PRODUCTION PERFORMANCE, BLOOD PARAMETERS AND ECONOMIC EFFICIENCY OF BLACK BALADI RABBITS RECEIVED ORALLY SOLVENT VITAMIN C UNDER COLD EGYPTIAN CONDITIONS

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(Received 01/10/2022, accepted 21/11/2022)

SUMMARY

Eighteen growing male Black Baladi rabbits (from El-Serw Experimental Station of Animal Production, Animal Production Research Institute) at 5 weeks of age were used for the study through winter months from January to March 2022. The rabbits were randomly allocated into two groups 9 rabbits of each as G1 and G2. Each group was further sub-divided into 3 replicate of 3 rabbits. Rabbits in G1 were fed diet free of feed additives, and gave 3.0 ml of distilled water orally as a vitamin solvent / kg live body weigh (LBW) / two times weekly thus, served as a control group. Rabbits in G2 were fed the same control diet plus quaffed solvent vitamin C in distilled water at 3.0 ml / kg LBW / two times weekly (each ml contained 5 mg vitamin C). Both G1 and G2 rabbits were used to investigate the influence of quaffed vitamin C on caring rabbits, growth performance, nutrients digestibility, carcass traits and meat quality, blood parameters and economic feasibility of growing rabbits under winter cold conditions in Egypt. Results showed that during the experimental period significantly higher ($P<0.05$) in rectal temperature of G1 rabbits than G2 rabbits. The most ($P>0.05$) heart rate was recorded in G1 rabbits compared to G2 rabbits. The G1 rabbits had more ($P<0.05$) respiration rate than G2 rabbits. The G2 rabbits had significantly ($P<0.05$) greater of final (LBW), daily body weight gain, feed conversion ratio and performance index than G1 rabbits. There were non-significance ($P>0.05$) differences in nutrients digestibility as dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF), ether extract (EE) and nitrogen free extract (NFE) among G1 and G2 treatments. The DM, CP, CF digestibility were higher ($P>0.05$) in G2 than those rabbits in G1. However, G1 rabbits had more ($P>0.05$) EE and NFE than G2 rabbits. A significant ($P<0.05$) differences were observed among G1 and G2 on carcass traits and meat quality superiority for G2 rabbits. The hematological, biochemical and oxidative parameters were improved in G2 compared to G1 rabbits. The results showed that the cost-benefit ratio was higher in G2 than in G1. Also, relative economical efficiency % increased in G2 rabbits compared to those in G1 rabbits. The production efficiency factor was greater in G2 that G1 rabbits. In conclusion, rabbits were orally received vitamin C could have beneficial effects on their performance under cold winter months without any side effects.

Key words: *Black Balady rabbits, ascorbic acid, growth performance, economical efficiency.*

INTRODUCTION

The domestic rabbit is a homoeothermic mammal; preferable period of growing was 6-12 weeks of age and the best thermo neutral zone of growing rabbits is 15-18 ^{o}C (Zeweil *et al.,* 2009) revealed that in tropical and sub-tropical countries, climatic temperature as a major constraint on production and reproduction. According to, Park *et al.* (2014) who found that rabbits and cold weather had done an excellent match; winter weather will increase energy expenditure and may be having positive impact on growth performance, weight maintenance and productivity if feeding rates are adjusted accordingly. Hence, Amitava and Kimberly (2014) indicated that alteration rabbit diet by supplying vitamins had improved the main physiological responses to cold load. Vitamin C is an essential micronutrient required for normal metabolic functioning. Thus, Smitha *et al.* (2014) reported that rabbits received vitamin C had the final weight, daily weight gain and total feed intake till 2.30 kg, 15.43gm and 42.88kg compared to 1.92 kg, 11.14 gm and 42.23 kg in control rabbits under tropical humid climate at 21 weeks of age; respectively. Furthermore, Hassan *et al.* (2016) noticed that vitamin C could guard against oxidative stress damage through free-radical scavenging. In particular oxidative activity, Abd-

El-Moniem *et al.* (2016) showed that rabbits supplying with vitamin C has higher scavenged lipid peroxidation as malondialdehyde (MDA) up to 20 nmol/ml than 40 nmol/ml in control. Also, the same authors recorded more, RBCs $10^6/mm^3$, Hb (g/dI), WBCs ($10^3/mm^3$) in vitamin C rabbit at 4.80, 11.00 and 6.29 than 4.27, 10.15 and 2.89 in control rabbits; respectively. Also, Okachi *et al.* (2017) confirmed that vitamin C during any stress (cold or heat) it produced rapidly consumed and amount synthesized fall below rabbit requirements. Hence, the same authors defined that final weight (FW), DWG, daily feed intake and daily protein intake were 1410.0, 13.6, 74.6 and 7.6 gm in rabbits given 400mg vitamin C / kg diet compared to 1400.0, 10.5, 74.9 and 6.7 gm in control rabbit; respectively. Likewise, Abdel-Latif *et al.* (2018) concluded that ameliorating diet with vitamin C as the antioxidants were helpful to improve the performance of rabbits and was recommended to be included in rabbit diets during the temperatures period changing. As well as, Sayed-Ahmed *et al.* (2018) revealed that fortification of rabbit diets with vitamin C could enhance the growth performance of growing rabbit during winter climate in Egypt. Vitamins are organic compounds that are essential for nutrients metabolism (Hassan *et al.*, 2021) revealed that vitamin C has more FW, BWG, pre-slaughter weight and hot carcass weight up to 2040.69, 22.84, 2066.70 and 1305.00 gm than 1872.33, 20.13, 1913.30 and 1136.67 gm in control rabbits; respectively. Beside, Anoh *et al.* (2022) recently suggested that vitamin C is prominent in the defense against superoxide ions, singlet oxygen, free radicals, neutralizes RNA, potential of dissolving in blood or cytosol and can act quickly before cell damage occurs. Thus, the aim of the current study was to determine how the quaffing orally vitamin C at 5 mg per ml/kg LBW/two times weekly during the cold winter season influences the growth performance, carcass characteristics, nutrients digestibility, blood parameters, antioxidant status and economic efficiency of growing black Balady rabbit.

MATERIALS AND METHODS

The present study was carried out at El-Serw, Domietta Governorate, Experimental Station of Animal Production, Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, Egypt. The Domietta lies between 0 25° 31" N and 17 49 °31" E at an altitude of 16 meter above sea level. The Domietta has an average ambient temperature of 20.33 °C and average relative humidity of 66.98 % from January to March 2022 which the period of this study conducted.

Animals, housing and diet of growing rabbits:

A total number of 18 of weaned black Balady male rabbits at 5 weeks of age were used in this study as experimental period continued for 12 weeks. Average initial live body weight (LBW) of rabbits up to 426.73±11.77gm was randomly assigned to form two experimental groups as G1 and G2. Each group is contained 9 rabbits which replicated in three replicates included 3 rabbits /replicate choose in a complete simple randomized design. The G1 was received daily a control diet plus orally 3.0 ml of distilled water as vitamin C solvent/kg LBW/two times weekly. However, G2 was fed the same control diet plus orally administrated the solvent vitamin C in distilled water at 3.0 ml/kg LBW/two times weekly (each ml contained 5 mg of vitamin C). Rabbits in each replicate were individually housed in galvanized wire cages (Dimensions of 50×50×35 cm) until marketing at 12 weeks of age. Both G1 and G2 rabbits were fed palletized feed *ad libitum*. Fresh water was automatically available all the time of study by stainless steel nipples fixed in each cage. Feed ingredients and chemical composition of experimental diet are shown in Table (1). The experimental diet was formulated to meet the recommended nutrients requirements of growing rabbits according to NRC (1994). Beside, all additives were pre-mixed with 1 kg of each diet and successively mixed into the remaining diet to obtain the homogenous inclusion level. The chemical analysis calculation of basal diet was explained according to Feed Composition for Animal and Poultry Feedstuffs used in Egypt (2001). Furthermore, the chemical analysis of diet and premix was performed according to AOAC (2007).

