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USAGE OF WHOLE DEPITTED LOW GRADE DATES AS UNCONVENTIONAL CONSTITUENT OF BROILER DIETS

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ABSTRACT:A total of 150 unsexed one-day old Arbor acers broiler chicks were randomly divided into five experimental groups. Each group consisted of 30 chicks distributed among 3 replicates with 10 chicks per replicate. The control group (G1) received a basal diet (yellow corn-soybean meal diet). Groups 2 and 3 received the basal diet after replacing 25% of yellow corn with whole de-pitted low grade dates meal (WDDM), either without (G2) or with (G3) multienzyme mixture (xylanase, β-glucanase and cellulase). Moreover, Groups 4 and 5 received the basal diet after replacing 50% of yellow corn with WDDM either without (G4) or with (G5) multienzyme mixture. The experiment prolonged for 6 weeks and the birds received starter diet from 0 to 3 weeks of age and grower diet from 4 to 6 weeks of age.

The results revealed that replacing 25% of yellow corn with WDDM plus enzyme mixture supplementation (G3) significantly increased body weight and body weight gain compared to G2, G4 and G5. However, broilers of G2 exhibited higher body weight than those fed WDDM in place of 50% of yellow corn without enzymes supplementation (G4), and surpassed those fed WDDM in place of 50% of yellow corn with enzymes (G5). Despite of the slight decrease of BW of G2, G3, G4 and G5 as compared with the control group (G1) (92.83, 98.49. 85.58 and 90.93 vs. 100%, respectively), however, because of the high cost of yellow corn and low cost of WDDM, the relative economic efficiency compared to the control group was better for all groups received WDDM without enzymes (105% and 109% for G2 and G4, resp.) or with enzymes (115% and 113% for G3 and G5, resp.). The diet contained WDDM instead of 25% of yellow corn fortified with enzymes (G3) also improved feed conversion ratio and digestibility of dry matter, ether extract, and crude fiber. Nevertheless, there were no significant differences in crude protein digestibility or feed intake among the experimental groups. However, replacing 25% or 50 %of corn with WDDM plus enzymes increased cholesterol and LDL without affecting triglycerides or HDL levels. Nevertheless, there were no significant effects on liver and kidney functions, antioxidant capacity, or hematological parameters. In conclusion, based on the relative economic efficiency and on the local availability of WDDM compared to imported yellow corn, replacing from 25% up to 50% yellow corn with whole low grade de-pitted dates meal plus enzymes mixture may be recommended for practical application in broiler diets.

Key words: broilers, de-pitted dates meal, body weight, economic efficiency, nutrient digestibility,

INTRODUCTION

The effective management of broiler chickens is determined by various factors including breed, management practices, housing conditions, and feed quality. Enhancing feed quality plays a crucial role in the productivity of the poultry industry. Notably, feed expenses typically account for 60-70% of the total production costs in this sector (Gunya and Masika, 2021).

Indeed, many agricultural industries generate substantial amounts of residues annually. Ineffective waste management can lead to environmental pollution and pose risks to both human and animal health (Azizi et al., 2021).

Agricultural by-products are increasingly being utilized in poultry feed in certain regions, driven by the growing competition for conventional ingredients between humans and the food industry. Incorporating these by-products as alternative feed ingredients is advised to lower production costs and enhance profitability (Sjofjan *et al*., 2021).

The palm date (Phoenix dactylifera L.) is a significant fruit crop in the Middle East and Mediterranean region. According to the Food and Agriculture Organization (FAO, 2021), Egypt produces 1.7 million tons of dates, accounting for over 21 percent of the global date production, which is estimated at eight million tons. However, it is estimated that around 30% of date fruits are discarded or utilized for animal feed due to their low quality, which includes issues such as inadequate texture, unattractive appearance, damage, blemishes, immaturity, or undersizing (Kchaou *et al*., 2016; Fernández-López *et al*., 2022).On the other hand, the use of palm date as an alternative feed ingredient is still limited due to its low protein and high crude fiber content. Palm dates composition includes approximately 71.8% mannose, 26.6% galactose, and 9.8-22.3% β-galactomannan polysaccharide. Additionally, it contains low levels of anti-nutrients such as oxalates, tannins, saponins, alkaloids, and cyanide (Hassan and Al-Aqil, 2015). Despite these factors, the low concentration of anti-nutritional compounds suggests that palm dates can be utilized as an alternative feed ingredient without significantly affecting the absorption of other essential nutrients such as minerals and protein.

Previous studies have indicated that date waste contains crude protein (2.4–4.0%), crude fat (0.34–3.9%), crude fiber (2.4–16.0%), carbohydrates (total sugars, 44–88%), nitrogen-free extract (NFE; 72.5–77.75%; rich in glucose and fructose), metabolizable energy (2321 to 3050 kcal/kg), methionine + cysteine (0.07 to 0.12%), and lysine (0.04 to 0.13%) (Vandepopuliere *et al*., 1995; Hussein *et al*., 1998; Baraem *et al*. 2006; El-Deek *et al*., 2010; Srour, 2024).

The inclusion of dates and their by-products in poultry diets has been found to enhance growth and fattening performance (Abudabos *et al*., 2015; Attia and Al-Harthi, 2015; Tareen *et al*., 2017). Studies also suggest that incorporating palm date extract, whole dates, and date fruit into broiler diets at varying percentages leads to increased live body weight (Al-Dawah, 2016; Tareen *et al.*, 2017). Furthermore, research by Raza *et al.* (2023) demonstrated that chicks fed a diet containing 9% dried dates exhibited higher weight gain compared to the control group. Also, Tabook *et al*. (2006) found that adding 5% of date fiber to the diet did not adversely affect broiler chicken performance. In addition, replacing wheat bran with date waste, which has similar energy and protein concentrations, in broiler diets up to 200 g/kg did not impact body weight gain (Abdel-Sattar *et al.*, 2019).

Therefore, the objectives of the current experiment were to investigate the usage of whole de-pitted dates low grade (not accepted for human consumption) with or without enzymes supplementation as unconventional replacement for yellow corn in broilers feeds and assess their impact on growth performance, nutrient digestibility, and economic efficiency of broilers from 1 to 42 days of age.

MATERIALS AND METHODS

Experimental design:

The experiment was conducted at March to April, 2023. The objective of this experiment was to evaluate the effect of partial replacement of yellow corn with whole low grade de-pitted dates with or without enzymes supplementation on growth performance, nutrient digestibility, and economic efficiency of broilers from 1 to 42 days of age.

The Saidi dates waste was collected from dates factories in El-Kharga oasis at New Valley governorate. The used dates consisted of low-quality dates, discarded dates of the culling process, and old date of the previous year production. These dates were processed by fruits de-pitted after sand, herbage and gravel removal. Then, it was sun-dried for 72 hours and ground in a heavy-duty high rotation hammer mill to pass through 1 mm. mesh sieve, producing a fine meal (WDDM) suitable for feeding and chemical analysis.

A total of 150 unsexed one-day old broiler chicks (Arbor Acres) obtained from a commercial hatchery were randomly allocated into five experimental groups (Treatments). Each experimental group consisted of 30 chicks distributed among 3 replicates; 10 chicks per replicate. The chicks of the five groups were fed according to the following order:

The 1st group (G1) served as control and received a basal diet (yellow corn- soyabean meal diet). Chicks in the 2nd and 3rd groups were fed the basal diet in which 25% of yellow corn was replaced with WDDM, either without (G2) or with (G3) enzymes mixture supplementation. While chicks in the 4th and 5th groups were fed the basal diet in which 50% of yellow corn was replaced with WDDM, either without (G4) or with (G5) enzymes mixture supplementation. Enzymes were supplemented in a 0.1% multi-enzyme product (Kemzyme) that combines three different NSP enzymes (xylanase, β-glucanase and cellulase). The experimental diets were formulated based on the guidelines provided by NRC (1994). The birds received starter diet till 21-days old and then grower diet till 42-days old. The ingredients and chemical analysis of the experimental diets are presented in Table (1).

It is very important to mention that this experiment was carried out to evaluate <u>the net effect</u> of partially replacing yellow corn with WDDM without applying any makeup or remedy for the differences in the level of any nutrient (energy, protein, amino acids, etc.) between the basal diet (yellow corn – soybean meal diet) and the experimental diets (WDDM diets).

