Al-Muthanna J. For Agric Sci Print ISSN: 2226-4086 Online ISSN:2572-5149
Vol. 10 , Issue. 02. 2023

https://muthjas.mu.edu.iq/ http://doi.org/10.52113/mjas04/10.2/32

Effect of Adding Different Levels of Silver -Curcumin Nanoparticles on Some Productive Traits, Blood Parameters and Antioxidant Status of Broiler Chickens

Saja K. S. Al-Zuhairi [1, 2], Khalid C. K. Al-Salhie [1], Zainab T. Y. Al-Abdullah [3]

Department of Animal Production, College of Agriculture, University of Basrah, Iraq [1]

Department of Animal Production, College of Agriculture, Thi-Qar University, Iraq [2]

Department of Chemistry, College of Education and Pure Sciences, University of Basrah, Iraq[3]

Email: saja-k@utq.edu.iq

khalid.chillab@uobasrah.edu.iq zt_yasin@yahoo.com

Received on 05/10/2023 Accepted on 19/11/2023 Published on 15/12/2023

Abstract:

The objective of the current study was to investigate the impact of adding different levels of silver-curcumin nanoparticles on some productive traits, blood parameters and antioxidant status of broiler chickens. A total of 144 broiler chicks (Ross308),one day old, with an average weight of 40 grams, were used in this study. The chicks were randomly distributed into four experimental treatments (each with 36 chicks), with three replicates for each treatment (12 chicks per replicate), using a completely randomized design for a period of 35 days. The first treatment was a control without addition, while the second, third, and fourth treatments, each added 1, 1.5, and 2 mg of silver-curcumin nanoparticles per liter of drinking water, respectively. The results indicated that the best average body weight, overall weight gain, and feed conversion efficiency were in the fourth treatment. The results indicated a significant increase ($p \leq 0.05$) in some blood parameters such as the packed cells volume , red blood cells, and hemoglobin concentration in the third and fourth treatments

Al-Muthanna J. For Agric Sci Print ISSN: 2226-4086 Online ISSN:2572-5149
Vol. 10 , Issue. 02. 2023
https://muthjas.mu.edu.iq/ http://doi.org/10.52113/mjas04/10.2/32

compared to the other experimental treatments. The results indicated a significant increase ($p \leq 0.05$) in the third and fourth treatments for the effectiveness of the GPX enzyme compared to the control and the second treatments. In terms of the CAT enzyme's efficiency, the results showed an improvement all treatments when compared to the control treatment. While the results did not indicate a significant difference in the mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), the activity of the enzyme superoxide dismutase (SOD), and the concentration of malondialdehyde (MDA) among the study treatments**.** It can be concluded that adding 2 mg/L of silver- curcumin nanoparticles has improved the growth of broilers and their feed conversion efficiency, as well as improving blood parameters and enhancing antioxidant enzymes such as glutathione peroxidase and catalase**.**

Keywords: Antioxidant enzymes ,Blood parameters ,Broiler, Silver- curcumin nanoparticles

introduction:

Nanotechnology is one of the technologies that has been introduced in the poultry industry recently, and it is an important and innovative technology that is working to revolutionize the poultry sector all on the world (Hameed., 2021). One of the most important aims of using nanoparticles in the poultry industry is to improve their production qualities, improve bioavailability, and enhance immunity, digestibility, growth performance of broilers (Ahmad *et al*., 2022). Nanoparticles, like nanocurcumin, can quickly interact with biological systems and pass through living organisms' cell membranes with ease. One suggestion to increase bioavailability, which increases its absorption, is to use nanocurcumin (Reda *et al*., 2020). Plant extracts are used as feed additives, but It is advantageous because it increases digestibility, benefits performance, health, and immune response, and has no negative effects on the health of animals. (Oluwafemi *et al.*, 2020; Al-Ashoor & Al-Salhie, 2020; Mahjar & Al-Salhie, 2022). Curcumin, a polyphenolic compound and one of the natural compounds extracted from turmeric roots, is the plant extract. It has a wide range of therapeutic advantages, including the ability to stimulate growth, act as an antioxidant and antimicrobial, and lessen the harmful effects of stress. One tactic is to use curcumin alone or in combination with other additives. nutrients to increase the health and productivity of poultry. (Geevarghese *et al*., 2023). Due to their antibacterial, antifungal, antiviral, anti-inflammatory, and anticancer properties, silver nanoparticles (AgNPs) are one of the

most important nanomaterials and have been used in biological and medical applications. Due to its antimicrobial and antifungal qualities, nanosilver has been used in a variety of industries, including poultry production (Al-Zubaidi *et al.*, 2021; AlMasoud *et al*., 2021) According to Dobrzanski *et al*. (2010), broiler chicken bedding can be made less pathogenic by using nano-silver. Therefore, the current study aimed to determine the effect of adding different levels of silver- curcumin nanoparticles on some production traits, blood parameters, and antioxidant status of broiler chickens.

