

The Effect of Adding Germinated Date Kernel Powder to the Diet on Production Performance and Some Broilers E.coli Bacteria

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ABSTRACT

The research aims to study the effect of adding normal date kernel powder at a concentration of (10%) and comparing it with germinated date kernel powder at a concentration of (10 and 20%) instead of the whole diet of broilers and its effect on the productivity and some microbial traits in the intestine of birds. In this study, 180 unsexed one-day-old Ross chicks, with an initial weight of 42 g were used, prepared from the Al-Anwar hatchery, which is one of the private hatcheries in Babylon governorate for the period from (21/5/2020) to (24/6/2020ims). The chicks were reared in one of the hatchery halls divided into (pens) of 1.5 x 1.5 m, and the chicks were randomly distributed into four treatments with 3 replicates for each treatment, where the treatment included 45 chicks and each replicate 15 chicks. Accordingly, the treatments were distributed as follows; the first treatment (T₁) represents a control diet without a date kernel and the second treatment (T₂) refers to a control diet with the addition of 10% non-germinated normal date kernel powder. In addition, the third treatment T₃, and fourth treatment (T₄) represent a control diet with the addition of 10% and 20% germinated date kernel powder respectively. The results included a highly significant response that occurred at the level ($p \leq 0.05$) to the treatments T₃, T₂, T₄, compared with the control treatment T₁ in the average total live body weight and the total weight gain, where treatment T₁ recorded the lowest average weight. All the treatments differed significantly at the level ($p \leq 0.05$) between them the ratio of feed intake, and the significant superiority was in favor of germination treatments T₃ and T₄. All treatments recorded a significant difference in the dressing percentage between them, but T₁, T₂, and T₃ were significantly superior to the rest of the treatments and were also significantly superior in live weight and carcass weight. On the other hand, it was observed only 3 birds in the treatment T₁ and 2 birds in the treatment T₂, and one in the treatment T₄, while there was no mortality observed in the treatment T₃. Finally, a significant decrease ($p \leq 0.05$) occurred in the number of harmful E.coli bacteria for the treatments T₂, T₃, and T₄ compared with the control treatment T₁, while these treatments were significantly increased ($p \leq 0.05$) in the number of beneficial lactobacilli bacteria, compared with the control treatment T₁.

KEYWORDS

Germinated Date Kernel, Production Performance, E. coli Bacteria.

Introduction

Date palm trees are among the old trees planted by Human, Iraq is the oldest country in its cultivation, where The historical city (Eridu), in the south of Iraq, was the first city in which the palm tree appeared in the year 4000 BC (Abdul Basit and Odeh, 2014). The number of date palms in Iraq during the year 2018 reached about 17 million palm trees (Central Statistical Organization, 2019). Thus, these dates are considered a mine of foodstuffs because of their nutritional and health benefits for humans (Al-Rumaidan, Khalid bin Nasser 2006). However, Date residues are used to feed animals and increase production (Ibrahim et al., 1998), and date kernel powder is used in feeding poultry to replace the expensive traditional feed to reduce the cost of feed (Al -Harthi et al., 2009). Poultry feeding is one of the main pillars in the poultry industry as feeding represents more than 70% of the total production cost (Al-Kassar, Ali Mahmoud Amer, 2012). Besides that, the date kernel is no less important than the importance of dates, as they contain dietary fiber, fats, some minerals, proteins, vitamins, and biologically active compounds that supply the body with many phytochemicals and health compounds (Biglari, et al., 2008). Moreover, it helps to avoid the risk of many diseases such as heart disease, cancer, and blood vessels, and the risk of many chronic and non-chronic diseases. On the other hand, it contains fibers that help to feel full, reduces obesity, reduces blood sugar, helps increase good cholesterol in the body and reduce bad cholesterol support, decrease blood pressure, and stone fragmentation. Furfural matter that is used in the production of insecticides is also extracted from the date kernel (Ibrahim, Abd al-Basit Odeh 2012). It contains a high amount of fat (Al-Farsi and Lee, 2008) and contains oils of high viscosity, rich in oleic acid, which is important in feeding poultry (Mortadha et al., 2015). Likewise, is considered anti-fungi, bacteria, viruses, and cancer prevention (Nagwa et al., 2009). It has been used to replace part of Maize (Daneshyar et al., 2014) or part of wheat (Mayada F. M., 2013) or mixed with acids or enzymes (Jaffer, 2010). Moreover, adding it to the diet has improved its nutritional qualities, and today for the first time it was used as a germinator in feeding poultry because of the effect of germination seeds (wheat, barley, and corn) on the nutritional value and improving it and converting some complex substances into simple (Amin et al., 2009). It has increased the number of sugars and