Housing and husbandry: Chicks were housed in battery brooders in semi-opened house. Chicks were fed the experimental diets *ad libtium* and given free access to water. The light schedule was as follows: 23 h light until the 7th day followed by 20 h of light from the 8th day until 3 days before slaughter test (8-39 days of age) then 24 h of light until 42-days of age. The brooding temperature (indoor) was 33, 30, 27 and 24-21 C^{o} during 1-7, 8-14, 15-20 and 21-42 days of age (declined gradually). Chicks received different recommended vaccines and were raised under common management practices for broiler chicks till six weeks old.

Production performances: Birds were weighed individually at start and weekly to record BW and calculate body weight gain (BWG). Feed intake (FI) was recorded at the same intervals as well as total period for each replicate and feed conversion ratio (FCR: g feed/g gain) values were calculated.

European Production Efficiency Index (EPEI) was calculated throughout the experimental period (1-42d of age), according to Hubbard broiler management guide (1999) as follows: -

$EPEI = \frac{BW\ (kg)\ x\ SR}{PP\ x\ FCR} x\ 100$ Where:

BW = Body weight (kg) SR = Survival rate (100% - mortality)

PP = Production Period (days) FCR = Feed conversion ratio (kg feed/kg gain)

Economic efficiency for all experimental treatments was calculated as follows.

$$\text{Economic efficiency} = \frac{\text{Total revenue} - \text{Total cost}}{\text{Total cost}}$$

Where:

Total revenue = BW × meat price

Total cost = feed cost + chicken cost + other cost

Relative economic efficiency = (Economic efficiency/control economic efficiency)*100

Carcass characteristics measurements: At 42 d of age, six broiler chicks from each group (2 per replicate) were slaughtered after 8 hours fasting, processed and the weight of carcass and internal organs were evaluated and expressed as (%) of live body weight (LBW).

Digestibility trial: At the end of the experiment, (38-42 d of age), 3 males from each group were housed individually in separate cages for 5 days. Birds were allowed to the experimental diets for 2 days as preliminary period followed by 3 days as a main experimental period, in which quantities of FI and excreta were accurately evaluated. The proximate analyses of samples of feed and dried excreta were carried out according to AOAC (2004). Accordingly, percent of nutrients digestibility were calculated.

Hematological and biochemical parameters: At slaughter**,** six blood samples were collected in heparinzed tubes from each group. Plasma was separated by centrifuging of blood at 3000 rpm for 20 minutes and stored at –20 ^{o}C for later analysis. Hb concentration was determined by the cyanomethemoglobein method **(Eilers, 1967)**. Wintrobe hematocrite tubes were used for determination of the hematocrite value. Blood samples were centrifuged for 20 minutes at 3000 (rpm), then hematocrite values were measured by reading the packed cell volume on the graduated scale.

RBC's were counted on an Ao bright line hemocytometer using light microscope at 400x magnification. Blood samples were diluted 200 times with physiological saline solution before counting. WBC's were counted on a Ao bright line hemocytometer using a light microscope at 100x magnification after diluting the blood samples 20 times with a dilitry fluid (3ml acetic acid glacial + 97 ml distilled water + some of Lushman stain) according to Hepler (1966). Glucose concentration (mg/dl) was measured according to Trinder (1969). total protein (g/dl) (Henry et al., 1974), albumin (g/dl) (Doumas, 1971) and globulin (g/dl) (Coles, 1974) were determined according to Bossuyt et al. (2003). Tri-iodothyronine (T3) and thyroxin (T4) concentration were measured using radioimmunoassay technique (RIA) according to (Darras et al., 1991). In addition, plasma samples were assigned for determination of creatinine and uric acid (Bartles et al., 1972), triglycerides (Fossati and Prencipe, 1982), total cholesterol (Stein, 1986), HDL (Lopez-Virella, 1977), while LDL was determined according to (Friedewald et al., 1972). The activity of plasma aspartate amino transferase, and plasma alanine amino transferase, were estimated according to Reitman and Frankle (1957).

Packed cell volume (%), Hemoglobin concentration and red cell indices (MCH and MCHC) were calculated according to the following equations:

Mean Corpuscular Hemoglobin (MCH) (Pg) = HbX10/ RBC's,

Mean Corpuscular Hemoglobin Concentration (MCHC) (g/dl) = HbX100/ Packed cell volume,

Mean corpuscular volume (MCV) (µm3 femtoliter 10-15) = (Hematocrite (%) / RBC's) ×10.

TAOC was determined according to Koracevic *et al.* (2001), SOD activity according to Misra and Fridovich, (1972), GPX activity according to Paglia and Valentine, (1967) and GSH activity according to Ellman, (1959).

Statistical Analysis: Data were analyzed by the GLM procedure of Statistical Analysis System (SAS), 2002) using one-way ANOVA with the following model:

$$Y_{ik} = \mu + T_i + e_{ik}$$

Where Y is the dependent variable; µ the general mean; T the effect of experimental treatments (groups) ; e the random experimental error.

Before analysis, all percentages were subjected to logarithmic transformation ($\log_{10} x + 1$) to normalize data distribution. The significance of the differences among means was determined using Duncan's new multiple range test (Duncan, 1955) at $P < 0.05$.

RESULTS AND DISCUSSION

Growth performance: The results of growth performance and economic efficiency of the broilers during the period from 1 to 42 days of age as affected by partial replacement of yellow corn with whole de-pitted dates meal are presented in Table (2). The results show that replacing 25% of corn in the diet with WDDM plus enzymes supplementation (G3) significantly increased body weight (BW) and body weight gain (BWG) during the growth phase (1to 42 d) compared to the diet contained WDDM instead of 25% of yellow corn but without enzymes supplementation and the diets contained WDDM in place of 50% of yellow corn with or without enzymes supplementation. However, it is worthy to mention that there was a slight decrease of BW of G2, G3, G4 and G5 as compared with the control group (G1): (92.83, 98.49. 85.58 and 90.93 vs. 100%, respectively). Nevertheless, the broilers received the basal diet containing WDDM instead 25% of yellow corn with or without enzymes (G2 and G3) exhibited notably higher BW than those received the basal diet containing WDDM in place of 50% of yellow corn with or without enzymes (G4 and G5),

Economic efficiency: Despite of the slight decrease of BW of G2, G3, G4 and G5 as compared with the control group (G1) (92.73, 98.46. 85.29 and 90.75 vs. 100%, respectively), however, because of the high cost of the imported yellow corn and low cost of WDDM, the relative economic efficiency – as compared to the control group - was better for all groups received WDDM without enzymes (105% and 109% for G2 and G4, resp.) or with enzymes (115% and 113% for G3 and G5, resp.). Furthermore, the broilers fed diets containing WDDM in place of 25% of yellow corn with or without enzymes supplementation exhibited higher European Production Efficiency Index compared to those fed diets containing WDDM in place of 50% of yellow corn with or without enzyme supplementation (Table 2).