Experimental design:

Monthly temperature-humidity index (THI):

Throughout the experimental period, ambient temperatures and relative humidity were measured into the rabbit housing using automatic thermo-hygrometer (^OC 14:140, H 10 – 99%; TFA Dostmann GmbH + Co. KG, Wertheim, Germany) twice a day at 8:30 a.m. and 14:30 p.m.. The temperature

humidity index (THI) was calculated using the equation for the rabbit modified by Marai *et al.* (2001) as follows:

$$THI = T - [(0.31 – 0.31 \times RH) (T – 14.4)]$$

THI: temperature humidity index.
T: an ambient temperature degree.
RH: the relative humidity percentage /100.
The values of THI obtained were compared to that classified for tropical regions as shown in Table (2).

Table (1): Composition and chemical analyses of the basal diet (as dry matter basis %).

Ingredients	(%)
Yellow Corn	8.00
Barley	20.00
Wheat barley	22.0
Soybean meal (44% CP)	16.00
Alfalfa hay	25.00
Mint straw	5.00
Di-calcium phosphate	1.27
Limestone	1.00
Vitamins and minerals premix*	0.33
NaCl	0.40
Di-methionine (99%)	1.00
Total	100.00
Chemical analysis (on DM basis %)	
Organic matter (OM)	91.47
Crude protein (CP)	18.27
Crude fiber (CF)	14.44
Ether extract (EE)	3.57
Nitrogen free extract (NFE)	55.19
Ash	8.53
Neutral detergent fiber (NDF)	38.41
Acid detergent fiber (ADF)	22.60
Non fiber carbohydrates (NFC)	31.22
Calcium	1.11
Available phosphate	0.49
Lysine	0.89
Methionine	0.42
Methionine + calcium	0.66
Digestible energy (Kcal /Kg)	2784.15

** Vitamins and premix / kg diet included Vitamin A 160000IU, Vitamin E 125 mg, Vitamin K 17 mg, Vitamin B_1 13 mg, vitamin B_2 43 mg, Vitamin B_6 18 mg, pantothenic acid 85 mg, Vitamin B_{12} 0.17 mg, Niacin 230mg, Folic acid 12 mg, Biotin, 0.60mg, Choline Chloride 4300mg, Fe 0.34 mg, Mn 670mg, Cu 56 mg, Co 3mg, Se 2.2 mg and Zn 480 mg.*
Neutral detergent fiber (NDF %) = 28.924 + (0.657×CF %) and Acid detergent fiber (ADF %) =9.432+ (0.912×CF %) according to Cheeke, (1987)].
Non fiber carbohydrates (NFC) = 100 – (CP + NDF + EE + ash) according to Calsamiglia et al. (1995).

Table (2): THI values and severity of heat stress.

NO. of categorize	THI values	Severity of heat stress
1	<27.80 ºC	Absence of heat stress
2	27.8–28.9ºC	Moderate heat stress
3	28.9–30 ºC	Severe heat stress
4	>30 ºC	Very severe heat stress

Physiological performance evaluation:

Measurements of rectal temperature (RT) and heart rate (HR) and respiratory rate (RR) were taken at 14.00 to 15.00 p.m. weekly. The RT was measured of each rabbit with a digital thermometer. The HR and RR were measured by counting the heartbeat of each rabbit representing their treatment for 1 min. with the help of a stethoscope.

Growth performance:

All rabbits in G1 and G2 were kept under the same management, hygienic and environmental conditions. The growing parameters included LBW, daily feed intake (DFI), average daily body weight gain (DBWG), feed conversion ratio (FCR) and performance index (PI) and metabolic weight (MW) were determined.

Digestibility trial:

Two replicate from G1 and G2 rabbits were randomly choosing for the digestibility trial (*n*= 6 per each group). Rabbits were housed in individual metabolism cages diet for a period of 7 days (preliminary period) for adaptation then dry dung were collected every 24 hours for 5 consecutive days (collection period). A dung of each replicate rabbits were daily collected, weighed before offering the morning diet at 9 a.m.. The daily dung was stored at -20°C. Then, five days of mixed dung samples were kept for routine analyses. At analysis process, the dung samples were dried in oven at 60°C for 48 hr., and chemically analyzed according to AOAC (2007).

Carcass characteristics and meat quality measurements:

At the end of the experimental period (12 weeks), slaughter yield and carcass quality measurements were performed on a total three rabbits for either G1 or G2 were chosen randomly. At slaughter, chosen rabbits from G1 and G2 were fasted for 12 h, individually weighed and slaughtered immediately. The slaughtered rabbits were bled, skinned and emptied of the digestive tract and urogenital organs before being weighted. After complete bleeding, pelt, viscera and tail were removed. Post-complete bleeding carcass and its components were weighed as edible parts. Heart, liver, kidneys, spleen and testes were also weighed as percentage of pre-slaughter weight. The chemical composition of meat in the right hind leg was determined in G1 and G2 according to Hassan *et al.* (2021). Dry matter (using an air-evacuated oven for 16 h), crude proteins, ether extract and ash were determined according to the AOAC (2007).

Blood analysis:

At 12 weeks of age, two blood samples were collected from G1 and G2 (*n*=3 in each) during slaughter. The first one was taken on EDTA for hematological parameters, while the second one was collected in clean tubes to obtain the clear serum which used for biochemical analyses.

The hematological parameters:

Regarding to the 1st aliquot was up to 2.5 ml which collected for use in hematological evaluations. The hematological evaluations included the concentration of hemoglobin (Hb), hematocrit value (Hct), red blood cells (RBC's), white blood cells (WBC's), platelets counts (Pit), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and red cell distribution width (RDW) were measured in whole blood samples. Leukocyte fraction included percentage of lymphocytes, monocytes, eosinophils, neutrophils and bosaphils was also determined. Hematological parameters were carried out according to the method of Grindem (2011) using a Hema Screen 18 automated hematology analyzer (Hospitex Diagnostics, Sesto Fiorentino, Italy).

Serum biochemical parameters:

Regarding to the 2nd aliquot, a 10 ml was taken into sterile test tube and left for 20 min at room temperature to coagulate; after centrifugation at 3500 rpm for 20 min, the generated serum was isolated and placed at -20°C until used in the biochemical assays. -Serum biochemical assays included total proteins, albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) were determined. These biochemical parameters were colorimetrically determined using profitable kits (purchased from Bio-diagnostic, Egypt).

Oxidative capacity:

Serum globulin concentration was obtained by difference oxidative capacity parameters such as lipid peroxidation was evaluated through measurement of serum malondialdehyde (MDA), total antioxidant capacity (TAC) and superoxide dismutase (SOD). Serum antioxidant constituents were inspected by colorimetric procedure consuming saleable kits (Bio-diagnostic, Cairo, Egypt).

Economic feasibility measurements:

A partial budgeting technique was utilized to evaluate the economic impact of treatments rabbits in G1 and G2 as follow:

Total feed cost = Total feed intake per rabbit x cost of one kg diet.

The total cost was estimated by considering feeding cost as well as the expense of vitamin C amount quaffed in G2 rabbits.

Total revenue = rabbit live body weight x price of kg live BW.

Net revenue = total revenue – total cost.

Cost-benefit ratio = total cost/total revenue.

Production efficiency factor (PEF) was calculated according to Emmert (2000) as follows:

PEF = [Livability × Mass (Kg) / FCR × Age per days] × 100.