minerals and reduces the total starch and dry matter content of grains and enzymes (Shipyard I.,2005). The germination of barley has increased the protein digestion factor to twenty times, as well as vitamins E and A (Cuddeford, 1989 and Shahid and Muhammad, 2017). Today it has been mixed in different proportions with the diets in replace part of Maize, to identify its effect on the productive traits and some intestinal bacteria, and to compare it with the normal date kernel.

Materials and Methods

The study was conducted in the field of poultry belonging to the Department of Animal Production at the College of Agriculture and Marshlands, Thi-Qar University for the period from (21/5/2020) to (24/6/2020). A 180 unsexed one-day-old Roos308 chicks were used, with an average weight of 42 g, prepared from the Al-Anwar hatchery in Babylon governorate, the chicks were reared in a hall inside the hatchery divided by BRC in the form of pens with dimensions 1.5 x 1.5 m. The chicks were distributed randomly into 4 treatments with 3 replicates for one treatment, where the single treatment included 45 chicks and each replicate 15 chicks. The chicks were reared for 35 days on a wood sawdust litter with a thickness of 3-5 cm and the lighting was 23 hours a day, and an hour of darkness to accustom the chicks when the electrical current was cut off, the feeding was free, as well as water. Plastic feeders and waterers were used, with a capacity of 5 kg feed and 5 liters water, respectively. The chicks were inoculated on the first day with Newcastle, Gumboro, and Avian Influenza vaccine, and at the age of one week they were vaccinated with the Newcastle vaccine in drinking water, as well as at the age of 14 days, the Newcastle vaccine was also re-vaccinated in drinking water. Therefore, the treatments were distributed as follows; the first treatment (T_1) represents a control diet without a date kernel and the second treatment (T_2) refers to a control diet with the addition of 10% non-germinated normal date kernel powder. In addition, the third treatment T_3 , and fourth treatment (T_4) represents a control diet with the addition of 10% and 20% germinated date kernel powder respectively.

Preparation of Date Kernel Powder

The date kernel was brought from one of the local molasses factories in Baghdad. They were cleaned, impurities and dirt removed, washed with water, and left to dry for two days at a temperature of 35 °C. Then, a portion of it was taken to grind in a volume of 1 ml and save until it was mixed with the diet as shown in (Figure 1)



Figure 1. Germinated kernel and normal kernel

The other portion was taken and washed well with sterilized (iodine 2%), after which it was washed with water and placed inside plastic dishes and covered well with a wet cloth, and left for 3 weeks in a warm place to be germinated. The plumule and radicle have emerged from the micropyle opening in the back of the date kernel up to a length of 5-6 cm. Besides, the germinated date kernel was dried at a temperature of 35 °C, then crushed and ground until they were mixed with the diet. The diets were mixed after grinding their materials in the feed store and the chemical analysis of the germinated and non-germinated date kernel used in the experiment was carried out in the central laboratory of the Atomic Energy Organization. Finally, the metabolizable energy was calculated based on (NRC 1994), which amounted to 3300 kcal/kg of date kernel powder as shown in Table (1).

Table 1. Chemical analysis of germinated date kernel and normal date kernel

Components	Non-germinated date kernel	Germinated date kernel
Dry matter%	90.2	86.9
Crude protein%	8.7	10.9
Raw fat%	6.9	6.4
Ash%	2.2	2.2
Crude fiber%	4.9	2.1
Nitrogen Free Extract (NFE)	6.67	75.98
Calcium%	0.69	0.72
Phosphorous%	0.21	0.31
Metabolizable energy kcal/kg	3300	3345

Chicks were fed on a standardized diet from 1-35 days that contained (2864.10) Metabolizable energy and (19.64%) protein, as Table (2) and in Table (3) showing the components of the diets used in the experiment and the calculated chemical estimate.

