Effect of vitamin C and/or vitamin B complex intake on some productive, physiological and reproductive traits in the female rabbits

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Summary

The aim of this work was to establish the vital role of using vitamin B complex and/or vitamin C in the reproduction. Twenty female rabbits were used and they were divided randomly into four equal groups, all animals were fed 100 g of concentrate pellets diet/ head. The first group was offered drinking water free of vitamins, (control group), second group was supplied with water containing vitamin C (40 mg/ 100ml water/ head), third group was supplied with water containing vitamin B complex (0.5 ml/100ml/head), and fourth group was water supplied containing 20 mg of vitamin C and 0.25 ml of vitamin B complex/100 ml water/head. At the beginning of the experiment, male rabbits were introduced to the females for mating for one hour at morning daily for two weeks before the food and water were supplied. The results revealed that, body weight of all groups increased progressively with age. The treated groups gained insignificantly more than the control group, the second and fourth group showed higher but insignificant. In second and third group caused significant increase in PCV, Hb, WBCs, lymphocyte percentage and decrease in neutrophil, monocyte and eosinophil percentages compared with the control group. However, blood glucose and serum cholesterol levels were significantly decreased ($P<0.05$) in second and fourth group when compared with first group. While vitamins groups caused insignificant increase in alkaline phosphatase activity enzyme. However, the treated groups showed significantly higher fertility rate and reproductive efficiency ratio compared with the control group and numerically higher in prolificacy ratio (%). But third and fourth group showed better prolificacy and reproductive efficiency ratio than the second group.

Keywords: Vitamin C, Vitamin B, pregnant rabbits, reproductive efficiency.

Introduction

Rabbit's husbandry was changed from fun into a rabbit-breeding of profitable economic projects especially of their meat reproduction and delicious and healthy of low fat as well as good feed conversion ratio (1). While (2) who was demonstrated that rabbit meat is a highly digestible, tasty, low caloric food, often recommended by nutritionists' over other meat yet, it is still considered a rich product, especially because of its time consuming preparation which requires culinary skills and because of cultural differences among European consumers. Vitamins are organic substances without energetic value but necessary for metabolism of animals or human organisms (3). These substances are not synthesized by the organisms themselves in adequate quantities; for this reason, vitamins must be provided by feeds or through the intestinal flora activity (4 and 5).Vitamin B complex are group of water-soluble vitamins those play important roles in cell metabolism. The B vitamins were once thought to be a single vitamin, referred to simply as vitamin B (6). Similarly vitamin C refers to a number of vitamins those have vitamins C activity in animals, including ascorbic acid and its salts, and some oxidized forms of the molecule like dehydro ascorbic acid (7). Vitamin C is the water soluble antioxidant that reacts with peroxyl radicals formed in the cytoplasm before they reach the membrane (8).Vitamin C is found in a high concentration in immune cells and is consumed a quickly during infection. Both ascorbic acid and/or vitamin B complex caused an improvement in body weight (9-11). Ascorbic is stimulatory to progesterone and oxytocin secretion, consistent with its know roles in hormone biosynthesis and synergizes with neurotransmitters in stimulating hormone secretion. However, the concentration of ascorbic acid in the corpus luteum appears to be greatly in excess of that required to facilitate hormone production (12).

Other authors, (13) revealed a strong correlation between follicle volume and the

serum ascorbate concentration suggesting that follicle growth, particularly during the late stage of exogenous stimulating, may be limited by the availability of ascorbic acid in the circulation. Therefore, the aim of this work was to establish the vital role of using vitamin B complex and/or vitamin C in the reproduction.