Materials and methods

Silver-curcumin nanoparticles preparation

The method described by Al-Abdullah *et al*., (2021), which is called the wet method or the oxidation-reduction method, was followed with some modification in preparing the silver-curcumin nanoparticles by taking 0.1 grams of each of silver nitrate and curcumin. Then complete the volume to 100 ml with deionized water, then place the mixture on a stirring device at a temperature of 80 degrees Celsius until the color of the solution changes from yellow-orange to brown, which gives an indication of the formation of nano-silver.

Nanoparticle detection

The surface morphology of the nanocomposite was determined using a scanning electron microscope (SEM). Drops of the nanoparticle solution were placed on an aluminum base and dried by evaporating water. The samples were sent to the CAC laboratory located in the capital, Baghdad, to be sent to the Islamic Republic of Iran for the purpose of examination. It is clear from Figure (1) that all the silver-curcumin nanoparticles were of an average size of (20-90) nanometers and were in the nanoscale range, distributed homogeneously, and that the surface was free of conglomerates

.

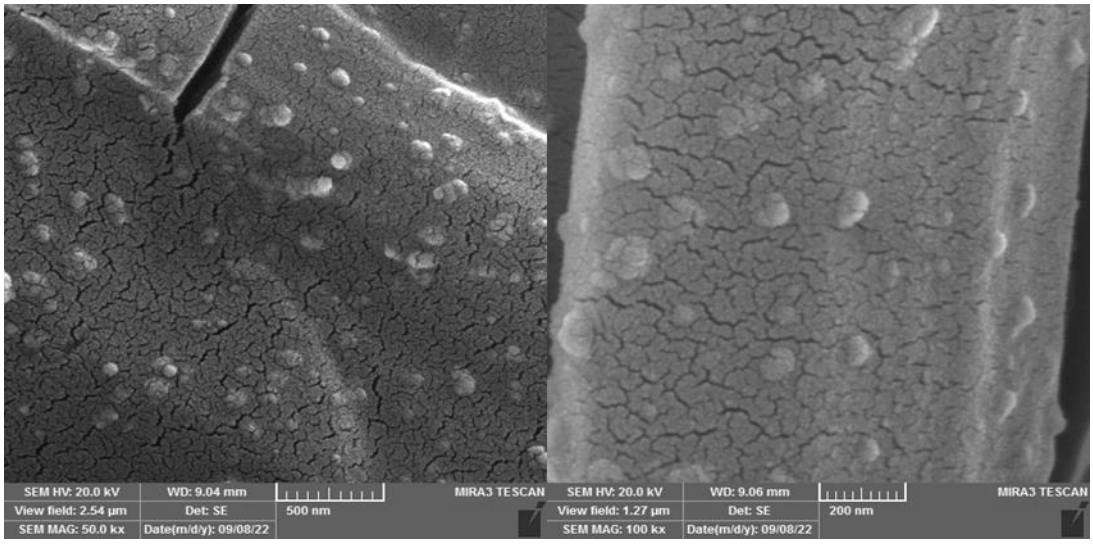

Figure (1) Scanning electron microscope of the prepared silver-curcumin nanoparticles

Experiment treatments

A total of 144 unsexed Ross308 chicks were used in this study. The chicks were randomly distributed into four experimental treatments (each with 36 chicks), with three replicates for each treatment (12 chicks per replicate).The first treatment was control without addition, while the second, third and fourth treatments, 1, 1.5 and 2 silver-curcumin nanoparticles were added per liter of drinking water, respectively.

Birds management:

The chicks were raised for five weeks (35 days) in controlled conditions. In the first week, the temperature was 34 degrees Celsius and was reduced by two degrees per week, reaching 26 degrees Celsius in the fifth week. The lighting was 24 hours a day. The chicks fed two different basal diets. The starter diet containing 23% crude protein and 2876 kcal\kg metabolizable energy for a period of(1-21) days. The second diet is a grower diet that contains 20.00 % crude protein and 3148 kcal\kg metabolizable energy for a period of (22-35) days. The chicks fed a pellet diets and *ad libitum* water access.

