to benefit of ewes and their lambs, which were given folic acid and cobalt at one or both them during gestation and birth this is one hand and another hand it was found a positive relationship and high significant correlation coefficients ($P \geq 0.01$) between living weight and different body dimensions in sheep, which confirms the possibility to take advantage of body measurements to predict final weight at various stages of sheep age. Also possible to rely on different body measurements in selection of healthy animals for purpose of improving their reproductive and productivity efficiency, which leads to increased incomes of benefit to the local breeders.

References

Al-Ani Ahmed Alaa Aladdin, Naser Nouri Al-Anbari, Liama Jawad Al-Jarayan and Yasin Hamed Farhan (2014). Cytoplasmic genetics and maternal impact in some body measurements of Turkish Awassi sheep. *Journal of Iraqi Agriculture Research,* **(19)**: Special Issue, 75-81. Baghdad, Iraq.

AI-Azzawi,W.A.R., M.H. AI-Salman and S.A. Hammed (1995). Relationship Between Body Weight and Dimension Traits in Awassi Sheep, Regional Symposium on:Integrated Crop-Livestock Systems in the Dry Areas of West Asia and North Africa,6-8 November,1-8., Amman, Jordan.

Al-Azzawi, Salah Hassan, Raed Ibrahim Khalil, Saeb Younis Abdulrahman and Nabil Najeeb Ahmed (2012). The study of effect of body weight on puberty sexual maturity of some carcass characteristics and improving of ovarian follicles. *Diyala Journal of Agricultural Sciences,* **4(1)**: 42-49, Diyala, Iraq.

Abu Alulla, Muhammad Badr Al-Din (1994). Principles of reproduction. A guide on improving reproduction in sheep in the Near East. Animal Production and Health Studies Series, Food and Agriculture Organization of the United Nations. 103. Rome, Italia.

Al-Chalabi, Qusay Abdul-Qader and Ezz Aldine winner (1982).

Biology in Life Chemistry, Ministry of Higher Education and Scientific Research, Mosul University, (1-2) Baghdad, Iraq.

Al-Essawi, Amir Jabor Obais and Anmar Abdul-Ghani Majeed Al-Wazir (2011). The effect of adding the bio-enhancer and black bean to the lactation of the acidic lambs on the body and testicular measurements. *Kufa Journal of Veterinary Sciences,* **2(1)**: 12-19, Iraq.

Afolayan, R.A., I.A. Adeyinka and C.A.M. Lakpini (2006). The estimation of live weight from body measurements in Yankasa sheep. *Czech J. Anim. Sci*., **51**: 343-348.

Al-Hilou, Murtadha Faraj Abdul-Hussain, Allawi Laiibi Dagher Al-Khuzaie and Ahmad Jaid (2009). Predicting body weight of different ages using some body measurements in Arabian sheep. *Diyala Journal of Agricultural Sciences:* **1 (2)**: 104-111.

AL-Rawi, Khashia, Mahmoud and Abdul-Aziz.Mahmoud Khalaf Allah (2000). Design and analysis of experiments agricultural, Foundation National Library for printing and publishing, University of Mosul / Page.30-32.

Al-Jalili, Zuhair Fakhri, Atallah Saeed, Salwa Lilo Aziz (1985). Production and conservation of meat. Ministry of Higher Education and Scientific Research. Institute of Baghdad, Iraq.

Al-Khuzai, A.L.D. (2000). The relationships between some of the placental factors and birth weight in Awassi sheep. *Iraqi. J. Agric.,* **Vol. S., No.7.,** : PP.139_145, Iraq.

Akins,S. Mathew (2012). Effects of Cobalt Supplementation and Vitamin B_{12} injections on location performations of Hoslstein Dairy Cows. Ph.D. of Philosophy, (Dairy Science). University of Wisconsin- Madison. USA.

Almahdawi, K.K., M.M. Mozhir, Hawraa Alhussainy and J.H. Suhad Aljabor (2017). Effect of dosages of folic acid and vitamin B_{12} on productive performance and body dimensions of Awassi ewes and lambs.Euphrates Journal of Agriculture Sciences, Second conference of College of Veterinary Medicine, Alqassim Green University, Iraq.

Arab Agricultural Organization (2008). Arab Agricultural Statistics Yearbook, League of Arab States. **Volume (27)**, December, Khartoum, Sudan.

Al-Rawi, Khashia.Mahmoud and Abdul-Aziz.Mahmoud Khalaf Allah (2000). Design and analysis of experiments agricultural, Foundation National Library for printing and publishing, University of Mosul/Page.30-32.

Al-Salivani, Amira Sami Abdi Ghazala (2006). Effect of Vitamin A and E on some physiological and reproductive characteristics of Awassi sheep seals MSc. Thesis, Department of Animal Resources, Faculty of Agriculture and Forestry, University of Mosul, Iraq.

Al-Sayegh, M.N., Rahoo and J.E. Al-Kass (2006). The production of sheep and goats, Dar Ibn Al-Athir for printing and publishing-Mosul University, Chapter III, pp.57-154.Iraq.

Al-Shimari, Salah Mahdi (2015). Effect of licorice extract on some body measurements and testicular tissue in Awassi male lambs. *Al-Furat Journal of Agricultural Sciences*, **7(4)**: 59-65 Alqassim Green University, Iraq.

Atta, M. and O.A.EL-Khidir (2004). Use of heart girth, wither height and scapuloischial length for prediction of live weight of Nilotic sheep. *Small Ruminant Research,* **55**: 233 – 237.

Al-Zaidan, Osama and Abdel-Ghani Abdel Aziz (2005). The relationship between mean of live weight and body dimensions of Karadi calves. *Journal of Mesopotamia Agriculture,* **23(2)**: 32-36, Mosul University, Iraq.