Livability = 100 – Mortality rate (%) the mortality % in this study reached to zero then the livability in this study = 100 - 0.

Mass (Kg) = Final live body weight.

FCR = -Feed conversion ratio.

Age in this study= 84 days.

Statistical analysis:

Statistical evaluation of significant difference between means (mean ± SEM) were performed by ANOVA followed by the Duncan *post hoc* test to determine significant differences in all the parameters among all vitamin using the SPSS/PC computer program (**SPSS, 2020**). The test in a completely randomized design as the following model;

$$Y_{ijK} = \mu + T_i + R_j + e_{ijK}$$

Yijk = the observation.

μ = the overall mean.

T_i = the fixed effect of treatments (i= 1 and 2).

R_j= Replicates (j=1, 2 and 3 / group).

e_{ij}= residual error.

RESULTS AND DISCUSSION

Monthly temperature-humidity index (THI):

The monthly temperature-humidity index (THI) inside the rabbit pen house during the experimental period from January to March is as shown in Figure (1). The months of average ambient temperature, relative humidity (RH %) and temperature humidity index (THI) inside the rabbit pen house were 19.56°C, 66.81% and 19.21, respectively. These results were nearly to those of Sayed-Ahmed *et al.* (2018) who recoded that ambient temperature, RH% and THI were 20.26ºC, 67.41% and 21.41 in winter under the same Egyptian climate condition. In the current study, the THI value up to 19.21 indicated that the months of experimental periods had absence of heat stress in the rabbit house (Marai *et al.*, 2001). Data obtained could be indicated that the overall means of THI in the morning was 18.61 however, in the afternoon up to 19.80 then, THI was higher in afternoon by 6.39% than THI in the morning. Generally, Donia *et al.* (2020) found that the thermo- neutral zone of temperature in rabbits is around 18 -21 ° C and when rabbits are exposed to elevated ambient temperature imbalances are induced in their body temperature.

Physiological performance evaluation:

Rectal temperature (RT):

The current results obtained that significantly higher (P<0.05) in RT of G1 rabbits (37.68 ºC) than G2 rabbits (36.24ºC) observed in Figure (2) during trial period. Thus, vitamin C has been reported to attrite RT in rabbits. These results are in harmony with those of Anoh *et al.* (2022) who found that vitamin C could be reduced RT up to 35.87 ºC compared to 37.68 ºC in control rabbits. Regarding to optimum range of RT in rabbits, Jaén-Téllez *et al.* (2021) recoded that the RT was ranged from 35.60 and 39.80 ºC in rabbits. On the other hand, Reddy and Sivajothi (2017) found that ranging of RT is between 38.61 and 39.72 ºC.

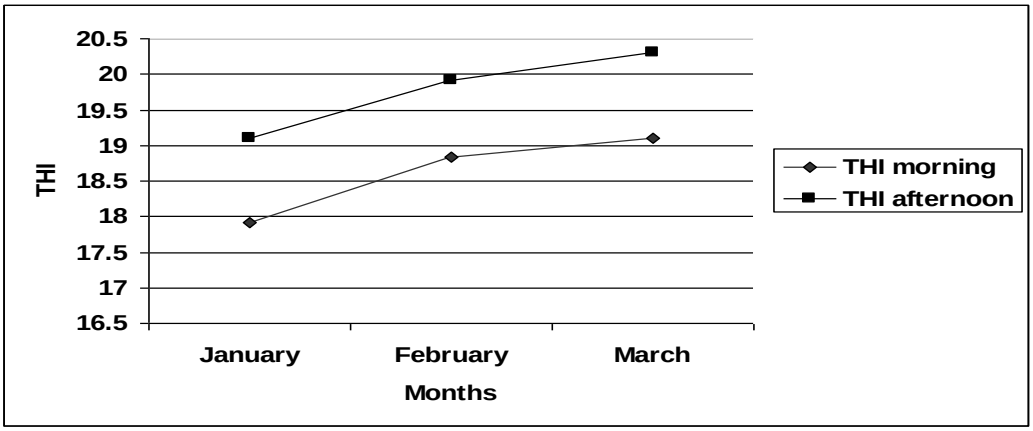

Figure (1): Monthly temperature humidity index (THI) of the rabbit's pen house.

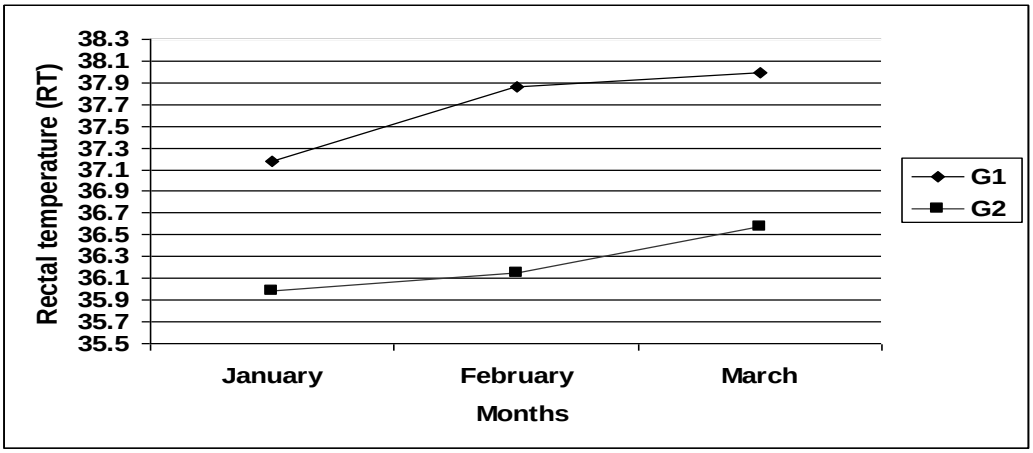

Figure (2): Monthly of rectal temperature (RT) in experimental groups.

Heart rate (HR):

The data in Figure (3) illustrated the HR in G1 and G2 rabbits during experimental months from January to March. The highest (P>0.05) HR was recorded in G1 rabbits (188.50 beats/min) compared with 188.04 beats/min within G2 rabbits. The represent results were agreed with the minimum and maximum range of HR which found by (Reddy and Sivajothi, 2017) revealed that HR range is from 187.0 to 250.0 beats /min in rabbits. The lowest of HR in G2 rabbits were explained by Daader *et al.* (2018) who suggested that vitamins may facilitate the ability of animals to maintain their body homeostasis including body temperature, heart rate and respiratory rate by provoking endogenous cellular defense mechanisms to cope with oxidative stress and inflammation. In contrary, Anoh *et al.* (2022) noticed that rabbit received vitamin C has increased HR (141.35 beats/ min) compared to141.03 beats/ min in control.

Respiratory rate (RR):

Diagram (4) observed that RR values in G1 and G2 rabbits. The G1 rabbits had more (P<0.05) RR than G2 rabbits during experimental period. The average of RR was reached to 48.35 and 45.80 beats/ min in G1 and G2 rabbits; respectively. The RR in rabbits of G1 was more than rabbits of G2 by 5.27%. This may be related to deficiency of vitamins supply (Daader *et al.*, 2018) found that the less vitamins had reduced physiological performance in rabbits. The optimum RR of rabbits was observed with 35.00 to 64.00 beats/min (Reddy and Sivajothi, 2017).