Based on the obtained results, it could be reported that taken growth performance (BW and BWG) in consideration, 25 % of yellow corn could be replaced with WDDM + enzyme mixture, however; taken relative economic efficiency in consideration, up to 50% yellow corn could be replaced with WDDM + enzyme mixture in broiler diets from 1 to 42 days of age.The results of the present study are in partial agreement with the findings of Attia *et al*. (2017), who observed improved BW and BWG in Japanese quails when fed a diet supplemented with enzymes derived from palm dates. Similarly, Debache, (2021) suggested that inclusion of date-fruit waste in broilers diet could be adequately used as an ingredient for broilers feed to get higher body weight and growth weight over commonly used broiler feeds. Raza, *et al.* (2023) reported that the weight gain was significantly higher in the group received 9% dried date meal compared to the control group. However, Al-Harthi (2006) and El-Deek *et al*. (2010) reported that the addition of date waste meal and whole inedible dates to broiler rations at various percentages did not affect body weight gain. Attia and Al-Harthi (2015) found that inclusion of date waste in broiler diet up to 20% in the growing-finishing period had no negative effects on growth performance, and the best growth performance was obtained with a diet containing 5% date waste. Also, Taha *et al.,* (2013); Al-Beitawi *et al*., (2014); and Abudabos *et al.*, (2018) reported similar results to the present results, Their studies have reported improved weight gain. Yalçın *et al*. (2012) reported that enzyme inclusion in broiler diets improved nutrient digestibility and growth performance. Additionally, the broiler chickens fed the basal diet containing WDDM in place of 25% or 50% yellow corn with enzymes supplementation (G3 and G5), exhibited notably higher BW compared to the other groups. This can be attributed to the improved utilization of nutrients and energy from the dates, facilitated by the enzyme supplementation. Enzymes such as xylanase and β-glucanase have been shown to break down non-starch polysaccharides in feed ingredients like dates, leading to better nutrient absorption and growth performance (Bedford and Schulze, 1998).The role of enzymes in enhancing the nutritional value of feed ingredients is well documented. Enzymes such as xylanase, β-glucanase, and phytase can break down non-starch polysaccharides and phytate, respectively, making nutrients more available to the birds (Bedford and Partridge (2010). The current results suggest that enzyme supplementation further enhances the benefits of WDDM inclusion, likely by improving the digestibility of the complex carbohydrates present in the dates. Enzyme supplementation plays a crucial role in diets rich in non-starch polysaccharides (NSP), as it enhances performance in monogastric animals (Choct *et al*., 1999). Additionally, date extracts contain some bioactive compounds that have antimicrobials and antioxidant properties, as these compounds regulate the microbial content in the digestive tract and preventing the growth of many harmful bacteria (Dalla and Sheboun 2009; Abuelgssim *et al*. 2020). This also improves the efficiency of utilizing nutrients and increases their absorption through blood (Akbarian *et al.* 2016), which reflected positively in improving the bird's health and enhancing their growth.

Our results indicate that enzyme supplementation enhanced the growth performance when partially replaced 25 or 50 % of corn with WDDM (G3 vs. G2 and G5 vs. G4). The impact of enzyme supplementation was more pronounced in G3 where BW and BWG did not significantly differed from those of the control group (G1). This suggests a threshold beyond which the benefits of enzyme supplementation may plateau or decrease due to potential imbalances or excesses in the diet. Similar observations were made by Cowieson and Adeola (2005), who noted that optimal enzyme efficacy is often observed at moderate inclusion levels of alternative feed ingredients. In contrast, Masoudi *et al*. (2011) reported that date flour at a 10-30% level caused a reduction in final body weight. El-Faham *et al.* (2017) found that giving 10% palm date waste in feed reduced the final body weight.

Our findings about economic efficiency are in agreement with Ibrahim *et al.* (2010) who demonstrated that DSM could be utilized rather than yellow corn (50% substitution) either without or with special kemzyme addition, which lead to best economic efficiency. Also, Mardhati *et al*. (2011) indicated that feed cost per kilogram broiler's live weight was lowest for rations with various types of palm date kernel compared to corn-soy-based ration in Malaysia. Furthermore, in broilers, the feed cost was significantly lower in birds fed date waste compared to those on the basal diet (Shakila, *et al*. 2012). The highest net profit was achieved by birds fed with 4.0% palm date kernel closely followed by those fed with 3.0% palm date kernel (Tareen, *et al*. 2017). Also, Al-Zuhairi *et al*. (2019) reported that adding date pomace powder to chicken feed at levels of 10, 20, and 30 % achieved the best production index value as compared to control. Additionally, the inclusion of dried date waste led to significant increases in revenue, profit and cost–benefit ratio in broilers (Raza, *et al.* 2023). El-Kelawy and El-Kelawy (2016) reported that multienzymes supplementation improved economic efficiency and production index of rabbits. Furthermore, El-Kelawy *et al.* (2020) demonstrated enzymes supplementation improved economic efficiency and production index at inclusion levels of 10% and 20% DSM. Also, Khatun *et al*., (2022) reported that adding the enzyme mixture achieved a greater profit than the control diet.

Feed conversion ratio: The results of feed intake and feed conversion ratio (FCR) of the broilers during the period from 1 to 42 days of age as affected by partial replacing of yellow corn with WDDM are presented in Table (3). It is worth noting that there were no significant differences in feed intake observed among the different experimental groups during all the experimental periods. However, the results indicate that FCR resulted from the replacement of 25% of corn in the diet with WDDM without or with enzymes supplementation (G2 and G3) were not significantly different from that of the control group (G1). However, FCR due to replacement of 50% of yellow corn with WDDM without or with enzymes (G4 and G5) during the growth phase (42 days) was slightly affected.

Previous studies support these findings, highlighting the benefits of partial replacement of conventional feed ingredients with alternative sources. For instance, Al-Harthi *et al.* (2009) observed similar improvements in FCR when date pits were used as a partial replacement in poultry diets. Additionally, Al-Marzooqi *et al.* (2010) reported that incorporating date by-products in broiler diets improved growth performance and nutrient utilization, particularly when enzymes were included. Also, these results align with the findings of Zarei *et al*. (2011), who demonstrated that enzyme supplementation can enhance the digestibility and nutrient availability of unconventional feed ingredients, leading to better FCR. Nevertheless, from economic standpoint, these FCR values indicate that the inclusion of WDDM up to 50% of yellow corn with enzyme supplementation could be an effective feeding strategy without adversely affecting broiler performance.

Apparent digestibility: The results of apparent nutrient digestibility at 6 weeks of age as affected by partial replacement of yellow corn with WDDM are presented in Table (4). The results indicate that digestibility of dry matter and ether extract did not significantly differ among G1 (control), G2 and G3. However; they were negatively affected in G4 and G5 compared to the control group. Digestibility of crude fibers was negatively affected in G2 and G4, however, it did not significantly differ among G1, G3 and G5. On the other hand, no significant differences in the digestibility of crude protein were detected among the treated groups.

It is noteworthy to mention that the insignificant differences in digestibility coefficient of DM, CP, CF and ether extract between G1and G3 may be understood that enzymes supplementation overcame the effect of replacing 25% of yellow corn with WDDM. However, this effect was not pronounced at 50% replacement rate except for protein and crude fibers digestibility coefficients.

In similar studies, Raza *et al*. (2023) reported significantly higher digestibility values for dry matter, crude protein, and ether extract when broiler chicken fed diets containing dried date meal at levels of 9% and 12% compared to the control. Furthermore, Kholif *et al.* (2015) found that treating date palm kernels with A. niger cellulolytic enzymes improved DM and OM in vitro digestibility (from 16 to 30 percent for DM and from 19 to 35 percent for OM). In addition, Horvatovic *et al*. (2015) and Jimoh (2018) found that adding multipurpose enzymes (xylanase, glucanase, cellulase, pectinase, hemicellulase, amylase) increased dry matter and crude fiber digestibility when compared to controls or diets supplemented with a single enzyme like xylanase or phytase.

Carcass characteristics: The results of the relative weight of carcass characteristics of broiler at 42d of age as affected by whole de-pitted dates meal are presented in Table (5). Broiler chickens fed the basal diet containing 50% WDDM in place of yellow corn with enzymes (G5) exhibited significantly lower intestinal weight percentage compared with G1 and G3 groups. However, no significant differences were detected among all groups in the percentages of dressing, proventriculus, gizzard, liver, heart, spleen, bursa, thymus, pancreas, and abdominal fat.

Our findings align with those of Attia and Al-Harthi (2015), who observed that incorporating date waste in broiler diets (0 to 200 g/kg) did not affect the dressing percentage or the weight of liver and gizzard, though it did alter intestinal characteristics. Similarly, El-Deek *et al.* (2010) and Zangiabadi and Torki (2010) found that whole dates at 175 and 350 g/kg had no impact on the pancreas, liver, heart, fat pads, gizzards, or lymphoid organs of broilers at 49 days of age. Zakaria *et al.* (2010) also noted no significant differences in carcass and organ percentages in Lohmann chicks with the addition of enzymes at various levels compared to control diets. Daneshyar et *al.* (2014) reported no negative effects on carcass traits with date pit inclusion in broiler diets. Hammod *et al.* (2018) concluded that date pits could replace corn at 15% without affecting dressing percentage or carcass cuts. Khan *et al.* (2019) found significant increases in the small intestine and liver weights with phytase enzyme supplementation, while multi-enzyme supplementation had no significant effects on carcass and organ weights. Hussein *et al*. (2020) and Yaqoob *et al.* (2022) observed significant increases in intestinal lengths and weights with multi-enzyme diets. Jam and Abbas (2022) found no significant differences in heart and gizzard weights when fed date flesh and pits extracts.