Al-Zubaidy, A. Abdalla and R.N. Daowd Al-Taey (2012). Effect of using Vitamin A and Folic acid in some production, Reproductive parameters local Awassi Lambs. *Journal of Mesopotamia,* **40(1)**: 1-10.Iraq.

Al-Zubaidy, K.M.D. and M.A.H. Al-Falahy (2016). Principles and procrdures of statistics designs and experimental designs. Ministry of Higher Education, And Scientific Research, University of Duhok, College of Agriculture., page (183-187). Kurdistan Region / Iraq.

Al-Zuhairi, Abdullah Muhammad Thanoon (2000). Human Nutrition. Second Edition. Dar Al Kutob for Printing and Publishing, University of Mosul, Iraq.

Davis, R.E. and D.J. Nicole (1988). Folic acid. *Int. Journal of Biochemical Science,* **20**: 133-139.USA.

Duncan, C.B. (1955). Multiple range and multiple "F" tests. *Biometrics.* **11**: 1-12.

Dumoulin, P.D., C.L. Girard, J.J. Matte and G.J. St-Laurent (1991). Effect of aparenteral supplement of folic acid and its interaction with level of feed intake on hepatic tissues and growth performance of young dairy heifers. *J. Anim. Sci,* **69**: 1657-1666.

Duplessis, M., C.L.Girard, D.E.Santschi, J.P. Laforest, J. Durocher and D. Pellerin (2014). Effects of folic acid and vitamin B12 supplementation on culling rate, diseases, and reproduction in commercial dairy herds. *J. Dairy Sci.,* **97** : 2346–2354.

El-Barody, M.A.A. (2002). Effect of folic acid supplementation on some physiological parameters of heat-stressed lambs. *Egypt, Alex. J. Agric. Res,* **47(1)**: 43-49.

F.A.O., Food and Agriculture Organization of the United Nations (2004). The state of food Insecurity in the world. The impact of changing food systems on small farmers in developing countries. page (20), Vial delle. Terme di caracalb, 00100, Rome,Italy.

Girard, C.L., F. Castonguay, F. Fahmy and J.J. Matte (1996). Serum and milk folate during the first two gestations and lactations in Rumanov, Finn sheep, and Suffolk ewes. *J. Anim. Sci.,* **74**: 1711-1715.

Hadi, Latif Essa (2009). The use of Zingiber officinal ginger and vitamin E on the productive, phylogenetic and reproductive traits of local black goats. Master Thesis,

Faculty of Veterinary Medicine, University of Baghdad, Iraq.

Hafez, B. and E.S.E. Hafez (2000). *Reproduction in Farm Animal*.7th ed.Lnc wilkins, Philadelphia, U.S.A. pp. 315.

Hanrahan, J.P. and J.B. Owen (1989). Single gene effects on ovulation rate in cambirdge sheep. 40th Annual meeting EAAP : Dublin.

Harb, M. (1994). Jordan pastoral system: A case study. Sheep production under extensive systems in the Near East. FAO, Rome.

Ibrahim, Mohamed Khairy Mohamed (1998). The breeding and production of sheep and goats. Arab House for Distribution and Publishing, Cairo, Egypt.

Jaid, Talib Ahmad and Murtadha Faraj Al-Hilou (2008). Effect of different body measurements on the reproductive efficiency of Arabi Ewes 1. Effect on fertility ratio. *Basrah Research Journal (Science),* **34(4)**: 52-60.

Khan, H., F.A. Muhammad, N. Riaz, G.R. Nawaz and M. Zubair (2006). Relationship of body weight with linear body measurements in goats. *J.Agric. and Biol.Sci.,* **1(3)**:51-54.

Mclaren, D.S. and M.Frigg (2001). Sight and lifemanual on Vitamin A.2nd ed. London,PP:31- 32.UK.

Nasser, Mohammed Emad Abd El-Wahab (2010). Influence of dietary cobalt on performance,nutrient digestibility and rumen activity in lambs.Lucrări ªtiinþifice - Vol. 53, Seria Zootehnie.

Potter, G.D., C.D. Little, N.W. Bradley and G.E. Mitchell (1971). Abomasal nitrogen in steers fed soybean meal, urea or urea plus two levels of molasses. *J. Anim. Sci.,* **32(3)**: 531-533.

Ravimurugan, T., A.K. Thiruvenkadan, K. Sudhakar, A.K. Panneerselvam and A. Elango (2013). The Estimation of Body Weight from Body Measurements in Kilakarsal Sheep of Tamil Nadu, India. *Iranian Journal of Applied Animal Science,* **3(2)**, 357-360.

Rutter, W. (1973). Anote on the progressive carcass weight changes of fattening store lambs. *Anim.prod.,* **16** : 95.

Saadoun, Abdul Sattar Salem, Hadeel Asim Mohammad and Khalid Hassani Sultan (2009). Effect of folic acid on some blood parameters and biochemical in pregnant ewes and lambs. *Iraqi Journal of Veterinary Science,* **23(2)**:299-306.

Saleh, Ahmed Alhaj Taha and Qusay Zaki Shams Aldin (2000). Different levels of energy in ration. 1. Effect on the performance of local lambs and some characteristics of carcass. *Journal of Mesopotamia Agriculture,* **32(2)**: 53-59, Iraq.

SAS (2012). Statistical Analysis System. SAS institute Inc. Release 9.12 Tsozo, North Carolina state University of Cary, NC, U.S.A.

Sirvstava, S.K. and K.L.Sghni (2000). Blood minerals lerel affecting pregnancy rate in cows and Buffaleos. *Indian. J. Anim. Sci.,* **70**: 33-34.