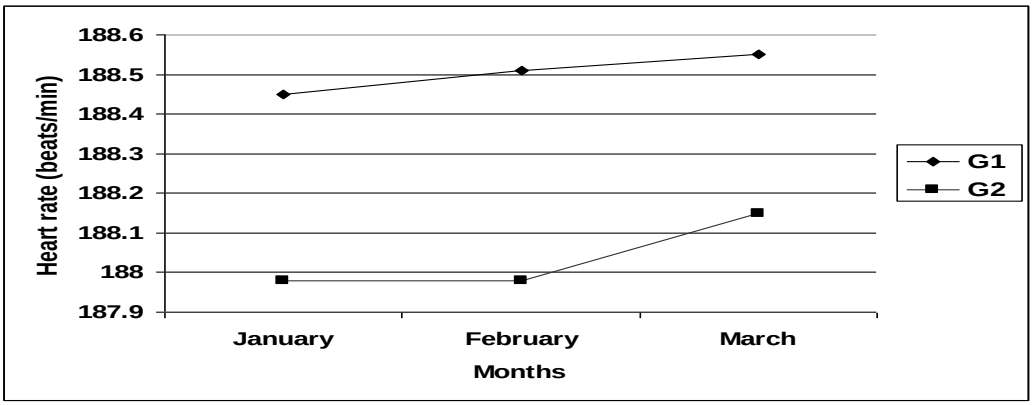

Figure (3): Monthly of heart rate (HR) in experimental groups.

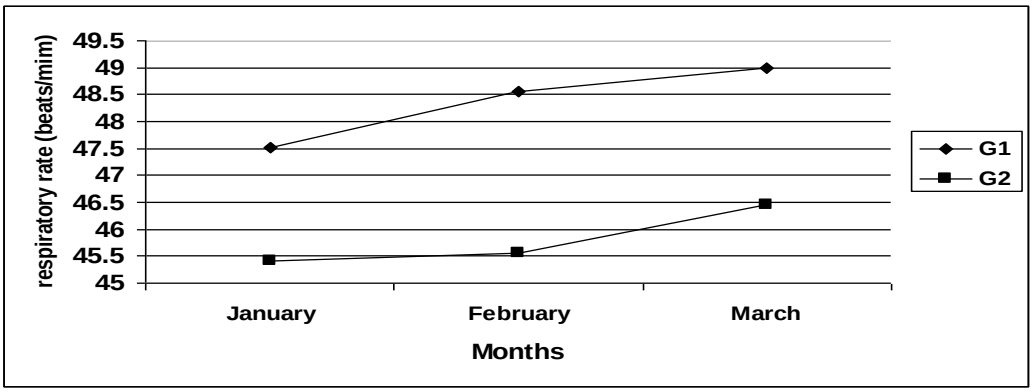

Figure (4): Monthly of respiratory rate (RR) in experimental groups.

Growing parameters:

Growth parameters of growing rabbits in G1 and G2 as affected by quaffed vitamin C in winter months is presented in Table (3). Results indicated that FLBW, DBWG, PI and MW of growing rabbits in G1 were declined (P<0.05) compared to those rabbits in G2. However, no significant effect in DFI and FCR has been observed among G1 and G2 rabbits reared during cold months. Throughout the experimental period, rabbits in G2 had more FLBW by 9.52%, DBWG by13.55%, PI by 26.38% and MW by 4.31% than G1 rabbits. Nevertheless, G2 rabbits had non-significant decrease in DFI and FCR by 1.43% and 13.31% compared to G1 rabbits, respectively. The present results are in harmony with those of Abd- El-Moniem *et al.* (2016) who noticed that adding 500 mg of vitamin C/kg diet for 8 weeks resulted in more FLBW, ABWG and DFI up to 2017, 24.66 and 95.35 gm, than 1882, 21.00 and 94.53 gm in control rabbits; respectively. As well as, Hassan *et al.* (2016) explained that improving of ADWG was due to drastic decreasing in rabbit daily feed intake and improvements in feed conversion ratio compared with the control group and may be due to the biological function of antioxidant activity. According to, Okachi *et al.* (2017) who reported that adding vitamin C could be improved growth performance, possibly because of prevent reactive oxygen species (ROS) that oxidize and destroy cellular biological molecules, inhibit some ATPase activities and finally cause a variety of impairments

to intestinal tissues. In addition, receiving of vitamin C may be enhanced digestive secretions such as saliva and digestive enzymes can increased the absorption and utilization of nutrients which refluxed on growth parameters (Abdel-Latif *et al.,* 2018). Also, the same authors reported that dietary supplementation of ascorbic acid at level of 200 mg in rabbits led to an improvement in growing rate. Furthermore, Sayed-Ahmed *et al.* (2018) suggested that rabbits during winter had better growing performance included FLBW, DBWG and DFI up to 2167.00, 25.97 and 112.31gm with 0.50 g of vitamin C/kg diet and 2182, 26.44 and 116.34 gm with 1.5g of vitamin C/kg diet than 2019, 23.62, 116.81 gm with control rabbit, respectively. Indeed, Sherif (2018) showed that weekly administration of vitamin C with 200mg/kg diet resulted positively in FLBW, DBWG, DFI and FCR up to 2078.0, 23.9, 90.6 gm and 3.83% compared to 2065, 20.9, 91.2 gm and 4.40% in control rabbits; respectively. Similarly, Hamza (2019) demonstrated that dietary vitamin C supplementation in rabbits at levels of 0.5, 1.0 and 1.5 g/kg diet could be increased final BW, BWG and FCR, while DFI was not changed. The present study has been noted that, among different experimental groups the G2 rabbits exhibited the highest growth performance (Hassan *et al.,* 2021) this could be related to its role in defending against pathogenic virus and bacteria and enhancing the immune system. Also, Al-Kurdy *et al.* (2021) concluded the addition of a vitamin C at 40 mg/kg/BW/day for 12 weeks could be had positive developed on growth rate by helps to reduce blood saturated fatty acid and to synthesize amino acids that control nervous system, essential to develop tissues and neurotransmitter formation, improves iron absorption and prevents the detrimental impact of the free radical and toxin. Beside, Al-Kanaan *et al.* (2021) recoded that supplementation of 200 mg vitamin C significantly increase rabbits live body weight, total weight gain and decreasing in average total feed intake comparing with control group.

Table (3): Growth parameters of growing rabbits in experimental groups.

Parameters	Experimental groups	
	G1	G2
Initial weight, gm	427.78±10.59	425.67±8.18
FLBW, gm	2003.33±63.34[b]	2471.67±102.97[a]
[1]DFI, gm	90.99±3.88	87.49±3.41
[2]DBWG, gm	18.76±0.25[b]	24.36±0.42[a]
[3]FCR	4.85±0.38	3.59±0.35
[4]PI	41.30±1.08[b]	68.86±1.77[a]
[5]MW	1.31±0.36[b]	1.46±0.38[a]

Means in the same row bearing different letters differ significantly (P < 0.05).

[1]DFI / rabbit = Feed intake (g) / replicate /week / Number of rabbits consumed feed during the week period

[2]DBWG = Final body weight (gm) - initial live body weight (gm) / Times between initial and final weight

[3]FCR = Feed amount (gm) / Body weight gain (gm)

[4]PI = Final live body weight (kg) ×100 / Feed conversion

[5]Metabolic weight (MW) was calculated as: (Initial body weight (kg) + Final body weight (kg) ÷ 2)$^{0.75}$ according to Willems et al. (2013).