Enzyme supplementation has been shown to enhance nutrient absorption and gut health, as noted by Abdel-Fattah *et al.* (2008) and

Cowieson *et al.* (2006). However, the present findings is consistent with Zyla *et al.* (2013), who reported that enzyme supplementation primarily affects the gastrointestinal tract without altering the weights of other visceral organs.

Overall, our results suggest that while partial replacing yellow corn with WDDM without or with enzyme supplementation significantly reduced intestines percentage, it did not negatively impact other vital organs percentages. This does not underscore the potential benefits of enzyme supplementation in diets containing unconventional feed ingredients like whole de-pitted dates meal.

Blood parameters: The results of blood parameters of broilers at 42 days of age as affected by whole de-pitted dates meal are presented in Table (6). The results revealed slight decrease of plasma total protein and albumin percentages in the groups received WDDM without or with enzymes supplementation as compared with the control group. Moreover, comparing with G1 there was a slight increase in cholesterol percentage in G2 and G3 but significant increase in cholesterol where in G4 and G5. Also, there was a significant increase in LDL in all groups received WDDM specially G4. However; the detected increase in cholesterol and LDL still lays with the normal range of these characters.

Moreover, no significant differences were detected between G2, G3, G4, G5 and their control (G1) in relation to globulin, glucose, T3, and T4, triglycerides, HDL RBCs, hemoglobin, PCV, MCH, MCHC, MCV, and WBCs.values.

No significant effects were observed on renal and hepatic function parameters, including AST, ALT, ALT/AST ratio, uric acid, creatinine, and uric acid/creatinine ratio, in broilers fed whole de-pitted dates meal with or without enzymes at 42 days of age. Additionally, no significant effects were proved for total antioxidant capacity (TAC), glutathione peroxidase (GSH-Px) activity, glutathione (GSH), and superoxide dismutase (SOD).

The current findings align with earlier research, such as that reported by Mohammed (2013), who demonstrated significant effects of including palm date in the diet on serum total protein, likely due to improved nutrient utilization, particularly of proteins and easily digestible sugars in dates. Similarly, Al-Dawah (2016) observed increased total protein levels when fed diets containing 5% and 10% date palm fruit compared to their control diet. Additionally, Abudabos *et al.* (2015) and Bolacali *et al.* (2021) found that diets supplemented with palm date extract reduced serum cholesterol levels compared to the control group. Jassim (2010) also noted significant effects of dates at 50, 100, and 150 g/kg on total protein, while albumin levels remained unaffected. Najafi *et al.* (2021) reported no significant differences in serum TG, cholesterol, HDL-C, and SOD values among four treatment groups fed whole date waste. Kamel et al. (2016) found that feeding various concentrations of date pits did not result in significant changes in liver function markers (ALT and AST) and kidney function markers (urea and creatinine), indicating no adverse effects on hepatic and renal functions.

The stability of the bird physiological status observed in this study is supported by the absence of significant changes in renal and liver function parameters, as well as antioxidant enzyme activities. Additionally, the hematological parameters remained constant, indicating the absence of any harmful impact of including WDDM in broiler diets.

Table(1): Ingredients and chemical composition of the experimental basal diets fed during different experiment periods

Ingredient (%)	Starter 0	Starter 25	Starter 50	Grower 0	Grower 25	Grower 50
Yellow Corn, Grain	57.00	42.6 0	28.4 0	60.60	45.4 0	30.2 0
Soybean Meal -44%	31.80	31.80	31.80	27.10	27.10	27.10
Dates Meal**	0.00	14.30	28.50	0.00	15.10	30.30
Soybean Oil	1.00	1.00	1.00	2.85	2.85	2.85
Gluten Meal	6.50	6.50	6.50	6.10	6.10	6.10
Dical. Phos.	1.70	1.70	1.70	1.50	1.50	1.50
Vit + Min. Premix*	0.30	0.30	0.30	0.30	0.30	0.30
Limestone	1.22	1.22	1.22	1.13	1.13	1.13
Common Salt	0.30	0.30	0.30	0.30	0.30	0.30
DL-Methionine	0.05	0.05	0.05	0.02	0.02	0.02
L-Lysine HCl	0.13	0.13	0.13	0.10	0.10	0.10
Enzyme mix***.	0.00	0.10	0.10	0.00	0.10	0.10
TOTAL	100.	100	100	100	100	100
Determined[1] and calculated[2] composition (% as fed basis)						
Nutrient						
Dry matter[1],%	85.61	85.12	85.36	86.25	86.12	85.84
Dry matter[2],%	86.23	85.94	85.64	86.71	86.40	86.09
ME (kcal/kg)[2]	2957	2817	2678	3122	2974	2826
Crude protein[1],%	23.03	22.12	21.36	21.01	20.06	19.27
Crude protein[2],%	23.19	22.38	21.57	21.14	20.29	19.42
Ether extract[1],%	3.42	2.97	2.51	5.44	4.86	4.39
Ether extract[2],%	3.58	3.09	2.60	5.52	5.00	4.47
Crude fiber[1],%	3.70	4.12	4.56	3.43	3.92	4.33
Crude fiber[2],%	3.63	4.07	4.50	3.36	3.83	4.29
Calcium[2],%	0.97	1.02	1.07	0.88	0.93	0.99
Total phosphorus[1],%	0.72	0.77	0.81	0.66	0.71	0.76
Available phosphorus[2],%	0.46	0.50	0.53	0.42	0.45	0.49
Lysine[2],%	1.17	1.14	1.11	1.02	0.99	0.96
Methionine[2],%	0.47	0.45	0.43	0.41	0.39	0.37
COST=	21390	19445	17514	21098	19044	16977

*Vit+Min mix. provides per kilogram of the diet: Vit. A, 12000 IU, vit. E (dl-α-tocopheryl acetate) 20 mg, menadione 2.3 mg, Vit. D3, 2200 IU, riboflavin 5.5 mg, calcium pantothenate 12 mg, nicotinic acid 50 mg, Choline 250 mg, vit. B_{12} 10 µg, vit. B_6 3 mg, thiamine 3 mg, folic acid 1 mg, d-biotin 0.05 mg. Trace mineral (mg/ kg of diet): Mn 80 Zn 60, Fe 35, Cu 8, Selenium 0.1 mg.

** contained 90.77% dry matter, 3.15 % crude protein, 5.26% crude fiber, 0.342% Ether extract, 2973(Kcal/kg) Gross energy.

***Enzyme complex (Kemzyme) contains 300 µ/g beta-glucanase , 5000 µ/g cellulase, 450 µ/g alfa amylase and 450 µ/g protease and lipase

Table (2): Effect of whole de-pitted dates meal on growth performance, economic efficiency and European Production Efficiency Index of broilers during the period from 1 to 42 days of age

Items	Dietary groups						
	G1 (Control)	**G2**	**G3**	**G4**	**G5**	**SEM**	**Sig.**
Live body weight (g)							
1d	46	45	46	46	46	0.75	0.424
7d	199a	191ab	198a	179c	184bc	6.31	0.002
14d	431a	418ab	434a	378c	398bc	15.31	0.002
21d	775a	740bc	766ab	688d	728c	20.61	0.004
28d	1260a	1194b	1243ab	1113c	1123c	31.57	0.002
35d	1649a	1569bc	1622ab	1442d	1514c	42.22	0.003
42d	2316a	2150b	2281a	1982c	2106b	62.13	0.007
Body weight gain (g)							
1-7d	153^{a}	$145a^{b}$	152^{a}	133^{c}	$139b^{c}$	6.33	0.003
7-14d	231^{a}	227^{ab}	236^{a}	199^{c}	$213b^{c}$	9.48	0.001
15-21d	345^{a}	322^{bc}	332^{ab}	311^{c}	330^{ab}	10.62	0.003
22-28d	484^{a}	454^{ab}	477^{a}	425^{bc}	395^{c}	20.71	0.006
29-35d	389	375	378	329	392	38.81	0.275
36-42d	667^{a}	582^{bc}	659^{ab}	540^{c}	592^{abc}	48.39	0.006
1 -42d	2270^{a}	2105^{b}	2235^{a}	1936^{c}	2060^{b}	62.08	0.008
Economic efficiency, Relative economic efficiency and European Production Efficiency Index							
Ec. Ef.	64.35	67.72	73.7	70.05	72.87	3.59	0.392
Relative Ec. Ef	100	105	115	109	113	--	--
EPEI	328a	286ab	323a	243b	270b	10.04	0.008