Table 2. The components of the experiment diet and their chemical analysis

Feed material	Percentage% *
Maize	64
Soybean meal ^[1]	32
Premix ^[2]	3
Limestone	0.7
Nacl table salt	0.3
Total	100
The calculated chemical estimate	
Crude protein%	19.64
Metabolizable energy kcal/kg	2864.10
Feed	

^[1] Soybean meal is a Turkish source, it contains (48%) protein and 2230 kcal / kg feed)

^[2] Premix contains d-imethionine phosphate, a group of vitamins, rare salts and anti-rot, crude protein 4%, metabolizable energy 550 kcal / kg feed, it was prepared by the German company BASF.

Table 3. The components of the diets used in the experiment and their calculated chemical analysis

Components	T ₁	T ₂	T ₃	T ₄
Maize	64.0	54.0	54.0	44.0
Soybean meal	32.0	32.0	32.0	32.0
Premix	3.0	3.0	3.0	3.0
Date kernel	10	10	20
Limestone	0.7	0.7	0.7	0.7
Table salt	0.3	0.3	0.3	0.3
Total	100	100	100	100
Crude protein%	19.64	19.60	19.77	19.55
Metabolizable energy kcal/kg	2864.10	2860.90	2857.81	2862.99

Studied Traits

Body weight, weight gain, feed intake, feed conversion ratio, mortality percentage, and dressing percentage were calculated according to the method of (Al-Fayadh et al., 1989). The numbers of aerobic bacteria, E.coli bacteria, and lactobacilli were calculated by pouring the mentioned dishes according to the method of (Harrigan et al., 1976).

Statistical Analysis

The statistical analysis of the studied traits was performed using the Completely Randomized Design (CRD) and the significance of the differences between the treatments was tested using the Duncan Multiple range test (Duncan. B.D. 1955) at a 0.05 significance level. Also, the Statistical Analysis System program (SAS 2012) was used in the statistical analysis.

Results and Discussion

• Body Weight

The statistical analysis results of the effect of adding germinated date kernel powder to the diet on the average final weight of the birds are shown in Table (4). These results showed that there are significant differences ($p \leq 0.05$) in the average final body weight between the treatments T_2 , T_3 , and T_4 compared with the control treatment T_1 , where the treatment T_2 and T_3 did not differ among them. The significant superiority was in favor of treatment T_4 , which contains 20% germinated kernels and this is consistent with the findings of (Mayada, 2013) by using the date kernel powder instead of a part of wheat in the diets of broilers. Together with, (Al-Humaidan et al., 2003) found significant differences in body weight compared with the standard diet, and this agreed with (Tareen et al., 2017) by noticed a significant difference in the final weight of birds when using date kernel soaked with organic acids. These results did not agree with the findings of both (EL-FAKI, 2002) that did not find significant differences in the final body weight when using the date kernel powder in chicken diets instead of a part of maize with proportions (5, 10, 15, 20%) and (Attia and Al-Harth, 2015). The reason for the final weight gain of the birds may be due to the fact that the date kernel powder contains good amounts of nutrients and carbohydrates that are a source of energy and contain crude protein (Tareen et al., 2017). Moreover, increasing the palatability, which is reflected in the efficiency of metabolism, which increases the live weight (Yang et al., 2008) and can enhance sufficient quantities of carbohydrates and starch to participate in the digestion of fats. The weight gain of the germinated kernel may be related to the size and rate of digestion and absorption of nutrients to increase the availability of digestive enzymes after germination (Anniosn, G. 1993).

• Feed Intake

From the statistical analysis of the effect of adding sprouted date kernel powder to the diet on the cumulative feed intake rate for birds, Table (4) indicates the presence of significant differences ($p \leq 0.05$) between the three treatments and the control treatment. Therefore, it can observe a significant superiority in treatment T_3 , which contains 10% of germinated date kernel over the rest of the treatments, followed by T_4 , T_2 , and T_1 respectively, which T_3 reached 3075, T_4 3040, T_2 3020, and T_1 2940 g, respectively. This is consistent with the findings of (EL-FAKI, 2002; Mayada, 2013 and Attia et al., 2015) by founding significant differences ($p \leq 0.05$) in the rate of feed intake. These results did not agree with the findings of (Daneshyar et al., 2014; Tareen et al., 2017; Al-Zuhairi et al., 2008 and Al-Khafaji et al., 2017) that did not find a significant difference ($p \leq 0.05$) in feed intake between the date kernel powder treatments and the standard treatment. The reason may be due to the increase in the feed intake in treatments in which the germinated date kernel powder was used because germination facilitates the elimination of enzyme inhibitors, which facilitates the digestion process and thus increases the percentage of feed intake, which is reflected in body weight and weight gain (Dastar et al., 2014). The reason may be due to the transformation of complex substances to simple substances by reducing the effect of anti-nutritional factors, and improves protein quality, increases the number of sugars and some minerals, reduces the total starch and dry matter content, and improves the vitamin content (Amal. Et al., 2007).