Digestibility trial:

The nutrient digestibility of G1 and G2 is shown in Table (4). There were non- significance (P>0.05) differences in the dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF) and ether extract (NFE) among G1 and G2 rabbits. The DM, CP, CF were higher (P>0.05) in G2 than those rabbits in G1. However, G1 rabbits had more (P>0.05) EE and NFE than G2 rabbits. The current results were indicated that vitamin C was supplied to G2 rabbits could be improved nutritive digestibility compared to G1 rabbits. Similarly, Sallam *et al.* (2005) indicated that the treatment with ascorbic acid supplementation up to 40 mg/kg body weight resulted insignificant increase in digestibility coefficients of DM, CP, CF, EE and NFE. On the same trend, Abd- El-Moniem *et al.* (2016) stated that the nutrient digestibility as CP, CF, EE and NFE was indicated non-significant, it reached to 75.47, 39.35, 65.59 and 71.72% with 500 mg/ kg diet however, 73.81, 34.32, 66.91 and 68.59% with control rabbits, respectively. Also the present results are in agree with those of Sayed-Ahmed *et al.* (2018) who obtained that insignificant differs in digestibility coefficient included DM, CP, CF, EE and NFE, it was 74.44, 38.34, 70.79 and 70.45% with 0.0 g/kg diet however, among

different levels of vitamin C it was 60.33, , 61.21, 72.16, 41.84, 70.80, and 70.81% with 0.5 g/kg diet, 65.21, 77.13, 41.53, 73.84 and 73.61% with 1.0 g/ kg diet and 64.55, 74.85, 44.15, 72.87 and 72.95% with 1.5g/kg diet; respectively. Also, the same authors obtained that in winter season the digestibility coefficient as DM, OM, CP, CF, EE and NFE was 62.37, 67.12, 76.75, 50.45, 81.04 and 71.46% however, in summer was 63.29, 63.94, 72.53, 32.53, 63.11 and 72.44%; respectively.

Regarding to nutritive values, the present results are supported (P>0.05) amelioration in nutritive values for G2 rabbits compared to G1 rabbits. Our results which were in parallel with Abd- El-Moniem *et al.* (2016) who showed that nutritive values as DCP and TDN were 13.74 and 61.75% in rabbits supplied by 500mg vitamin C/kg diet compared to 13.44 and 61.75% in control rabbits, respectively. As well as, Sayed-Ahmed *et al.* (2018) noticed that nutritive value such as DCP and TDN was non-significantly among treatment rabbits, it reached to13.53 and 68.89% in control rabbit however, using different levels of vitamin C was 13.12 and 70.81% with 0.5mg /kg diet, 14.02 and 73.49% for 1.0mg/kg diet and 13.60 and 71.85% using 1.5mg/kg diet, respectively. The enhancement in all digestion coefficient and nutritive values in antioxidants supplemented may be due to many reasons: firstly, promoting the growth of useful bacteria in the gut, secondly, decrease the viscosity of digestive content in the small intestine as a result of hydrolyzing part of none starch polysaccharides (NSP) and thirdly, by reducing NSP, the gut flora modified then decreasing fermentation in the small intestine and improve nutrient utilization as documented by Abduljawad (2020).

Regarding to nutritive energy values, rabbits in G1 (2693.46 Kcal) show lower DE values without significant differences to other rabbits in G2 (2807.21 Kcal) supplied with vitamin C. Similarly, the DE was ranged respectively between 2740 and 2842 Kcal for control and vitamin C (Abd- El-Moniem *et al.*, 2016), but 3040, 3117, 3239 and 3163 Kcal for 0, 0.5, 1.0 and 1.5 mg vitamin C/kg diet; respectively (Sayed-Ahmed *et al.*, 2018). Generally, Ettaib and Bahar (2021) found that improvement notably in the digestibility of energy and the most analytical fractions (dry matter, crude protein, ether extract) including crude fibre which corroborates the results obtained in this study.

Table (4): Nutrient digestibility and nutritive values of growing rabbits in experimental groups.

Items	Experimental groups	
	G1	G2
Digestibility coefficient, %		
Organic matter (OM)	64.98±0.83	65.65±0.29
Dry matter (DM)	64.61±0.85	65.81±0.26
Crude protein, (CP)	73.82±0.52	74.48±0.33
Crude fiber, (CF)	34.53±2.25	35.33±1.18
Ether extract, (EE)	66.52±2.44	66.64±2.55
Nitrogen free extract, (NFE)	67.55±0.92	67.67±0.33
Calculation of nutritive values, %		
DCP	13.49±0.95	13.61±1.11
DCF	4.99±0.05	5.10±0.07
DEE	2.37±0.003	3.38±0.002
DNFE	37.28±8.59	37.35±7.98
TDN	61.09±6.25	63.67±8.58
**Calculation of nutrient energy values, kcal		
DE	2693.46±21.87	2807.21±25.65

To find out the digestible crude of protein (DCP) = digestibility coefficient of the CP in manure × CP content of the feedstuff /100. Digestible crude of fiber (DCF) = digestible coefficient CF in manure × CF content of the feedstuff /100. Digestible of ether extract (DEE) = digestible coefficient EE in manure × EE content of the feedstuff /100. Digestible of nitrogen free extract (DNFE) = digestibility coefficient of NFE in manure × NFE content of the feedstuff /100.

** Total digestible nutrients (TDN %) = DCP (%) + DCF (%) +DNFE (%) + (DEE (%) × 2.25) according to Abd El-Moniem et al. (2016).*

***Calculation of energy values was calculated according to NRC (2007) as following:-*
Digestible energy (DE) = 44.09 × TDN %.

Carcass characteristics and meat quality measurements:

Data on carcass trait, organ characteristics and meat analysis of rabbits fed the experimental diets in G1 or G2 are summarized in Table (4). Regarding to carcass trait and organ characteristics, a significant (P<0.05) differences were observed among G1 and G2 treatments in live weight, carcass weight, edible parts, giblet parts and dressing percentage as well as in some of the relative organ

weights such as heart and kidneys. Rabbits in G2 had significantly (P<0.05) higher mean live weight, carcass weight, fore part, mid part, heart, kidneys, total edible giblets and mean dressed carcass weight than those on G1 rabbits. This tends to suggest that rabbits which had access to the diet containing vitamin C had higher carcass yield. The improvement in the carcass traits and organ characteristics % with vitamin C is in line with the observations made by Okachi and Ani, (2016) who demonstrated that vitamin C has powerful antibacterial and antioxidant effect against enteric pathogens which can lead to an enhancement of the digestive and immune systems which reflected on carcass characteristics. The same author observed that addition vitamin C at 200mg/kg diet has more weight of live weight, carcass weight, liver, heart, kidneys and dressing up to 1.32, 0.97, 3.70, 0.24, 0.64 gm and 73.15% than 1.27, 0.72, 3.27, 0.19, 0.55 gm and 56.80% in control; respectively. Confirmation, Sherif (2018) found that vitamin C supplementation at a level of 0.5 g/kg diet was positively (P<0.05) affected on carcass and total edible parts; they were reached to 60.1 and 63.9% compared to 57.5 and 61.5 in those received control diet; respectively. The variation in carcass traits percentage among rabbits might be related to the use of different genotypes, feed quality and the live body weight at slaughter (Belabbas et al., 2019). Based on the present results, Hassan et al. (2021) who stated that the use of vitamin C supplementations in the rabbit at 1.0 g/kg diet has beneficial effects on carcass weight, dressing, liver, heart, spleen, edible giblets and total edible parts till 1305.00 gm, 63.14, 52.60, 0.39, 1.98, 6.47 and 69.69% contrast to 1136.67 gm, 59.41, 3.93, 0.35, 1.62, 5.16 and 64.62 % in control diet; respectively. In contrast with, Sayed-Ahmed et al. (2018) noticed that dietary supplementation of vitamin C did not have significant effects on dressing (%) and organs weights (g/kg slaughter weight) of growing rabbits in comparison without addition group. Regarding to meat quality measurements, data concerning the effects of vitamin C on the chemical composition of rabbit meat are shown in Table (4). Results indicated that G2 has an attempt to establish superiority (P>0.05) over G1 rabbits. Regarding ascorbic acid concentration, results were revealed that significantly (P<0.05) higher ascorbic acid concentration in hind leg meat of G2 rabbits compared to the G1 rabbits. Hence, rabbits were received vitamin C in G2 had the highest concentration (0.365 mg/100 g DM) of ascorbic acid (AA), while the G1group was the lowest one (0.005 mg/100 g DM). On the other hand, there were insignificant differences in DM, CP and ash contents among G1 and G2 rabbit's meat. In the current study, receiving of vitamin C may be increased concentration of AA in meat. Similar findings were also described by Abdulameer (2018) who indicated that dietary supplementation of vitamin C may cause an increase in the vitamin C of rabbit's meat and reducing the oxidation of the lipids. As well As, Horváth and Babinszky (2019) mentioned that AA is actively transported into tissues, but during stress, AA is produced and consumed rapidly and its amount synthesized fall below animal requirements. Our results were confirmed by Hassan et al. (2021) who recorded that rabbits meat trials included DM, CP, EE and AA in rabbits fed vitamin C were 26.65, 22.17, 2.92 and 0.379 mg/ 100g DM compared to 26.92, 22.20, 3.49 and 0.006 mg/100g DM in control diet; respectively.

