Iraqi Journal of Market Research and Consumer Protection
(2022) 14(1): 15- 25
DOI: http://dx.doi.org/10.28936/jmracpc14.1.2022.(2)
Al-Hatheel & Ibrahim



المجلة العراقية لبحوث السوق وحماية المستهلك

# EFFECT OF INJECTED DIFFERENT CONCENTRATIONS OF ALCOHOLIC EXTRACT OF *Moringa oleifera* LEAVES POWDER IN HATCHING EGGS OF ADVANCED AGE OF BROILER BREEDERS ON PRODUCTIVE PERFORMANCE AND CARCASSES OF BROILER CHICKENS

***Hayder D. Al-Hatheel* [1], *Basil M. Ibrahim*[2]**

[1]Researcher, Directorate of Wasit Agriculture, Ministry of Agriculture, Wasit, Iraq. hayder19760@gmail.com
[2]Professor PhD., Department of Animal Production, College of Agricultural Engineering Sciences, University of Baghdad, Baghdad. Iraq basil.m@coagri.uobaghdad.edu.iq

**Received 15/ 5/ 2022, Accepted 21/ 6/ 2022, Published 30/ 6/ 2022**

**This work is licensed under a CCBY 4.0 https://creativecommons.org/licenses/by/4.0**

## ABSTRACT

**This experiment was conducted to study the effect of injecting hatching eggs into a flock of broiler aged mothers with different concentrations of the alcoholic extract of *Moringa oleifera* powder on productive performance of broilers during the period of rearing of 35 days. The study included two experiments for a period at 2/10/2021 to 28/11/2021, where eggs were injected into the Mustafa Poultry Hatchery/ Wasit Governorate- Aziziyah District. A 400 hatching eggs of 308 Ross mothers of modern broilers used at age of 48 week, eggs of average weight 66 ± 1 g/egg were collected in same day then stored for two days. A quarter of treatments were randomly distributed with 100 eggs for each treatment. The first treatment T1 without injection as control treatment, and T4, T3, and T2 (while injected into the space air) on day 12 of, in an amount of 0.2 mL for each egg, with concentration of 450, 300, 150 µg/mL, respectively. The hatched chicks were bred in the same fields, where 180 chicks of the chicks were distributed into four treatments, 45 chicks for each treated and three replicates (15 chicks) for each T1, T2, T3 and T4 were placed in a cage for 35 days. The results Showed A significant ($p<0.05$) increase for T4 compared to the control in body weight, body weight gain and relative weight of the gizzard, will all injection treatment recorded a highly significant decrease in the total feed consumption and feed conversion ratio compared to control treatment. While there were no significant differences between treatments in the percentage of total Mortality, relative weights of the heart, liver, breast and thighs and dressing ratio.**

**Keywords:** Egg injection, alcoholic extract, Moringa leaves, productive performance.

# تأثير حقن تراكيز مختلفة من المستخلص الكحولي لمسحوق اوراق المورينجا المجففة *Moringa oleifera* في بيض التفقيس لأمهات فروج اللحم المتقدمة في العمر على الأداء الإنتاجي وصفات ذبائح فروج اللحم

***حيدر دهام جلوب الهذيل* [1]، *باسل محمد ابراهيم*[2]**

[1]باحث، مديرية زراعة واسط، وزارة الزراعة، جمهورية العراق، واسط، العراق. hayder19760@gmail.com
[2]أستاذ، قسم الانتاج الحيواني، كلية علوم الهندسة الزراعية، جامعة بغداد، بغداد ، العراق. basil.m@coagri.uobaghdad.edu.iq

## الخلاصة

**أجريت هذه الدراسة لمعرفة تأثير حقن بيض التفقيس لأمهات فروج اللحم المتقدمة في العمر وبتراكيز مختلفة من المستخلص الكحولي لمسحوق اوراق المورينجا المجففة *Moringa oleifera* في الأداء الانتاجي لفروج اللحم خلال مدة التربية البالغة 35 يوماً، اذ تضمنت الدراسة تجربتين وللمدة من 2021/10/2 ولغاية 2021/11/28، حيث تم حقن البيض في مفقس المصطفى للدواجن/ محافظة واسط/ قضاء العزيزية واستعمل فيها 400 بيضة تفقيس من امهات فروج اللحم Ross 308 من الشركة الحديثة لأمهات بيض التفقيس بعمر 48 أسبوعاً وجمع البيض جمعة واحدة وخزن لمدة يومين وبمعدل وزن 66±1غم/ بيضة ووزعت عشوائياً على اربع معاملات بواقع 100 بيضة لكل معاملة وكانت المعاملة الاولى هي معاملة السيطرة T1 (بدون حقن) في حين حقنت في الفسحة الهوائية وباليوم 12 من الحضانة ثلاث معاملات منها T2 وT3 و T4بالمستخلص الكحولي لمسحوق اوراق المورينجا المجففة وبكمية 0.2 مل لكل بيضة وبتركيز 150 و300 و450 مايكروغرام/ مل على التوالي، وتم تربية الأفراخ الفاقسة لنفس المعاملات بنظام الاقفاص في حقول الشركة الحديثة للدواجن في قضاء العزيزية، اذ استخدم 180 فرخ من الافراخ الفاقسة تم توزيعها على اربع معاملات منها T1 معاملة سيطرة ومعاملات الحقن T2 وT3 وT4 وبواقع 45 فرخ لكل معاملة وبثلاث مكررات لكل معاملة (15 فرخاً لكل مكرر)، وتم وضع كل مكرر في قفص وتربيتها لمدة 35 يوماً، وقد اظهرت النتائج ارتفاع معنوي ($p<0.05$) في وزن الجسم والزيادة الوزنية الكلية والوزن النسبي للقانصة لمعاملة الحقن T4 مقارنة بمعاملة السيطرة، بينما سجلت جميع معاملات الحقن انخفاضاً عالي المعنوية ($P<0.01$) في كمية العلف المستهلك في معامل التحويل الغذائي الكلي مقارنة بمعاملة السيطرة، بينما لم تظهر اختلافات معنوية بين المعاملات في نسبة الهلاكات الكلية ونسبة التصافي مع وبدون الأحشاء القابلة للأكل والأوزان النسبية للقلب والكبد والقطعيات الرئيسية (الصدر والأفخاذ) والثانوية (الظهر والأجنحة).**