Data collection

Productive traits

At the start of the experiment, when the chicks were one day old, they were all weighed together, and the average starting weight was 40 g. The final weight, overall weight gain, cumulative amount of feed consumed, and feed conversion efficiency were measured at the end of the experiment (at the age of 35 days) according to (Akomah *et al*, 2021).

Blood parameters and antioxidant status

The birds fasted for 3 hours. Blood samples were collected from 33-day-age birds from a leg vein, one male bird for each replicate randomly. In order to determine blood parameters, 1 ml of blood was drawn and put into tubes containing an anticoagulant (EDTA). These parameters were included thered blood cells (RBC $x10^6$ mm3), packed cells volume (PCV%), hemoglobin concentration(Hb g.dl-1), mean corpuscular volume (MCV fl), mean corpuscular haemoglobin (MCH pg) and mean corpuscular haemoglobin concentration (MCHC g.l-1).All blood parameters were measured based on (Campbell, 1995). The blood sample was centrifuged at a speed of 3000 rpm for 15 minutes to separate the serum from the blood components. The serum was collected and placed in sealed tubes. The activity of the antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase (GPX) were calculated based on Flohe and Günzler (1984) . The catalase enzyme (CAT) was calculated based on the method of (Beer and Sizer, 1952)The concentration of malondialdehyde (MDA) was calculated according to the method (Yagi, 1998).

statistical analysis:

The data were analyzed using the statistical analysis program SPSS (SPSS, 2018), and the Duncan test was used to determine whether the differences between the coefficients were significant ($p\leq 0.05$).

Results and discussion:

Productive traits

The results in Table (1) indicate the effect of adding different levels of silver-curcumin nanoparticles on the productive characteristics of broiler chickens. The results showed that there are significant differences between the various treatments in terms of final body weight, overall weight gain, and cumulative feed conversion efficiency. Comparing the fourth treatment to the other experimental treatments, there was a significant difference ($p\leq 0.05$) in average body weight and overall weight gain as well as an improve in cumulative feed conversion efficiency. However, there were no significant differences in cumulative feed consumption. The action of the nano-silver curcumin preparation, which functions as an antioxidant and inhibits free radicals in addition to its role in inhibiting harmful bacteria, may be the cause of this significant improvement in average weight, overall weight gain, and cumulative feed conversion efficiency. This increases protein synthesis rates and boosts the birds' immunity (Badran., 2020). Recently, the use of nano-curcumin in poultry feed has been discussed. By increasing the bioavailability of curcumin using nanotechnology, this may improve the physiological and productive performance and health status of poultry. (Hani & Shivakumar, 2014). As a natural and safe additive, nanocurcumin can be used to boost

nutritional value (Partovi *et al.*, 2020). According to earlier studies, nanocurcumin had a favorable impact on live body weight and feed conversion efficiency (Rajput *et al*, 2013). According to Marchiori *et al*. (2019), quail birds' feed conversion factor was increased when 10 mg of nano-encapsulated curcumin/kg was added. Gogoi *et al*., (2019) research also demonstrated that broiler chickens' body growth and feed conversion efficiency were enhanced when nano-curcumin was added to their drinking water. The role of nanoparticles in enhancing food solubility in intestinal fluids and facilitating food absorption by the digestive system may be responsible for the increase in food conversion efficiency (Yao *et al*., 2015).

Table (1) The effect of adding different levels of silver- curcumin nanopaticles on the productive traits of broiler chickens (mean ± standard error)

Treatments	Initial body weight(g)	Final body weight(g)	Overall weight gain (g)	Cumulative feed intake (g)	Cumulative feed conversion efficiency(g.g)
T1	40.00± 0.00	2001.46^{d} 0.79±	1961.46^{d} ±0.79	2940.99 21.71±	1.49^{a} 0.01±
T2	40.00± 0.00	2051.18^{c} 2.31±	2011.18^{c} ±2.31	2933.70 39.98±	1.45^{a} 0.02±
T3	40.00± 0.00	2206.21^{b} 1.91±	2156.21^{b} ±1.91	2855.18 96.08±	1.32^{b} 0.04±
T4	40.00± 0.00	2291.33^{a} 1.45±	2251.33^{a} ±1.45	2928.04 38.22±	1.30^{b} 0.01±
significant	N.S	*	*	N.S	*

Different letters in the same column mean there are significant different at $p \leq 0.05$. N.S; non-significant.