Table (4): Carcass measurements and meat quality measurements of growing rabbits in experimental groups.

Items	Experimental groups.	
	G1	G2
Carcass weight, gm		
Pre-slaughter weight	2007.84±173.20[b]	2475.45±183.54 [a]
Carcass weight	1260.57±150.53[b]	1725.98±137.69[a]
Edible, giblet parts and dressing of carcass, %		
Fore part	18.01±6.82[b]	20.93 518.33±62.87[a]
Mid part	15.94 ±7.60[b]	18.65 ±4.38 [a]
Hind part	18.64±4.64	19.33 ±3.46
Heart	0.27±0.02[b]	0.31 ±0.01[a]
Liver	3.74 ±0.78	4.08 ±0.59
Head	4.98 ±0.89	4.98 ±0.82
Kidneys	0.71 ±0.02 [b]	0.85 ±0.03[a]
Spleen	0.05 ±0.01	0.05 ±0.00
Testes	0.42 ±0.01	0.50 ±0.01
*Edible giblets (%)	4.72±0.33	5.24±0.24
**Total edible giblets (%)	63.02±10.47[b]	69.94±9.08[a]
***Dressing percentage	67.76±8.99[b]	74.71±11.1[a]
Meat quality measurements		
Moisture (%)	73.43	64.11

Dry matter (DM) (%)	34.56±0.22	35.88±0.17
Crude protein (CP) (%)	21.22±0.09	21.42±0.19
Ether extract (EE) (%)	3.42±0.05	2.91±0.11
Ash (%)	1.79±0.13	1.89±0.08
Ascorbic acid (mg/100 g DM)	0.005±0.001[b]	0.365±0.02[a]

Means in the same row bearing different letters differ significantly (P < 0.05).
**Edible Giblets %= liver (gm) + kidneys (gm) + heart (gm) / Pre-slaughter weight (gm) ×100.*
*** Total edible parts (%) = Carcass wt+ edible giblets / Pre-slaughter weight (g) ×100.*
****Dressing percentage %= Carcass weight including the head ×100*
Live pre-slaughtering weight

Blood analysis:

Hematological parameters:

As shown in Table (5) the data were recorded upon the findings of G2 on total erythrocyte counts (RBC), hemoglobin (Hb), mean cell volume (MCV) packed cell volume (PCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), platelets count (Pit) and total leukocyte counts (WBC) at end of the 12-week of treatment. The treatment with G1 and G2 could be produced non-significant (P>0.05) in erythrogram and leukogram parameters while, G1 rabbits did not impact any greater changes than G2 rabbits. In the same trend, Abd- El-Moniem *et al.* (2016) found that RBC's ($10/mm^3$), Hb (g/d), PCV%, MCV(FI), MCHC% and platelets were 4.27, 10.15, 28.68, 67.19, 35.76 and 225.00 in control rabbits, but in rabbits received vitamin C rising up to 4.80, 11.00, 32.98, 68.65, 33.65 and 317.00, respectively. In this respect, Sayed-Ahmed *et al.* (2018) who estimated that dietary ascorbic acid supplementation of growing rabbits could be indicated insignificantly values of hematological parameters. They revealed that rabbits were supplied vitamin C with 1.5 g/Kg diet obtained higher (P>0.05) RBCs (10^6/ml), hemoglobin (g/dI), hematocrit (%), WBCs (10^3/ml) and lymphocytes (10^3/ml) up to 4.39, 10.03, 0.32, 4.77 and 2.33 than 4.24, 8.91, 0.32, 4.51 and 2.08 in control rabbits; respectively.

Table (5): Hematological parameters of growing rabbits in experimental groups..

Hematological parameters	Experimental groups	
	G1	G2
Erythrogram		
RBC's, (100^3 cell/µL)	6.24±0.36	6.53±0.63
Hb, g/dL	10.42±0.65	11.33±0.74
HCT, %	39.01±2.33	39.43±2.48
Hgb,%	84.44±4.80	85.00±5.51
MCV, fL/cell	60.33±0.72	61.40±2.67
MCH, pg/cell	17.17±0.23	17.47±0.59
MCHC, g/dL	28.17±0.21	28.73±0.12
RDW, %	16.33±0.22	17.90±0.58
Pit, $10^3/mm^3$	229.17±58.72	307.67±47.89
WBC's, $10^3/mm^3$	4.93 ±0.91	4.91±0.0.95
Leukogram fraction %		
Neutrophils	31.20±4.37	31.47±2.73
Lymphocytes	54.63±4.44	55.00±2.08
Monocytes	8.70±0.55	9.33±0.67
Eosinophils	3.31±0.03	3.40±0.00
Basophiles	0.65±0.00	0.67±0.00

Means in the same column within each classification bearing different letters are significantly different (P<0.05).

The hematological parameters such as RBCs, WBCs, MCV, MCH and MCHC are helpful in monitoring the health condition (Al-Kurdy *et al.*, 2021). The previous authors recorded that RBC's $\times10^6/mm^3$, WBC's$\times10^3/mm^3$, MCV (FI), MCH (pg) and MCHC (dI) were 5.8, 7.6, 83.4, 27.0 and 31.3 in rabbits treated with vitamin C compared to 5.4, 7.1, 83.2, 26.5 and 31.1 in control rabbits, respectively. The results indicated that treatment with ascorbic acid ameliorated its detrimental effect

on hematological parameters (Hassan *et al.*, 2021) and this result refers to the absorption of about 80-90 percent ascorbic acid in the gastrointestinal tract. In regards to leukogram fraction, our results are agreement with observed by (Sayed-Ahmed *et al.*, 2018), but vary by (Abd- El-Moniem *et al.*, 2016) who noticed that 500 mg of vitamin C /Kg diet has WBC's, lymphocyte and heterophile up to 6.29, 5.57 and 0.36 10^3/mm^3compared to 2.89, 2.62 and 0.06 10^3/mm^3 in rabbits fed 0 mg of vitamin C; respectively.