Materials and Methods

This work was carried out at the animal house, College of Veterinary Medicine, University of Baghdad; twenty female local rabbits with average body weight 0.60-0.70 Kg, aged about 2.0-2.5 months were purchased from a local market dealer. The animals were fed 100 g on concentrate diet (pellets) ad libitum and green forages for two weeks as preliminary period (for acclimization). Also drinking tap water was offered. At the end of the preliminary period, rabbits were divided randomly into four equal groups (5 each) according to their body weight and kept in houses as follows: First group was kept as a control group and gave water free from vitamins. Second group was given water contain vitamin C (200 mg/500 ml of water) each rabbit gets almost 40 mg of vitamin C /100 ml water. Third group was given water containing vitamin B complex (2.5 ml/500 ml of water) each rabbit gets almost 0.5 ml vitamin B/ 100 ml of water. Fourth group was given water containing (100 mg of vit. C and 1.25 ml of vit B/ 500 ml of water) each rabbit gets almost 20 mg of vit C and 0.25 ml of vitamin B/ 100 ml of water all groups were offered green roughages freely. Water was supplied free of vitamins when they finished. At beginning of the experiment, before concentrate diet and water supply, male rabbits were introduced to the females for mating for one hour a day at morning for two weeks. Body weights of all rabbits were measured at weekly intervals, furthermore, blood samples were taken also at weekly intervals before concentrate diet was supplied for some blood parameters viz.; PCV, Hb, WBCs and their differentials (14), blood sugar (15), serum cholesterol (16) and alkaline phosphatase enzyme activity (17). At parturition, numbers of born from each female were recorded to find out pregnancy rate and prolificacy percentages. Data were analyzed as Complete Randomized Design of one or two ways (4 treatments), Least significant differences (LSD) was applied to detect the significant differences among different group means at the level of ($P < 0.05$) (18).

Results and Discussions

Body weight increased in all female rabbits of all groups with age progress, but the treated groups gained insignificantly more weight than the first group particularly during the last week of the study.

Table, 1: Effect of Vit. C and/or Vit. B on the body weight (g) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	1160±169.1	1700±122.5	1800±122.5	1860±124.9
Second	1440±169	1860±87.2	1940±60	2040±103
Third	1200±184.4	1680±106.8	1780±106.8	2000±89.5
Fourth	1420±111.3	1840±74.8	1900±70.7	1940±67.8

The increase in body weight of all groups of rabbits during the experimental period indicated that these rabbits were at the growth rate, these results are in accordance with the previous studies (19 and 20), who noticed that rabbits continue in growth up to 5 months of age. The insignificantly increase in the body weight of the treated groups may be attributed to the effect of ascorbic acid and/ or vitamin B complex those caused an improvement in body weight, these results were in the same trend with (10 and 11), besides all animals in treated groups were gained highly pregnancy rate in comparison with the control group (21).

Packed cell volumes percentages showed significant increased with progress of the experiment, all groups (Table, 2). The PCV percentages of the treated groups initiated significantly higher values than those of the control group from the 2nd week of the study and continued up to the end of the experiment. While Hb showed the same trend in the Hb as

in PCV% (Table, 3) i.e. the treated groups had significantly higher values than the control group during the whole studied period.

Table, 2: Effect of Vit. C and/or Vit.B on the PCV (%) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	30.50±0.50 Cc	32.00±0.82 Cbc	35.00±1.29 Bab	37.75±0.63 Ca
Second	33.50±0.96 Bc	41.00±1.73 Ab	41.50±2.22 Ab	44.00±0.82 Ba
Third	39.50±1.26 Ab	41.50±1.26 Aab	42.0±1.83 Aab	44.50±1.71 Ba
Fourth	34.00±0.82 Bc	36.50±0.95 Bc	42.00±0.82 Ab	47.00±1.29 Aa

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Table, 3: Effect of Vit. C and/or Vit.B on the Hb (gm/dl) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	11.0±0.58 Bb	11.00±0.58 Bb	11.50±0.50 Cb	13.00±0.41 Ca
Second	12.00±0.31 Bb	14.00±0.71 Aa	14.50±1.19 Ba	15.25±1.11 Ba
Third	14.00±0.82 Abc	15.00±0.58 Ab	16.00±0.82 Ab	17.50±0.96 Aa
Fourth	14.00±0.82 Abc	14.50±0.95 Ab	15.25±1.11 ABb	17.00±1.29 Aa

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

The gradual increase in blood components such PCV% and Hb for all groups could be attributed to the fact that rabbits were in good management and feeding regime. By age progress, there was significantly or numerically increased in treated groups compared with the control group, this might be attributed to an increase in absorption of nutrients in the intestine due to an increase in feed intake which reflect more metabolic activation in the animals by using vitamin C and/or vitamin B complex, because vit C play a vital role in Hb synthesis and has a vital role as antioxidant (9) or vit C act as cofactor to activates the enzymes responsible for maturing red blood cells and increase the Hb and PCV values, also vitamin B complex caused an increase in PCV% percentage may be due to the effect of folic acid and vitamin B12 which caused an increase in the PCV% (22).

The total number of WBCs slightly and gradually increased in all groups with age progress, however the treated groups showed significantly higher values than the control group from the 1st week of the study up to the end, but in differences were established among different treated groups in their means during the whole studied period.