blood parameters

The results of Table (2) indicate the effect of the silver-curcumin nanoparticles on the blood parameters. The results showed a significant effect($p \leq 0.05$) of the silver-curcumin nanoparticles on some blood characteristics between the study treatments. The findings demonstrated the third and fourth treatments' superiority over other treatments in terms of the packed cells volume, red blood cells, and hemoglobin concentration. The antioxidant like properties of the active ingredients in nano-curcumin may be the cause of this. It has been discovered to be a superior free radical scavenger. As was clearly evident in the improvement in weight rates, this notable improvement in cellular blood parameters may reflect the health and development of growth in broiler chickens. Given that these characteristics have a positive correlation coefficient, it might be because there are more red blood cells (Campbell, 1995). According to the findings, there was not a significant difference between the study treatments in terms (MCV), (MCH), and (MCHC). The findings of the present study did not support those of Abd El-Hack *et al*. (2021), who demonstrated that consuming nano-curcumin increased the (MCV), (MCH) and (MCHC) of broilers. Given that the concentrations of the nano-curcumin used were (0.3, 0.5, and 0.2)cm3/kg, respectively, the difference could be explained by the concentrations of the nano-curcumin used.

Table (2) Effect of adding different levels of silver-curcumin nanoparticles on some blood parameters of broiler chickens (mean ± standard error)

Treatments	RBC (million/mm3)	PCV (%)	HB (g/100 ml)	MCV (fl)	MCH (pg/cell)	MCHC (g/100 ml)
T1	2.76 [b] 0.19±	25.67 [b] 1.45±	8.55 [b] 0.48±	93.00 0.57±	30.97 0.39±	33.32 0.00±
T2	2.71 [b] 0.10±	25.33 [b] 0.88±	8.44 [b] 0.29±	93.46 0.53±	31.14 0.16±	33.30 0.00±
T3	3.46 [a] 0.10±	31.33 [a] 0.88±	10.44 [a] 0.29±	90.54 0.19±	30.17 0.02±	33.31 0.00±
T4	3.60 [a] 0.06±	32.00 [a] 0.57±	10.66 [a] 0.19±	88.88 0.55±	29.61 1.20±	33.31 0.00±
significant	*	*	*	N.S	N.S	N.S

Different letters in the same column mean there are significant different at $p \leq 0.05$. N.S; non-significant.

Antioxidant status

According to Table 3, the antioxidant enzymes CAT, SOD, GPX, and malondialdehyde (MDA) (Umol/L) in the serum of broiler chickens are affected by nano silver-curcumin. The results recorded a significant increase ($p \leq 0.05$) in the third and fourth treatments regarding the effectiveness of the GPX enzyme compared to the control and the second treatments. In terms of the CAT enzyme's efficiency, the results showed an improvement in all treatments when compared to the control treatment. This could be explained by the fact that birds treated with nano silver curcumin showed increased activity of the GPX and CAT enzymes in their blood serum, which supports curcumin's role in reducing oxidative stress by altering hepatic nuclear transcription factors and lowering lipid peroxidation in muscle and serum. (Sahin *et al*, 2012). Curcumin's supporting function in preserving cells' antioxidant status by suppressing enzymes may be the cause. oxidants, limiting the activity of free radicals, and promoting glutathione synthesis (El-Agamy, 2010). These findings concurred with those of Badria *et al*. (2015), who demonstrated how curcumin helps to reduce oxidative stress by protecting free fatty acids from oxidation. Both the concentration of malondialdehyde (MDA) and Superoxide dismutase (SOD) did not significantly differ between the various study treatments. The findings of the present study supported those of Araghi *et al*., (2017), who suggested that there was no significant variations existed between his study's parameters in terms of MDA concentration. These results did not agree with those of Abd El-Hack *et al*., (2021), who discovered a significant increase in the activity of the enzyme superoxide dismutase (SOD) when nano-curcumin was added to the diet at a concentration of 0.5 cm3/kg compared to the control treatment. The reason for the discrepancy may be due to variations in the concentrations used or the conditions of the experiment.