Biochemical parameters:

Data in Table (6) discusses the biochemical blood parameters in G1 and G2 of Black Balady rabbits at 12 weeks of age. Serum levels of total protein, albumin, cholesterol, triglycerides and HDL appeared significantly (P<0.05) higher in G2 rabbits than G1 rabbits. The significantly (P<0.05) higher of LDL was observed with G1 rabbits than G2 rabbits. In harmony with the present results of some authors (Sayed-Ahmed *et al.*, 2018, Sherif, 2018, and Al-Kurdy *et al.*, 2021) they asserted that addition of vitamin C to diet could be improved biochemical blood parameters of rabbits. Furthermore, Hassan *et al.* (2021) recoded that using of 1.0 g of vitamin C/kg diet can change rabbits plasma blood concentration included total protein (g/dL), globulin (g/dl), total cholesterol (mg/dL), triglyceride (mg/dL), LDL (mg /dL), total lipids (mg/dL) and ascorbic acid (mg/L) up to 6.40, 2.27, 101.20, 96.62, 80.11, 144.24 and 197.69 compared to 5.53, 1.69, 121.69, 123.00, 89.29, 156.01 and 157.26 in control rabbits, respectively. In regarding with enzyme activity of liver function, the G2 rabbits appeared (P<0.05) lower values in AST and ALT than G1 rabbits. However, the levels of enzyme activity of liver function is located in normal range (Adikwu and Deo, 2013), that reported the range of normal AST (indicated liver cell necrosis may cause elevations in this enzyme) is between 10 to 40 units per liter and ALT (it may indicate liver inflammation and necrosis) between 7 to 56 units per liter, but it is safe when mild elevations are generally considered to be 2-3 times higher than the normal range. Also, the former authors posited that vitamin C ameliorated stannous chloride induced toxicity in the liver, decreased levels of free radicals and also reported that use of vitamin C gave hepatoprotection against liver toxicity. This is supported by the work of (Sayed-Ahmed *et al.*, 2018) they reported that dietary vitamin C supplement may have protective effect on the liver and also improve hepatic function refluxed (P<0.05) on ALT and AST which reached to57.72 and 63.20 U/L with vitamin C at 0.5g /Kg diet, 56.74 and 57.56 U/L with 1.0 g vitamin C /Kg diet and 53.22 and 48.96 U/L with 1.0g/kg diet compared to 40.01 and 43.66 U/L in control rabbits, respectively. As well as, Sherif, (2018) observed that vitamin C has optimal (P>0.05) range condition of AST and ALT enzymes; it was 60.21 and 12.80 U/L compared to 59.33 and 13.63 U/L in control rabbits, respectively.

Table (6): Biochemical parameters and enzymes activity of growing rabbits in experimental groups.

Blood parameters	Experimental groups	
	G1	G2
Biochemical parameters		
Total protein, g/dL	6.62±0.25[b]	7.37±0.09 [a]
Albumin, g/dL	4.24±0.33 [b]	4.60±0.15[a]
Cholesterol, mg/dL	55.06±4.55[a]	45.33±3.53 [b]
Triglycerides, mg/dL	84.68±5.26 [a]	80.67±17.30[b]
HDL, mg/dL	48.69±1.22[b]	56.00±1.53 [a]
LDL, mg/dL	121.00±2.81[a]	111.00±4.16[b]
VLDL, mg/dL	16.95±1.15	16.13±3.46
Enzymes activity of liver function		
AST, U/L	41.65±8.21[a]	46.33±2.91[b]
ALT, UL	40.05±18.31[a]	47.33±0.88[b]

Means in the same column within each classification bearing different letters are significantly different (P<0.05).

Oxidative capacity:

The diagram is presented in Figure (5) discusses the oxidative capacity among G1 and G2 rabbits. The results demonstrated that G2 rabbits had the positive effects on the enzymatic antioxidant compared to G1 rabbits. More (P<0.05) TAC (0.31mg/ml) and SOD (0.41µ/ml) levels in G2 rabbits than TAC (0.17 mg/ml) and SOD (0.30 µ/ml) in G1 rabbits. However, G1 rabbits has greater (P<0.05) of MDA (0.31 mmol/ml) than 0.18 mmol/ml in G2 rabbits. The results are in accordance with previous studies by Abd- El-Moniem *et al.* (2016) who reported that MDA level was significantly (P< 0.01)

depleted, but other beneficial oxidative enzymes as catalase (CAT) activity and glutathione (GSH) contents were significantly increased in vitamin C rabbits compared with those in control ones. Also, these results of the best oxidative capacity may be due to the beneficial effect of ascorbic acid on reduction oxidative damage initiated by free radicals and improve body organs function as mentioned above (Sayed-Ahmed *et al.*, 2018). According to, Sherif (2018) found insignificant improvement in oxidative activity by supplementation of vitamin C (0.5 g/kg diet) the TAC and MDA were 1.11 and 27.56 µmol/ml, but 1.18 and 27.67 µmol/ml in control rabbits, respectively. The antioxidant in diet rabbits showed a positive ($P<0.05$) effect on total antioxidant capacity compared with control group (Zeweil *et al*., 2016) revealed that TAC was 0.81 mmol/ml and MDA was 17.57 mmol/ml in control rabbits however, in rabbits received an antioxidant substances the TAC reached to 1.42 mmol/ml and MDA up to 13.07 mmol/ml. The finding of this study is also consistent with findings of El-Badry *et al.* (2019) who showed that antioxidant materials has reduced MDA up to 1.96 mmol/ml compared to 3.28 mmol/ml in control rabbits. The slightly ($P>0.05$) increase in oxidative enzyme as glutathione transferase (GST) or substantial decrease in thiobarbituric acid-reactive substances (TBARS) in rabbits had treated with ascorbic acid was in accordance with the previous studies (Al-Kanaan *et al.*, 2021) who concluded that adding of vitamin C could improve oxidative activity of GST up to 0.90 µmol/hr and reduced TBARS to 0.23 comparing to control rabbits which has less GST at 0.88 µmol/hr and increased concentration of TBARS to 0.30. As well as, Hassan *et al.* (2021) reported that rabbit groups were given vitamin C at level 1.0 g / kg diet has higher TAC and SOD up to 1.33 mmol/L and 30.30 µ/L than 1.28 mmol/L and 28.20 µ/L in control rabbits, respectively. Increasing in lipid peroxidation and mitochondrial swelling were prevented by ascorbic acid. This is supported by findings of Anoh *et al.* (2022) who observed that 0.5 ml of dietary vitamin C supplementation is able to increase global antioxidant capacity and also reported to confer protective effect against endotoxins induced oxidative damage to protein.

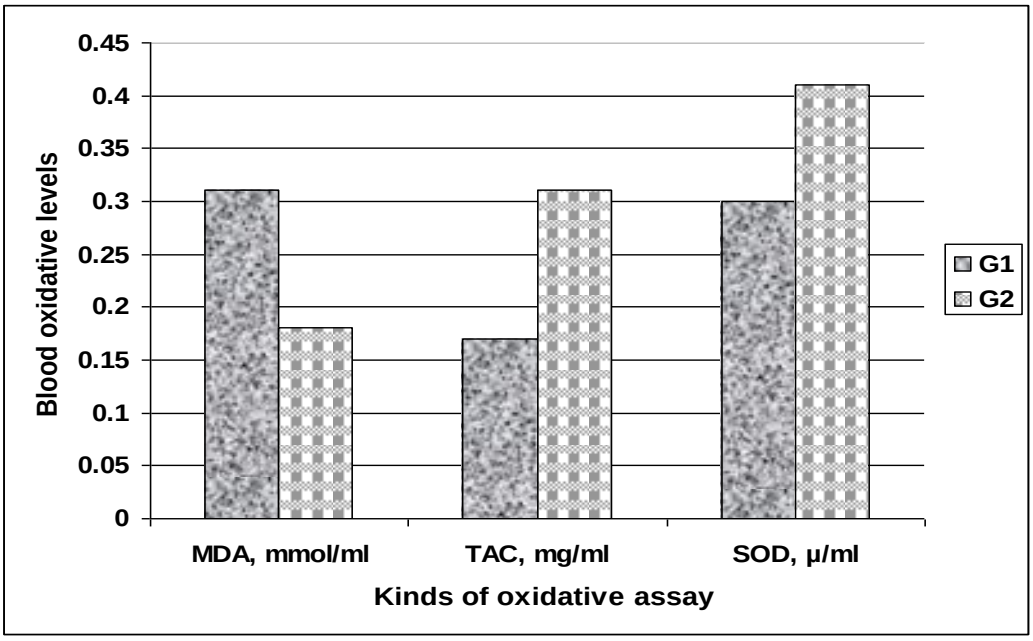

Figure (5): oxidative capacity of growing rabbits in experimental groups.