Table, 4: Effect of Vit. C and/or Vit.B on the WBC (cell/mm3) of rabbits, (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	5127.3±109.9 Cb	5509.0±117.5 Bb	6143.5±196.6 Ca	6257.0±144.65 Ba
Second	5350.3±196.8 BCc	6092.8±46.06 Ab	7038.5±208.5 Aa	6839.8±116.4 Aa
Third	5869.3±63.7 Ab	6194.85±141.0 Aab	6265.5±71.68 BCab	6570.3±165.71 ABa
Fourth	5644.5±165.7 ABb	6362.5±162.70 Aa	6596.0±189.8 Ba	6647.8±150.3 Aa

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

The slightly and gradually increase in WBCs of all rabbits could be attributed to the development of immune system of all animals with age progress and these results agreed with (20). The values of treated groups were significantly increased more than the control group, this could be due to the vitamin C plays an important role in protecting the membrane of leukocytes from oxidative damage (23), while author (24) showed that vitamin C was necessary for chemical attraction of the WBCs and its role for immune cells protection, also vitamin B complex showed an effect in production of the immune cells (25).

The lymphocytes percentages showed similar trend as the total white blood cells

counts during the experimental studied weeks (Table, 5) but the treated groups had significantly higher values than the control group particularly in late studied weeks. Neutrophils percentage showed significant differences were existed during the different studied weeks (Table, 6), also there were significant differences among different treatments. Monocytes percentage were in contrast with the lymphocyte percentages (Table, 7). The monocyte percentage were significantly decreased with time progress in all groups. Thus second group recorded significantly higher value than the third and fourth group in the mean of whole studied period.

Table , 5: Effect of Vit. C and/or Vit. B on the lymphocyte percentage % of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	44.33±2.19 Cb	48.33±0.88 ABa	47.67±2.33 Ba	44.00±1.16 Bb
Second	42.00±1.73 Bc	45.00±1.73 Bbc	48.33±0.88 Bab	51.00±0.58 Aa
Third	45.67±1.76 Ab	48.00±2.08 ABab	51.88±0.88 Aa	51.67±0.88 Aa
Fourth	45.67±2.33 Ab	50.67±1.33 Aab	48.67±0.88 Bab	52.67±0.67 Aa

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Table, 6: Effect of Vit. C and/or Vit.B on the Neutrophil percentage % of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	40.00±1.16 Aa	35.67±1.20 BCc	37.00±2.52 b	38.00±3.06 Bb
Second	35.00±1.00 Cb	34.67±1.45 Bb	36.33±0.88 a	34.67±0.33 Cb
Third	37.67±1.20 Bb	37.00±0.58 Bb	36.44±1.20 b	38.00±1.16 Ba
Fourth	37.33±0.67 Bb	40.00±1.16 Ab	36.00±0.58 b	42.67±1.20 Aa

Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Table , 7: Effect of Vit. C and/or Vit.B on the Monocyte percentage % of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	13.33±2.40 Ba	10.00±0.00 Ba	9.33±2.33 bc	11.33±1.45 Ab
Second	19.00±3.06 Aa	13.67±0.88 Aa	10.67±0.67 c	9.67±0.88 Bc
Third	12.00±2.33 Ba	9.67±0.88 Bb	10.00±1.16 ab	8.00±1.73 Bb
Fourth	13.00±2.08 Ba	6.33±1.45 Cc	10.33±0.88 b	3.67±0.88 Cd

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Eosinophil percentage, (Table, 8) showed that no significant differences existed among different treatments in their eosinophil percentages except in the overall means during the whole studied period. Basophil percentages almost similar along the whole studied weeks and treatments and no differences were established (Table, 9).

Table, 8: Effect of Vit. C and/or Vit.B on the Eosinophil percentage % of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	4.00±0.58	6.00±0.50 A	5.00±2.50	6.00±2.31 A
Second	5.00±0.58	6.00±1.16 A	4.33±0.33	4.00±0.58 A
Third	3.33±0.88	5.33±1.67 A	3.00±0.58	2.33±0.88 B
Fourth	3.67±0.88	2.67±0.67 B	4.67±0.33	1.33±0.33 B

Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Table, 9: Effect of Vit. C and/or Vit. B on the Basophil percentage % of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	0.33±0.33	0.00±0.00	3.00±0.00	0.67±0.33
Second	0.67±0.33	0.67±0.33	0.33±0.33	0.33±0.00
Third	0.67±0.33	0.00±0.00	0.33±0.33	0.00±0.00
Fourth	0.33±0.33	0.33±0.33	0.33±0.33	0.00±0.00

The increase in the lymphocyte percentages in the treated groups could be due to vitamin B12 and folic acid. Researchers (26) showed that vitamin B12 and folic acid deficiency caused a damage in WBC especially lymphocyte percentages, while (27) showed that lymphocyte percentage was decrease when ascorbic acid concentration in the blood decreased however, (8 and 25) found that ascorbic acid concentration have an effect on neutrophil percentages, while vitamin B12 and folic acid caused an important role in the activity of WBC counts.