[a,b,c,d] Means in the same row followed by different letters are significantly different at ($P \leq 0.05$);, SEM= Standard error of mean. Ec. Ef.= Economic efficiency, Relative Ec. Ef= Relative Economic efficiency, EPEI= European Production Efficiency Index

Table (3): Effect of whole de-pitted dates meal on feed intake and feed conversion ratio of broilers during the period from 1 to 42 days of age

Items	**Dietary groups**						
	G1 (Control)	G2	G3	G4	G5	SEM	Sig.
Feed intake (g/bird)							
1-7d	186	178	185	202	201	4.61	0.249
7-14d	302	313	309	262	295	8.91	0.254
15-21d	466	477	468	451	453	7.31	0.627
22-28d	775	783	771	734	758	9.83	0.397
29-35d	844	830	829	863	877	7.98	0.156
36-42d	1243	1187	1200	1244	1250	22.2	0.727
- 1- 42d	3816	3768	3763	3756	3835	27.27	0.729
Feed conversion ratio (g feed/g gain)							
1-7d	1.22	1.23	1.23	1.52	1.45	0.049	0.091
7-14d	1.31	1.37	1.31	1.32	1.38	0.037	0.887
15-21d	1.36	1.48	1.41	1.45	1.37	0.027	0.393
22-28d	1.60b	1.73b	1.62b	1.73b	1.93a	0.031	0.014
29-35d	2.18	2.24	2.21	2.68	2.24	0.097	0.311
36-42d	1.89	2.04	1.84	2.32	2.14	0.071	0.136
1-42d	1.68c	1.79bc	1.69c	1.94a	1.86ab	0.02	0.002

[a,b,c,d] Means in the same row followed by different letters are significantly different at ($P \leq 0.05$);, SEM= Standard error of mean.

Table (4): Effect of whole de-pitted dates meal on apparent nutrients digestibility (%) of broilers at 42 days of age

Group	**G1(Control)**	**G2**	**G3**	**G4**	**G5**	**SEM**	**Sig.**
Dry matter	75.10a	71.37ab	74.13a	63.83b	67.80ab	2.35	0.036
Crude protein	74.67	68.6	71.97	60.73	65.57	3.17	0.075
Ether extract	73.87a	67.57ab	72.10a	57.67c	63.90bc	2.1	0.002
Crude fiber	37.90a	30.57bc	34.97ab	25.20c	31.87abc	2.07	0.014

[a,b,c] Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); DM:; Sig., significantly SEM, Standard error of mean.

Table (5): Effect of whole de-pitted dates meal on relative weight of carcass characteristics and body organs of broilers at 42d of age

Group	G1 (Control)	G2	G3	G4	G5	SEM	Sig.
Dressing %	72.03	72.08	73.51	73.04	74.38	0.742	0.162
Proventriculus, %	0.605	0.543	0.558	0.559	0.54	0.028	0.498
Gizzard, %	1.78	1.76	1.74	1.64	1.6	0.106	0.694
Liver, %	3.15	2.82	2.93	2.58	2.61	0.164	0.116
Heart, %	0.735	0.613	0.72	0.678	0.685	0.046	0.397
Spleen, %	0.175	0.15	0.157	0.144	0.166	0.015	0.59
Intestines %	5.18a	4.47ab	4.72a	4.37ab	3.66b	0.302	0.024
Bursa, %	0.281	0.286	0.289	0.258	0.305	0.021	0.624
Thymus, %	0.508	0.61	0.523	0.594	0.538	0.042	0.366
Pancreas, %	0.38	0.374	0.311	0.375	0.343	0.02	0.102
Abdominal fat, %	1.25	1.09	1.21	1.01	1.13	0.153	0.837

[a,b,c] Means in the same row followed by different letters are significantly different at ($p \leq 0.05$).; Sig., significantly SEM, Standard error of mean.

Table (6): Effect of whole de-pitted dates meal on blood parameters of broilers at 42 d of age

Group	G1 (Control)	G2	G3	G4	G5	SEM	Sig.
Biochemical parameters							
Total protein, g/dl	5.92a	5.39bc	5.46b	5.00c	5.23bc	0.134	0.001
Albumin, g/dl	3.09a	2.87ab	2.92ab	2.72b	2.80b	0.072	0.016
Globulin, g/dl	2.82	2.51	2.54	2.28	2.43	0.135	0.1
Glucose, mg/dl	248	229	238	212	226	8.49	0.07
T3 (ng/ml)	1.99	1.93	1.94	1.84	1.88	0.065	0.544
T4 (ng/ml)	11.3	11.28	11.51	10.77	10.96	0.701	0.947
lipid profile							
Triglycerides (mg/dl)	314	299	304	283	294	8.13	0.121
Cholesterol (mg/dl)	186b	194ab	189b	207a	202a	4.39	0.009
HDL (mg/dl)	67.52	63.73	65.37	60.08	63.28	1.87	0.104
LDL (mg/dl)	55.11d	70.54bc	62.27cd	90.46a	79.86ab	4.36	0.005
renal and liver functions							
AST, U/L	39.09	41.87	40.14	38.55	39.09	1.41	0.493
ALT, U/L	26.64	24.26	23.72	26.15	25.05	1.64	0.689
ALT/AST	0.7	0.58	0.59	0.69	0.65	0.056	0.522
Uric acid (mg/dl)	20.58	17.92	20.06	19	21.63	1.474	0.456
Creatinine (mg/dl)	0.745	0.763	0.796	0.828	0.818	0.032	0.315
Uric acid / Creat.	27.63	24.12	25.23	23.09	26.4	1.926	0.494
antioxidants enzymes							
TAC, U/mL	13.11	11.8	11.93	10.55	11.65	0.637	0.118
GSH-Px, U/mL	770	782	723	687	706	36.03	0.304
GSH, U/mL	110	104	112	114	109	4	0.574
SOD, U/mL	209	241	212	229	223	13.84	0.475
hematological criteria							
RBC’s (10^6/ml)	4.88	4.64	4.74	4.73	4.69	0.1	0.545
Hemoglobin (g/100ml)	11.22	10.57	11.57	10.72	11.18	0.49	0.614
PCV, %	25.7	28.28	24.54	23.47	24.68	1.28	0.119
MCH, U/g	23.01	22.87	24.45	22.68	23.94	1.1	0.745
MCHC, %	44.71	37.7	47.87	46.17	45.42	2.82	0.138
MCV	52.74	61.65	51.8	49.7	52.8	3.16	0.109
WBC’s (10^3/ml)	16.79	16.12	15.87	16.57	16.6	0.33	0.294

[a,b,c] Means in the same row followed by different letters are significantly different at ($p \leq 0.05$);.; Sig., significantly SEM, Standard error of mean; T3= triiodothyronine;
T4=thyroxine; HDL=high-density lipoprotein; LDL=low-density lipoprotein; AST=aspartate amino transferase; ALT=alanine amino transferase; TAC=total antioxidant capacity; GPX-Px =glutathione peroxidase; GSH= glutathione; SOD=superoxide dismutase; RBC’s, red blood cell; PCV, packed cell volume; MCH, mean corpuscular hemoglobin; MCV, Mean cell volume, MCHC, Mean Corpuscular Hemoglobin Concentration; WBC’s, white blood cell.

REFERENCES

Abdel-Fattah, S.A.; El-Sanhouty, M.H.; El Madnay, N.M. and Abdel-Azeem, F. 2008. Thyroid activity, some blood constituents, organs morphology and performance of broiler chicks supplemental organic acids. International Journal of Poultry Science, 7(3):215-222

Abdel-Sattar, W.M.; Sadek, K.M.; Elbestawy, A.R. and Mourad, D.M. 2019. Biochemical protective role of Phoenix dactylifera seeds against aflatoxicosis in broilers. Damanhour Journal of Veterinary Sciences, (1): 5–12.