**الكلمات المفتاحية: حقن البيض، مستخلص كحولي، اوراق المورينجا، الأداء الأنتاجي.**

## INTRODUCTION

The in ovo injection technology is one of the early feeding techniques for bird embryos, through which nutrients are injected into the egg at different ages of the incubation period **(Tainika & Şekeroğlu, 2020)**. The aim is to produce a healthy chicks, which are characterized by a high ability to performance production. In ovo injection technology is one of the modern technologies and trends that have emerged recently in order to improve hatching characteristics, quality of hatched chicks and their future performance, its aim is to deliver nutritional solutions to the fetus and thus benefit from them to increase growth and development of the internal organs of the fetus, as well as reduce fetus deaths **(Hamdani *et al*., 2013)**. the purpose of injecting the eggs is to reach the a mature organs of the body, especially the digestive system. The delay in the hatching process and the survival of the hatched chicks for a longer period inside the hatchery and without obtaining food until transferred to the field leads to a decrease in body weight that may reach 0.18 g/hour **(Careghi *et al*., 2005; Dibner *et al*., 2008).** Broilers are an important source of protein and a good source of income in countries that suffer from a lack of food because it is high growth rate compared to the rest of the animals in addition to the speed of the capital cycle and the increase in human consumption of these products, therefore, researchers tended to use some techniques to improve production, maintain bird health and reduce mortality through medicinal plants in powdered form or through drinking water or injecting its extracts into hatching eggs as partial substitutes in poultry diets as a result of the high prices of feed materials, in addition to the fact that medicinal plants do not cause problems and side effects to humans and animals, in addition to their availability, cheap prices, and use in treating many diseases. Many studies have been conducted on the use of these plants to treat the problems that hatched chicks are exposed to, and among those studies is early feeding by injecting hatching eggs with solutions and nutrients (In ovo feeding technology) to improve the embryonic development and provide an additional food source for the embryos before the hatching process, thus accelerating the development of the digestive tract and increasing its ability to digest and absorb nutrients in the newly hatched chicks, as well as reducing stress on chicks during and after hatching, and consequently the early growth of chicks, maintaining the health of birds, reducing fatalities and improving their ability to produce during the post-hatching stage **(Zhang *et al*., 2020)**. the process of early feeding by injecting hatching eggs was to fill the shortage of nutrients in the egg, especially in the last stages of embryonic development, due to the embryos' need for nutrients in the period before and after embryonic development **(Jha *et al*., 2019)**. *Moringa oleifera* is a multi-use medicinal plant that contains compounds of high nutritional value and has importance in human and animal health, the one of the most important of these compounds are alkaloids, flavonoids, tannins, saponins, and glycosides, as well as containing phenols and carotenoids **(Teixeira *et al*., 2014; Nazmy *et al*., 2016)**. The leaves of the Moringa tree are characterized by their high nutritional and therapeutic value because they contain a large quantities of vitamin A, vitamin B group, vitamin C, vitamin E and mineral elements such as calcium, potassium, phosphorous and iron, and it is perfect source of amino acids, fatty acids and antioxidants **(Burham, 2017; Su & Chen, 2020)**. One of the characteristics of the alcoholic extract of Moringa leaves is that it has features that differ according to the type of solvent that is used to extract the active compounds found in Moringa leaves **(Doughari *et al*., 2007)**. for the lack of studies on injecting hatching eggs of aged broiler mothers with the extract The alcoholic extract of dried moringa leaves powder, so this study came to examine the effect of injecting the alcoholic extract on the productive performance and characteristics of the carcass.