On other hands, vitamin C caused a reduction in the adhesion of monocyte with blood vessels which decline the occurrence of atherosclerosis (28). In the meantime, author (29) who was founded that vitamin B12 deficiency has no effect on the percentage of basophil ratio. Blood sugar of all rabbits groups decreased with time progress, along the whole studied period (Table,10), but in second and fourth groups, showed significantly lower values than the third group and first group particularly in late studied period.

Table, 10: Effect of Vit. C and/or Vit.B on Glucose (mg/dl) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	134.25±1.55 a	131.50±1.26 Aab	129.00±1.00 Aab	124.00±3.74 Ab
Second	134.18±2.22 a	125.50±2.22 Bb	112.50±5.62 Bc	98.00±4.96 Bd
Third	130.25±2.90 a	128.50±1.71 AB ab	125.50±2.22 Abc	120.00±3.56 Ac
Fourth	129.00±1.29 a	127.00±1.73 ABab	104.00±5.31 Cb	97.50±2.22 Bb

Different capital letters showed significant difference among treatments at the level of (P < 0.05).
Different small letters showed significant difference among periods at the level of (P < 0.05).

This reduction in the blood glucose in second and fourth groups could be attributed to the role of vitamin C on the insulin function which has a vital role in reduction in oxidizing agents and reducing blood sugar level in rats which increased in the stress, also by using vitamin C caused an increase in insulin release by action on glucose-6-phosphate (30). Cholesterol level in all rabbits groups sharply decreased after one week of the experiment (Table,11), then the treated groups continue to decrease, while the control group almost settled up to the end of the experiment, however, the treated groups showed significantly lower values than the control group during the 3rd and 4th weeks of the study.

Table, 11: Effect of Vit. C and/or Vit.B on the Cholestrol concen. (mg/dl) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	124.65±1.77Aa	114.75±4.96 Ab	103.75±5.45 Ac	111.50±6.29 Ab
Second	120.50±3.01 AB b	110.00±4.55 AB b	81.50±6.02 Bc	68.50±3.10 Bd
Third	113.50±4.57 BC a	105.25±3.15 Bb	82.75±4.72 Bc	74.50±4.99 Bd
Fourth	108.50±4.35 Ca	94.25±2.72 Cb	84.50±2.22 Bc	73.75±2.32 Bd

Different small letters showed significant difference among periods at the level of (P < 0.05).
Different capital letters showed significant difference among treatments at the level of (P < 0.05).

Vitamin C has more effective in cholesterol reduction in blood serum than vitamin B. While researcher (7) who was showed with an increase in dietary intake of vitamin C during the initial stages of captivity significantly decrease serum cholesterol values. Also authors (31) who was showed similar trend using vitamin C in rabbits fed

petroleum contaminated diet. However, a number of studies have conducted that antioxidant vitamin prevent lipid peroxidation and oxidative damage, thus impede the progress of atherosclerocis (32 and 33). The alkaline phosphatase enzyme activity of all rabbits groups sharply increased during the 2nd week of the experiment, the treated groups showed significantly higher values than the control group at the last week of the experiment (Table, 12).

Table, 12: Effect of Vit. C and/or Vit.B on the Alkaline phosphatase activity (ALP, IU/L) of rabbits (Mean ± SE).

Treat./period	Week1	Week2	Week3	Week4
First	23.55±2.29	54.15±2.13	57.58±2.61	60.88±1.22
Second	20.33±1.45	51.03±3.48	65.08±2.41	76.53±2.85
Third	27.08±3.25	55.95±4.11	62.98±3.26	71.83±3.05
Fourth	32.35±1.96	53.13±3.10	61.75±3.23	76.98±2.61

Different small letters showed significant difference among periods at the level of (P < 0.05).