Abudabos, A. M.; Alyemni, A. H., and Al Marshedi, M. A. 2018. Effect of replacing dietary barley with date palm co-products on growth performance, carcass characteristics, and meat quality of broiler chickens. Animal Nutrition, 4(2): 144-148.

Abudabos, A.M.; Abdelrahman, M.M.; Suliman, G.M. and Al-Sagan, A.A. 2015. Effect of whole inedible date and amino acid supplementation on growth performance of Ross 308 broiler chicks. Animal Review, 2(1): 9-18. DOI:10.18488/JOURNAL.AR/2015.2.1/101.1.9.18.

Abuelgassim, A.O.; Eltayeb, M.A. and Ataya, F.S. 2020. Palm date (Phoenix dactylifera) seeds: A rich source of antioxidant and Phoenix dactylifera antibacterial activities. Czech Journal of Food Sciences, 38, 2020 (3): 171–178.

Akbarian, A.; Michiels, J.; Degroote, J.; Majdeddin, M.; Golian, A. and De Smet, S. 2016. Association between heat stress and oxidative stress in poultry; mitochondrial dysfunction and dietary interventions with phytochemicals. Journal of animal science and biotechnology, (7): pp.1-14.

Al-Beitawi, N. A.; El-Ghousein, S. S., and Abdullah, A. Y. 2014. Performance, carcass quality and blood constituents of broilers fed graded levels of date pits. Livestock Science, (163) :36-41.

Al-Dawah, N.K. 2016. Evaluation of the effect of dates Al-Zahdi addition in broiler chicken diet on some chemical parameters and body weight. Kufa Journal for Veterinary Medical Science, 7(1): 35-40.

Al-Harthi, M. A.; El-Deek, A. A.; Yakout, H. M. and AL-Refaee, M. 2009. The Nutritive Value of Date Waste Meal as a Feedstuff for Lohmann Brown Pullets and Layers. Journal of Poultry Science,(46):303-312.

Al-Harthi, M.A. 2006. The influence of date waste meal supplemented with enzymes, probiotics or their combination on broiler performance. Egyptian Poultry Science, 26:1031-1055.

Al-Marzooqi, W.; Al-Farsi, M.A.; Kadim, I.T.; Mahgoub, O. and Goddard, J.S. 2010. The effect of feeding different levels of sardine fish silage on broiler performance, meat quality and sensory characteristics under closed and open-sided housing systems. *Asian*-Australasian Journal of Animal Sciences, 23(12): pp.1614-1625.

AL-Zuhairi , S.K.; Al-Zamili, I.F.; Al-Waeli, S.K. and Al-Gharawi, J.K. 2019. Effect of early feeding diet dilution by sputter dates on some productive performance of broilers. (2): 3509-Plant Archives193514.

A.O.A.C. 2004. Official Methods of Analysis. 15th Association of Official Analytical Chemists Washington, D.C.

Attia, A.A.; El-Hindawy, M.M.; Ismail, I.E. and Salama, A.A. 2017. EFFECT OF AZZAWI DATE WASTE MEAL WITH OR WITHOUT AVIZYME SUPPLEMENTATION ON GROWTH PERFORMANCE OF JAPANESE QUAIL. Zagazig Journal of Agricultural Research, 44(6): pp.2607-2619.

Attia, Y.A. and Al-Harthi, M. 2015. Effect of supplementation of date waste to broiler diets on performance, nutrient digestibility, carcass characteristics and physiological parameters. European Poultry Science/Archiv für Geflügelkunde, (79): 1–10.

Azizi, M. N.; Loh, T. C.; Foo, H. L. and Teik Chung, E. L. 2021. Is Palm Kernel Cake a Suitable Alternative Feed Ingredient for Poultry? Animals 11 (2): 338. doi:10.3390/ani11020338.

Bartels, H.; Böhmer, M. and Heierli, C. 1972. Serum creatinine determination without protein precipitation. Clinica chimica acta; international journal of clinical chemistry, (37): pp.193-197.

Baraem, I.; Imad, H.; Riad, B.; Yehia, M. and Jeya, H. 2006. Physico-chemical characteristics and total quality of five date varieties grown in the United Arab Emirates. International journal of food science & technology. 41 (8): 919-926.

Bedford, M.R. and Partridge, G.G. 2010. 13 Feed Enzymes, the Future: Bright Hope or Regulatory Minefield. Enzymes in farm animal nutrition, p.304.

Bedford, M.R., and Schulze, H. 1998. Exogenous enzymes for pigs and poultry. Nutrition Research Reviews, 11(1): 91-114.

Bolacali, M.; Irak , K.; Tufan, T. and Küçük, M. 2021. Effects of gender and dietary date palm extract on performance, carcass traits, and antioxidant status of Japanese quail. South African Journal of Animal Science, 51 (No. 3).

Bossuyt, P.M.; Reitsma, J.B.; Bruns, D.E.; Gatsonis, C.A.; Glasziou, P.P.; Irwig, L.M.; Lijmer, J.G.; Moher, D. and Rennie, D. 2003. Towards complete and accurate reporting of studies of diagnostic accuracy: the STARD initiative.

Choct, M.; Hughes, R.J. and Bedford, M.R. 1999. Effects of a xylanase on individual bird variation; starch digestion throughout the intestine; and ileal and caecal volatile fatty acid production in chickens fed wheat. British Poultry Science, (40): 419–422.

Coles, E.H. 1974. Veterinary clinical pathology (No. Ed. 2). WB Saunders.

Cowieson, A. J., and Adeola, O. 2005. Carbohydrases, protease, and phytase have an additive beneficial effect in nutritionally marginal diets for broiler chicks. Poultry Science, 84(12), 1860-1867.

Cowieson, A.J.; Acamovic, T. and Bedford, M.R. 2006. Supplementation of corn–soy-based diets with an Eschericia coli-derived phytase: effects on broiler chick performance and the digestibility of amino acids and metabolizability of minerals and energy. Poultry Science, 85(8): pp.1389-1397.

Dalla, T. and Sheboun, A. 2009. Evaluation of some medical plants and their extracts as feed additives in broiler diets on health indicators and productive performance. Tishreen University Journal for Research and Scientific Studies-Biological Sciences Series 36(4): 49-67.

Daneshyar, F.; Afzali, N. and Farhangfar, H. 2014. Effects of different levels of date pits in broilers' feed contaminated with aflatoxin B1on broilers' performance and carcass characteristic. African Journal of Biotechnology.(13): 185-193.

Darras, V. M.; Vanderpooten, A.; Huybrechts, L. M.; Berghman, L. R.; Dewil, E.; Decuypere, E., and Kühn, E.R. 1991. Food intake after hatching inhibits the growth hormone induced stimulation of the thyroxine to triiodothyronine conversion in the chicken. Hormone and metabolic research, 23(10): 469-472.

Debache, K. 2021. Growth performance of novel food based on mixture of boiled-dried granulated Tenebrio molitor larvae and date-fruit waste in broiler chicken farming. Asian Journal of Agriculture, 5(1).

Doumas, B.T.; Watson, W.A. and Biggs, H.G. 1971. Albumin standards and the measurement of serum albumin with bromcresol green. Clinica chimica acta, 31(1): 87-96.

Duncan, D.B. 1955. Multiple Range and Multiple F- test. Biometrics, (11):1- 42.

Eilers, R.J. 1967. Notification of final adoption of an international method and standard solution for hemoglobinometry specifications for preparation of standard solution. American journal of clinical pathology, 47(2): 212-214.

EL-Deek, A. A.; Attia, Y. A. and AL-Harthi, M.A. 2010. Including whole inedible date in grower-finisher broiler diets and the impact on productive performance, nutrient digestibility and meat quality. Animal, (4):1647-1652.

El-Faham, A.I.; Ali, N.G.; Ali, R.A. and Abdelaziz, M.A.M. 2017. Date palm waste in starter-grower diets and impact on productive and physiological performance of broilers. Egyptian Journal of Nutrition and Feeds, 20(2): 299-308.