Economic feasibility measurements:

With respect to the price of kilogram of diet, vitamin C, price of sell rabbit economical efficiency has been calculated in Table (7). The cost-benefit ratio (CBR) was more by 0.79 in G2 than 0.61 in G1. Also, EER % was increased in G2 rabbits until 129.51% compared to 100.00 in G1 rabbits. In addition the production efficiency factor (PEF) was greater in G2 that G1 rabbits up to 82.21 than 49.24%, respectively. Actually, economical assessment of the either G1 or G2 groups revealed a substantial increase in the total and net revenue and an increase in cost-benefit ratio with G2 group. Despite the raise cost of vitamin C in G2 rabbits, but increasing in LBW sold in G2 could compensate the greater cost, which led to enhance cost-benefit ratio in G2 rabbits. In line with the current findings, Abd- El-

Moniem *et al.* (2016) reported that higher economical feed efficiency with vitamin C included total revenue (LE), net revenue (LE), economical feed efficiency (EE) and EE relative to control (%) was 33.14, 19.79, 1.48 and 121.00 than 28.22, 15.51, 1.22 and 100.00 in control rabbits, respectively. Also, Okachi *et al.* (2017) noticed that vitamins C should be included in the diet of growing rabbits enhance revenue and reduced feed cost (RFC) per kg of rabbits. As well as, Sayed-Ahmed *et al.* (2018) noted that as the addition vitamin C at 5 g /kg diet to rabbit diet could increase final margin from 20.05 to 22.35 LE/rabbit. Also, Hassan *et al.* (2021) calculated that total revenue (LE), net revenue (LE), economical feed efficiency (EE) and EE relative to control (%) was greater in vitamin C rabbits till 4.59, 3.05, 1.98 and 107.81 than 4.04, 2.26, 1.84 and 100.00 in control rabbits, respectively.

Table (7): Economic feasibility measurements in experimental groups.

Items	Experimental groups	
	G1	G2
Average of total feed intake (ATFI)= (ADFI× trail days) [A], g	7643.16	7349.16
Total consumption of vitamin. C, ml	-	79.09
Cost of feed intake= (A × price of kg), LE	61.15	58.79
*Cost of vitamin C, LE	-	39.55
**Total cost, LE [B]	61.15	98.34
Final body weight, kg [C]	2006.44	2479.99
Economic feasibility measurements		
***Total revenue [D = (C × price of sale kg rabbit)]	100.32	124.00
Net revenue [D-B]	39.17	25.66
Cost-benefit ratio (CBR) [B / D]	0.61	0.79
****EER relative to control, %	100.00	129.51
Production efficiency factor (PEF), %	49.24	82.21

** Vitamin C: solvent in water which produced by Ab chemical for raw pharmaceutical, Egypt.*
***Price in year 2022 for CFM was 8000 EL / ton, but for vitamin C 500 EL / litter.*
****Price of sale kg rabbit is 50 (LE).*
***** EER=economical efficiency relative with G2= CBR of G2 – CBR of G1÷ CBR of G1×100 +100 (conceder EER of G1 is 100%).*

CONCLUSION

Based on the data presented above, it could be concluded that gave vitamin C orally to black Balady rabbits enhanced growth performance, nutrients digestibility, weight of carcass, stabilized the normal blood parameters (as hematological and biochemical) and elevated balance of economic feasibility measurements for rabbits exposed to cold stress. Generally, from both the best health and an economic point of view, several benefits might be gained by adding vitamins thus; these additives had caused the most revenue to the diet of commercial rabbits under Egyptian conditions.

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الأداءالإنتاجى ومعايير الدم والكفاءة الاقتصادية للأرانب السوداء البلدي حصلوا بالفم على فيتامين ج مذاب تحت الظروف المصرية الباردة

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معهد بحوث الإنتاج الحيوانى ، مركز البحوث الزراعية ، دقى ، جيزة ،مصر.

تم استخدام ثمانية عشر من ذكور الأرانب السوداء البلدي من فرع الأرانب محطة التربية بالسرو التابعة لمعهد بحوث الإنتاج الحيوانى بعمر 5 أسابيع للدراسة خلال أشهر الشتاء من يناير إلى مارس2022. تم تقسيم الأرانب عشوائياً إلى مجموعتين 9 أرانب لكلا من G1 و G2. تم تقسيم كل مجموعة إلى 3 مكررات3 أرانب /مكرره. تم تغذية الأرانب في G1 على نظام غذائي خالٍ من إضافات الأعلاف ، وأعطيت 3.0 مل من الماء المقطر عن طريق الفم كمذيب فيتامين / كجم من وزن الجسم الحي (LBW) / مرتين أسبوعياً ، وبالتالي ، تم استخدامها كمجموعة (كنترول). تم تغذية الأرانب في G2 بنفس بعليقة الكنترول بالإضافة إلى فيتامين ج مذاب في ماء مقطر بمعدل 3.0 مل / كجم LBW / مرتين أسبوعياً (كل مل يحتوي على 5 مجم فيتامين ج). تم استخدام كل من الأرانب G1 و G2 لدراسة تأثير فيتامين ج في رعاية الأرانب وأداء النمو وهضم العناصر الغذائية وصفات الذبيحة وجودة اللحم مقاييس الدم والجدوى الاقتصادية لنمو الأرانب تحت ظروف البرد الشتوي في مصر. أظهرت النتائج خلال فترة التجربة ارتفاع معنوي (P <0.05) في درجة حرارة المستقيم لأرانب G1 مقارنة بأرانب G2. تم تسجيل أكثر معدل لضربات قلب (P> 0.05) في الأرانب G1 مقارنة مع G2 الأرانب. كان معدل تنفسG1 (P <0.05) أكثر من G2. وقد حققت G2 زيادة معنوية (P <0.05) للوزن النهائي (LBW) ، وزيادة وزن الجسم اليومي ، ونسبة تحويل الغذاء ، ومؤشر الأداء عن G1. وكذلك كان هناك اختلافات غير معنوية (P> 0.05) في معاملات هضم العناصر الغذائية لكل من المادة الجافة (DM) ، المادة العضوية (OM) ، البروتين الخام (CP) ، الألياف الخام (CF) ، مستخلص الأثير (EE) والمستخلص الخالي من النيتروجين (NFE) بين G1 و G2. وكانت DM، CP، CF أعلى (P> 0.05) في G2 مقارنة مع G1. لوحظ وجود فروق معنوية (P<0.05) بين G1 و G2 لصفات الذبيحة وتفوق جودة اللحوم فى G2. تم ملاحظة تحسن فى مقاييس الدم والكيمياء الحيوية والأكسدة في G2 مقارنة بأرانب G1. كانت نسبة التكلفة إلى الفائدة أكبر بمقدار 0.79 في G2 من 0.61 في G1. كما زادت الكفاءة الاقتصادية النسبية٪ في أرانب G2 مقارنة بتلك الموجودة في أرانب G1. كان عامل كفاءة الإنتاج أكبر في G2 من الأرانب G1.