Table (3) The effect of adding different levels of silver-curcumin nanoparticles on the activity of antioxidant enzymes CAT, SOD, GPX and the concentration of malondialdehyde in the serum of broiler chickens (mean ± standard error)

Treatments	MDA (Umol/L)	CAT (Umol/L)	SOD (Umol/L)	GPX (Umol/L)

T1	14.98 0.54±	32.19[b] 1.11±	5.79 ±0.89	454.46[b] 22.83±
T2	15.02 2.68±	47.44[a] 3.72±	3.68 0.43±	455.90[b] 12.10±
T3	16.68 0.93±	44.30[a] 1.67±	6.20 0.60±	538.85[a] 26.15±
T4	16.95 0.54±	40.33[a] 1.09±	6.48 1.30±	560.95[a] 31.50±
significant	N.S	*	N.S	*

Different letters in the same column mean there are significant different at $p \leq 0.05$. N.S; non-significant.

Conclusions:

It can be concluded that adding 2 mg/L of silver curcumin nanoparticles to broilers' drinking water improved their average weight, overall weight gain, and cumulative feed conversion efficiency. It also improved some blood parameters, including red blood cells (RBC), pacted cells volume (PCV), hemoglobin concentration (Hb), and antioxidant status.

References

Abd El-Hack, M. E., Alaidaroos, B. A., Farsi, R. M., Abou-Kassem, D. E., El-Saadony, M. T., Saad, A. M., ... & Ashour, E. A. (2021). Impacts of supplementing broiler diets with biological curcumin, zinc nanoparticles and Bacillus licheniformis on growth, carcass traits, blood indices, meat quality and cecal microbial load. Animals, 11(7), 1878.

Ahmad, I., Raja, N. I., Kazmi, A., Wahab, A., Ali, A., Younas, Z., ... & Rahimi, M. (2022). Comprehensive approaches of nanoparticles for growth performance and health benefits in poultry: an update on the current scenario. BioMed Research International, 2022.

Akomah, C., Sogunle, O., Adeyemi, O. , & Bamgbose, A. (2021). Growth performance and hematological characteristics of pullet chickens fed different feed forms supplemented with or without Oyster mushroom (Pleurotus ostreatus). Nigerian Journal of Animal Production. https://doi.org/10.51791/njap.v48i5.3202

Al-Abdullah, Z. T., Altameemi, I. A., and Sadda, A. M. (2021). A New Comparison between Ag-Nano Adsorbent and Walnut Shell Adsorbent. Egyptian Journal of Chemistry, 64 (8), 4017-4026.

Al-Ashoor, D.S. & Al-Salhie, K.C.K.(2020). Effect of Adding Broccoli Leaves (Brassica oleracea L. var. italica) Extract to Drinking Water on Eggs Production and Intestinal Microflora of Japanese Quail Coturnix japonica Temmink & Schlegel, 1849. Basrah Journal of Agricultural Sciences, 33(2), 42–51. https://doi.org/10.37077/25200860.2020.33.2.04

AlMasoud, N., Alhaik, H., Almutairi, M., AHoujak, A., Hazazi, K., Alhayek, F., Aljanoubi, S., Alkhaibari, A., Alghamdi, A., Soliman, D. A., Alomar, T. S., & Awad, M. A. (2021). Green nanotechnology synthesized silver nanoparticles: Characterization and testing its antibacterial activity. Green Processing and Synthesis, 10, 518–528.

Al-zubaidi, L. A., Wsain, S. M., & Ibrahim, S. M. (2021). Evaluate the Antifungal and detoxification activity of silver nanoparticles. prepared with the Curcuma plant extract against Aflatoxin B1 in broiler feed. IOP Conf. Series: Earth and Environmental Science 779 .1-11.012076 IOP Publishing doi:10.1088/1755-1315/779/1/012076.

Araghi, A., Nazaktabar, A., Sayrafi, R., Salehi, A., Golshahi, H., Jahanbakhsh, M., & Seifi, S. (2017). The effects of in ovo nanocurcumin administration on oxidative stress and histology of embryonic chicken heart. Poultry Science Journal, 5(2), 105-111.

Badran, A. M. (2020). Effect of dietary curcumin and curcumin nanoparticles supplementation on growth performance, immune response and antioxidant of broilers chickens. Egyptian Poultry Science Journal, 40(1), 325-343.

Badria, F.A., Ibrahim, A.S., Badria ,A.F. & Elmarakby, A.A. (2015). Curcumin Attenuates Iron Accumulation and Oxidative Stress in the Liver and Spleen of C+hronic Iron-Overloaded Rats. PLoS 1 10(7): e0134156. doi:10.1371/journal.pone.0134156

Beers, R. F., and Sizer, I. W. (1952). A spectrophotometric method for measuring the breakdown of hydrogen peroxide by catalase. J Biol chem, 195 (1), 133-140.