## MATERIALS AND METHODS

The study was included two experiments. This first experiment was carried out in Al-Mustafa Poultry Hatchery in Al-Aziziyah District/ Wasit Governorate- iraq. From 2-23/10/2021. In this experiment, 400 hatching eggs were used from one flock of broiler mothers ROSS 308 from the Modern Company for Hatching Eggs, Mothers of one age and the eggs were collected at one The mothers were 48 weeks old and the average egg weight used in the experiment was 66±1 g/egg. The eggs were incubated in a (Setter) multi stage incubator in 3/10/2021 at eight o'clock in the evening, at a temperature of 37.8°C and a relative humidity of 60%. The hatcher was at a temperature of 37°C and a relative humidity of 85%. The eggs were randomly distributed to the treatments, with 100 eggs for each treatment, the eggs used in the experiment and the injection process were examined by light at the age of 12d from incubation to exclude unfertilized eggs and the hatching eggs were injected after performing the light examination of the eggs, and the injection process was carried out in the air space by special syringes that use for insulin injection to the diabetics patient after piercing the egg with the puncture pen of the sugar measuring device and closing the hole with nail dye, a special lamp for the light examination was used to determine the area of the air space in order for the injection process to be more accurate. The division of transactions was as follows:-

1. Treatment 1(T1) : control group without injection.
2. Treatment 2 (T2) : Injection of hatching eggs with alcoholic extract of dried moringa leaf powder at a concentration of 150 µg/mL and at an amount of 0.2 mL per egg in the air space and at the age of 12d from incubation.
3. Treatment 3 (T3) : Injection of hatching eggs with alcoholic extract of dried moringa leaf powder at a concentration of 300 µg/mL and at an amount of 0.2 mL per egg in the air space and at the age of 12d from incubation.
4. Treatment 4 (T4) : Injection of hatching eggs with alcoholic extract of dried moringa leaf powder at a concentration of 450 µg/mL and at an amount of 0.2 mL per egg in the air space and at the age of 12d from incubation.

The alcoholic extract was prepared in the laboratories of the Ministry of Science and Technology / Department of Environment and Water, and the dilution was carried out in the laboratories of the College of Agricultural Engineering Sciences / University of Baghdad. The extraction process was carried out by Bassey method **(Bassey *et al.*, 2013)** after the dried Moringa leaves were grinded using an electric grinder and 100 g of The dry powder was added to 500 mL of 80% ethyl alcohol in a glass beaker with a capacity of 1000 mL .Eggs of each treatment group were weighed using a sensitive electronic balance before being placed in the incubators and numbered and fixing the weight of each egg in special records for the purpose of calculating the percentage of egg weight loss on the $18^{th}$ d of laying eggs in incubators, as well as calculating the other hatching characteristics and the quality of hatching chicks. The injection process was carried out at the end of the $12^{th}$d of putting the eggs in the incubators, and the injection process was carried out in the air space, a special medical syringe used to inject the eggs (an Italian-made syringes used for injection of insulin for diabetics patients with the size of 1 mL and divided into 10 parts, measuring 30 g Gauge) and a depth of 20 mL and a dose of 0.2 mL then close the hole of the crust by dyeing nails. And after the egg is pierced from the wide end (from the side of the air space) by a machine that use to pierces the finger with the sugar measuring device, the punching machine was tested before the injection process to ensure that there were no scratches, breakage or damage to the egg shell. The injection process took place inside the multi-stage incubator in order to maintain the temperature of the eggs and not take them outside the hatching machines with the alcoholic extract placed inside the incubator before starting the injection process in order to gain the

temperature of the incubator, this was confirmed by **Salary *et al*., (2014)** to prevent heat shock for fetuses, and after completing the injection process, the eggs were returned to the trays designated for them in the incubator.

After the hatching process was completed, the second experiment was started, where 180 chicks were selected from the treatments of the first experiment (45 chicks from each treatment) where the hatched chicks were transported by a special car and in a moderate atmosphere from the Al-Mustafa poultry hatchery to one of the modern poultry company's fields, the length of the field was 50 m and the width of 11m , before the transfer process, the hall was completely cleaned, washed, sterilized, and fumigated with potassium permanganate and formalin, with all openings in the hall closed during the fumigation process. Breeding was used in multi-store cages (3 floors), and each floor contains 4 cages, thus the number of cages used in the experiment is 12 cages, so the total number of chicks used in the experiment is 180 chicks resulting from the treatments of the first experiment (hatching experiment) and the dimensions of each cage (123 × 62 cm), the experiment was divided into four treatments, 45 chicks for each Treatment and (3 replicates) treated (15 chicks for each replicate). The experiment started on 24/10/2021 and ended on 28/11/2021, the first treatment: chicks resulting from hatching eggs without injection, and the second treatment: chicks resulting from hatching eggs that were injected on the $12^{th}$ d of incubation with the alcoholic extract of dried moringa leaves powder at a concentration of 150 µg/mL, the third treatment: Chicks resulting from hatching eggs were injected on the $12^{th}$ d of incubation with the alcoholic extract of dried Moringa leaf powder at a concentration of 300 µg/mL, and the fourth treatment: Chicks resulting from hatching eggs were injected on the $12^{th}$ d of incubation with the alcoholic extract of dried Moringa leaf powder at a concentration of 450 µg/mL.

**Studied characteristics**

productive characteristics

1. Weekly body weight.
2. Weekly and total weight gain.
3. Weekly and total feed consumption.
4. Weekly and total food conversion factor.
5. Fetal mortality rate.

characteristics of the carcass

1. Dressing ratio with edible viscera.
2. Dressing ratio without edible viscera.
3. Edible viscera weight (liver, gizzard, heart).
4. The relative weight of the main carcass pieces.
5. The relative weight of the secondary carcass pieces, including (back, wings and neck).