El-Kelawy, H. M. and M. I. El-Kelawy 2016. Impact of dietary supplementation with multi enzyme and/or probiotic on growth performance, nutrients digestibility and blood constituents of growing rabbits. Egyptian Journal Nutrition and Feeds, 19 (2): 313-323.

El-Kelawy, M.I.; El-Shafey, A.S. and Hamdon, H.A. 2020. The effects of date stone meal with or without enzymes suplemntation on growth performance, nutrient digestibility and economical efficiency of rabbits. Egyptian Journal of Nutrition and Feeds, 23(1): 87-98.

Ellman, G.L. 1959. Tissue sulfhydryl groups. Archives of biochemistry and biophysics, 82(1):70-77.

Fernández-López, J.; Viuda-Martos, M.; Sayas-Barberá, E.; Navarro-Rodríguez de Vera, C. and Pérez-Álvarez, J.A. 2022. Biological, nutritive, functional and healthy potential of date palm fruit (Phoenix dactylifera L.): Current research and future prospects. Agronomy, (12): 876.

Food and Agriculture Organization (FAO) of the United Nations 2021, Date palm cultivation. Retrieved August 20, 2005 from http://www.fao.org/ OOREP/006/ Y4360E/ y4360 e 00.htm (FAOSTAT, 2021).

Fossati, P. and Prencipe, L. 1982. Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clinical chemistry, 28(10), pp.2077-2080.

Friedewald, W. T.; Levy, R. T. and Frederickson, D.S. 1972. Estimation of the concentration of low-density lipoprotein cholesterol in plasma without use of the preparative ultracentrifuge. Clinical chemistry, (18): 499-502.

Gunya, B. and Masika, P.J. 2021. Eisenia fetida worm as an alternative source of protein for poultry: A review.International Journal of Tropical Insect Science, 42(1): pp.1-8.. https://doi.org/10.1007/s42690-021-00531-6

Hammod, A.J.; Ali, N.A.; Alkassar, A.M. and Jameel, Y.J. 2018. The effect of partial replacement of maize by date pits on broiler performance. Journal Pure Appl. Microbiol, (12): pp.807-813.

Hassan S.M. and Aqil, A.A.A. 2015. Effect of adding dietary date (*Phoenix dactylifera*) pits meal with/or without β-mannanase on productive performance and eggshell quality parameters of layer hens. International journal poultry science، 14(11): 595-601. https://doi.org/10.3923/ijps.2015.595.601

Henry, J.M.; Heffner Jr, R.R.; Dillard, S.H.; Earle, K.M. and Davis, R.L. 1974. Primary malignant lymphomas of the central nervous system. Cancer, 34(4): pp.1293-1302.

Hepler, P.K.; Huff, C.G. and Sprinz, H. 1966. The fine structure of the exoerythrocytic stages of Plasmodium fallax. The Journal of cell biology, 30(2): pp.333-358.

Horvatovic, M.P.; Glamocic, D.; Zikic, D. and Hadnadjev, T.D. 2015).Performance and some intestinal functions of broilers fed diets with different inclusion levels of sunflower meal and supplemented or not with enzymes. Brazilian Journal of Poultry Science, (17): 25–30.

Hussein, E. O. S.; Suliman, G. M.; Alowaimer, A. N.; Ahmed, S. H.; Abd El-Hack, M. E.; Taha, A. E. and Swelum, A.A. 2020. Growth, carcass characteristics, and meat quality of broilers fed a low-energy diet supplemented with a multi-enzyme preparation. Poultry science, 99(4): 1988-1994.

Hussein, A.S.; Alhadrami, G.A. and Khalil, Y.H. 1998. The use of dates and date pits in broiler starter and finisher diets. Bioresource Technology, 66(3): pp.219-223.

Ibrahim, M. R.; H. M. El-Banna and El-Manylawi, M.A. 2010. Evaluating utilization of ground date stone meal with or without kemzyme in the diets of growing New Zealand rabbits. IV International Date Palm Conference. Acta Horticulturae, (882): p.691 -697.

Jam, N.A. and Abbas, R.J. 2022. Effect of Using Date (L.) and Pits Aqueous Phoenix dactylifera Extracts on Growth Performance and Some Carcass Characteristics of Broiler Chickens. Indian Journal of Ecology (2022) 49 Special Issue (20): 318-323.

Jassim, J.M. 2010. Effect of Using Date By-product with Enzyme on Performance and Blood Parameter of Broiler. International Journal of Poultry Science, (9): 895–897.

Jimoh, A. 2018. Effects of enzyme cocktails on in vitro digestibility of palm kernel cake. Journal of Central European Agriculture, 19, (1): pp. 114–125.

Kamel, E.R.; Manaa, E. A. and Farid, A.S. 2016. The Effects of Dietary Date Pit on the Productive and Economic Efficiency of Japanese Quail. Alexandria Journal of Veterinary Sciences. 51(2): 211-221.

Kchaou, W.; Abbès, F.; Mansour, R.B.; Blecker, C.; Attia, H. and Besbes, S. 2016. Phenolic profile, antibacterial and cytotoxic properties of second grade date extract from Tunisian cultivars (Phoenix dactylifera L.). Food chemistry,(194): 1048–1055.

Khan, K.; Zaneb, H.; Rehman, Z. U.; Maris, H. and Rehman, H. 2019. Effect of phytase supplementation on growth performance in broiler chickens. Pakistan Journal of Zoology. 51 (2): 731-735.

Khatun, A.; Chowdhury, S.D.; Roy, B.C.; Gani, S.M.S.; Ray, B.C. and Ahmed, T. 2022. Effects of feeding multi-strain probiotics and multi-enzymes to broilers on growth performance, intestinal morphology and cost effectiveness of production. Advances in Animal and Veterinary Sciences. 10(2):389-396.

Kholif, A.; Farahat, E.; Hanafy, M.; Kholif, S. and El-Sayed, R. 2015. Utilization of cellulolytic enzymes to improve the nutritive value of date kernels and the investigation of the impact of adding these enzymes to lactating goat's diets on rumen fermentation and nutrients digestibility. Asian Journal of Animal Science, (9): 441-447.

Koracevic, D.; Koracevic, G.; Djordjevic, V.; Andrejevic, S., and Cosic, V. 2001. Method for the measurement of antioxidant activity in human fluids. Journal of clinical pathology, 54(5): 356-361.

Lopes-Virella, M. F.; Stone, P.; Ellis, S., and Colwell, J.A. 1977. Cholesterol determination in high-density lipoproteins separated by three different methods. Clinical chemistry, 23(5): 882-884.

Mardhati M.; Wong H.K. and Noraini S. 2011. Growth performance and carcass quality of broilers fed with palm kernel meal-based rations. (2): Journal of Tropical Agriculture and Food Science, (39): 157-166.

Masoudi A.; Chaji M.; Bojarpour M. and Mirzadeh K. 2011. Effects of different levels of date pits on performance, carcass characteristics and blood parameters of broiler chickens. Journal of Applied Animal Research, 39(4): 399- 405. DOI: https://www.doi.org/10.1080/09712119.2011.621790.

Misra, H.P. and Fridovich, I. 1972. The role of superoxide anion in the autoxidation of epinephrine and a simple assay for superoxide dismutase. Journal of Biological chemistry, 247(10): 3170-3175.

Mohammed, M.F. 2013. The influence of adding date to broiler diet on performance and blood characters. International Journal of Advanced Biological Research, 3(4) 2013: 540-544.

N.R.C. 1994. Nutrient requirements for poultry. (9th Ed.) National Academy Press, Washington, D.C.

Najafi, S.; Ghasemi, H.A.; Hajkhodadadi, I. and Khodaei-Motlagh, M. 2021. Nutritional value of whole date waste and evaluating its application in ostrich diets. Animal, 15(3): p.100165.

Paglia, D.E. and Valentine, W.N. 1967. Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidase. The Journal of laboratory and clinical medicine, 70(1): pp.158-169.