• Weight Gain

Table (4) shows the results of the statistical analysis results of the effect of adding germinated date kernel powder to the diet on the total weight gain. Thus, it was evident that there is a significant superiority ($p \leq 0.05$) in the treatments that contain germinated and non-germinated kernel powder with the control treatment, and the experimental treatments did not differ among them. Also, an arithmetic increase was observed in the three treatments in favor of the germination treatments, and the weight gain rates were 1729 g, 1819 g, 1853 g, and 12842 g for the study

treatment respectively. However, these results are consistent with the findings of (EL-FAKI, 2002; Attia et al., 2015; Mayada, 2013; Biggs et al., 2007; Al-Khafaji et al., 2018 and Al-Humaidan et al., 2003) by founding significant increase ($p \leq 0.05$) in the rate of weight gain when using date kernel in diets compared to the standard diet. The reason for the weight gain may be due to the fact that the date kernel contains a number of carbohydrates, which are a source of energy, and crude protein, which helps the palatability of the feed. This is reflected in the efficiency of metabolism and has the ability to enhance sufficient quantities of carbohydrates and starch to contribute to the digestion of fats and thus weight and weight gain increases (Yang et al., 2008). The reason for the weight and weight gain increases may be the germination that improves the nutritional value of the date kernel powder by increases the digestive value and the occurrence of absorption of nutrients present in the diet. Besides, the extent to which birds benefit from the feed intake and convert it into the meat and works to reduce harmful bacteria and increase beneficial bacteria (Saad Abdel-Hussein et al., 2009). These results did not agree with the findings of (Al-Zuhairi et al., 2008; Daneshyar et al., 2014 and Tareen et al., 2017) that did not find significant differences ($p \leq 0.05$) in the rate of weight gain.

• **Feed Conversion Efficiency**

The statistical analysis results of the effect of adding germinated date kernel powder to the diet on the average Feed conversion efficiency are shown in Table (4). These results indicated that there were no significant differences ($p \leq 0.05$) between the first and second treatments with each other and between the third and fourth treatments with each other. But, the two treatments T_1 and T_2 differed from the two treatments T_3 and T_4 , and the germinated kernel treatments were better than the comparison treatment and the normal kernel treatment T_1 and T_2 , respectively, as the normal kernel treatment T_2 was mathematically superior over the T_1 treatment. This is agreed with the findings of (Al-Humaidan et al., 2003; Mayada F.M., 2013; Attia et al., 2015 and Tareen et al., 2017), and the reason may be due to the high efficiency of feed conversion in the treatments of date kernel powder. The latter contains carbohydrates, which are a source of energy and protein, which increases palatability and is reflected in the efficiency of feed conversion (Al-Harithi, 2006 and Yang et al., 2008). Furthermore, (Saad Abdel-Hussein, et al., 2009) emphasized that kernel germination improves the nutritional value, increases the digestive value, and occurs an absorbent of nutrients in the diet, which increases the feed intake and converts it into the meat, which increases the efficiency of feed conversion. The reason may be due to the role of raw ingredients that are highly digestible as a source of energy and the availability of glucose sugars, which helps in the digestion and absorption of dry matter, which is reflected in increasing the feed conversion (Al-Mousawi et al., 2016). These results did not agree with (Al-Zuhairi et al., 2008 and Daneshyar et al., 2014) and (Tareen et al., 2017) that did not find significant differences in the efficiency of feed conversion.

• **Percentage of Total Mortality (%)**

The statistical analysis results of the effect of adding germinated date kernel powder to the diet on the mortality percentage are shown in Table (4). These results indicated a significant decrease ($p \leq 0.05$) in the mortality percentage between the treatments in favor of the additional treatments compared to the control treatment. Thus, it was observed only 3 chickens in treatment T_1 and 2 chickens from treatment T_2 and one chicken from treatment T_4 , as for the treatment T_3 , there are no mortality of a total of 45 chickens. This is consistent with (Shahid., 2017) and (Amal B.K et al., 2007) that the date kernel and germination provide an acidic medium that eliminates harmful bacteria and increases the beneficial bacteria, which gives good health that reduces mortality.