**Chemical analysis of diet**

| Chemical structure (%) | Super pre- starter (1-6 d ) | Starter(7-14 d) | Grower(15-27d ) | Finisher(28-35 d) |
|---|---|---|---|---|
| **Protein** | 23.3 | 22.39 | 21 | 18.69 |
| **Energy** | 3025 | 2900 | 3020 | 3070 |
| **Fiber** | 3 | 2.58 | 2.48 | 2.44 |
| **Fat** | 6.4 | 3.81 | 5.23 | 5.62 |
| **Ash** | 6 | 6.31 | 6 | 5.39 |
| **Calcium** | 0.88 | 0.92 | 0.88 | 0.8 |
| **Phosphor** | 0.44 | 0.46 | 0.44 | 0.4 |
| **Methionine** | 0.66 | 0.70 | 0.63 | 0.54 |
| **Lysine** | 1.6 | 1.50 | 1.32 | 1.17 |
| **Methionine +cysteine** | 1.20 | 1.12 | 1.01 | 0.90 |

**Statistical analysis**

Statistical analysis of the data was carried out using the statistical analysis system **SAS** (**2012**) program to study the influence of the Studied treatment on the Different Characterization and according to the significant comparative between the means in the **Duncan (1955)** polynomial test .

## RESULTS AND DISCUSSIONS

**Average weekly body weight, average weekly and total weight gain**

The results showed, as shown in (Table, 1), the influence of injecting hatching eggs with the alcoholic extract of dried Moringa leaf powder on the average weekly body weight to the no Significant differences in the body weight characteristic for the 1st. and third weeks between all treatments, while there was Asignificant Difference ($p<0.05$) in the average body weight for the T4 injection treatment and for the second, fourth and fifth weeks, where their means were recorded at 545.02, 1849.78 and 2450.30 g, respectively, compared to the control treatment, which reached 528.26, 1745.85 and 2289.20 g, respectively, at the same time, no significant differences were observed between the T4 injection treatment and the T2 and T3 injection treatments, which had no significant differences between them and the control treatment.

**Table (1):** Effect of Injecting Hatching Eggs with alcoholic extract of dried Moringa leaf powder on the average weekly body weight (g/bird) of broilers (mean ± standard error).

| Treatments | 1st Week | 2nd Week | 3rd Week | 4th Week | 5th Week |
|---|---|---|---|---|---|
| T1 | 213.46 ± 1.54 | 528.26± 3.50 b | 1061.92± 13.20 | 1745.85±24.76b | 2289.20 ± 63.59 b |
| T2 | 215.19 ± 1.50 | 535.91 ± 5.49 ab | 1083.82± 13.75 | 1814.93±22.48ab | 2413.51±23.82 ab |
| T3 | 215.77 ± 2.62 | 538.40±4.83 ab | 1096.75± 13.28 | 1808.26±15.04 ab | 2405.02±29.31 ab |
| T4 | 218.66 ± 1.02 | 545.02 ± 4.83 a | 1102.80± 14.86 | 1849.78± 22.78 a | 2450.30 ± 6.74 a |
| Significance | NS | * | NS | * | * |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder at condensation of 150, 300 and 450 µg per mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments. NS: No significant differences. * There are significant differences at the p<0.05 probability level**.

The results also showed in (Table, 2) the effect of injecting hatching eggs with an alcoholic extract of dried Moringa leaf powder on the weekly and cumulative weight gain, the results showed that there was no significant effect of injecting hatching eggs on the rate of weight gain for the first, second, third and fifth weeks, respectively. While there was a significant superiority (0.05p<) for the injection treatments T2 and T4, which recorded weight gain of 731.11 and 746.98 g/bird, respectively, compared to the control treatment, which amounted to 683.93 g/bird for the fourth week, and there were no significant differences between the injection treatments for the same characteristics at the same week. The results indicated in the same table that there were Significant difference ($p<0.05$) in the Total weight gain of the T4 injection treatment, which recorded 2406.51 g / bird compared to the control treatment 2245.72 g / bird, while there were No significant difference between the two injection treatedT2 and T3 and between the control treatment for the same character.

**Table (2):** Effect of Injecting Hatching Eggs with alcoholic extract of dried moringa leaf powder on the rate of weekly and total weight gain (g/bird) for broilers (mean ± standard error).

| Treatments | 1st week | 2nd Week | 3rd Week | 4th Week | 5th Week | Total weight gain |
|---|---|---|---|---|---|---|
| T1 | 169.99± 1.53 | 314.79 ±4.92 | 533.66± 9.91 | 683.93±11.69 b | 543.35± 41.79 | 2245.72± 63.54 b |
| T2 | 170.97± 2.10 | 320.70± 4.30 | 547.91± 8.69 | 731.11±21.35 a | 598.57± 1.52 | 2369.27± 24.46 ab |
| T3 | 171.86± 2.88 | 322.62 ±2.30 | 558.35± 9.63 | 711.69± 7.21 ab | 596.75± 15.47 | 2361.28± 29.29 ab |
| T4 | 174.93± 0.94 | 326.35± 4.32 | 557.78± 10.12 | 746.98± 8.52 a | 600.46± 16.05 | 2406.51± 6.73 a |
| Significance | NS | NS | NS | * | NS | * |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder at condensation of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments. NS: No Significant differences. * There are significant differences at the p<0.05 probability level**.