Raza, M.H.; Tahir, M.; Naz, S.; Alhidary, I.A.; Khan, R.U.; Losacco, C. and Tufarelli, V. 2023. Dried Date (Phoenix dactylifera L.) Meal Inclusion in the Diets of Broilers Affects Growth Performance, Carcass Traits, Nutrients Digestibility, Fecal Microbiota and Economics. Agriculture 2023,(13):1978. https://doi.org/10.3390/ agriculture13101978.

Reitman, S. and Frankel, S. 1957. A Method for determination of enzymatic activities. Am. J. Clin. Path, (287): 56-58.

SAS, 2006. SAS/STAT User's guide statistics. SAS institute INC., Cary. NC, USA.

Shakila, S.; Reddy, P.S.; Reddy, P.V.V.; Ramana, J.V. and Ravi, A. 2012. Effect of palm kernel meal on the performance of broilers. Tamilnadu Journal of Veterinary and Animal Sciences, 2012, (8): 227–234.

Sjofjan, O.; Adli, D.N.; Natsir, M.H.; Nuningtyas, Y.F.; Wardani, T.S.; Sholichatunnisa, I.; Ulpah, S.N. and Firmansyah, O. 2021. Effect of dietary modified-banana-tuber meal substituting dietary corn on growth performance, carcass trait and dietary-nutrients digestibility of coloured-feather hybrid duck. Jurnal Ilmu Ternak dan Veteriner, 26(1): p.39-48.

Srour, Ibtesam. A. (2024). Utilization of Fungi Treated Date Palm Residues in Japanese Quail Feeding. PhD. Thesis, Faculty of Agriculture, New Valley University.

Stein, E.A. 1986. Quantitative enzy m atic colorim etric determination of total cholesterol in serum or plasma. In: Textbook of Clinical Chemistry. NW Tietz, editor. WB. Saunders, Philadelphia, USA, pp.879-886.

Tabook, N.M.; Kadim, I.T.; Mahgoub, O. and Al-Marzooqi, W. 2006. The effect of date fiber supplementation with an exogenous enzyme on the performance and meat quality of broiler chickens. British Poultry Science, 2006; (47):73- 82.

Taha, H.J., M.F.M. Al-Yasri and Alkhilani, M.H.F. 2013. Effect of addition different levels of dates flesh (*Phoenix dactyliphera* L) to ration contain probiotic on boiler chickens performance reared under heat stress. International Journal of Advanced Biotechnology and Research, 3(2): 306-311.

Tareen, M.H.; Wagan, R.; Siyal, F.A.; Babazadeh, D.; Bhutto, Z.A.; Arain, M.A. and Saeed, M. 2017. Effect of various levels of date palm kernel on growth performance of broilers. Veterinary World.10(2):227-232. doi:10.14202/vetworld.2017.227-232.

Trinder, P. 1969. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Annals of clinical Biochemistry, 6(1): 24-27.

Vandepopuliere, J.M.; Al-Yousef, Y. and Lyons, J.J. 1995. Dates and date pits as ingredients in broiler starting and coturnix quail breeder diets. Poultry Science, 74(7): 1134-1142. DOI: 10.3382/PS.0741134.

Yalçın, S.; Eser, H.; Yalçın, S.; Şahin, A., and Özkan, S. 2012. Effects of dietary enzymes on the performance, carcass characteristics, and digestive tract development of broiler chickens. Asian-Australasian Journal of Animal Sciences, 25(10): 1367-1372.

Yaqoob, M. U.; Yousaf, M.; Iftikhar, M.; Hassan, S.; Wang, G.; Imran, S. and Wang, M. 2022. "Effect of multi-enzymes supplementation on growth performance, meat quality, ileal digestibility, digestive enzyme activity and caecal microbiota in broilers fed low-metabolizable energy diet", Animal Bioscience, 35(7): 1059.

Zakaria, H. A.; Jalal, M. A. and Ishmais, M. A. A. 2010. "The influence of supplemental multi-enzyme feed additive on the performance, carcass characteristics and meat quality traits of broiler chickens", International Journal of Poultry Science, 9(2), 126-133.

Zangiabadi, H. and Torki, M. 2010. The effect of a beta-mannanase-based enzyme on growth performance and humoral immune response of broiler chickens fed diets containing graded levels of whole dates. Tropical Animal Health and Production, 42(6): 1209-1217. DOI: 10.1007/s11250-010-9550-1.

Zarei, M.; Ehsani, M. and Torki, M. 2011. Productive performance of laying hens fed wheat-based diets included olive pulp with or without a commercial enzyme product. African Journal of Biotechnology, 10(20): pp.4303-4312.

Żyła, K.; Grabacka, M.; Pierzchalska, M.; Duliński, R. and Starzyńska-Janiszewska, A. 2013. Effect of inositol and phytases on hematological indices and α-1 acid glycoprotein levels in laying hens fed phosphorus-deficient corn-soybean meal-based diets. Poultry Science, 92(1): pp.199-204.

الملخص العربي

استخدام التمور منخفضة النوعية منزوعة النواة كمكون غير تقليدي في علائق بدارى اللحم

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تم توزيع ١٥٠ كتكوت بدارى اللحم (أربر إكرز) عمر يوم واحد عشوائيًا إلى خمس مجموعات تجريبية، كل مجموعة تضم ٣٠ كتكوتًا موزعة على ٣ مكررات. المجموعة الأولى (G1) كانت مجموعة المقارنة وتلقت عليقة أساسيًة (ذرة صفراء- كسب فول صويا). المجموعتان الثانية والثالثة تلقتا العليقة الاساسية بعد ان استُبدل فيها ٢٥% من الذرة الصفراء بمسحوق التمر منخفض النوعية منزوع النواة بدون (G2) أو مع (G3) إضافة مخلوط للانزيمات (زيلانيز – بيتاجلوكاناز – سليولاز). المجموعتان الرابعة والخامسة تلقتا العليقة الاساسية بعد ان استُبدل فيها ٥٠% من الذرة بمسحوق التمر بدون (G4) أو مع (G5) اضافة مخلوط الإنزيمات.

أوضحت النتائج أن استبدال ٢٥% من الذرة في العليقة بمسحوق التمر منخفض النوعية مع إضافة مخلوط للإنزيمات أدت الى زيادة معنوية فى وزن الجسم ومعدل الزيادة فى وزن الجسم مقارنة بالعليقة التي استبدل فيها ٢٥% من الذرة بمسحوق التمر بدون إنزيم أو٥٠% من الذرة بمسحوق التمر مع أو بدون إنزيم. وأظهرت الطيور التي تغذت على عليقة استبدل فيها ٢٥% أو ٥٠% من الذرة بمسحوق التمر مع مخلوط إنزيمى كفاءة اقتصادية أفضل، متفوقة على الطيور التي تغذت على عليقة الكنترول او استبدل فيها ٢٥% بدون مخلوط انزيمى. ولم تظهر النتائج أي فروق معنوية في استهلاك الغذاء بين المجموعات خلال الفترات التجريبية بينما أظهرت النتائج تحسنًا ملحوظًا في معامل التحويل الغذائي عند استبدال ٢٥% من الذرة بمسحوق التمر مع اضافة مخلوط الإنزيمات. كما أظهرت الطيور التي تغذت على عليقة استبدل فيها ٢٥% من الذرة بمسحوق التمر مع أو بدون إنزيم أو ٥٠% من الذرة بمسحوق التمر مع مخلوط الانزيمات تحسنًا في معاملات الهضم، خاصةً للمادة الجافة، والدهن، والألياف الخام.، ولم تختلف هذه القيم معنويا بالنسبة لمعامل هضم البروتين عن مجموعة المقارنة. بالاضافة لم تكن هناك اختلافات معنوية في وظائف الكبد والكلى أو في صفات الدم بين المجموعات التجريبية.

وبناء على ما توصل اليه البحث فانه يمكن القول بأن استبدال ٢٥% الى ٥٠% من الذرة الصفراء بمسحوق التمر منخفض النوعية منزوع النواة مع اضافة مخلوط الإنزيمات، أدى إلى معدلات نمو مقبولة والى تحسن ملحوظ فى الكفاءة الاقتصادية مع غياب اى تاثيرات سلبية على هضم العناصر الغذائية او صفات الدم أوالوظائف الفسيولوجية للكلية والكبد في بدارى اللحم من عمر يوم حتى عمر ٦ اسابيع..