Campbell, T. W. (1995). Avian hematology and cytology. Iowa State University Press, 176-198 p.

Dobrzanski, Z., Stępniowska, A., & Kozłowski, K.(2010). The Effectiveness of Nano-silver and Mineral Sorbents in the Reduction of Ammonia Emissions from Livestock Manure. Przemysł Chemiczny, 4, 348–351

El-Agamy, D.S. (2010). Comparative effects of curcumin and resveratrol on aflatoxin B 1-induced liver injury in rats. Arch. Toxicol.; 84:389–396.

Flohé, L. and Günzler, W. A. (1984). Assays of glutathione peroxidase. In Methods in enzymology Vol. 105, pp: 114-120.

Geevarghese, A. V., Kasmani, F. B., & Dolatyabi, S. (2023). Curcumin and curcumin nanoparticles counteract the biological and managemental stressors in poultry production: An updated review. Research in Veterinary Science, 104958.

Gogoi, C., Sarma, J., Barua, C. C., Tamuly, S., Upadhyaya, T. N., Islam, S., Sonowal ،J., Borthakur, U., Banerjee, D. K.,& Barkathullah, N. (2019). Evaluation of nano-curcumin on experimentally induced coccidiosis in broiler chicks. International Journal of Chemical Studies, 7(3), 4514-4520.

Hameed, H. M. (2021). Physiological role of Nanotechnology in Animal and Poultry nutrition. Egyptian Journal of Veterinary Sciences, 52(3), 311-317.

Hani, U., & Shivakumar, H.G. (2014). Solubility enhancement and delivery systems of curcumin a herbal medicine: a review. Current Drug Delivery, 11(6), 792-804.

Mahjar, N.T. & Al-Salhie, K.C.K.(2022). The effects of In Ovo Injection of Garlic (Allium sativum L.) Extract on Hatchability, Liver Enzymes and Antioxidant status of Broiler Chickens. Basrah Journal of Agricultural Sciences, 35(1), 61–70. https://doi.org/10.37077/25200860.2022.35.1.05

Marchiori, M.S., Oliveira, R.C.,Souza, C.F., Baldissera, M.D., Ribeiro, Q.M., Wagner, R.& Boiago, M.M. (2019). Curcumin in the diet of quail in cold stress improves performance and egg quality. Anim. Feed Sci. Technol., 254, 114192.

Oluwafemi, R. A., Olawale, I., & Alagbe, J. O. (2020). Recent trends in the utilization of medicinal plants as growth promoters in poultry nutrition-A review. Research in: Agricultural and Veterinary Sciences, 4(1), 5-11.

Partovi, R., Seifi, S., Pabast, M., Mohajer, A., & Sadighara, P. (2020). Effect of dietary supplementation of nanocurcumin on oxidant stability of broiler chicken breast meat infected with Eimeria species. In Veterinary Research Forum (Vol. 11, No. 2, p. 159). Faculty of Veterinary Medicine, Urmia University, Urmia, Iran.

Rajput, N., Muhammad, N., Yan, R., Zhong, X., & Wang, T. (2013). Effect of dietary supplementation of curcumin on growth performance, intestinal morphology and nutrients utilization of broiler chicks. The Journal of Poultry Science, 50(1), 44-52.

Reda, F. M., El-Saadony, M. T., Elnesr, S. S., Alagawany, M., & Tufarelli, V. (2020). Effect of dietary supplementation of biological curcumin nanoparticles on growth and carcass traits, antioxidant status, immunity and caecal microbiota of Japanese quails. Animals, 10(5), 754.

Sahin, K., Orhan, C., Tuzcu , Z., Tuzcu, M. & Sahin, N. (2012). Curcumin ameloriates heat stress via inhibition of oxidative stress and modulation of Nrf2/HO-1 pathway in quail. Food Chem. Toxicol.; 50:4035–4041.

SPSS, Statistical Package for the Social Sciences (2018). Quantitative Data Analysis with IBM SPSS version 24: A Guide for Social Scientists. New York: Routledge. ISBN, 978-0-415-5 7918-6.

Yagi, K. (1998). Simple Assay for the Level of Total Lipid Peroxides in Serum or Plasma. Free Radical and Antioxidant Protocols,108, 101-106. https://doi.org/10.1385/0-89603-472-0:101.

Yao, M., Mc Clements, D. J. & Xiao, H. (2015). Improving oral bioavailability of nutraceuticals by engineered nanoparticle-based delivery systems. Current opinion in food science, 2, 14-19.