It is evident from (Tables 1 and 2) that there is a significant superiority of some injection treatments in terms of body weight and weight gain, especially in the treatment of T4 injections when the concentration of the alcoholic extract of Moringa leaf powder increases, the reason for the significant superiority may be attributed to the increase in the concentration of Moringa leaf extract, which allows for more absorption of nutrients and thus benefit from the nutrients and active compounds in Moringa leaves, which is positively reflected on BW and weight gain, and this is what **Jayanti *et al*. (2017)** indicated. In addition, early feeding by injecting eggs increases the size of the muscles and the surface area for absorption in the villi with the height of the villi and the increase in the depth of the crypts, thus, the ration is more useful as a result of the development of the alimentary canal, which is positively reflected on both Body Weight and weight gain **(Ohta *et al*., 2001)**. In addition, the improvement in body weight and weight gain in the injection treatments is due to the improvement in the quality of the hatched chicks and the presence of a positive and direct relationship between the weight, length and vitality of the chick at the age of one day and the subsequent productive performance, the length of the chick is the best indicator for expressing the quality of the hatched chicks and their subsequent productive performance in comparison with the weight of the chick, and studies have shown that every cm increase in the length of the chick leads to an increase in body weight when marketing at the age of 43 days from 113-214 g **(Patbandha *et al*., 2017)**. Or this improvement may be attributed to the Moringa leaf extract, in general, containing large amounts of vitamins, minerals and essential amino acids that contribute to building body tissues and antioxidants such as flavonoids and multiple phenols that help eliminate free radicals and thus protect cells from oxidative stress and thus improve the digestion and absorption of food **(Chatterjee *et al*., 2017).** In addition to containing active and effective compounds that stimulate the immune system, Moringa leaf extract can maintain the health of the intestine and increase its absorption of nutrients because the extract works to activate the immune system and to contain anti-bacterial compounds that increase the beneficial bacteria in the intestine and reduce harmful bacteria and thus reflect positively on body weight and weight gain. These results were agreed with the findings of **EI-Tazi (2014), Nanle *et al*. (2017), Sharmin *et al*. (2020) &Khalid *et al*. (2021)** by adding Moringa leaf powder to broiler diets in varying proportions, which led to a significant improvement in body weight when Marketing and overall weight gain.

**Average weekly and total feed consumption and weekly and total feed conversion factor**

The results in (Table 3) showed the effect of injecting hatching eggs with the alcoholic extract of dried Moringa leaf powder on the rate of weekly and total feed consumption. There were

no significant differences in the rate of feed consumption for the first week between the experimental treatments. While there was significant decrease ($p<0.01$) and ($p<0.05$) for the second and third weeks and the total feed consumption for all injection treatments T2, T3, and T4 compared to the control treatment . As for feeding consumption in the 5th week, there was a significant decrease ($p<0.05$) for the T3 injection treatment, which recorded 1012.17 g/ bird compared to the control treatment, which amounted to 1061.81 g/bird, The T2 injection treatment witnessed a significant decrease ($p<0.05$) in the fifth week, which recorded 1012.53 g/bird compared to the control treatment, which amounted to 1068.49 g/bird. While there were no significant differences in the weekly and total feed consumption among all injection treatments.

**Table (3)**. Effect of Injecting Hatching Eggs with alcoholic extract of dried Moringa leaf powder on the weekly and total feed Consumption rate (g/bird) for broilers (mean ± standard error).

| Treatments | 1st Week | 2nd Week | 3rd Week | 4th Week | 5th Week | Total feed consumption |
|---|---|---|---|---|---|---|
| T1 | 177.02± 0.80 | 498.42± 7.59 a | 782.67± 8.66 a | 1061.81±16.36 a | 1068.49± 19.95 a | 3588.40± 44.74 a |
| T2 | 174.39± 2.46 | 465.06± 3.18 b | 736.04± 11.08 b | 1025.69±7.22 ab | 1012.53± 8.29 b | 3413.72± 7.35 b |
| T3 | 172.57± 2.01 | 460.75± 5.85 b | 727.20± 15.11 b | 1012.17±14.20 b | 1039.24± 7.46 ab | 3411.93± 44.01 b |
| T4 | 174.75± 2.08 | 464.06± 2.46 b | 743.64± 10.31 b | 1047.20± 7.31 ab | 1037.73±11.84 ab | 3467.39± 7.26 b |
| Significance | NS | ** | * | * | * | ** |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder at condensation of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments. NS: No significant differences. * There are significant differences at the p<0.05 probability level. ** There are significant differences at the level of probability p<o.o1.**

The results also showed in (Table, 4) the effect of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder on the weekly and total feed conversion factor. It was observed that there was a significant improvement in the weekly feed conversion factor at the level ($p<0.05$) for the fifth week and ($p<0.01$) for the first, second, third and fourth weeks and the total feed conversion factor, respectively, for all injection treatments compared to the control treatment, while there were no significant differences between the injection treatments for all weeks except for the first week, where a significant difference occurred for the T4 injection treatment, which recorded 0.99 g of feed/g weight gain compared to the T2 injection treatment, which amounted to 1.02 g of feed/g weight gain, and the latter, in turn, does not differ significantly from the control.