The increase in ALP enzyme activity in all groups refered to the high metabolic process of these rabbits, which played a vital role in this process either in bone or muscle anabolism which caused an increase in its level in the body with age progress. These results agreed with (20). Supplementation of vit. C or vit. B or both of them showed numerically higher values than that of the control group particularly at the last week of the experiment. Other workers (34) Demonstrated that ascorbic acid performs numerous physiological function include the synthesis of collagen, carnitine and neurotransmitters, the synthesis and catabolism of tyrosin and the metabolism of microsome.

Table (13) showed that all animals in the treated groups were fertile and produced small rabbits, while only two females of the control group became pregnant and produced small rabbits. The fertility rate of all treated groups was (100%) and significantly recorded higher than the control group (40%). But the prolificacy rate of the treated groups recorded insignificantly higher values than the control group.

Table, 13: Effect of Vit. C and/or Vit.B on the fertility, prolificacy and reproduction efficiency of rabbits.

Treat./period	Fertility %	Prolificacy %	Reproduction efficiency
First	40.0±25.0 b	400.0±0.0	160.0±98.0 b
Second	100.0±0.0 a	440±40.0	440±40.0 a
Third	100.0±0.0 a	520±49.0	520± 49.0 a
Fourth	100.0±0.0 a	520±49.0	520±49.0 a

Different small letters in one column showed significant difference at the level of (P < 0.05).

Hence the reproductive efficiency of the treated groups was significantly higher than the control group. In general group showed better values in their reproductive efficiency ratios than the second group. This indicated that ascorbic acid dependence of reproductive is of immediate practical interact as regulator of fertility, also vitamin B complex has an effect (35).

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تأثير تجريع فيتامين سي و/او فيتامين ب المركب على بعض الصفات الانتاجية والفسلجية والتناسلية في اناث الارانب

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الخلاصة

هدفت الدراسة الحالية دراسة تاثير تجريع فيتامين سي و/ او فيتامين ب المركب على بعض الصفات الانتاجية والفسلجية التناسلية. استخدمت عشرون من اناث الأرانب وقسمت عشوائيا وبالتساوي إلى أربع مجاميع وغذيت على 100 غرام من العلف المركز لكل ارنب . زودت المجموعة الأولى بمياه الشرب خالية من الفيتامينات اما المجموعة الثانية فقد زودت بمياه الحاوية على فيتامين C بجرعة 40 ملغم/ 100 مل ماء/ ارنب. في حين ان المجموعة الثالثة زودت بمياه شرب تحوي فيتامين ب المركب وبجرعة (0.5 مل / 100 مل ماء / ارنب) اما المجموعة الرابعة فقد زودت بمياه شرب تحتوي على 20 ملغ من فيتامين C و 0.25 مل من فيتامين B المركب/ 100مل من الماء / حيوان). في بداية التجربة، أدخلت ذكور الأرانب على الإناث وذلك للتزاوج لمدة ساعة واحدة يوميا في الصباح لمدة أسبوعين قبل أن يتم توفير الطعام والماء. اظهرت النتائج زيادة الوزن لجميع المجاميع مع تقدم العمر وقد كانت المجاميع المعاملة أكثر وزنا من مجموعة السيطرة، وأظهرت المجموعة الثانية والمجموعة الثالثة قيم أعلى وبصورة غير معنوية. وان استخدام فيتامين C وفيتامين B المركب كمادة مضافة ادت الى زيادة معنويةعلى مستوى ($P <0.05$) في حجم خلايا الدم المرصوصة، خضاب الدم، خلايا الدم البيض، نسبة الخلايا اللمفاوية بينما ادت الى انخفاض في النسب المئوية لخلايا العدلة، والوحيدة وخلايا الحمضات مقارنة مع مجموعة السيطرة .لوحظ انخفاض معنوي في مستويات السكر والكولسترول في الدم ($P <0.05$) في المجموعة الثانية و الرابعة C ومجموعة الخليط عند مقارنتها بمجموعة السيطرة. بينما تسببت المجاميع التي اعطيت الفيتامينات زيادة ضئيلة في نشاط إنزيم ALP. ومع ذلك، أظهرت المجموعات المعاملة ارتفاع معنوي ($P <0.05$) في معدل الخصوبة ونسبة الخصب مقارنة مع مجموعة السيطرة في حين اظهرت المجموعة الثالثة والرابعة أعلى نسبة مقارنة مع المجموعة الثانية وبصورة غير معنوية.

الكلمات المفتاحية: فيتامين C، فيتامين B، الارانب الحوامل، الكفاءة التناسلية.