• **Dressing Percentage**

The statistical analysis results of the effect of adding germinated date kernel powder to the diet on the dressing percentage are shown in Table (4). These results indicated that there was a significant difference between the experimental treatments and the significant superiority was ($p \leq 0.05$) in favor of the additional treatments compared to the control treatment, Besides that, the treatment T_3 was significantly higher than the rest of the treatments, they were as follows: T_1 67.31, T_2 68.52, T_3 70.90, and T_4 69.39, which are consistent with the findings of (Tareen et al., 2017; Attia et al., 2015 and Daneshyar et al., 2014). The reason for the high dressing percentage may be that the date kernel powder helps in the digestion and absorption of dry matter, and this increases the feed conversion ratio and thus increases the dressing percentage (Al-Mousawi et al., 2016). Furthermore, germination has an important role in raising the feed value, absorbing nutrients, and benefiting from the feed intake, and converting it into the meat, which

increases the dressing percentage (Saad Abdel-Hussein et al., 2009) and Shahid and Muhammad Judi, 2017). On the other hand, these results did not agree with (Masoudi et al., 2011; Al-Zuhairi et al., 2008 and (Al-Khafaji et al., 2018) that did not find significant differences in dressing percentage.

Table 4. The effect of normal germinated date kernel powder on average body weight, weight gain, feed intake, feed conversion ratio, dressing percentage, and mortality

Studied traits	T ₁	T ₁	T ₁	T ₁	Significance level
Average body weight (g)	1794 c ± 2.49	1810 b ± 2.94	1886 b ± 4.08	1890 a ± 5.67	*
Feed intake rate (g)	2940 d ± 2.95	3020 c ± 3.65	3075 a ± 3.51	3040 b ± 2.94	*
Average weight gain (g)	1729 b ± 3.65	1819 a ± 7.73	1853 a ± 4.08	1842 a ± 5.94	*
Feed conversion ratio	1.70a ± 0.029	1.68a ± 0.046	1.66b ± 0.041	1.65 b ± 0.011	*
Dressing percentage %	67.31 d ± 0.025	68.52 c ± 0.031	70.09 a ± 0.041	69.39 b ± 0.040	*
Mortality percentage %	6.66 a ± 0.011	4.44 b ± 0.033	0.00 d ± 0.00	2.22 c ± 0.021	*

* There were significant differences ($p \leq 0.05$) between the treatments.

• Intestinal Bacterial Content

The statistical analysis results of the effect of adding different levels of germinated date kernel powder to the diet on the numbers of aerobic bacteria, E.coli bacteria, and lactobacillus bacteria in the Duodenum of the experiment birds are shown in Table (5). These results indicated a significant decrease ($p \leq 0.05$) in the E.coli bacteria and a significant increase in the beneficial aerobic bacteria (lactobacillus bacteria) in the Jejunum area in favor of feeding treatments of germinated and non-germinated date kernel powder compared to the standard treatment, which achieved the highest rate. This is agreed with (Min et al., 2007) which attributes the reason for the significant increase in lactobacilli bacteria, being insensitive to stomach acidity, on the contrary, the acidity provides it with a suitable medium for its proliferation and reduces the numbers of harmful E.coli bacteria. Along with (Moharregheh et al., 2009 and Shakila et al., 2012) finding, which they observed that the date kernel powder reduces the percentage of harmful E.coli bacteria because dates achieve a good diet that expels them as a result of the vital competition with the beneficial bacteria.

Table 5. The number of total aerobic bacteria, lactobacilli, and E.coli bacteria

Studied traits	T ₁	T ₁	T ₁	T ₁	Significance level
Total aerobic bacteria	5.260 ± a 0.036	4.810 ± d 0.026	4.430c ± 0.026	4.603 d ± 0.032	*
Lactobacilli bacteria	4.090a ± 0.036	4.546 b ± 0.037	4.510b ± 0.030	4.620 a ± 0.026	*
E.coli bacteria	11.320a ± 0.036	11.090b ± 0.036	10.650 c ± 0.030	10.840 d ± 0.045	*

* There were significant differences ($p \leq 0.05$) between the treatments.

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