**Table (4)** . Effect of Injecting Hatching Eggs with alcoholic extract of dried Moringa leaves powder on weekly and total feed conversion factor.(g of feed/g of weight gain) for broilers (mean ± standard error).

| **Treatments** | **1st Week** | **2ndWeek** | **3rd Week** | **4th Week** | **5th Week** | **total food conversion factor** |
|---|---|---|---|---|---|---|
| T1 | 1.04±0.01 a | 1.58±0.00a | 1.52± 0.04 a | 1.55±0.02 a | 1.97± 0.10 a | 1.60± 0.02 a |
| T2 | 1.02±00.0ab | 1.44±0.01 b | 1.33 ± 0.00 b | 1.40±0.02 b | 1.69 ± 0.01 b | 1.44 ± 0.01 b |
| T3 | 1.00±0.00bc | 1.42± 0.00 b | 1.29 ± 0.00 b | 1.42±0.02 b | 1.74 ± 0.03 b | 1.44 ± 0.00 b |
| T4 | 0.99± 0.00 c | 1.42± 0.01 b | 1.32 ± 0.00 b | 1.39± 0.00 b | 1.72 ± 0.02 b | 1.44 ± 0.00 b |
| Significance | ** | ** | ** | ** | * | ** |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried moringa leaf powder at condensation of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments * There are significant differences at the p<0.05 probability level. ** There are significant differences at the level of probability p<o.o1.**

It is evident from (Tables 3 and 4) that there is a highly significant decrease (P<0.01) in the total feed consumption rate and a highly significant improvement (P<0.01) in the total feed conversion factor in all injection treated compared to the control Treatment. This significant improvement in the above two characters is attributed to the effect of the active compounds in the alcoholic extract of Moringa leaves, in addition to containing high quantities and concentrations of nutrients such as vitamins, minerals and amino acids, which increase the efficiency of utilization of the consumed feed **(Hassan *et al*., 2016)**. Flavonoids are the most important active compounds found in Moringa that act as antioxidants and effective antibacterials against harmful bacteria and increase the effectiveness of beneficial bacteria in the intestinal flora, thus, an improvement in digestion and absorption and an improvement in the health of the bird, which leads to an increase in body weight and total weight gain that we obtained in (Tables 1 and 2) and a significant decrease in total feed consumption (Table 3), which leads to an improvement in the feed conversion factor in injection treatments. The results of the studies showed the existence of a positive relationship between the weight of the hatched chicks and the feed conversion factor and between **Petek *et al*. (2008)** through their study of the relationship between the length and weight of the chick and the subsequent productive performance, as it was found that the chick weight is better than its length as an indicator of improving the feed conversion factor for broilers. These results were consistent with what was obtained by **Ayo-Ajasa *et al*. (2016), Alabi *et al*. (2017), Nduku *et al*. (2020), & Sharmin *et al*. (2020),**who noticed a significant decrease in feed consumption and an improvement in feed conversion factor when using different concentrations. From the powder of Moringa leaves and their extracts in broiler ration and through drinking water during the breeding period of broilers. The results (Table 5) showed be that there were No Significant differences in the percentage of total deaths among all experimental treatments during the 35-day breeding period, as no deaths were recorded in the injection treatments, while the control treatment recorded the death of only one bird.

**Table (5):** Effect of Injecting Hatching Eggs with alcoholic extract of dried moringa leaf powder on the total mortality of broilers (mean ± standard error).

| Treatment | Total mortality percentage |
|---|---|
| T1 | 0.02 ± 0.02 |
| T2 | 0.00 ± 0.00 |
| T3 | 0.00 ± 0.00 |
| T4 | 0.00 ± 0.00 |
| Significance | NS |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried moringa leaf powder at condensation of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments . NS: No significant differences.**

## Characteristics of the carcass

The results of the study in (Table 6) showed that there were no significant differences between the treatments of injecting hatching eggs with alcoholic extract of Moringa leaf powder and the control treatment in the percentage of dressing with and without edible viscera and the proportions of the edible internal organs, which are the heart and liver. While there was a significant difference (p<0.05) in the relative weight of the gizzard for the T4 injection treatment, which amounted to 0.80% compared to the T2 treatment, which recorded 0.63% and this may be due to the fact that the concentration of treatment T4 450 µg / mL is higher than the concentration of treatment T2 150 µg / mL and the increase in concentration improved the digestion and absorption process, as well as the increase in weight and total weight gain for the T4 injection treatment, which recorded 2406.51 g/fowl, compared to the T2 injection treatment, which amounted to 2369.27 g/bird.

**Table (6):** Effect of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder on the ratio of dressing with and without edible viscera and ratio of edible viscera (heart, liver and gizzard) (mean ± standard error).

| Treatments | Dressing ratio with edible viscera | Dressing ratio without edible viscera | Relative weight for the heart | Relative Weight for the liver | Relative Weight for the gizzard |
|---|---|---|---|---|---|
| T1 | 80.80 ±0.46 | 76.90 ± 0.51 | 0.38 ± 0.02 | 2.77 ± 0.09 | 0.72 ±0.07 ab |
| T2 | 80.64± 0.41 | 77.05 ± 0.44 | 0.43 ± 0.02 | 2.50 ± 0.12 | 0.63 ±0.03 b |
| T3 | 79.43± 0.55 | 76.05 ± 0.30 | 0.39 ± 0.03 | 2.75 ± 0.10 | 0.68 ± 0.04 ab |
| T4 | 80.02± 0.46 | 76.14 ± 0.38 | 0.43 ± 0.04 | 2.63 ± 0.17 | 0.80 ± 0.04 a |
| Significance | NS | NS | NS | NS | * |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried moringa leaf powder at concentrations of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. The presence of different letters in the same column leads to significant differences between treatments. NS: No significant differences. * There are significant differences at the p<0.05 probability level.**

The results of the study in (Table, 7) showed the effect of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder on the relative weight of the main pieces (breast and thighs) and secondary cuts (back, wings and neck) in broiler carcasses to the absence of significant differences in the relative weight of these cuts for all experimental treatments except for the relative weight of the neck piece in which T2 treatment showed a significant decrease (p<0.01)), which recorded 4.31% compared to the control treatment and T3 and T4, which amounted to 5.09, 4.98, 5.00%, respectively.

**Table 7**. Effect of injecting hatching eggs with alcoholic extract of dried moringa leaf powder on the relative weight of the main pieces (breast, thighs) and secondary cuts (back, wings, neck) in broiler carcasses (mean ± standard error).

| Treatments | Breast( %) | Thighs (%) | Back (%) | Wings (%) | Neck (%) |
|---|---|---|---|---|---|
| T1 | 39.63 ± 0.33 | 27.70 ± 0.34 | 17.96 ± 0.40 | 9.42 ± 0.25 | 5.09 ± 0.09 a |
| T2 | 39.54 ± 0.47 | 27.74 ± 0.31 | 18.83 ± 0.42 | 9.50 ± 0.13 | 4.31 ± 0.13 b |
| T3 | 39.76 ± 0.53 | 27.00 ± 0.40 | 18.87 ± 0.24 | 9.31 ± 0.17 | 4.98 ± 0.06 a |
| T4 | 39.45 ± 0.95 | 26.89 ± 0.33 | 18.95 ± 0.43 | 9.66 ± 0.27 | 5.00 ± 0.12 a |
| Significance | NS | NS | NS | NS | ** |

**T1: control treatment (without injection), T2, T3, and T4: treatments of injecting hatching eggs with alcoholic extract of dried Moringa leaf powder at concentrations of 150, 300 and 450 µg/mL, respectively, at a dose of 0.2 mL. Different letters in the same column indicate significant differences between the treatments. NS: No significant differences. ** There are significant difference OF the level of probability(p<o.o1).**

And the results of the study in terms of the absence of Significant Difference in most of the characteristics of the carcass, weights and the main and secondary techniques, the results agreed with what was stated by each of the **Ayo-Ajasa *et al*. (2016), Alabi *et al*. (2017), & Kumar *et al*. (2020).**

## CONCLUSION

Post-production performance A significant increase in body weight and an increase was observed for the T4 injection treatment compared to the control treatment, while all injection treatments recorded a high significant decrease in the amount of feed consumed and a significant improvement in the total food conversion factor compared to the control treatment, while there were no significant differences between the treatments in the percentage of mortality while a significant superiority was obtained in the relative weight. The gizzards of T4 injection treatment compared to T2 injection treatment, and a very significant decrease for T2 injection treatment compared to the rest of the treatments in relative neck weight.

**REFERENCES**

1. Alabi, O.J., Malik, A.D., Ng'Ambi, J.W., Obaje, P. & Ojo, B.K. (2017). Effect of aqueous *Moringa oleifera* (Lam) leaf extracts on growth performance and carcass characteristics of hubbard broiler chicken. *Brazilian Journal of Poultry Science*, 19, 273-280.
2. Ayo-Ajasa, O.Y., Abiona, J.A., Fafiolu, A.O., Egbeyale, L.T., Njoku, C.P., Omotayo, I.G. & Abel, F.A.S. (2016). Performance characteristics of broilers fed graded levels of *Moringa oleifera* leaf meal. *Malaysian Journal of Animal Science*, 19(1), 23-31.
3. Bassey, R.B., Bala, D.N., Edagha, I.A. & Peter, A.I. (2013). The effect of ethanolic extract of *Moringa oleifera* on alcohol-induced testicular histopathologies in pre-pubertal albino Wistar rats. *Biology and Medicine*, 5, 40-45.
4. Burham, B. (2017). Phytochemical, proximate composition and minerals contents of *Moringa oleifera*. *Chemistry Research Journal*, 2(2), 78-83.
5. Careghi, C., Tona, K., Onagbesan, O., Buyse, J., Decuypere, E. & Bruggeman, V. (2005). The effects of the spread of hatch and interaction with delayed feed access after hatch on broiler performance until seven days of age. *Poultry science*, 84(8), 1314-1320.
6. Chatterjee, P.K., Anantharaya, V.N.M., Shiva, R.K., Kumar, N.A., Shetty, S.B., Budihal, S.V. & Bhat, M.R. (2017). Pre and post-treatment effects: estimation of serum testosterone and lipid peroxidation levels on *Moringa olifera* extract induced cadmium exposed rats. *Pharmacognosy Journal*, 9(6), 846-849.
7. Dibner, J.J., Richards, J.D. & Knight, C.D. (2008). Microbial imprinting in gut development and health. *Journal of Applied Poultry Research*, 17(1), 174-188.
8. Doughari, J.H., Pukuma, M.S. & De, N. (2007). Antibacterial effects of *Balanites aegyptiaca* L. Drel. and *Moringa oleifera* Lam. on *Salmonella typhi. African Journal of biotechnology*, 6(19), 2212-2215.
9. El-Tazi, S.M. (2014). Effect of feeding different levels of *Moringa oleifera* leaf meal on the performance and carcass quality of broiler chicks. *International Journal Science and Research*, 3(5), 147-151.
10. Hamadani, H., Alam Khan, A., Banday, M.T. & Hamadani, A. (2013). Early chick feeding and in-ovo nutrition two manage mental strategies to combat the effects of delayed feeding. *International Journal of Modern Plant and Animal Sciences*, 1, 123-141.
11. Hassan, H.M.A., El-Moniary, M.M., Hamouda, Y., El-Daly, E.F., Youssef, A.W. & Abd El-Azeem, N.A. (2016). Effect of different levels of *Moringa oleifera* leaves meal on productive performance, carcass characteristics and some blood parameters of broiler chicks reared under heat stress conditions. *Asian Journal of Animal and Veterinary Advances*, 11(1), 60-66.
12. Jayanti, L.A., Manwar, S.J., Khose, K.K. & Wade, M.R. (2017). Effect of supplementation of *Moringa oleifera* leaf powder on growth performance of broilers. *Journal of Poultry Sciences and Technology*, 5(3), 28-34.
13. Jha, R., Singh, A.K., Yadav, S., Berrocoso, J.F.D. & Mishra, B. (2019). Early nutrition programming (in ovo and post-hatch feeding) as a strategy to modulate gut health of poultry. *Frontiers in Veterinary Science*, 6(82), 1-10.
14. Khalid, N., Sakhawat, S.F., Mehmood, H., Ali, M.M., Ali, R., Amin, Y. & Ayaz, M. (2021). Effects of *Moringa oleifera* leaf powder as feed additives on growth performance and blood parameters of broiler. *Journal of Animal Health and Production*, 9(3), 271-276.
15. Kumar, R., Kumar, K., Kumr, A., Prasad, S.K., Kumar, B.B. & Sinha, P. (2020). Effect of *Moringa oleifera* aqueous leaf extract and ascorbic acid supplementation on carcass characteristic and production cost analysis of broiler chicken. *Journal Entomology and Zoology Studies*, 8(2),68-70.

16. N'nanle, O., Tété-Bénissan, A., Tona, K., Teteh, A., Voemesse, K., Decuypere, E. & Gbeassor, M. (2017). Effect of in ovo inoculation of *Moringa oleifera* leaves extract on hatchability and chicken growth performance. *Europe Poultry Science*, 81,1-9.
17. Nazmy, S., Hassan, B., Nihad, A.A., Abeer, E., Abd Elhamid, E.M. & Farid, M. (2016). Biochemical studies on *Moringa oleifera* leaves extract. *Journal of Biology, Agriculture and Healthcare*, 6(16), 33-42.
18. Nduku, X.P., Mabusela, S.P. & Nkukwana, T.T. (2020). Growth and meat quality of broiler chickens fed *Moringa oleifera* leaf meal, a probiotic and an organic acid. *South African Journal of Animal Science*, 50(5): 710-718.
19. Ohta, Y., Kidd, M.T. & Ishibashi, T. (2001). Embryo growth and amino acid concentration profiles of broiler breeder eggs, embryos, and chicks after in ovo administration of amino acids. *Poultry Science*, 80(10), 1430-1436.
20. Patbandha, T.K., Garg, D.D., Marandi, S., Vaghamashi, D.G., Patil, S.S. & Savsani, H.H. (2017). Effect of chick weight and morphometric traits on growth performance of coloured broiler chicken. *Journal of Entomology and Zoology Studies*, 5(6), 1278-1281.
21. Petek, M., Orman, A., Dikmen, S. & ALpay, F. (2008). Relations between day-old chick length and body weight in broiler, quail and layer. *Uludağ Üniversitesi Veteriner Fakültesi Dergisi*, 27(1-2), 25-28.
22. Salary, J., Sahebi-Ala, F., Kalantar, M. & Matin, H.R.H. (2014). In ovo injection of vitamin E on post-hatch immunological parameters and broiler chicken performance. *Asian Pacific Journal of Tropical Biomedicine*, 4, S616-S619.
23. SAS. (2012). *Statistical Analysis Software*. User's Guide for Personal Computers, Release 6.12. SAS Institute Inc. Cary, NC, USA.
24. Sharmin, F., Sarker, N.R. & Sarker, M.S.K. (2020). Effect of using *Moringa oleifera* and *Spirulina platensis* as feed additives on performance, meat composition and oxidative stability and fatty acid profiles in broiler chicken. *Journal Nutrition and Food Sciences*, 10(3), 1-8.
25. Su, B. & Chen, X. (2020). Current status and potential of *Moringa oleifera* leaf as an alternative protein source for animal feeds. *Frontiers in Veterinary Science*, 7, 1-13.
26. Tainika, B. & Şekeroğlu, A. (2020). In ovo feeding technology for optimization of incubation and hatching in broiler chickens. *Turkish Journal of Agriculture-Food Science and Technology*, 8(1), 183-186.
27. Teixeira, E.M.B., Carvalho, M.R.B., Neves, V.A., Silva, M.A. & Arantes-Pereira, L. (2014). Chemical characteristics and fractionation of proteins from *Moringa oleifera* Lam. leaves. *Food Chemistry*, 147, 51-54.
28. Zhang, J., Cai, K., Mishra, R. & Jha, R. (2020). In ovo supplementation of chit oligosaccharide and chlorella polysaccharide affects cercal microbial community, metabolic pathways, and fermentation metabolites in broiler chickens. *Poultry Science*, 99(10), 4776-4785.